LINCOLN *Continental*

1964 SHOP MANUAL

LINCOLN - MERCURY DIVISION

FORD MOTOR COMPANY

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1964

LINCOLN-CONTINENTAL

SHOP MANUAL

SERVICE DEPARTMENT
FORD DIVISION
FORD MOTOR COMPANY

(001)

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GROUP INDEX

SPECIFICATIONS AT END OF EACH GROUP

FOREWORD

This shop manual provides the Service Technician with complete information for the proper servicing of the 1964 Lincoln Continental.

The information is grouped according to the type of work being performed, such as diagnosis and testing, frequently performed adjustments and repairs, in-vehicle adjustments, overhaul, etc. Specifications and recommended special tools are included.

Refer to the opposite page for important vehicle identification data.

The descriptions and specifications in this manual were in effect at the time this manual was approved for printing. The Ford Motor Company reserves the right to discontinue models at any time, or change specifications or design, without notice and without incurring obligation.

SERVICE DEPARTMENT

FORD MOTOR COMPANY

LINCOLN-CONTINENTAL IDENTIFICATION

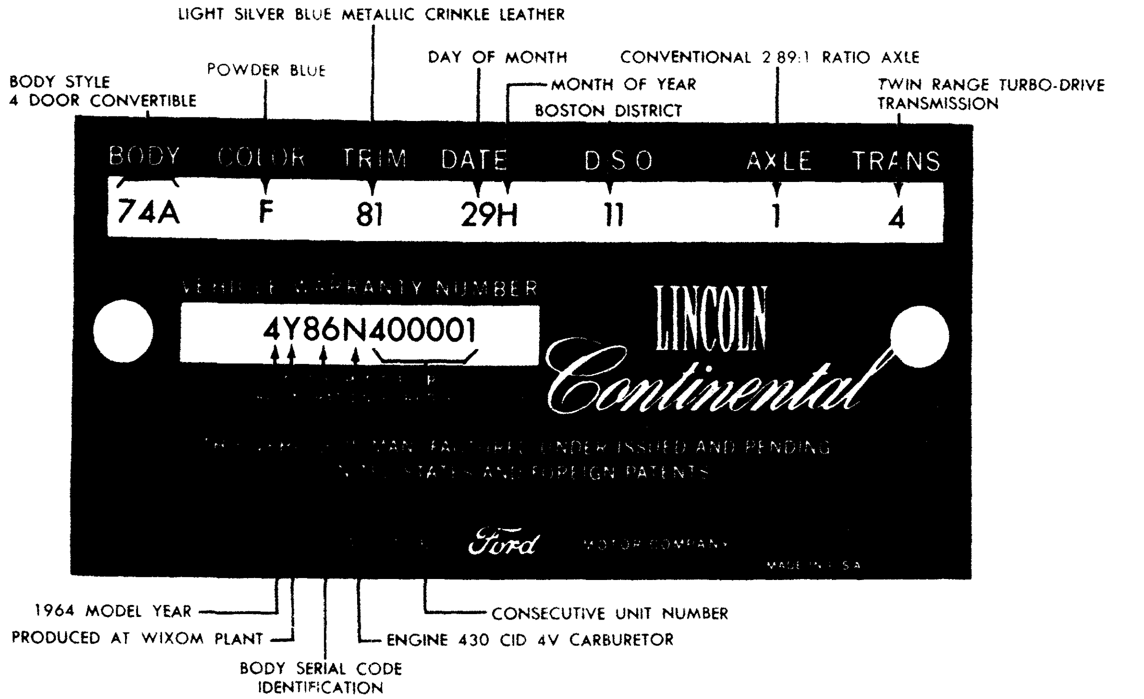


FIG. 1—1964 Lincoln-Continental Warranty Plate

Figure 1 illustrates the 1964 Lincoln-Continental Warranty Plate. The Warranty Plate is located on the rear (lock) face of the left front door.

The official Vehicle Identification Number for title or registration purposes is located on the right front fender apron above the upper suspension arm opening (Fig. 2). Do not use the "Warranty Number" on the Warranty plate for title or registration purposes.

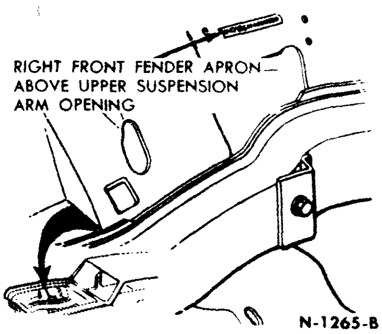


FIG. 2—Vehicle Identification Number Location

VEHICLE DATA

Example (Fig. 1):

(74A W 81 29H 11 1 4)

74A	4-Door Convertible
W	Rose
81	Light Silver Blue Metallic Crinkle Leather
29H	29th Day August
11	Boston District
1	2.89:1 Axle Ratio
4	Twin Range Turbo-Drive Transmission

BODY

53A	4-Door Sedan
74A	4-Door Convertible

COLOR

Two-tone paint codes use the same symbols as the single colors except that two symbols are used. The lower body color code will appear first in the Warranty Plate Paint Color Space.

If a special paint is used, the paint color space will not be stamped.

Code	*M-30-J Number	Color	Sales Name
A	1724	Black	Black Satin
C	1620	Dark Gray Metallic	Princeton Gray
E	1446	Silver Blue Metallic	Silver Blue
F	1226	Light Blue	Powder Blue
G	1636	Buff	Buckskin
H	1544	Nocturne Blue Metallic	Nocturne Blue
J	1515	Red	Fiesta Red
M	1619	White	Arctic White
N	921	Platinum	Platinum
O	1629	Light Green Metallic	Silver Green
Q	1624	Medium Blue Metallic	Huron Blue
R	1633	Yellow	Encino Yellow
S	1453	Dark Green Metallic	Highlander Green
T	1631	Light Beige Metallic	Desert Sand
U	1070	Med. Turquoise Metallic	Regal Turquoise
W	1555	Pink Metallic	Rose
X	1632	Maroon Metallic	Royal Maroon
Z	1630	Medium Beige Metallic	Silver Sand

*"M-32-J" Acrylic Paint Alternate with "M-30-J"

TRIM

Deviation trim sets will use existing trim codes plus 2 suffix. A trim code with a numeral suffix is not serviced, while a trim code with an alphabetical suffix is serviced.

CODE	TRIM SCHEMES
	Motif Cloth and Crinkle Leather (Bench-Biscuit)
20	Rose Beige and Rose Beige
22	Blue and Blue
27	Turquoise and Turquoise
	(Bench-Pleated)
70	Rose Beige and Light Rose Beige D/L
71	Silver Blue and Light Silver Blue Metallic
72	Blue and Light Blue D/L
74	Beige and Pearl Beige
76	Black and White
77	Turquoise and Light Turquoise D/L
	Broad Cloth (Bench-Pleated)
31	Medium Silver Blue
	Versailles Cloth and Crinkle Leather (Bucket-Biscuit)
44	Beige and Beige
46	Black and Black
51	Silver Blue and Light Silver Blue Metallic
	(Bench-Biscuit)
61	Silver Blue and Light Silver Blue Metallic
64	Beige and Beige
66	Black and Black
	Crinkle Leather (Bucket-Biscuit)
50	Rose Beige
51	Silver Blue
52	Blue
54	Beige
55	Red
56	Black
57	Turquoise
58	Burgundy
59	Palomino
	(Bench-Pleated)
80	Light Rose Beige Metallic
81	Light Silver Blue Metallic
82	Light Blue D/L
84	Pearl Beige
85	Red
86	Black
87	Light Turquoise D/L
88	Burgundy

DATE

The code letters for the month are preceded by a numeral to show the day of the month when the car was completed. The second year code letters are to be used if 1964 model production exceeds 12 months.

Month	First Model Year	Second Model Year
January	A	N
February	B	P
March	C	Q
April	D	R
May	E	S
June	F	T
July	G	U
August	H	V
September	J	W
October	K	X
November	L	Y
December	M	Z

DSO

Domestic Special Orders, Foreign Special Orders, and Pre-Approved Special Orders have the complete order number recorded in this space. Also to appear in this space is the two-digit code number of the District which ordered the unit. If the unit is regular production, only the District code number appears.

DISTRICT CODE

Code	District	Code	District
11	Boston	34	Detroit
12	Philadelphia	41	Chicago
13	New York	44	St. Louis
14	Washington	45	Twin Cities
21	Atlanta	51	Denver
22	Dallas	52	Los Angeles
24	Jacksonville	53	Oakland
25	Memphis	54	Seattle
31	Buffalo	81	Ford of Canada
32	Cincinnati	84	Home Office Reserve
33	Cleveland	90-99	Export

AXLE

A number designates a conventional axle, while a letter designates an Equa-Lock differential.

Code	Ratio
1	2.89:1
3	3.11:1
A	2.89:1

TRANSMISSION

The numeral "4" indicates a dual-range automatic transmission.

VEHICLE WARRANTY NUMBER

Example (Fig. 1): 4Y 86N 400001

4	1964 Model Year
Y	Wixom Assembly Plant
86	4-Door Convertible
N	8-Cylinder 430 Cubic Inch Engine
400001	First Unit Built (Consecutive Unit Number)

MODEL YEAR

The numeral "4" designates 1964

ASSEMBLY PLANT

Code	Assembly Plant
S	Pilot Plant
Y	Wixom

MODEL

The model code number identifies the product line series and the particular body style: the first of the two digits shows the product line, and the second digit shows the body style.

Code	Body Type
82	4-Door Sedan
86	4-Door Convertible

ENGINE

Code	
N	8-Cylinder 430 Cubic Inch 4-V Carburetor
7	8-Cylinder 430 Cubic Inch 4-V Carburetor (Low Compression)

CONSECUTIVE UNIT NUMBER

The assembly plant, with each model year, begins with consecutive unit number 400001 and continues on for each car built.

BRAKES

GROUP 2

PART 2-1 GENERAL BRAKE SERVICE

1 DIAGNOSIS AND TESTING

PRELIMINARY TESTS

1. Check the fluid level in the master cylinder, and add FoMoCo **heavy-duty** brake fluid if required.

2. Push the brake pedal down as far as it will go while the car is standing still and the engine is running. If the pedal travels more than halfway between the released position and the floor, check the brake adjustment and the automatic adjusters.

To check adjuster operation, follow the procedure described under "Brake Shoe Adjustments" in Part 2-2, Section 2.

Make several reverse brake stops to ensure uniform adjustment at all wheels.

3. With the transmission in neutral, stop the engine and apply the parking brake. Depress the service brake pedal several times to exhaust all vacuum in the system. Then, depress the pedal and hold it in the applied position. Start the engine. If the vacuum system is operating, the pedal will tend to fall away under foot pressure and less pressure will be required to hold the pedal in the applied position. If no action is felt, the vacuum booster system is not functioning. Follow the procedures in the "Booster Diagnosis Guide."

4. With the engine shut off, exhaust all vacuum in the system. Depress the brake pedal and hold it in the applied position. If the pedal gradually falls away under this pressure, the hydraulic system is leaking. Check all tubing hoses, wheel cylinders and connections for leaks.

If the brake pedal movement feels spongy, bleed the hydraulic system to remove air from the lines and cylinder. See "Hydraulic System Bleeding", Section 2. Also, check for leaks or insufficient fluid.

5. Should one of the brakes be locked and the car must be moved, open the brake cylinder bleeder screw long enough to let out a few drops of brake fluid. **This bleeding operation will release the brakes, but it will not correct the cause of the trouble.**

ROAD TEST

The car should be road tested only if the brakes will safely stop the car. Apply the brakes at a speed of 25-30 mph to check for the existence of the trouble symptoms listed in Table 1, with the exception of those resolved in the preliminary tests and brake chatter. To check for brake chatter or surge, apply the brakes lightly from approximately 50 mph. For each of the symptoms encountered, check and eliminate the causes which are also listed in Table 1.

If the causes of noisy or grabbing brakes listed in Table 1 have been checked and eliminated and the brakes still grab, follow the applicable procedures in the "Booster Diagnosis Guide."

If the brakes fail to release or if the pedal is slow in returning, follow the applicable procedures indicated in the "Booster Diagnosis Guide."

BRAKE BOOSTER TROUBLE DIAGNOSIS GUIDE

BOOSTER INOPERATIVE	If the preliminary tests show that the unit is not operating, remove the hose from the power unit and check the vacuum source by placing a thumb over the hose. Remove the thumb and note the volume of suction (gulp of air). In case of little or no suction, check the reserve tank, vacuum check valve, and fittings for vacuum leaks. If no trouble is found in the vacuum source, install the hose, making sure there are no kinks, and check the power unit. Check the air cleaner to make sure that it is clean and free of restrictions. Remove the booster unit from the car as described in Part 2-2, Section 3. Refer to "Disassembly of Booster Unit," Part 2-2, Section 4 for the internal checks that follow. Remove the booster body from the end plate, and inspect the internal vacuum hose to see that it is properly installed and is not restricted. If the hose is faulty, replace it. Also, be sure the inside of the body is clean. Inspect the booster piston for faulty packing and replace if necessary. Inspect the piston plate attaching bolts for looseness and a consequent vacuum leak. Tighten if necessary. Also check the piston to make sure it is not jammed.
SLOW BRAKE PEDAL RETURN (OR FAIL TO RELEASE)	This condition may result from a clogged booster air cleaner or improper master cylinder push rod adjustment. Refer to "Disassembly of Booster Unit," Part 2-2, Section 4 for checking internal causes. Internal causes may be a restricted air passage, sticky valve plunger, broken valve return spring, or the atmospheric poppet valve stuck in a closed position. The air passages should be checked for restrictions and blown out. The valve plunger may be touched up lightly with crocus cloth. **Do not oil.** Replace if necessary. If the return spring is broken, weak, or distorted, it should be replaced. The booster piston must be disassembled to locate and correct the cause of a sticking poppet valve. If the poppet valve appears faulty, it should be replaced. Inspect the vacuum check valve for faulty operation. Be sure that the booster piston is free to move in its normal stroke.
GRABBING BRAKES	This condition may result from a broken poppet spring or a sticking poppet valve. Remove the booster unit from the car as described in Part 2-2, Section 3. Remove the booster body from the end plate, and disassemble the booster piston. Refer to "Disassembly of Booster Unit" in Part 2-2, Section 4. If the poppet return spring is broken, weak or disturbed, replace it. If the poppet valve appears worn or bent, it should be replaced.

TABLE 1—Brake Trouble Symptoms and Possible Causes

Possible Causes of Trouble Symptoms	Trouble Symptoms												
	One Brake Drags	All Brakes Drag	Hard Pedal	Spongy Pedal	Car Pulls to One Side	One Wheel Locks	Brakes Chatter	Excessive Pedal Travel	Pedal Gradually Goes to Floor	Brakes Uneven	Shoe Click After Release	Noisy or Grabbing Brakes	Brakes Do Not Apply
Mechanical Resistance at Pedal or Shoes		x	x										
Brake Line Restricted	x	x	x		x								
Leaks or Insufficient Fluid				x				x	x				x
Improper Tire Pressure					x					x			
Improperly Adjusted or Worn Wheel Bearing	x				x								
Distorted or Improperly Adjusted Brake Shoe	x	x	x		x	x		x				x	
Faulty Retracting Spring	x				x								
Drum Out of Round	x				x		x						
Lining Glazed or Worn			x		x	x	x	x				x	x
Oil or Grease on Lining					x	x	x			x		x	x
Loose Carrier Plate	x					x	x						
Loose Lining							x						
Scored Drum										x		x	
Dirt on Drum-Lining Surface												x	
Faulty Brake Cylinder	x				x	x						x	
Dirty Brake Fluid	x	x								x			x
Faulty Master Cylinder		x						x	x				x
Air in Hydraulic System	x			x				x					x
Self Adjusters Not Operating					x			x					
Insufficient Shoe-to-Carrier Plate Lubrication	x										x	x	
Tire Tread Worn						x							
Poor Lining to Drum Contact							x						
Loose Front Suspension							x						
"Threads" Left by Drum Turning Tool Pulls Shoes Sideways											x		
Cracked Drum								x					

2 COMMON ADJUSTMENTS AND REPAIRS

PARKING BRAKE LINKAGE ADJUSTMENT

Check the parking brake cables when the brakes are fully released. If the cables are loose, adjust them as follows:

1. Fully release the parking brake pedal by pushing down on the manual release lever.
2. Raise the car.
3. Loosen the adjusting nut on the equalizer rod, then turn the lock nut in front of the equalizer several turns forward (Fig. 15, Part 2-2, Section 3).
4. Depress the parking brake pedal slowly until the initial locking position is obtained.
5. Turn the adjusting nut forward against the equalizer until approximately 100 lbs. of force at the outside diameter of the tire is required to turn the rear wheels.
6. Tighten the lock nut against the equalizer.
7. Release the parking brake, and check to make sure that the brake shoes return to the fully released position.
8. Depress the parking brake pedal with 100 lbs. of pedal force.
9. Release the parking brake again, and check as in step 7.
10. If the rear brakes do not fully release, check the cables for kinks or binds. Free the cables as required.

MASTER CYLINDER PUSH ROD ADJUSTMENT

The push rod is designed with a self-locking adjustment screw to provide the correct relationship between the booster piston and the master cylinder piston. The adjustment screw is set to the correct height at the time of the original assembly of the power unit. **Under normal service the adjustment screw does not require any further attention providing the push rod assembly remains in the original unit.** However, when a new push rod is used, or the push rod assembly is transferred to another unit, the distance from the end of the adjustment screw to the mounting surface of the booster body should be checked. Use either a micrometer depth gauge to a dimension of 1.200 inch or a height gauge as shown in Fig. 1. The details for making a height gauge are given in Fig. 2.

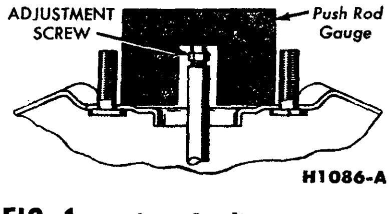


FIG. 1—Push Rod Adjustment

After assembly of the master cylinder to the power section, the piston cup in the hydraulic cylinder should just clear the compensating port hole when the unit is in the fully released position. This can be checked by placing a few drops of brake fluid over the compensating port and applying light air pressure to the output port of the master cylinder. If air bubbles appear, the port is open. If the primary piston cup overlaps the compensating port, there will be no flow of air through the compensating port. If this condition exists, the adjustment screw should be turned into the push rod a slight amount or until the compensating port is open.

HYDRAULIC SYSTEM BLEEDING

When any part of the hydraulic system has been disconnected for repair or replacement, air may get into the lines and cause spongy pedal action. Bleed the hydraulic system after it has been properly connected to be sure that all air is expelled from the brake cylinders and lines.

The hydraulic system can be bled manually or with pressure bleeding equipment.

MANUAL BLEEDING

Bleed the longest lines first. Keep the master cylinder reservoir filled with new heavy-duty brake fluid during the bleeding operation.

Never use the brake fluid which has been drained from the hydraulic system.

1. Position a 3/8-inch box wrench on the bleeder fitting on the right rear brake wheel cylinder. Attach a rubber drain tube to the bleeder fitting. **The end of the tube should fit snugly around the bleeder fitting.**
2. Submerge the free end of the tube in a container partially filled with clean brake fluid, and loosen the bleeder fitting approximately 3/4 turn.

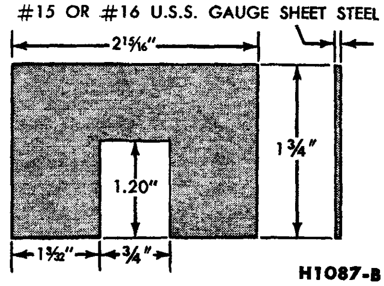


FIG. 2—Push Rod Gauge Dimensions

3. Push the brake pedal down slowly through its full travel. Close the bleeder fitting, then return the pedal to the fully-released position. Repeat this operation until air bubbles cease to appear at the submerged end of the tube.
4. When the fluid is completely free of air bubbles, close the bleeder fitting and remove the drain tube.
5. Repeat this procedure at each brake wheel cylinder in order: left rear, right front, and left front. Refill the master cylinder reservoir after each brake cylinder is bled and when the bleeding operation is completed. The fluid level should be within 3/8-inch of the top of the reservoir.

PRESSURE BLEEDING

Bleed the longest lines first. **Never use brake fluid which has been drained from the hydraulic system.**

The bleeder tank should contain enough new heavy-duty brake fluid to complete the bleeding operation, and it should be charged with 10-30 pounds of air pressure.

1. Clean all dirt from the master cylinder reservoir cap.
2. Remove the master cylinder reservoir cap, install an adapter cap to the reservoir, and attach the bleeder tank hose to the fitting on the adapter cap.

Adapter cap 2162 can be used, or an adapter cap can be fabricated by cutting a hole in the center of a filler cap and soldering a fitting at the hole.

3. Position a 3/8-inch box wrench on the bleeder fitting on the right rear brake wheel cylinder. Attach a

rubber drain tube to the bleeder fitting. **The end of the tube should fit snugly around the bleeder fitting.**

4. Open the valve on the bleeder tank to admit pressurized brake fluid to the master cylinder reservoir.

5. Submerge the free end of the tube in a container partially filled with clean brake fluid, and loosen the bleeder fitting.

6. When air bubbles cease to appear in the fluid at the submerged end of the drain tube, close the bleeder fitting and remove the tube.

7. Repeat this procedure at each brake wheel cylinder in order: left rear, right front, and left front.

8. When the bleeding operation is completed, close the bleeder tank valve and remove the tank hose from the adapter fitting.

9. Remove the adapter cap, refill the master cylinder reservoir to within ⅜ inch from the top of the reservoir, and install the filler cap.

3 CLEANING AND INSPECTION

BRAKE ASSEMBLY

1. Remove the wheel from the drum, then remove the drum as outlined in Part 2-2, Section 2. Wash all the parts except the brake shoes in a cleaning fluid and dry with compressed air.

2. Brush all dust from the backing plates and interior of the brake drums.

3. Inspect the brake shoes for excessive lining wear or shoe damage. If the lining is worn to within 1/32 inch of the rivet heads or if the shoes are damaged, they must be replaced. Replace any lining that has been oil saturated. Replace lining in axle sets. Prior to replacement of lining, the drum diameter should be checked to determine if oversize linings must be installed.

4. Check the condition of the brake shoes, retracting springs, and drum for signs of overheating. If the springs show any loss of load or change in free length indicating overheating, replacement of the retracting and hold down springs is necessary. **Overheated springs lose their pull and could cause the new lining to wear prematurely if they are not replaced.**

5. If the car has 40,000 or more miles of operation, or signs of extreme overheating are present when relining brakes, the wheel cylinders should be disassembled and inspected for wear and dirt in the cylinder. The cylinder cups should be replaced thus avoiding future problems.

6. Inspect all other brake parts and replace any that are worn or damaged.

7. Inspect the brake drums and, if necessary, refinish. Refer to Part 2-2, Section 4 for refinishing.

BOOSTER UNIT

A disassembled view of the brake booster is shown in Fig. 3.

After disassembly, immerse all metal parts in a suitable solvent. Use only alcohol on rubber parts or parts containing rubber. After the parts have been thoroughly cleaned and rinsed in cleaning solvent, the metal parts which come in contact with hydraulic brake fluid or rubber parts should be rewashed in clean alcohol before assembly. Use an air hose to blow dirt and cleaning fluid from the recesses and internal passages. When overhauling a power booster, use all parts furnished in the repair kit. **Discard all old rubber parts.**

Inspect all other parts for damage or excessive wear. Replace damaged or excessively worn parts. If the inside of the booster body is rusted or corroded, polish it with steel wool or fine emery cloth. Replace the body shell when scored.

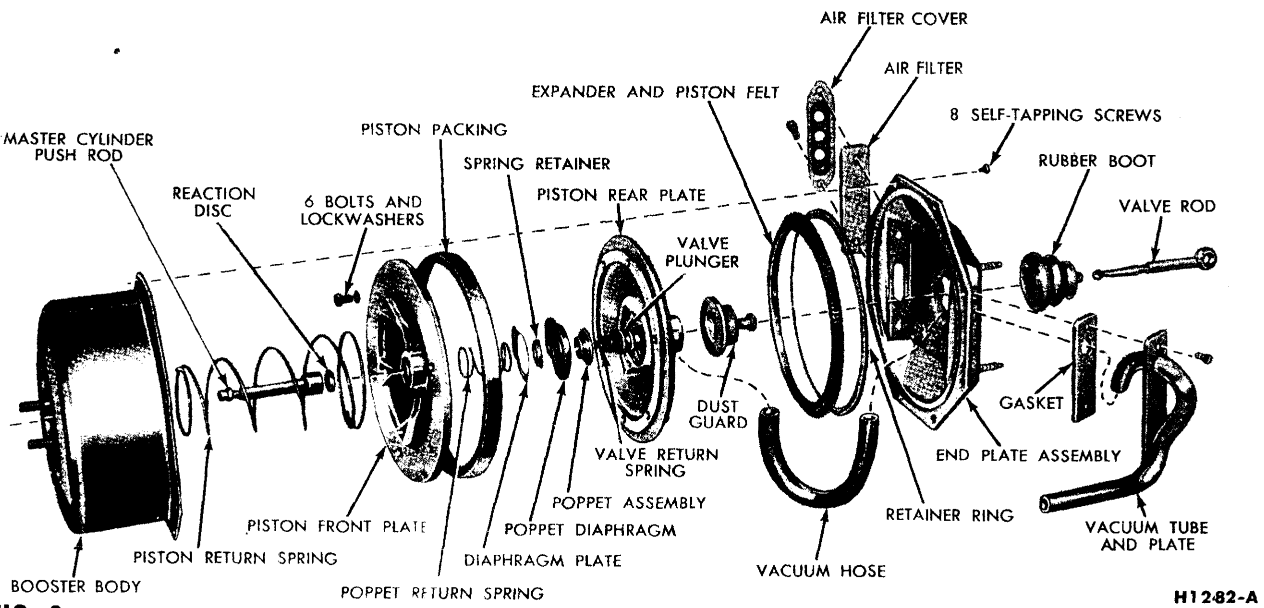


FIG. 3—Booster Unit Disassembled

PART 2-2 BRAKE SYSTEM

1 DESCRIPTION AND OPERATION

HYDRAULIC SELF-ADJUSTING BRAKE SYSTEM

The hydraulic brake system on the 1964 Lincoln employs single anchor, internal expanding and self-adjusting brake assemblies which are powered by a vacuum booster as standard equipment.

The master cylinder converts physical force from the brake pedal and booster into hydraulic pressure against the pistons in the wheel cylinders. The wheel cylinder pistons in turn convert hydraulic pressure back into physical force at the brake shoes.

The self-adjusting brake mechanism consists of a cable, cable guide, adjusting lever, and adjuster spring (Fig. 1). The cable is hooked over the anchor pin at the top and is connected to the lever at the bottom. The cable is connectd to the secondary brake shoe by means of the cable guide. The adjuster spring is hooked to the primary brake shoe and to the lever. The automatic adjuster operates only when the brakes are applied while the car is moving rearward and only when the secondary shoe is free to move toward the drum beyond a predetermined point.

With the car moving rearward and the brakes applied, the "wrap-around" action of the shoes following the drum forces the upper end of the primary shoe against the anchor pin. The action of the wheel cylinder moves the upper end of the secondary shoe away from the anchor pin. The movement of the secondary shoe causes the cable to pull the adjusting lever upward and against the end of a tooth on the adjusting screw star wheel. The upward travel of the lever increases as lining wear increases. When the lever can move upward far enough, it passes over the end of the tooth and engages the tooth. When the brakes are released, the adjusting spring pulls the lever downward causing the star wheel to turn and

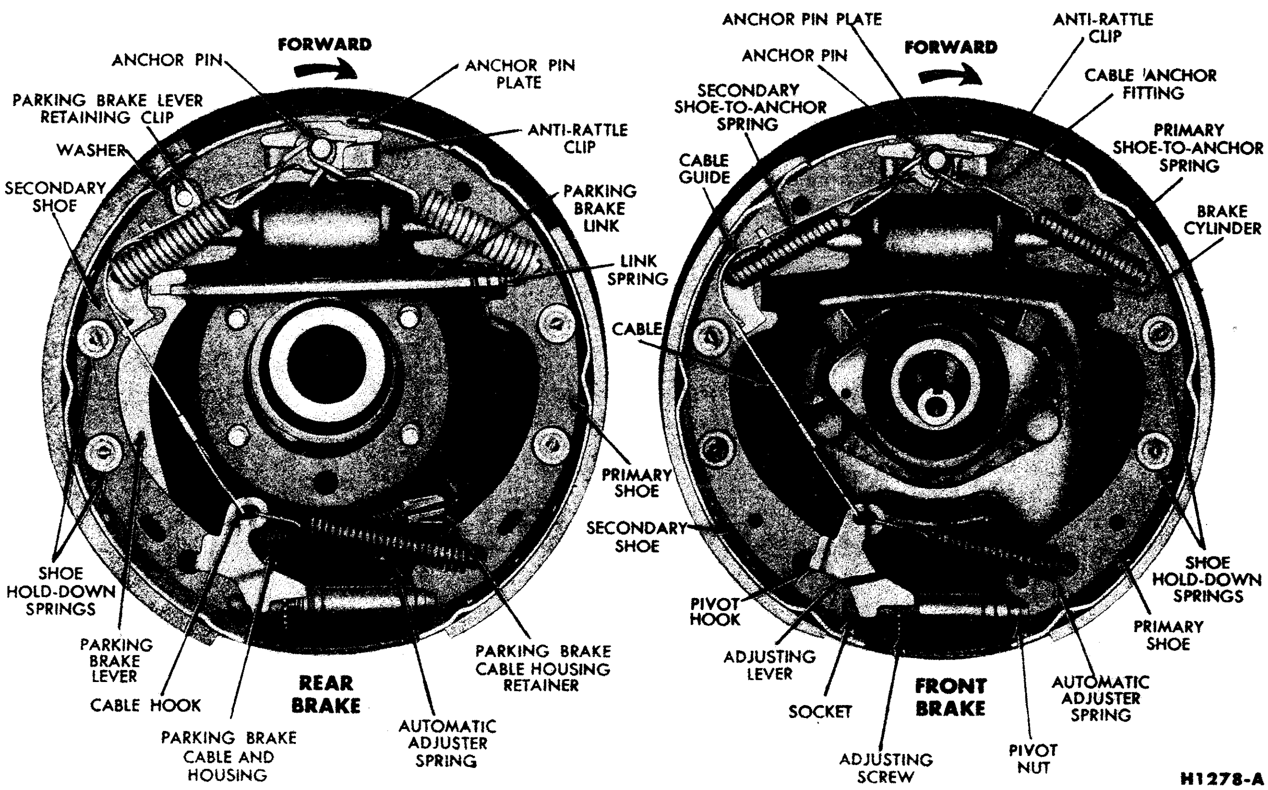


FIG. 1—Lincoln Self-Adjusting Brake Assemblies

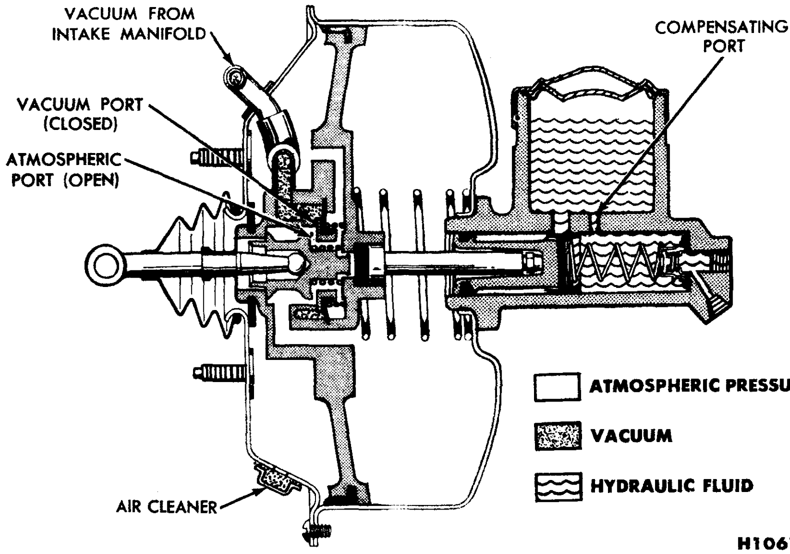


FIG. 2—Booster in Released Position

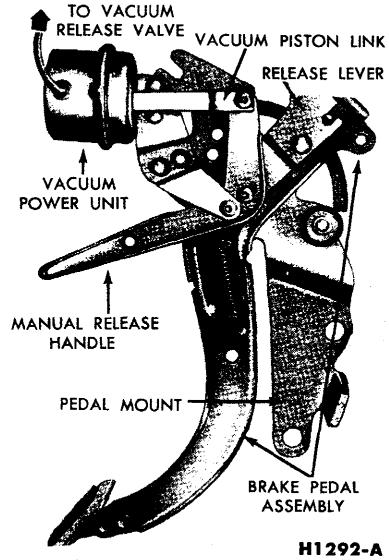


FIG. 4—Parking Brake Control Assembly

expand the shoes. The star wheel is turned one tooth at a time as the linings progressively wear.

With the car moving forward and the brakes applied, the secondary shoe is against the anchor pin and the primary shoe is moved toward the drum. Therefore, the adjuster does not operate.

The rear brake assembly is basically the same as the front brake. The conventional parking brake lever, link, and spring are used in the rear brake.

The anchor pins on all brakes are fixed and non-adjustable.

BOOSTER SYSTEM

The booster assembly (Figs. 2 and 3) is mounted on the engine side of the dash panel. A vacuum reservoir, mounted on the left front fender splash shield, gets its vacuum from the engine intake manifold. When the engine is stopped, a check valve traps vacuum in the reservoir.

The vacuum reservoir maintains enough vacuum (after the engine has stopped) for several power-assisted brake applications. Should the power unit fail, the car can still be braked, although greater pedal pressure by the driver will be necessary for a given application.

The chamber in back of the booster piston is at all times open to atmospheric pressure through an air cleaner. When the pedal is in the released position, the valve return spring holds the valve operating rod and plunger back against the piston rear plate leaving the atmospheric port open and the vacuum port closed (Fig. 2). The atmospheric pressure in the rear chamber is free to pass through the open atmospheric port of the valve and the porting in the piston to the chamber area in front of the piston. The booster piston is, therefore, balanced in atmosphere (atmospheric pressure on both sides) and does not move.

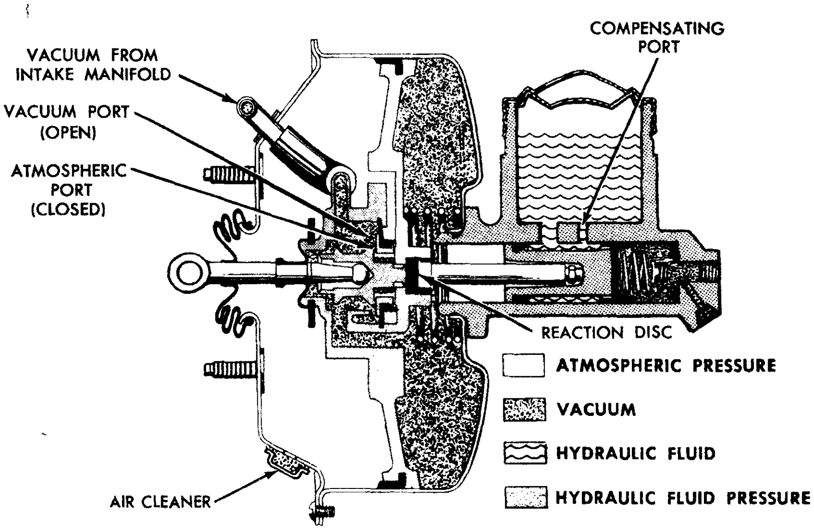


FIG. 3—Booster in Applied Position

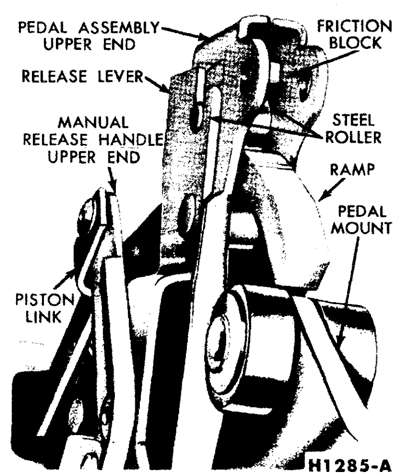


FIG. 5—Parking Brake Locking and Release Mechanism

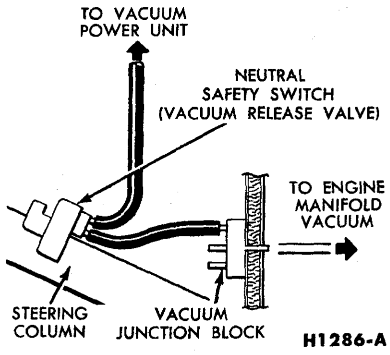


FIG. 6–Vacuum Connections for Automatic Parking Brake Release

As the brake pedal is depressed (Fig. 3), the valve operating rod and plunger move forward against the poppet valve to close the atmospheric port. Further travel of the rod and plunger moves the poppet away from the vacuum seat to open the vacuum port and establish direct connection between the intake manifold (or reservoir) through the porting in the valve and piston to the forward chamber. As vacuum removes air from the forward chamber, atmospheric pressure behind the booster piston exerts the force against the hydraulic push rod and piston that supplies the power assist. The amount of assist supplied by the power unit is always directly proportional to the amount of pressure being supplied to the pedal. Gradual application of the brakes is thus possible.

PARKING BRAKES

An independent foot-operated parking brake control actuates the rear wheel brake shoes through a cable linkage. The operating cable is routed from the parking brake control assembly to the equalizer lever which is attached to the equalizer assembly. The rear brake cables connect the equalizer assembly to the parking brake lever at each rear secondary shoe (Figs. 15 and 17).

When the pedal is depressed the secondary brake shoes are forced against the rear brake drums. The pedal is held in the applied position by the wedging action of a steel roller between a friction block and a ramp in the control assembly (Fig. 4).

A vacuum power unit will release the parking brakes automatically when the transmission selector lever is moved into any drive position with the engine running. The brakes will not release automatically, however, when the selector lever is in the neutral or park position with the engine running, or in any position with the engine off.

The parking brake control assembly is mounted to a bracket on the dash panel to the left of the steering column (Fig. 15). The pedal assembly pivots on the stationary pedal mount (Fig. 4). A steel roller and friction block are assembled to the upper end of the pedal. A steel ramp is attached to the pedal mount in such manner that the roller is positioned between the friction block and the ramp (Fig. 5). The angle of the friction block with respect to the ramp is such that the roller will ride on the ramp as the pedal is depressed; however, when the applying motion stops and the pedal starts to release, the roller becomes wedged between the friction block and the ramp thus locking the brakes in the applied position. Since the roller is mounted in the release lever, a slight movement of the release lever will force the roller out of its wedged position allowing the brakes to release. The release lever is actuated automatically by the vacuum control or by the manual release handle which is connected to the lever.

The vacuum power unit with mounting bracket is riveted to the control assembly. The vacuum actuated piston within the unit is connected by a link to the upper end of the release handle which actuates the release lever to move the steel roller out of the locked position (Figs. 4 and 5). The lower end of the release handle extends out for alternate manual release in the event of a vacuum power failure or for optional manual release at any time.

Hoses connect the power unit and the engine manifold to a vacuum release valve in the transmission neutral switch(Figs. 4 and 6). Moving the transmission selector lever into any drive position with the engine running will open the release valve to connect engine manifold vacuum to one side of the actuating piston in the power unit. The pressure differential thus created will cause the piston and link to pull the manual release handle which, in turn, actuates the release lever.

2 IN-CAR ADJUSTMENTS AND REPAIRS

BRAKE SHOE ADJUSTMENTS

The car should be in a raised position with the wheels off the floor. **If the car is raised on a frame-contact hoist, disconnect the parking brake cables to prevent the rear brakes from being partially applied due to rear axle and spring sag on the hoist.**

The hydraulic service brakes are self-adjusting and require a manual adjustment only after the brake shoes have been relined, replaced, or when the length of the adjusting screw has been changed while performing some other service operation.

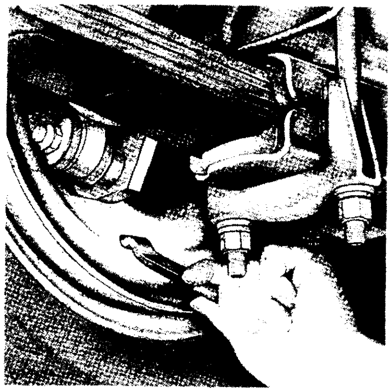
The brake drums should be at normal room temperature when adjusting the brake shoes. If the shoes are adjusted when the drums are hot and expanded, the shoes may drag when the drums are cool and contracted.

1. After the shoes have been installed or the adjusting screw has been turned, install the drum. Be sure that all excess grease, oil, and other foreign material are wiped off the backing plate and drum.

Before installing the brake drum on the front wheel spindle, wipe the spindle completely free of grease. Install the drum carefully so that the grease seal retainers within the hub will not be damaged.

2. Remove the adjusting hole cover from the backing plate and, from the backing plate side, turn the adjusting screw upward to expand the shoes (Fig. 7). Expand the shoes until a slight drag is felt when the drum is rotated.

3. **Remove the drum.** Mark the tooth on the star wheel where the lever contacts the adjusting screw. While holding the adjusting lever out of engagement with the adjusting screw, back off the adjusting screw with a ¾ turn with the fingers. If finger movement will not turn the screw, free it up; otherwise, the self-adjusting lever will not turn the screw. Lubricate the screw with a



H1315-A

FIG. 7—Expanding Brake Shoes

thin uniform coating of Stanolube—HD Moly Grease—Grade 2.

Any other adjustment procedure may cause damage to the adjusting screw with consequent self-adjuster problems.

4. Apply a small quantity of high-temperature grease to the points where the shoes contact the backing plate, being careful not to get the lubricant on the linings. Install the drum.

On front wheels, install the wheel outer bearing, washer, and adjusting nut, then adjust the wheel bearings as outlined in Part 3-1, Section 2.

On rear wheels, install the three Tinnerman nuts and tighten securely.

5. Install the wheel on the drum and tighten the mounting nuts to specification.

6. Install the adjusting hole cover on the brake backing plate.

7. When adjusting the rear brake shoes, check the parking brake cables for proper adjustment. Make sure that the equalizer lever operates freely.

8. After the brake shoes have been properly adjusted, check the operation of the brakes.

FRONT BRAKE DRUM

REMOVAL

1. Raise the car so that the wheel is clear of the floor.

2. Remove the hub cab, and remove the wheel from the drum. Remove the bearing dust cap, cotter pin, nut lock, adjusting nut, and washer.

3. Pull the brake drum approximately two inches outward and push back into position. Remove the wheel bearing and withdraw the brake drum.

If the brake drum will not come off easily, insert a narrow screwdriver through the brake adjusting hole in the backing plate, and disengage the adjusting lever from the adjusting screw. While thus holding the adjusting lever away from the adjusting screw, back off the adjusting screw with the brake adjusting tool 2018-A (Fig. 8). **Back off the adjustment only if the drum cannot be removed easily. Be very careful not to burr, chip, or damage the notches in the adjusting screw; otherwise, the self-adjusting mechanism will not function properly.** If the adjustment was changed, make sure that the adjuster lever seats properly in the shoe web.

INSTALLATION

1. If the drum is being replaced, remove the protective coating from the new drum with carburetor degreaser. Install new bearings and a grease retainer. Soak the new grease retainer in light engine oil at least 30 minutes before installation. Pack the wheel bearings, install the inner bearing cone and roller assembly in the inner cup, and install the new grease retainer. See Part 3-1, Section 2.

If the original drum is being installed, make sure that the grease in the hub is clean and adequate.

2. Install the drum assembly, outer wheel bearing, washer and adjusting nut.

3. Adjust the wheel bearing as outlined in Part 3-1, Section 2, then install the nut lock, cotter pin and the grease cap.

4. Install the wheel and hub cap. If the adjustment was backed off, adjust the brake as outlined under "Brake Shoe Adjustment".

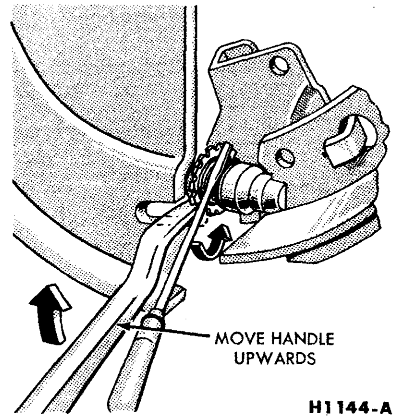
REAR BRAKE DRUM

REMOVAL

1. Raise the car so that the wheel is clear of the floor.

2. Remove the hub cap and wheel. Remove the three Tinnerman nuts and remove the brake drum.

If the brake drum will not come off, insert a narrow screwdriver through the brake adjusting hole in the backing plate, and disengage the adjusting lever from the adjusting screw. While thus holding the adjusting lever away from the adjusting screw, back off the adjusting screw with the brake adjusting tool (Fig. 8).



H1144-A

FIG. 8—Backing off Brake Adjustment

Back off the adjustment only if the drum cannot be removed easily. Be very careful not to burr, chip, or damage the notches in the adjusting screw; otherwise, the self-adjusting mechanism will not function properly.

INSTALLATION

1. Remove the protective coating from a new drum with carburetor degreaser.

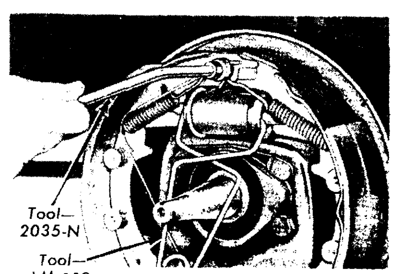
2. Place the drum over the brake assembly and into position. Install the three Tinnerman nuts and tighten securely.

3. Install the wheel. If the adjustment was backed off, adjust the brake as outlined under "Brake Shoe Adjustments".

BRAKE SHOES AND ADJUSTING SCREW

REMOVAL

1. With the wheel and drum removed, install a clamp over the ends



H1281-A

FIG. 9—Retracting Spring Removal

of the brake cylinder as shown in Fig. 9.

2. Contract the shoes as follows:

a. Disengage the adjusting lever from the adjusting screw by pulling backward on the adjusting lever (Fig. 1).

b. Move the outboard side of the adjusting screw upward and back off the pivot nut and as far as it will go.

3. Pull the adjusting lever, cable and automatic adjuster spring down and toward the rear to unhook the pivot hook from the large hole in the secondary shoe web. **Do not attempt to pry the pivot hook out of the hole.**

4. Remove the automatic adjuster spring and adjusting lever (Fig. 1).

5. Remove the primary shoe to anchor spring with the tool shown in Fig. 9. With the same tool, remove the secondary shoe to anchor spring and unhook the cable eye from the anchor pin.

6. Remove the anchor pin plate and the anti-rattle clip.

7. Remove the cable guide from the secondary shoe (Fig. 1).

8. Remove the shoe hold down springs, shoes, adjusting screw, pivot nut, and socket.

9. On rear brakes, remove the parking brake link and spring. Disconnect the parking brake cable from the parking brake lever.

10. After removing the rear brake secondary shoe, disassemble the parking brake lever from the shoe by removing the retaining clip and spring washer (Fig. 1).

INSTALLATION

1. Back off the parking brake adjustment.

2. Before installing the rear brake shoes, assemble the parking brake lever to the secondary shoe and secure with the spring washer and retaining clip.

3. Apply a light coating of high-temperature grease at the points where the brake shoes contact the backing plate.

4. Position the brake shoes on the backing plate and secure the assembly with the hold down springs. On the rear brake, install the parking brake link and spring. Connect the parking brake cable to the parking brake lever (Fig. 1).

5. Install the anti-rattle clip and the anchor pin plate on the anchor pin.

6. Place the cable eye over the anchor pin with the crimped side toward the backing plate.

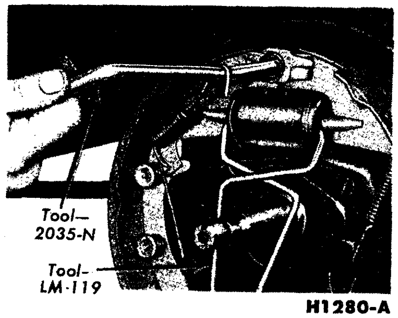


FIG. 10—Retracting Spring Installation

7. Install the cable guide on the secondary shoe web with the flanged hole fitted into the hole in the secondary shoe web. Thread the cable around the cable guide groove (Fig. 1).

It is imperative that the cable be positioned in this groove and not between the guide and the shoe web.

8. Install the secondary shoe to anchor spring (Fig. 10).

9. Install the primary shoe to anchor spring with the tool shown in Fig. 10.

Be certain that the cable eye is not cocked or binding on the anchor pin when installed. All parts should be flat on the anchor pin. Remove the brake cylinder clamp.

10. Apply high-temperature grease (Stanalube-HD Moly Grease—Grade 2) to the threads and the socket end of the adjusting screw. Turn the adjusting screw into the adjusting pivot nut to the limit of the threads and then back off ½ turn.

Interchanging the brake shoe adjusting screw assemblies from one side of the car to the other would cause the brake shoes to retract rather than expand each time the automatic adjusting mechanism operated. To prevent installation on the wrong side of the car, the socket end of the adjusting screw is stamped with an R or L (Fig. 11). The adjusting pivot nuts can be distinguished by the number of grooves machined around the body of the nut. Two grooves indicate a right hand nut; one groove indicates a left hand nut.

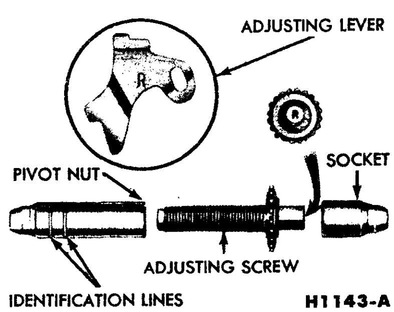


FIG. 11—Adjusting Screws and Lever Identification

11. Place the adjusting socket on the screw and install this assembly between the shoe ends with the adjusting screw toothed wheel nearest the secondary shoe.

12. Hook the cable hook into the hole in the adjusting lever. The adjusting levers are stamped with an R or L to indicate their installation on a right or left hand brake assembly (Fig. 11).

13. Position the hooked end of the adjuster spring completely into the large hole in the primary shoe web. The last coil of the spring should be at the edge of the hole. Connect the loop end of the spring to the adjuster lever hole (Fig. 1).

14. Pull the adjuster lever, cable and automatic adjuster spring down and toward the rear to engage the pivot hook in the large hole in the secondary shoe web (Fig. 1).

15. After installation, check the action of the adjuster by pulling the section of the cable between the cable guide and the adjusting lever toward the secondary shoe web far enough to lift the lever past a tooth on the adjusting screw wheel. The lever should snap into position behind the next tooth, and release of the cable should cause the adjuster spring to return the lever to its original position. This return action of the lever will turn the adjusting screw one tooth.

If pulling the cable does not produce the action described, or if the lever action is sluggish instead of positive and sharp, check the position of the lever on the adjusting screw toothed wheel. With the brake in a vertical position (anchor at the top), the lever should contact the adjusting wheel $\frac{3}{16}$ inch ($\pm \frac{1}{32}$ inch) above the centerline of the screw. If the contact point is below this centerline, the lever will not lock on the teeth in the adjusting screw wheel, and the screw will not be turned as the lever is actuated by the cable.

To determine the cause of this condition:

a. Check the cable end fittings.

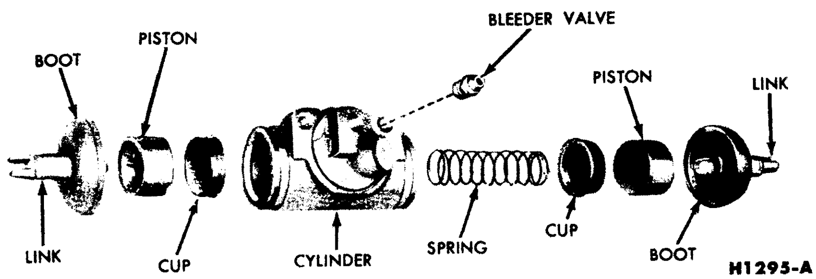


FIG. 12—Wheel Cylinder

The cable should completely fill or extend slightly beyond the crimped section of the fittings. If it does not meet this specification, possible damage is indicated and the cable assembly should be replaced.

b. Check the cable length. The cable should measure 11⅛ inches (± 1/64 inch) from the end of the cable anchor to the end of the cable hook.

c. Check the cable guide for damage. The cable groove should be parallel to the shoe web, and the body of the guide should lie flat against the web. Replace the guide if it shows damage.

d. Check the pivot hook on the lever. The hook surfaces should be square with the body of the lever for proper pivoting. Replace the lever if the hook shows damage.

e. See that the adjusting screw socket is properly seated in the notch in the shoe web.

WHEEL CYLINDER REPAIR

DISASSEMBLY

1. Remove the links and the rubber boots from the ends of the brake cylinder. Remove the pistons, cups, and return spring from the cylinder bore (Fig. 12).

2. Remove the bleeder screw from the cylinder.

INSPECTION

1. Wash all parts in clean denatured alcohol. If alcohol is not available, use specified brake fluid. Dry with compressed air.

2. Check all internal parts for excessive wear or damage. **If any of the internal parts require replacing, all should be replaced.**

3. Inspect the cylinder bore for score marks or rust. If either condition is present, the cylinder bore must be honed. **However, the cylinder should not be honed more than 0.003 inch beyond its original diameter.**

4. Check the bleeder hole to be sure that it is open.

ASSEMBLY

1. Apply a coating of heavy-duty brake fluid to all internal parts.

2. Thread the bleeder screw into the cylinder and tighten securely.

3. Insert the return spring, cups, and pistons into their respective positions in the cylinder bore (Fig. 12). Place a boot over each end of the cylinder.

WHEEL CYLINDER REPLACEMENT

REMOVAL

1. With the wheel in a raised position, remove the wheel and the drum.

2. Remove the brake shoe assemblies following procedures outlined in this section.

3. Disconnect the brake line from the brake cylinder. **Be sure the engine is stopped and there is no vacuum in the booster system before disconnecting the hydraulic lines.**

To disconnect the hose at a front cylinder, loosen the tube fitting that connects the opposite end of the hose to the brake tube at a bracket on the frame. Remove the horseshoe-type retaining clip from the hose and bracket, disengage the hose from the bracket, then unscrew the entire hose assembly from the front brake cylinder.

At a rear cylinder, unscrew the tube fitting that connects the tube to the cylinder. **Do not pull the metal tube away from the cylinder. Pulling the tube out of the cylinder connection will bend the metal tube and make installation difficult.** The tube will separate from the cylinder when the cylinder is removed from the backing plate.

4. Remove the brake cylinder retaining bolts and lock washers and remove the cylinder. Remove the clamp from the cylinder.

INSTALLATION

Wipe the end(s) of the hydraulic line to remove any foreign matter before making connections.

1. **To install a front cylinder:**
   a. Insert the front cylinder into the opening on the backing plate with the inlet toward the rear of the car. Install the retaining bolts and lock washers.
   b. Install a new copper gasket over the hose fitting. Screw the hose assembly into the cylinder.
   c. Engage the opposite end of the hose to the bracket on the frame, install the horseshoe-type retaining clip, and connect the brake tube to the hose with the tube fitting nut. Tighten the nut to specification.
2. **To install a rear cylinder:**
   a. Place the rear wheel cylinder into position. Enter the tubing into the cylinder, and start the tube fitting nut into the threads of the cylinder.
   b. Secure the cylinder to the backing plate by installing the retaining bolts and lock washers.
   c. Tighten the tube fitting nut to specification.

3. Install the links in the ends of the brake cylinder, install the shoe and adjuster assemblies, and adjust the shoes as outlined in this section.

4. Install the brake drum and wheel, and bleed the brakes as outlined in Part 2-1, Section 2.

BRAKE BACKING PLATE REPLACEMENT

REMOVAL

1. Remove the wheel and brake drum. Disconnect the brake line from the brake cylinder.

2. Remove the brake shoe and adjuster assemblies and the wheel cylinder as outlined in this section. On the rear wheels, disconnect the parking brake lever from the cable.

3. If the rear backing plate is being replaced, rotate the axle shaft so that the hole in the axle shaft

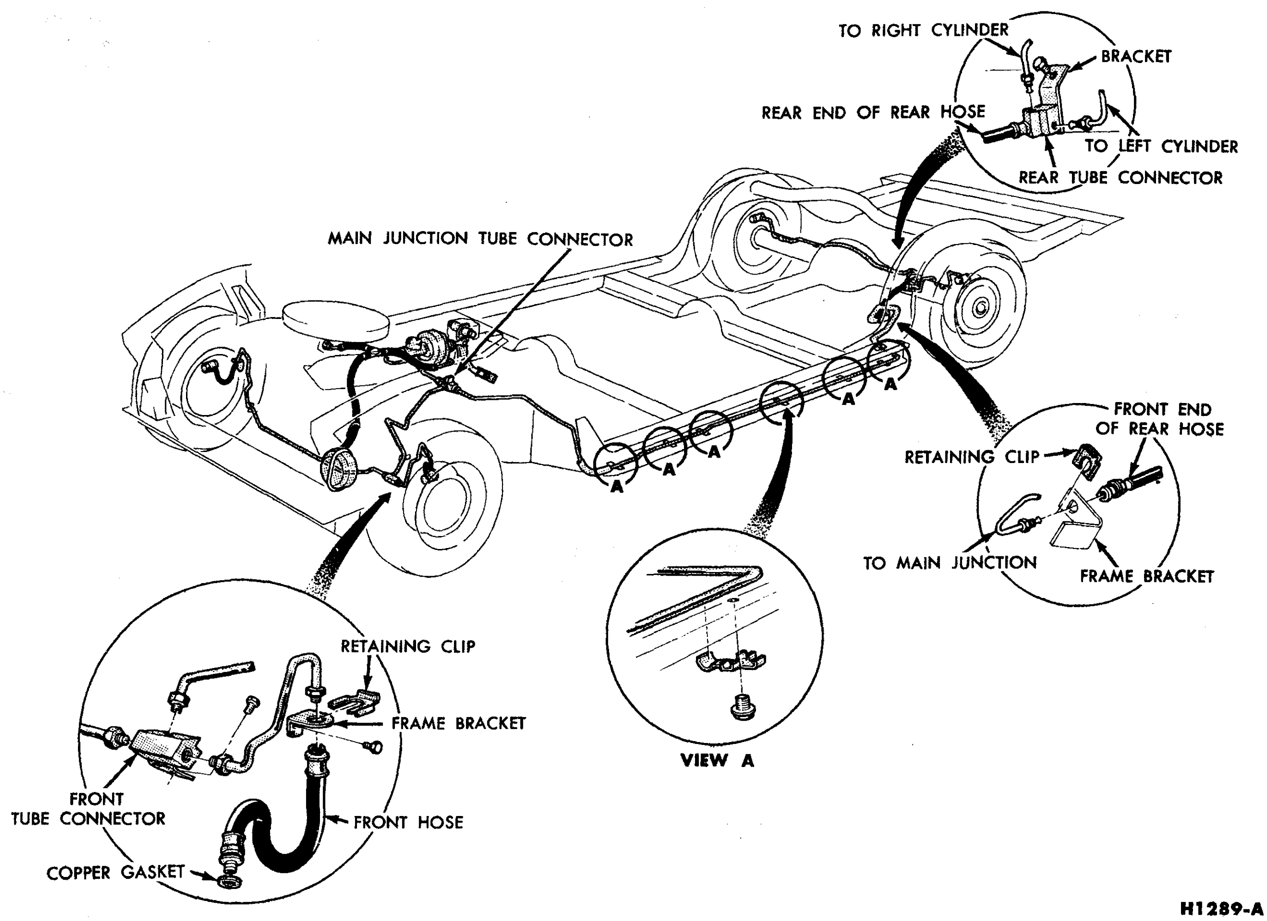


FIG. 13—Service Brake System

flange lines up with the backing plate retaining nuts, and remove the nuts. Pull the axle shaft assembly out of the housing with tool 4235C and a slide hammer (Part 4-2), then remove the backing plate.

If the front backing plate is being replaced, remove the bolts and nuts that secure the plate to the front wheel spindle and remove the plate.

INSTALLATION

1. Position a new **rear** backing plate on the retaining bolts in the axle housing flange. Insert the axle shaft into the housing so that the splines engage the differential side gear with the bearing retainer sliding onto the retaining bolts and against the backing plate. Install the retaining nuts through the access hole in the axle shaft flange.

Position a new **front** backing plate to the wheel spindle and install the retaining bolts and nuts.

2. Install the wheel cylinder and connect the brake line as outlined in this section.

3. Install the brake shoe and adjuster assemblies as outlined in this section. On a rear brake, connect the parking brake cable to the lever. Install the brake drum and wheel.

4. Adjust the brake shoes and bleed the brake system as outlined in this section.

HYDRAULIC LINES

Steel tubing is used throughout the brake system with the exception of the flexible hoses at the front wheels and at the rear axle housing brake tube connector (Fig. 13).

Always bleed the entire system after any hose or line replacement.

BRAKE TUBE REPLACEMENT

If a section of the brake tubing becomes damaged, the entire section should be replaced with tubing of the same type, size, shape, and length. **Copper tubing should not be used in a hydraulic system.** When bending brake tubing to fit underbody or rear axle contours, be careful not to kink or crack the tube.

All brake tubing should be flared properly to provide good leak-proof connections. Clean the brake tubing by flushing with clean denatured alcohol before installation.

When connecting a tube to a hose, tube connector, or brake cylinder, tighten the tube fitting nut to the specified torque with Milbar tool 1112-144 or equivalent.

BRAKE HOSE REPLACEMENT

A flexible brake hose should be replaced if it shows signs of softening, cracking, or other damage.

When installing a new front brake hose, position the hose to avoid contact with other chassis parts. Place a new copper gasket over the hose fitting and screw the hose assembly into the front brake cylinder. Engage the opposite end of the hose to the bracket on the frame so that the hose is 3/8-5/8 inch from the lower flange of the No. 2 cross member with the suspension at normal position (Fig. 13). Install the horseshoe-type retaining clip, and connect the tube to the hose with the tube fitting nut.

A rear brake hose should be installed so that it does not touch the muffler outlet pipe or shock absorber.

Place a new gasket over the rear hose fitting and screw the hose assembly into the rear brake tube connector. Engage the front end of the hose to the bracket on the frame so that the hose bends are in a plane between the bracket and connector. Install the horseshoe-type retaining clip, and connect the tube to the hose with the tube fitting nut.

3 REMOVAL AND INSTALLATION

MASTER CYLINDER

REMOVAL

1. Disconnect the battery ground cable.
2. Remove the hydraulic line outlet fitting from the master cylinder.
3. Disconnect the stop light switch wires. **It is not necessary to remove the stop light switch.**
4. Remove the two nuts and lock washers that secure the master cylinder to the booster unit (Fig. 14). Separate the master cylinder from the booster unit and make sure that the master cylinder does not rest on the push rod.
5. Remove the rubber seal from the outer groove at the end of the master cylinder.
6. Remove the push rod from the power unit. **Do not disturb the adjusting screw.**

INSTALLATION

1. Apply a light coating of lubricant COAZ-19584-A to the piston end of the hydraulic push rod and guide the piston end of the push rod into the center bore of the booster piston.
2. Twist the push rod to make certain the end of the piston is bottomed against the reaction disc and there is no air pocket between the end of the push rod and the reaction disc.
3. Before proceeding with the installation, check the distance from the outer end of the push rod to the master cylinder mounting surface at the end of the vacuum cylinder (Part 2-1, Fig. 1). This dimension should be from 1.175 to 1.180 inch measured metal to metal. If the push rod dimension is not correct, see "Master Cylinder Push Rod Adjustment", Part 2-1, Section 2.
4. When the push rod adjustment is correct, replace the rubber seal in the groove at the end of the master cylinder.
5. Position the master cylinder over the push rod onto the two studs that are integral with the booster body.
6. Install the attaching nuts and lock washers and torque the nuts to specifications.
7. Replace the stop light switch wires.
8. Install the master cylinder hydraulic line outlet fitting.
9. Bleed the brake system. Fill the master cylinder to ¼-½ inch from the top of the filler opening. Replace the filler cap and gasket.
10. Connect the battery ground cable.

FIG. 14—Master Cylinder and Booster Installation

BOOSTER UNIT

REMOVAL

1. Disconnect the battery ground cable.
2. Remove the three retaining bolts, nut and washer, and remove the two left side fender apron-to-cowl braces for access (Fig. 14).
3. From inside the car, remove the six retaining screws and the instrument panel lower outer extension from the underside of the instrument panel.

Before removing the lower outer extension from cars equipped with a speed control, remove the control head (two retaining screws) from the underside of the instrument panel. Disconnect the light and wire (plug-in connector) from the control lead.

4. Remove the C-washer that retains the brake pedal to booster push rod (Fig. 16), and disconnect the rod from the pedal. Remove the nylon bushings from the rod.
5. Loosen the hood release handle-to-bracket lock nut, and remove the release handle and cable assembly from the bracket to obtain clearance for removing the booster retaining nuts.
6. Remove the five retaining nuts from the booster mounting studs at the passenger side of the dash panel.
7. From under the hood, disconnect the vacuum hose from the booster and remove the booster assembly.

INSTALLATION

1. Install the booster assembly on the engine side of the dash panel. The mounting studs and valve rod go through the holes in the dash panel.
2. Connect the vacuum hose to the booster. A new clamp will be required.
3. From inside the car, install the booster retaining nuts on the mounting studs and torque them to specifications.
4. Install the nylon bushings in the eye of the push rod. Use grease to lubricate the bushings.
5. Connect the push rod to the brake pedal assembly and secure with the C-washer (Fig. 16).
6. Position the hood release handle and cable assembly in the bracket at the bottom of the instrument panel, and tighten the lock nut.
7. Position the lower outer extension assembly to the underside of the instrument panel and secure with six attaching screws.

On cars equipped with a speed control, connect the light and wire (plug-in connector) to the control head. Mount the control head to the underside of the instrument panel and secure with two screws.

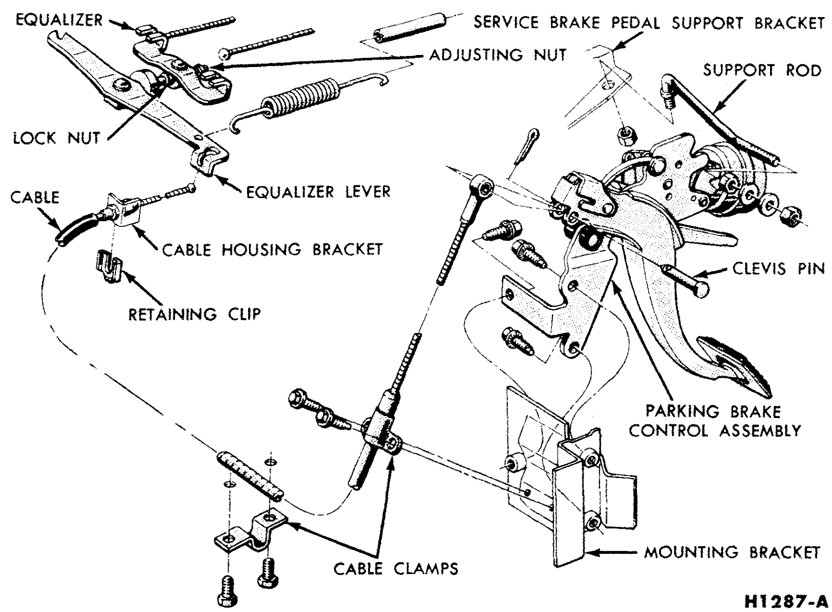


FIG. 15—Parking Brake Control and Linkage Connections

8. Connect the vacuum hose to the booster and secure with the hose clamp.

9. Install the two left side fender apron-to-cowl braces and secure in place with the three retaining bolts, nut, and washer.

10. Connect the battery ground cable.

11. Bleed the brakes as detailed in Part 2-1, Section 2.

VACUUM RESERVOIR

REMOVAL

1. Raise the front of the car.
2. Loosen the clamp and disconnect the vacuum hose at the reservoir fitting.
3. Remove the two reservoir bracket retaining screws and remove the reservoir.

INSTALLATION

1. Position the reservoir, and secure it with the two bracket retaining screws.
2. Install the hose and new clamp on the reservoir fitting and tighten the clamp.
3. Lower the front of the car.

PARKING BRAKE CONTROL ASSEMBLY

REMOVAL

1. Disconnect the parking brake cable from the equalizer lever underneath the car (Figs. 15 and 17).
2. Disconnect and remove the support rod from the parking brake control assembly and the service brake pedal support bracket (Fig. 15).
3. Remove the control assembly-to-mounting bracket screws.
4. Disconnect the hose from the vacuum power unit.
5. With the parking brake in the fully released position, remove the cotter pin and clevis pin.
6. Disconnect the operating cable from the clevis, and remove the control assembly.

INSTALLATION

1. Attach the parking brake cable to the clevis on the control assembly and secure with the clevis pin and cotter pin (Fig. 15).
2. Connect the hose to the vacuum power unit.
3. Position the parking brake control assembly to the mounting bracket on the dash panel, and install the mounting screws.
4. Connect the support rod to the parking brake control assembly and to the service brake pedal support bracket.
5. From underneath the car, connect the ball end of the operating cable to the equalizer lever.
6. Adjust the parking brake linkage.
7. Check the operation of the automatic release.

PARKING BRAKE VACUUM POWER UNIT

REMOVAL

1. Remove the parking brake control assembly from the car as described under "Removal" in the foregoing procedure.
2. Drill out or grind off the two rivets that retain the vacuum power unit to the parking brake control assembly.
3. Drill out or grind off the rivet that connects the vacuum piston link to the release lever, and remove the power unit.

INSTALLATION

1. Position the vacuum power unit on the parking brake control assembly and secure with two round head bolts and nuts.
2. Connect the vacuum piston link to the release lever with a shoulder

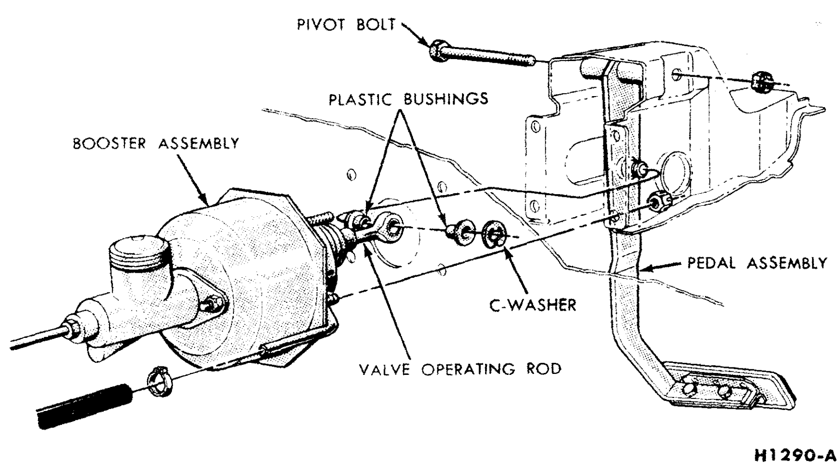


FIG. 16—Brake Pedal and Related Parts

bolt nut and wave washer. The wave washer is positioned on the shoulder bolt between the vacuum piston link and the release lever. The link and release lever must pivot freely.

3. Install the parking brake control assembly in the car as described under "Installation" in the foregoing procedure.

4. Test the lock and automatic release operations of the parking brake control assembly with the engine running in all the transmission selector lever positions. With the engine running, the parking brake should remain engaged in neutral or park and should release in any drive position.

BRAKE PEDAL

REMOVAL

1. Disconnect the battery ground cable.

2. From inside the car, remove the six retaining screws and the instrument panel lower outer extension from the underside of the instrument panel.

Before removing the lower outer extension from cars equipped with a speed control, remove the control head (two retaining screws) from the underside of the instrument panel. Disconnect the light and wire (plug-in connector) from the control lead.

3. Remove the C-washer that retains the push rod to the brake pedal assembly (Fig. 16), and disconnect the rod from the pedal. Remove the bushings from the rod.

4. Remove the nut from the brake pedal pivot bolt.

5. On cars equipped with air conditioning, remove the air conditioning icing switch, motor and bracket. Remove the pivot bolt and the brake pedal assembly from the support bracket.

INSTALLATION

1. Position the brake pedal assembly in the support bracket and install the pivot bolt and nut. Install the air conditioning icing switch, motor and bracket assembly on cars so equipped.

2. Install the nylon bushings in the eye of the push rod. Lubricate the bushings. Connect the push rod to the brake pedal assembly and secure with the C-washer (Fig. 16).

3. Position the hood release handle and cable assembly in the bracket at the bottom of the instrument panel, and tighten the lock nut.

4. Position the lower outer extension assembly to the underside of

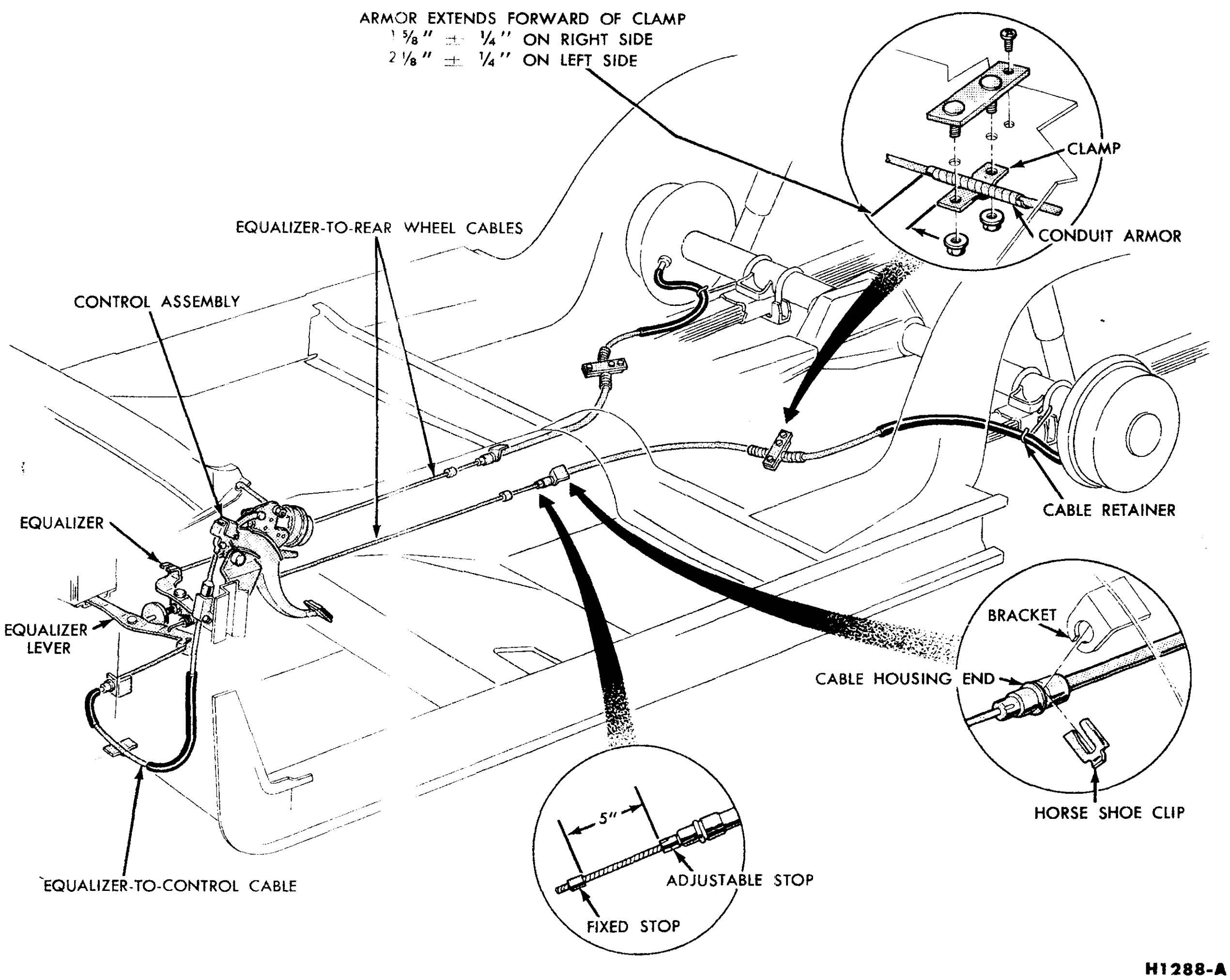


FIG. 17—Parking Brake System

the instrument panel and secure with six attaching screws.

On cars equipped with a speed control, connect the light and wire (plug-in connector) to the control head. Mount the control head to the underside of the instrument panel and secure with two screws.

5. Connect the battery ground cable.

6. Start the engine and apply the brakes to make sure that they are operating properly.

PARKING BRAKE EQUALIZER TO CONTROL ASSEMBLY CABLE

REMOVAL

1. Disconnect the parking brake cable from the equalizer lever underneath the car (Figs. 15 and 17).

2. Disconnect and remove the support rod from the parking brake control assembly and the service brake pedal support bracket (Fig. 15).

3. Remove the control assembly-to-mounting bracket screws.

4. Disconnect the hose from the vacuum power unit.

5. With the parking brake in the fully released position, remove the cotter pin and clevis pin.

6. Disconnect the operating cable from the clevis, and remove the control assembly.

7. Remove the left front fender splash shield.

8. Remove the retaining bolts and cable clamps (Fig. 15).

9. Remove the underbody support plate.

10. Remove the horseshoe-type retaining clip at the cable bracket, and disengage the cable from the bracket (Fig. 15). Remove the cable.

INSTALLATION

1. Engage the parking brake cable housing with the bracket and secure with the horseshoe-type retaining clip (Fig. 15).

2. Install the underbody support plate.

3. Position the cable and retaining clamps at the underbody and mounting bracket, then install the clamp retaining bolts (Fig. 15).

4. Install the left front fender splash shield.

5. Attach the parking brake cable to the clevis on the control assembly and secure with the clevis pin and cotter pin (Fig. 15).

6. Connect the hose to the vacuum power unit.

7. Position the parking brake control assembly to the mounting bracket on the dash panel, and install the mounting screws.

8. Connect the support rod to the parking brake control assembly and to the service brake pedal support bracket.

9. From underneath the car, connect the ball end of the operating cable to the equalizer lever.

10. Adjust the parking brake linkage.

11. Check the operation of the automatic release.

PARKING BRAKE EQUALIZER TO REAR WHEEL CABLE

REMOVAL

1. Raise the car and remove the hub cap and wheel.

2. Remove the three Tinnerman nuts that hold the brake drum in place, and remove the drum.

3. Loosen the equalizer rod adjusting nut and disconnect the cable from the equalizer (Fig. 15).

4. Remove the horseshoe-type clip that retains the cable housing to the body bracket and pull the cable and housing out of the bracket (Fig. 17).

5. Remove the clamp retaining nuts and the cable clamp. Disengage the cable housing from the hook-type retainer at the spring U-bolt.

6. Working on the wheel side of the backing plate (Fig. 1), compress the prongs on the cable retainer so that they can pass through the hole in the backing plate. Draw the cable retainer out of the hole.

7. With the spring tension off the parking brake lever, lift the cable out of the slot in the lever and remove it through the backing plate hole.

INSTALLATION

1. Pull enough of the cable through the housing so that the end of the cable may be inserted through the backing plate hole from the inner side and engaged with the slot in the parking brake lever.

2. Pulling the excess slack from the cable, insert the cable housing into the backing plate access hole so that the retainer prongs expand (Fig. 1).

3. Position the cable to the underbody and install the retaining clamp so that the cable conduit armor extends forward of the clamp as shown in Fig. 17. Install the clamp retaining nuts.

4. Hook the cable housing to the retainer at the spring U-bolt.

5. Engage the forward end of the cable housing with the frame bracket and secure with the horseshoe-type clip.

6. While holding the adjustable cable stop against the cable housing end, pull the cable through the housing until there is a distance of five inches between the two stops as shown in Fig. 17. Crimp the adjustable stop against the cable to hold this dimension.

7. Insert the ball end of the cable into the equalizer.

8. Install the rear drum. Tighten the three Tinnerman nuts that retain the drum and install the wheel and hub cap.

9. Adjust the parking brake linkage as outlined in Part 2-1, Section 2.

4 MAJOR REPAIR OPERATIONS

BRAKE DRUM REFINISHING

Minor scores on a brake drum can be removed with a fine emery cloth. A drum that is excessively scored or shows a total indicator runout of over 0.007 inch should be turned down. Remove only enough stock to eliminate the scores and true up the drum. The refinished diameter must not exceed 0.060 inch oversize (11.150 inches).

If the drum diameter is less than 0.030 inch oversize (11.120 inches) after refinishing, standard linings must be installed. If the drum diameter is 11.120-11.150 inches, oversize linings must be installed.

After a drum is turned down, wipe the refinished surface with a cloth soaked in clean, denatured alcohol. If one drum is turned down, the opposite drum on the same axle should also be cut down to the same size.

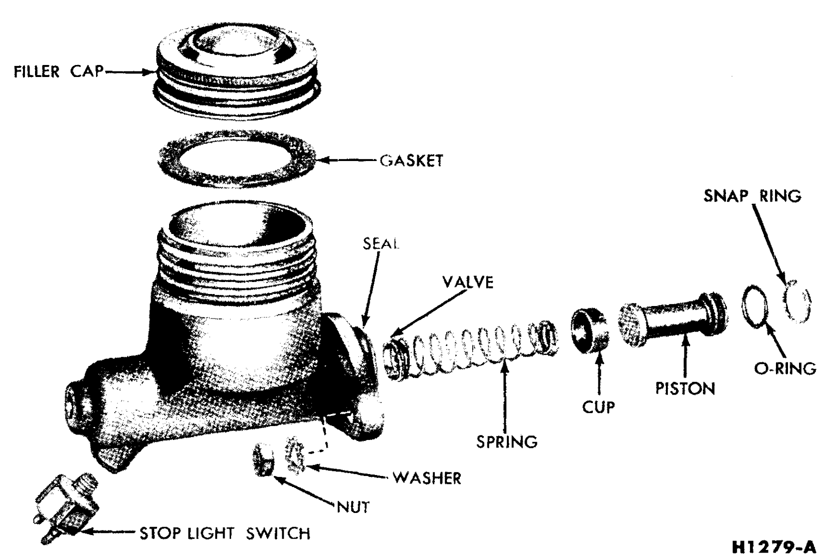


FIG. 18—Brake Master Cylinder Disassembled

BRAKE SHOE RELINING

Brake linings that are worn to within 1/32 inch of the rivet or have been saturated with grease or oil should be replaced. Failure to replace worn linings will result in a scored drum. **When it is necessary to replace linings, they must also be replaced on the wheel on the opposite side of the car.**

Inspect brake shoes for distortion. cracks, or looseness. If this condition exists, the shoe should be discarded. **Do not repair a defective brake shoe.**

1. Wash the brake shoes thoroughly in a clean solvent. Remove all burrs or rough spots from the shoes.

2. Check the inside diameter of the brake drum. If the diameter is less than 11.120 inches, standard linings may be installed. If the diameter is 11.120-11.150 inches, oversize linings should be installed.

3. Position the new lining on the shoe. Starting in the center, insert and secure the rivets, working alternately towards each end. Install all parts supplied in the kit. **Genuine Lincoln replacement linings are ground and no further grinding is required.**

4. Check the clearance between the shoe and lining. The lining must seat tightly against the shoe with not more than 0.005-inch clearance between any two rivets.

MASTER CYLINDER DISASSEMBLY

1. Clean the outside of the cylinder, and remove the filler cap and gasket. Pour out any brake fluid that may remain in the cylinder or reservoir.

2. Remove the stop light switch and the brake line fitting from the forward end of the cylinder (Fig. 18).

3. Remove the snap ring from the bore at the rear of the cylinder with tool 33621 (Fig. 19).

4. Remove the piston assembly, cup, and the spring and check valve assembly from the cylinder bore. Remove the O-ring from the piston.

CLEANING, INSPECTION, AND REPAIRS

1. Clean all master cylinder parts in clean, denatured alcohol, and inspect the parts for wear or damage, replacing them as required. **When using a master cylinder repair kit, install all the parts supplied.**

2. Check the ports and vents in the master cylinder to make sure that all are open and free of foreign matter.

3. Check the ports in the piston to make sure that they are open and free of foreign material.

4. Inspect the cylinder walls for scores or rust, and recondition them if necessary. **Hone the cylinder walls no more than necessary (0.003 inch maximum). Oversize pistons and cups are not available for excessively honed cylinders.**

5. Remove any burrs or loose metal that may have resulted from the honing operation, and clean the cylinder with denatured alcohol.

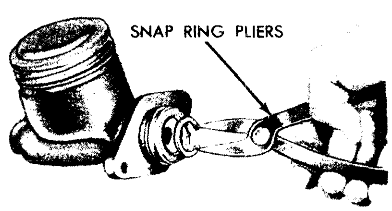


FIG. 19—Removing Snap Ring from Master Cylinder H1291-A

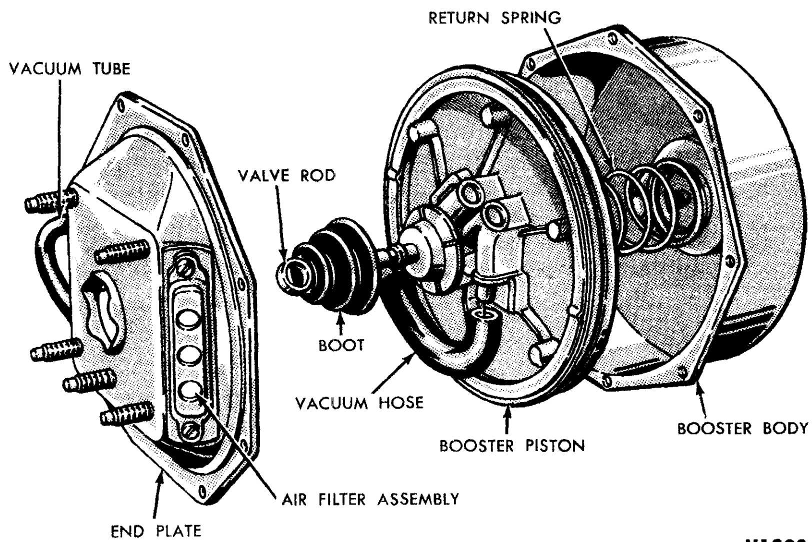


FIG. 20—End Plate and Piston Removed

ASSEMBLY

1. Dip all parts except the master cylinder body in clean FoMoCo **heavy-duty** brake fluid.
2. Install the brake line fitting and the stop light switch on the cylinder and tighten them securely.
3. Install the O-ring on the piston. Install the spring, seal, and check valve assembly, seal, cup, and piston in the cylinder bore (Fig. 18).
4. Install the snap ring in the rear end of the bore (Fig. 19).

DISASSEMBLY OF BOOSTER UNIT

When overhauling the assembly, always use a repair kit. If replacement of the piston packing or diaphragm is necessary, use a piston packing and diaphragm kit.

REMOVAL OF END PLATE, AIR CLEANER AND BOOSTER PISTON

1. Disengage the rubber boot from the scalloped flange of the end plate, and slide the boot back on the push rod.
2. Scribe alignment marks across the end plate and booster body. Remove six of the eight end plate attaching screws, leaving two opposite screws. Press down on the end plate while removing the remaining two screws to prevent the piston return spring from expanding.
3. Scribe across the face of the piston to register with the mark on the end plate; then, remove the end plate with the booster piston and piston return spring.

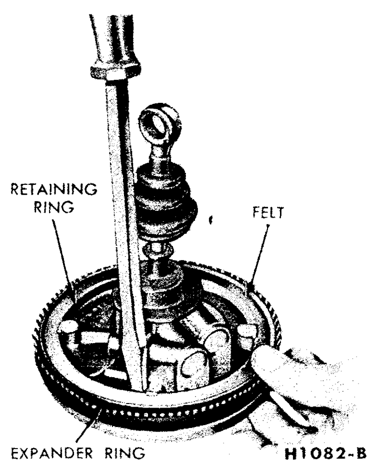


FIG. 21—Retaining Ring Removal

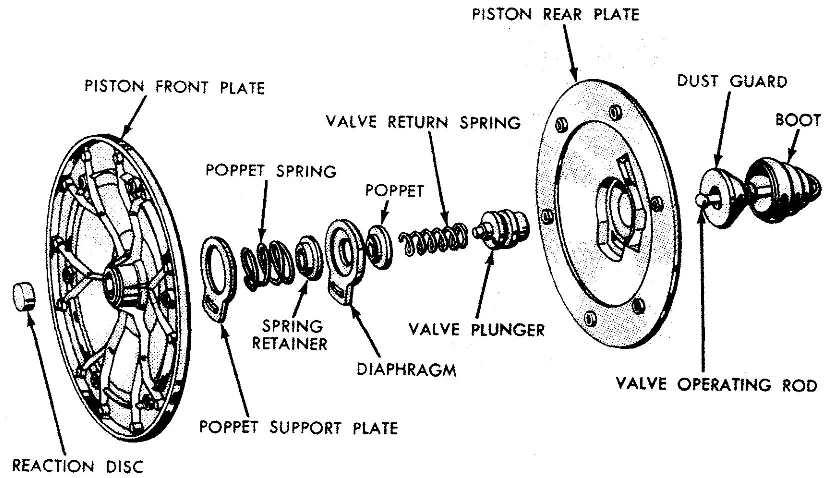


FIG. 22—Piston and Valve Disassembled

4. Slide the vacuum hose from the booster piston and from the vacuum tube on the inside of the end plate. Separate the end plate from the booster piston assembly by sliding the valve rod and rubber boot through the hole in the end plate (Fig. 20).
5. Remove the screws, vacuum tube and plate, and gasket from the end plate. Remove the attaching screws, air filter cover, and air filter from the end plate (Part 2-1, Fig. 3).

REMOVAL OF FELT RETAINER, FELT, AND EXPANDER RING

1. Spring the felt retaining ring sufficiently to disengage the ring from the grooves in the bosses on the piston rear plate (Fig. 21).
2. Remove the piston felt and expander ring from the piston assembly (Part 2-1, Fig. 3).

DISASSEMBLY OF BOOSTER PISTON AND VALVE

1. Remove the six bolts and lock washers from the piston front plate. Lift off the piston rear plate, valve rod, and plunger assembly. Remove the leather piston packing from the piston front plate.
2. Remove the valve return spring, poppet and diaphragm assembly, poppet spring, and diaphragm support plate. Separate the poppet spring retainer and the poppet diaphragm from the poppet (Fig. 22).
3. Remove the rubber reaction disc from the piston front plate. If necessary, use a piece of rod having a smooth flat end to push the reaction disc out of the piston plate.
4. Disengage the rubber dust guard from the shoulder on the piston rear plate. Slide the guard back on the valve rod so that the plunger can be pushed far enough off its seat for cleaning and inspection.

Do not separate the valve operating rod from the valve plunger unless it is necessary to replace faulty or damaged parts. To replace either the valve operating rod or valve plunger, hold the assembly with the valve plunger down and inject alcohol in the valve plunger through the opening around the valve rod to wet the rubber lock in the plunger, then drive or pry the valve plunger off the valve rod.

With the plunger separated from the rod, pull the rod out from the rear side of the piston plate; then slide the dust guard and rubber boot from the ball end of the rod (Fig. 22).

ASSEMBLY OF BOOSTER UNIT

ASSEMBLY OF BOOSTER PISTON AND VALVE

1. If the valve operating rod and the valve plunger were separated, slide the rubber boot and the dust guard over the ball end of the rod. Insert the rod through the hole in

the piston rear plate from the rear side (Fig. 22). Dip the valve plunger in alcohol and assemble it to the ball end of the valve operating rod. Make certain that the ball end of the rod is locked in place in the valve plunger. It may be necessary to tap the end of the rod to seat the ball end of the rod in the valve plunger.

2. While holding the valve plunger firmly in its seat in the front side of the plate, assemble the rubber dust guard over the shoulder on the rear side of the piston plate.

3. Clamp the valve operating rod in a vise with the piston rear plate up. Lay the leather piston packing on the rear plate with the lip of the leather over the edge of the plate.

4. Install the valve return spring over the end of the valve plunger.

5. Assemble the poppet diaphragm over the end of the poppet (Fig. 22). Make certain that the diaphragm is in the recess of the poppet.

6. Press the poppet spring retainer over the end of the poppet into the relief of the diaphragm.

7. Assemble the poppet and diaphragm assembly over the valve return spring and into the recess of the piston rear plate.

8. Install the diaphragm plate in the recess of the diaphragm.

9. Install the poppet spring over the shoulder of the retainer.

10. Center the poppet spring on the piston front plate. Align and assemble the piston front plate to the piston rear plate.

11. Hold the piston front and rear plates together and install the six

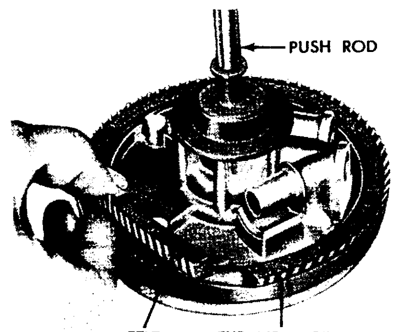


FIG. 23—Felt and Expander Ring Installation

piston plate bolts and lock washers. Leave the bolts loose.

12. Insert the rubber reaction disc into the recess at the center of the piston front plate.

Use care not to lose the reaction disc out of the piston before the push rod is installed.

ASSEMBLY OF EXPANDER RING, FELT, AND RETAINER

1. Turn the piston assembly upside down and assemble the expander ring against the inside lip of the leather packing as shown in Fig. 23.

2. Saturate the felt with booster body oil and assemble it in the expander ring.

3. Assemble the retainer ring over the bosses on the piston rear plate making certain that the retainer is anchored in all six grooves of the piston plate. Securely tighten the six cap screws in the piston front plate.

ASSEMBLY OF BOOSTER BODY, PISTON, AND END PLATE

1. Attach the hose to the tube of the vacuum piston and align the hose to lay flat against the piston.

2. Apply a thin coat of booster body oil to the bore of the booster body.

3. Saturate the air filter felt with booster body oil.

4. Assemble the air filter and cover to the end plate with attaching screws (Fig. 20).

5. Insert the short end of the vacuum tube through the gasket, and install the tube, gasket, and plate assembly to the end plate. Secure with attaching screws (Part 2-1, Fig. 3).

6. Install the end plate over the valve operating rod and pull the rubber boot through the hole in the end plate at the same time (Fig. 20). Attach the vacuum hose to the tube inside of the end plate.

Before proceeding further, make certain that the reaction disc is in place in front of the piston plate.

7. Center the small diameter end of the piston return spring in the booster body. Center the piston on the spring and align the scribe marks on the piston, the booster body, and end plate. Compress the spring and install two attaching screws at opposite sides to hold the end plate and booster body together. Install the balance of the screws and tighten all screws uniformly.

8. Assemble the rubber boot over the scalloped flange of the end plate.

PART 2-3 SPECIFICATIONS

DIMENSIONS—In Inches

Brake	Drum Inside Diameter	Drum Maximum Boring Limit	Lining Length		Lining Width		Lining Thickness		Wheel Cylinder Bore Diameter	Master Cylinder Bore Diameter
			Primary	Secondary	Primary	Secondary	Primary	Secondary		
Front	11.090	11.150	9.39	12.21	3	3	0.320	0.320	1³⁄₃₂ (1.094)	⅞ (0.875)
Rear									¹⁵⁄₁₆ (0.938)	

BRAKE CHECK AND ADJUSTMENTS

Type of Check or Adjustment	Specification	
Brake Shoe Repair	**Drum Diameter** 11,090-11.120 inch	**Brake Lining Required** Standard
	11.120-11.150 inch	Oversize
	Maximum Brake Lining Clearance (Midway between Rivets)—0.005 inch	
	Maximum Lining Wear Limit (From Top of Rivets)—¹⁄₃₂ inch	
Master Cylinder	Hydraulic Master Cylinder Bore Maximum Honed Diameter—0.878 inch	
Power Unit	Push Rod Adjustment—1.200 inch	
Drum Out-of-Round	Refinish if Total Indicator Runout Exceeds 0.007 inch	
Self-Adjustment Cable Length	End of Cable Anchor to End of Cable Hook—11⅛ inch ±¹⁄₆₄	

TORQUE LIMITS

Description		Foot-Pounds
Parking Brake Control Assembly Mounting Bolts		15-19
Master Cylinder to Booster Body		22-28
Booster to Dash Panel		15-25
Brake Tube Fitting Nuts at Master Cylinder, Rear Wheel Cylinders, and at all Connectors		70 in.-lbs. (Max.)
Brake Tube Fitting Nuts at Brake Hoses		110 in.-lbs. (Max.)
FRONT BRAKES		
Wheel to Hub and Drum Assembly Nuts		75-110
Front Wheel to Spindle Nut While Rotating Wheel		17-25
Brake Backing Plate to Spindle Nuts	Upper	25-35
	Lower	70-95
Wheel Cylinder to Backing Plate		10-20
REAR BRAKES		
Drum to Axle Shaft Flange Speed Nut		Hand Push Fit
Wheel to Drum and Axle Shaft Flange Nuts		75-110
Rear Wheel Bearing Retainer Plate and Brake Backing Plate to Axle Housing Flange Nuts		30-45
Wheel Cylinder to Backing Plate		10-20
Brake Fluid—M3833-D Brake Shoe Adjusting Screw Lubricant—Stanolube—HD Moly Grease—Grade 2		

SUSPENSION, STEERING, WHEELS AND TIRES

GROUP 3

PART 3-1 SUSPENSION, STEERING, WHEELS AND TIRES GENERAL SERVICE

1 DIAGNOSIS AND TESTING

Table 1 lists various suspension, steering, and wheel and tire trouble symptoms and their possible causes. The possible causes are listed in the table in the order in which they should be checked. For example, refer to the fourth trouble symptom in Table 1, "Hard Turning When Stationary." When checking the possible causes, check item 1 (tire pressure) and item 2 (tire size) before proceeding with items 11, 16, and 20 as indicated.

PRELIMINARY CHECKS

The following preliminary checks should always be made before performing any trouble shooting operations. Also, see Table 1.

CHECK FLUID LEVEL

Run the engine until the fluid is at normal operating temperature. Then turn the steering wheel all the way to the left and right several times, and shut off the engine.

Check the fluid level in the reservoir. If the level is low, add enough automatic transmission fluid to raise the level to a point one inch from the top, or to the F mark on the dip stick. **Do not overfill the reservoir.**

CHECK FOR FLUID LEAKS

With the engine idling, turn the steering wheel from stop to stop several times. Check all possible leakage points. Tighten all loose fittings, and replace any damaged lines or defective seats.

CHECK TURNING EFFORT

With the front wheels properly aligned and tire pressures correct, check the effort required to turn the steering wheel.

1. With the car on dry concrete, set the parking brakes.

2. With the engine warmed up and running at idle speed, turn the steering wheel to the left and right several times to warm the fluid.

3. Remove the steering wheel hub cap assembly. Attach a torque wrench to the steering wheel nut. Measure the pull required to turn the wheel at least one complete revolution in both directions. The steering effort should not exceed 5 lbs. pull at the steering wheel rim. If a torque wrench is used, **re-check nut torque after test.**

FLUID PRESSURE TEST

A fluid pressure test will show whether the pump or some other unit in the power steering system is causing trouble in the system.

The pressure testing gauge set, tool 3500-E, requires modification to make it adaptable for installation in the power steering hydraulic system. The parts required and the modification procedure are as follows:

a. Power Steering Pressure Line C1VV-3A719-A or subsequent lines released for this application. (Refer to the appropriate Parts Catalog.)

b. Inverted Flare Connector (3/8 inch O.D. Tube x 1/4 inch Pipe Thread).

c. Inverted Flare Connector (5/16 inch O.D. tube x 1/4 inch Pipe Thread).

d. Flared Tube Female Coupling (3/8 inch O.D. Tube x 1/4 inch Pipe Thread).

The connectors and the coupling are standard-type fittings and can be purchased locally.

TABLE 1—Trouble Symptoms and Possible Causes

POSSIBLE CAUSES OF TROUBLE / TROUBLE SYMPTOMS	Jerky Steering	Loose Steering	Hard Steering and/or Loss of Power Assist	Hard Turning When Stationary	Steering and Suspension Noises	Shimmy or Wheel Tramp	Pull to One Side	Side-to-Side Wander	Body Sway or Roll	Tire Squeal on Turns	Binding or Poor Recovery	Abnormal or Irregular Tire Wear	Sag at One Wheel	Hard or Rough Ride	Rear Suspension Misalignment (Dog-Tracking)
1. Incorrect Tire Pressure			X	X		X	X	X	X	X	X	X	X	X	
2. Tire Sizes Not Uniform			X	X			X	X		X		X	X		
3. Overloaded or Unevenly Loaded Vehicle								X				X	X	X	
4. Power Steering Fluid Level Low-Leak	X		X	X	X										
5. Sagging or Broken Spring					X		X	X	X			X	X	X	
6. Rear Spring Tie Bolt Off Center							X					X			X
7. Broken Rear Spring Tie Bolts					X	X	X	X	X			X			X
8. Rear Spring Front Hanger Mislocated							X					X			X
9. Bent Spindle Arm							X	X		X		X			
10. Bent Spindle							X	X		X		X			
11. Lack of Lubrication	X		X	X	X						X			X	
12. Air in Power Steering System	X		X		X	X									
13. Obstruction in Power Steering Lines			X	X	X										
14. Loose or Weak Shock Absorber					X	X		X	X			X		X	
15. Loose or Worn Suspension Arm Bushings					X	X						X		X	
16. Binding Front Suspension Ball Joints or Steering Linkage	X		X	X	X						X			X	
17. Loose, Worn, or Damaged Steering Linkage or Connections	X	X			X	X		X		X		X			
18. Loose Steering Gear Mountings	X	X			X	X		X							
19. Insufficient Steering Pump Pressure			X	X							X				
20. Incorrect Steering Gear Adjustment	X	X	X	X	X	X		X	X		X	X			
21. Incorrect Brake Adjustment	X				X		X					X			
22. Incorrect Front Wheel Bearing Adjustment	X	X			X	X	X	X				X			
23. Wheel Out of Balance	X					X						X		X	
24. Incorrect Front Wheel Alignment			X		X	X	X	X		X	X	X			
25. Out-of-Round Wheel or Brake Drum						X						X		X	
26. Frame or Underbody Out of Alignment							X					X			X
27. Bent Rear Axle Housing					X		X					X			X
28. Excessive Wear of Power Steering Pump Internal Parts			X		X										
29. Steering Gear Valve Spool Binding or Out of Adjustment			X	X			X				X				
30. Obstruction Within Steering Gear	X		X	X							X				

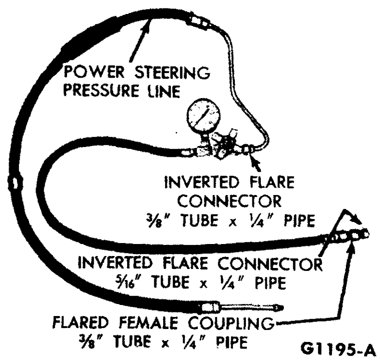


FIG. 1—Modified Pressure Gauge Assembly

e. To modify tool 3500-E, remove the hose from the hand shut-off valve block. Install the 3/8 inch x 1/4 inch inverted flare connector in the valve block, and assemble the pressure line, C1VV-3A719-A (or subsequently released line) to the connector (Fig. 1). Assemble the 3/8 x 1/4 inch coupling and the 5/16-inch connector to the free end of the hose leading to the pressure gauge.

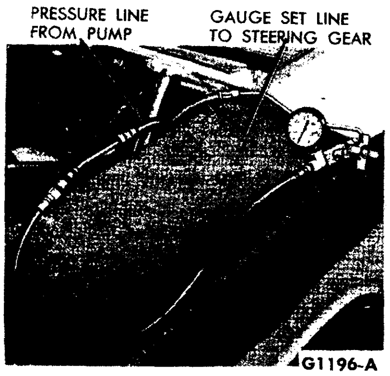


FIG. 2—Pressure Testing Gauge Installation

1. To check the pump pressure, disconnect the pressure line (upper line) at the steering gear. Connect the modified pressure-testing gauge assembly, tool 3500-E, between the pressure line from the pump and the steering gear. (See Fig. 2.)

2. Make sure the hand-valve at the gauge is fully opened. Start the engine and cycle the steering gear from stop to stop until the gear housing is warm. Check the fluid level in the reservoir and add fluid, if necessary.

3. Turn the steering wheel to the full right and full left turn positions and observe the gauge readings.

CAUTION: Hold the wheels in this position only long enough to obtain an accurate reading.

The gauge should read between 1120 and 1250 psi. If the pressure is less than 1120 psi, close the valve at the gauge and note the pump pressure. If it is low with the valve closed, it indicates that the pump is not operating properly. If the pressure goes up with the valve closed, it indicates that the low pressure in the system must be due to internal leakage in the power unit, providing all connections are tight.

4. Remove the pressure testing gauge set, and connect the pressure line at the steering gear. Fill and bleed the system.

VALVE SPOOL CENTERING CHECK

The valve spool centering check requires the use of the modified pressure testing gauge set, tool 3500-E. The parts required and the modification procedure are outlined above.

For the complete Valve Spool Centering procedure, refer to Part 3-3, Section 4, "Assembly of Steering Gear."

2 COMMON ADJUSTMENTS AND REPAIRS

WHEEL ALIGNMENT ADJUSTMENTS

After front wheel alignment factors have been checked, make the necessary adjustments. **Do not attempt to adjust front wheel alignment by bending the suspension or steering parts.**

CASTER

1. Position the car on a level floor or on runway-type wheel alignment equipment. Position a suitable gauge on the front wheels and check the caster angle. Correct caster is negative 3/4° to negative 2 1/4°. Maximum difference between wheels should not exceed 1/2° with 1/4° preferred.

2. To adjust caster, raise the hood. Loosen the bolts that secure the upper suspension arm shaft to the frame member and, with the aid of a pry bar, move the shaft in or out, as required. A movement of approximately 3/32 inch at either the front or rear bolt location will change the caster 1/2°. Inboard movement of the front bolt, or outboard movement of the rear bolt, will change caster in the negative direction. Outboard movement of the front bolt, or inboard movement of the rear bolt, will change caster in the positive direction.

3. When the caster is correct, torque the shaft retaining bolts to specification and recheck the caster and camber to insure the readings have not changed.

CAMBER

1. With the car on runway-type wheel alignment equipment, or on a level floor, position a suitable gauge on the wheels and check the camber angle. Correct camber is 0° to positive 3/4°. Maximum difference between wheels should not exceed 1/2° with 1/4° preferred.

2. To adjust camber, raise the hood. Loosen the bolts that secure the upper suspension arm shaft to the frame member and, with the aid of a pry bar, move the shaft in or out, as required. A movement of approximately 3/64 inch of the entire shaft will change the camber 1/4°. Inboard movement will change the camber in the negative direction. Outboard movement will change the camber in the positive direction.

3. When the camber is correct, torque the shaft retaining bolts to specification and recheck the camber and caster to insure the readings have not changed.

TOE-IN AND STEERING WHEEL ALIGNMENT ADJUSTMENTS

TOE-IN

Toe-in is adjusted by means of the sleeve at the outer end of each spindle connecting rod. The toe-in specification is 1/16 inch to 3/16 inch.

1. Set the front wheels in the straight-ahead position. To be sure the wheels are straight-ahead, push the car backward about six feet; then, pull it forward about three feet. The last movement of the car must be forward to position the wheels properly.

2. Remove the cap from the steer-

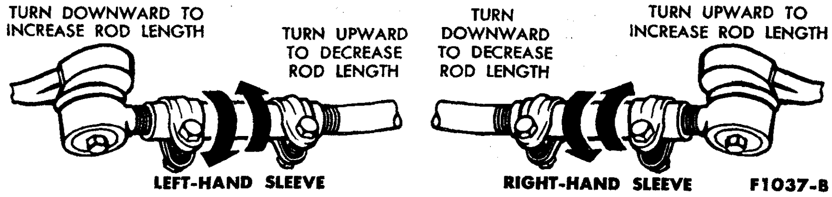


FIG. 3—Spindle Connecting Rod Adjustments

ing wheel hub by pressing downward and turning the cap to the left. Make sure the alignment mark on the hub of the steering wheel is lined up with the mark on the end of the steering shaft. The mark on the end of the shaft indicates the high-point of the steering gear. With the front wheels straight-ahead, the alignment marks should be vertical and the steering wheel spokes should be in their normal position. If repositioning is required, refer to STEERING WHEEL SPOKE POSITION adjustment procedure which follows.

3. To adjust toe-in, loosen the two clamps on each spindle connecting rod sleeve. Lengthen or shorten both spindle connecting rods an equal amount to obtain the correct toe-in. Lengthening both rods increases toe-in. Shortening both rods decreases toe-in (Fig. 3).

4. Torque the adjusting sleeve clamp bolts to specification. **To prevent interference, both bolts should be in a vertical position on the rear side of the sleeve and the clamps should not project beyond the ends of the sleeve.**

STEERING WHEEL SPOKE POSITION

When the steering gear is on the high-point, the front wheels should be in the straight-ahead position and the steering wheel spokes should be in their normal position. The marks on the end of the steering shaft and on the hub of the steering wheel should also be lined up and in a vertical position. If necessary, the spokes can be repositioned without changing the toe-in setting (Fig. 4).

1. Loosen the clamps on both spindle connecting rod sleeves (Fig. 3).

2. Turn both sleeves upward or downward the same number of turns to move the steering wheel spokes to their normal position. If the wheel is turned clockwise from its normal position, turn both sleeves upward (viewed from the rear). If the wheel is turned counterclockwise, turn both sleeves downward (viewed from the rear).

3. Tighten the sleeve clamp bolts to specified torque.

TURNING ANGLE

The angular relationship of one front wheel to the other must change as the vehicle makes a turn. The turning angle of an outside wheel should be 17° 42′ when the inside wheel is turned 20°. If the turning angle does not check to these specifications, crosswear of tires will result. Bent parts are generally the cause of an incorrect turning angle.

THEORETICAL KING PIN INCLINATION

Theoretical king pin inclination is the tilt of the top of the spindle toward the centerline of the car. King pin inclination is merely a theoretical value as the desired inclination is built into a car at the time of manufacture and cannot be adjusted. Unless related parts are bent, the angle will be 7° when the camber angle is positive ¾°.

WHEEL INSPECTION

Wheel hub nuts should be inspected and tightened to specification during pre-delivery inspection. Loose wheel hub nuts may cause shimmy and vibration. Elongated stud holes in the wheels may also result from loose hub nuts.

Keep the wheels and hubs clean. Stones wedged between the wheel and drum, and lumps of mud or grease can unbalance a wheel and tire.

Check for damage that would affect the runout of the wheels. Wobble or shimmy caused by a damaged wheel will eventually damage the wheel bearings. Inspect the wheel rims for dents that could permit air to leak from the tires.

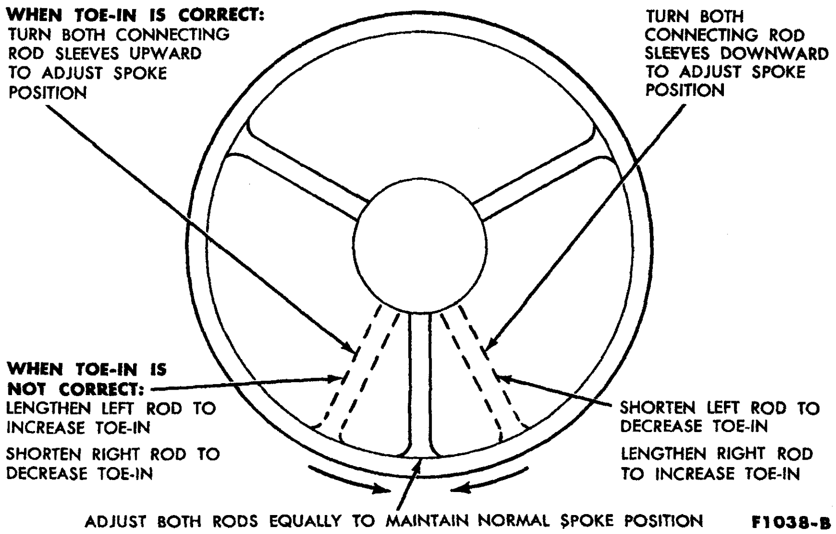


FIG. 4—Toe-In and Steering Wheel Spoke Alignment Adjustments

3 CLEANING AND INSPECTION

FRONT END GENERAL INSPECTION

Whenever possible, front wheel alignment checks should be performed on stationary wheel aligning equipment. In the absence of such equipment, portable equipment may be used and the work may be performed on a level floor. The floor area should be level within ¼ inch from front to rear of the car and within ⅛ inch from side to side. It might be well, if portable equipment is used frequently, to mark off a known level area on the shop floor.

Prior to checking or setting the front wheel alignment, be sure all front suspension and steering system nuts and bolts are properly torqued. It is especially important to have the drag strut nut and the upper arm shaft bolts tightened to the proper torque specification, as a loose nut or bolt can directly affect the caster or camber reading. The items which follow also should be checked and, if necessary, corrected before aligning the wheels.

1. Be sure the tires are inflated to the proper pressure at all four wheels.
2. Be sure the front wheel bearings are adjusted properly and that the wheels turn freely.
3. Check the shock absorbers for leaks. Replace the shock absorbers if necessary.
4. Check for looseness at the tie-rod ends. Looseness can affect the toe-in readings and adjustment. To inspect the front suspension for looseness or wear, it will be necessary to raise the car.

CAUTION: Do not raise the car by means of the lower suspension arms. This will release the tension on the lower ball joints.

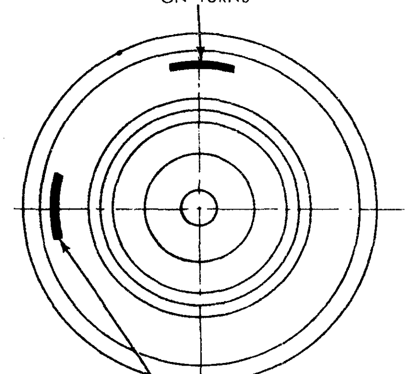


FIG. 5—Front Wheel Position for Checking Alignment

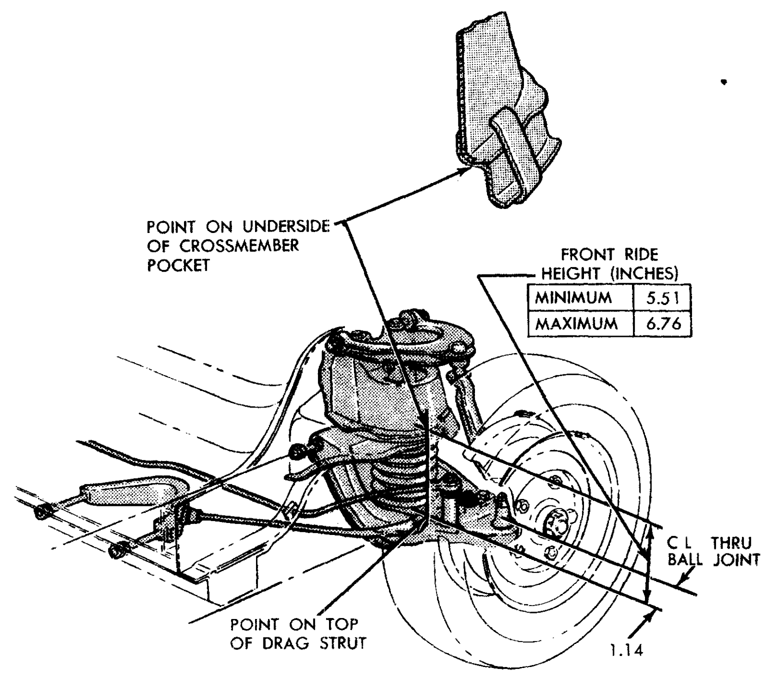


FIG. 7—Front Suspension Riding Height Measurement

5. Be sure the wheels are balanced.
6. Check the runout of each front wheel and tire using a dial indicator against the rim outer band. If the runout exceeds ⅛ inch, correction may be made by rotating the wheel on the drum. When the minimum runout has been obtained, mark the point of greatest runout so the wheels can be positioned as shown in Fig. 5 when checking the front end alignment. Hold a piece of chalk against the wheel rim or the tire sidewall while spinning the wheel. The chalk will mark the rim or tire at the point of greatest runout.

WHEEL ALIGNMENT DEFINITIONS

An understanding of the factors involved in wheel alignment is necessary, before an accurate job of alignment can be performed.

CASTER

Caster is the forward or rearward tilt of the top of the wheel spindle. If the spindle tilts to the rear, caster is positive. If the spindle tilts to the front, caster is negative (Fig. 6).

CAMBER

Camber is the amount the front wheels are tilted at the top. If a wheel tilts outward, camber is positive. If a wheel tilts inward, camber is negative (Fig. 6).

TOE-IN

Toe-in is the turning inward of the front wheels, so that they are closer together at the front than at the rear.

BALL JOINT INSPECTION

LOWER ARM

1. Raise the front of the car.
2. Adjust wheel bearing to no end play (see Part 3-4 for bearing adjustment procedure).
3. Attach a dial indicator to the lower arm. Position the indicator

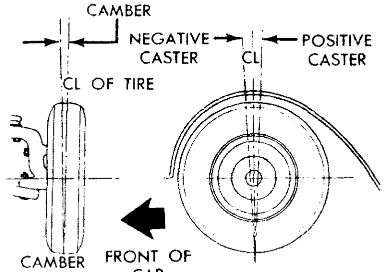


FIG. 6—Caster and Camber Angles

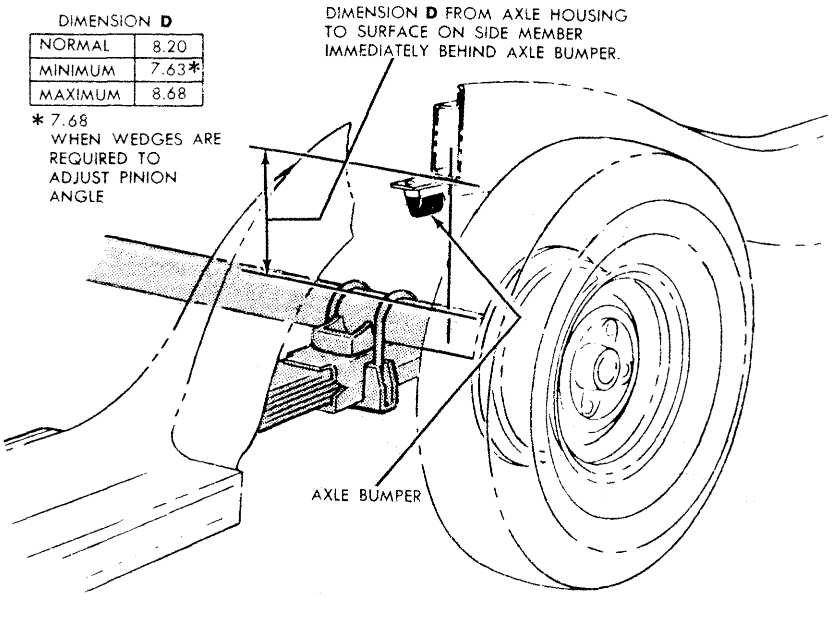


FIG. 8—Rear Suspension Riding Height Measurement

plunger on the wheel rim at the bottom of the tire.

4. Grasp the tire at the top and bottom, and slowly move the tire in and out, noting the reading on the dial indicator.

5. If the reading exceeds 0.250 inch, replace the ball joint (refer to Part 3-2, Section 2, for the replacement procedure).

UPPER ARM

Refer to Part 3-2, Section 2, for the procedure required to disconnect the ball joint from the spindle prior to checking ball joint stud rotating torque.

RIDING HEIGHT MEASUREMENT

In cases of vehicle riding height complaints, accurate measurements of the front and rear suspension will be necessary to determine which spring should be replaced, if any. Some riding height variation between similar models must be expected due to the weight of optional accessories. In addition, a vehicle in customer usage can gain 100 or more pounds over several thousand miles usage due to mud deposits on the underbody. This weight increase can account for a noticeable reduction in riding height. Therefore, excessive accumulations of mud should be removed before checking the riding height.

Before checking the front or rear curb weight suspension riding height, perform the following steps:

1. Position the vehicle on a smooth, level floor.

2. Inflate all tires to 24 psi. The fuel tank should be full. Any loading must be removed from the passenger and luggage compartments.

3. Place the front seat in its rearmost position.

FRONT SUSPENSION

1. Push the front bumper downward at the center about one inch. Release very slowly so that suspension friction stops the car. Measure between the points shown in Fig. 7. Measure and record the reading obtained on each side of the car.

2. Raise the front bumper at the center about one inch and release very slowly. Again measure and record the readings obtained on each side of the car as in Step 1.

3. Average the two readings obtained on each side of the car to obtain the true riding height. The difference between one side of the car and the other should not be more than ½ inch.

REAR SUSPENSION

1. To measure the riding height, push downward on the center of the rear bumper about one inch and release it slowly. Measure between the points shown in Fig. 8.

2. Raise the rear bumper at the center about one inch and release it slowly. Again measure the riding height. The average of the two measurements is the true riding height. The riding height specifications are shown in Fig. 8.

POWER STEERING PUMP CLEANING AND INSPECTION

1. Wash all parts in clean solvent, and dry them with clean cloths or compressed air.

2. Inspect the rotor shaft for wear, scoring, nicks, or burrs. Replace the shaft if it is damaged or if the inner keyway is damaged.

3. Inspect the rotor, rollers, and the cam ring for wear or scoring.

4. Make sure the inner faces of the cover and the housing are free of paint, nicks, or burrs. Check all oil passages for restrictions.

5. Inspect the valving surfaces (areas where the rotor and rollers contact) for wear or scoring. Replace the pressure plate or the cover if worn or scored. Inspect the bushing in the pressure plate for wear or scoring, and replace the plate if necessary.

6. Inspect the control valve for scores, nicks, or burred edges. Replace the valve if damaged. **Do not disassemble the valve.** Check the valve for free movement in the housing bore.

7. Inspect the tube seat in the housing. If damaged, remove it with an E-Z-Out and install a new seat.

PART 3-2 SUSPENSION

1 DESCRIPTION AND OPERATION

FRONT SUSPENSION

The front wheel suspension is a ball joint type utilizing coil springs and double acting shock absorbers. Fore and aft movement of each front wheel is controlled by a non-adjustable type stabilizing strut (drag strut) connected to the suspension lower arm and to a point forward on the number one crossmember (Fig. 1). A single rubber-cored bushing is used at the inner end of the suspension lower arm. Caster and camber are adjusted without the use of shims. Adjustment is accomplished by movement of the serrated upper arm shaft.

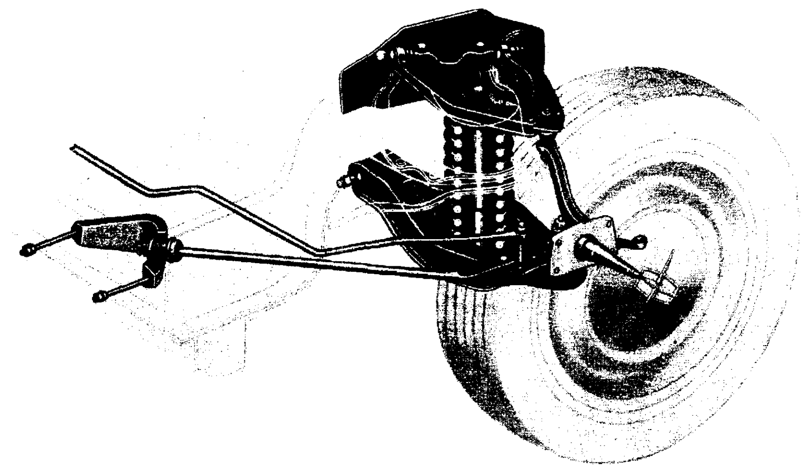


FIG. 1–Front Suspension

REAR SUSPENSION

The major components of the rear suspension system are the leaf springs which are mounted to the underbody (Hotchkiss Design) and the restricted, double-acting, telescopic-type shock absorbers (Fig. 2).

The springs are insulated from the axle with rubber-lined clamps and attached to the axle with U-bolts. Laterally slotted holes in the axle mounting pads are provided for spring-to-axle alignment.

The rear shock absorbers are the direct-acting type which have an integral stud at the upper end and are attached to the crossmember by a mounting plate. The shock absorber lower end is stud mounted to a bracket welded to the forward side of the axle housing.

2 IN-CAR ADJUSTMENTS AND REPAIRS

BALL JOINT REPLACEMENT

The lower ball joint is riveted to the lower arm whereas the upper ball joint is bolted to the upper arm. When replacing a ball joint, use all the parts supplied in the kit.

LOWER ARM

1. Raise the car. Place a support under each rail to the rear of the lower arm in the lifting pad area.

2. Remove the wheel and tire, then remove the hub and drum.

3. Remove the brake backing plate, and wire it to the underbody to prevent damage to the brake hose.

4. Remove the cotter pin from the lower ball stud, and loosen the nut one to two turns.

5. Using a brass hammer, tap the spindle until the ball stud pops loose against the nut.

6. Place a jack under the spring pocket in the lower arm, and raise the arm slightly. Place a support stand under the lower arm as a safety precaution.

7. Remove the nut from the ball joint stud. Raise the upper arm and spindle until the spindle clears the ball stud. Prop the upper arm in the raised position.

8. Remove the ball joint rivet heads with a chisel. Punch the remaining portion of the rivets from the holes, and remove joint.

9. Install the new joint using the parts supplied in the kit. Torque the nuts to specification. Make sure the joint is completely filled with the specified lubricant.

10. Lower the upper arm while guiding the spindle over the ball stud. Install the stud nut and tighten it to specification. Continue to tighten the nut to line up the cotter pin hole. Install the cotter pin.

11. Install the brake backing plate, and tighten the retaining nuts to specified torque.

12. Install the hub and drum and the wheel and tire. Torque the wheel nuts to specification.

13. Adjust the wheel bearings, and lower the car.

UPPER ARM

1. Place a jack under the outer end of the lower arm, and raise the arm. Place a support stand under the side rail in the lifting pad area.

2. Remove the wheel and tire.

3. Remove the cotter pin from the upper ball stud, and loosen the nut one to two turns.

4. Pry the arm upward and, using a brass hammer, tap the spindle at

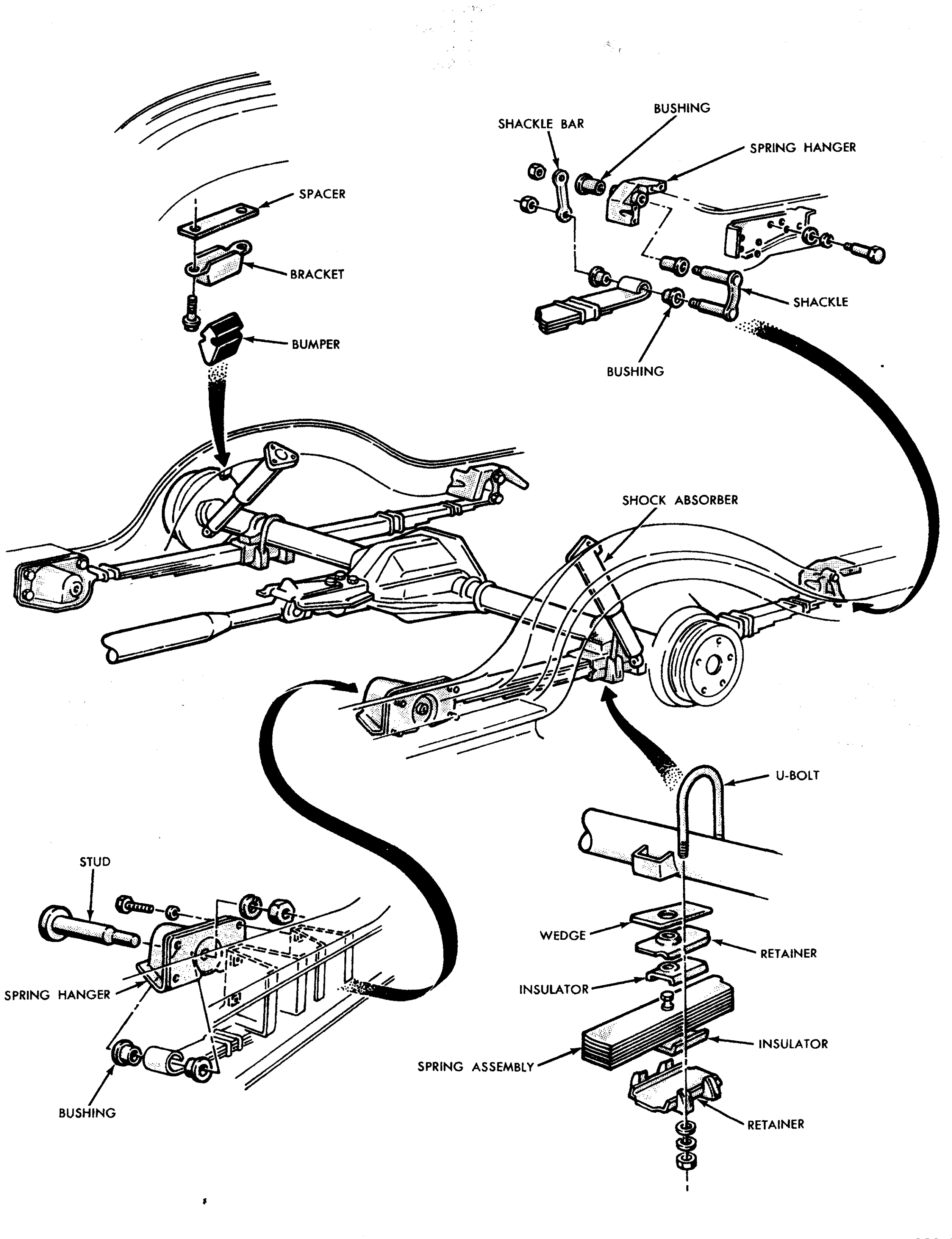


FIG. 2–Rear Suspension Components

the stud boss until the ball stud loosens against the nut. Remove the nut.

5. Raise the upper arm to free the ball stud from the spindle. Wire the upper end of the spindle to the underbody to prevent damage to the brake hose.

6. Check the torque required to rotate the ball joint stud. If the torque is found to be less than 12 in-lbs, replace the ball joint.

7. Remove the ball joint retaining nuts and bolts, and remove the joint.

8. Install the new joint using the parts supplied in the kit. Torque the nuts to specification. Make sure the joint is completely filled with the specified lubricant.

9. Guide the ball joint stud into the spindle. Install the stud nut and torque it to specification. Continue to tighten the nut to line up the cotter pin hole. Install the cotter•pin.

10. Install the wheel and tire. Torque the wheel nuts to specification.

3 REMOVAL AND INSTALLATION

FRONT WHEEL SPINDLE

REMOVAL

1. Raise the car. Place a support under each side rail to the rear of the lower arm in the lifting pad area.

2. Remove the wheel and tire, then remove the hub and drum.

3. Remove the brake backing plate, and wire it to the underbody to prevent damage to the brake hose.

4. Disconnect the spindle arm connecting rod from the spindle arm with tool 3290-C. See Fig. 3.

5. Remove the cotter pins from both ball joint stud nuts. Loosen the nuts one to two turns.

6. Using a brass hammer, tap the spindle at the lower ball joint until the ball stud pops loose against the nut. Pry upward on the upper arm, and tap the spindle at the upper ball joint until the ball stud loosens against the nut.

7. Place a jack under the outer end of the lower arm, and raise the arm several inches. Remove both ball stud nuts, and remove the spindle.

INSTALLATION

1. Position the new spindle onto the upper and lower ball joint studs, install the stud nuts and tighten the nuts to specifications. Continue to tighten both nuts until the cotter pin holes line up with the slots, then install new cotter pins.

2. Connect the spindle connecting rod to the spindle arm. Install the retaining nut and tighten the nut to specification. Continue to tighten the nut until the cotter pin hole lines up with the slot, then install a new cotter pin.

3. Assemble the brake carrier plate, gaskets and dust shield to the spindle. Install the retaining bolts and nuts, and tighten to specifications (Fig. 3).

4. Install the wheel, hub and drum, and adjust the wheel bearing.

5. Lubricate the steering stop on the lower arm and the mating flat on the spindle with specified lubricant.

6. Remove the safety stands, lower the car and check camber, caster and toe-in.

FRONT SHOCK ABSORBER

REMOVAL

1. Remove the stud nut at the upper eye of the shock absorber. Remove the upper eye stud bracket to crossmember retaining bolt and remove the stud bracket. Refer to Fig. 3.

2. Remove the bolts which retain the shock absorber to the suspension lower arm. Lower, and remove the shock absorber.

3. Examine the shock absorber unit and rubber bushings. Replace parts that are defective, deteriorated, or worn.

INSTALLATION

1. Fully extend the shock absorber and position it inside the coil spring. Connect the lower end of the shock absorber to the suspension lower arm. Torque the retaining nuts to specification.

2. Insert the upper bracket stud through the bushing in the shock absorber upper eye. Install the stud bracket to crossmember retaining bolt. **Do not tighten the bolt at this time.**

3. Install the upper eye bracket stud nut. Torque the nut to specification.

4. Torque the stud bracket to crossmember retaining bolt to specification. **The shock absorber upper eye stud nut must be tightened to compress the rubber bushing before the stud bracket is bolted to the crossmember; otherwise, the upper attachment could be loose and noisy.**

FRONT SPRING AND LOWER ARM

REMOVAL

1. Raise the vehicle. Place a support under each underbody side rail to the rear of the lower arm in the lifting pad area. Refer to Fig. 3.

2. Remove the wheel and tire assembly; then, remove the hub and drum.

3. Loosen the brake backing plate to provide clearance at the end of the arm when it is lowered.

4. Remove the shock absorber.

5. Disconnect the stabilizing strut (drag strut) from the lower arm.

6. Disconnect the stabilizer bar from the suspension arm.

7. Remove the cotter pin from the slotted nut attaching the lower ball joint to the end of the spindle boss. Loosen the nut one to two turns.

8. Using a brass hammer, tap the spindle until the ball stud pops loose against the nut.

9. Place a jack under the outer end of the lower arm and raise the arm several inches.

10. Install the spring compressor tool 5310-A (Fig. 4) inside the spring with the jaws of the tool toward the center of the car.

11. Remove the nut from the ball joint stud. Lower the jack until the spindle and spring are free, and remove the spring and insulators.

12. Remove the lower arm to crossmember nut, bolt, washers, and spacer, then remove the arm.

INSTALLATION

1. Connect the inner end of the lower arm to the underbody crossmember. **Do not tighten the retaining nut at this time.** Refer to Fig. 3.

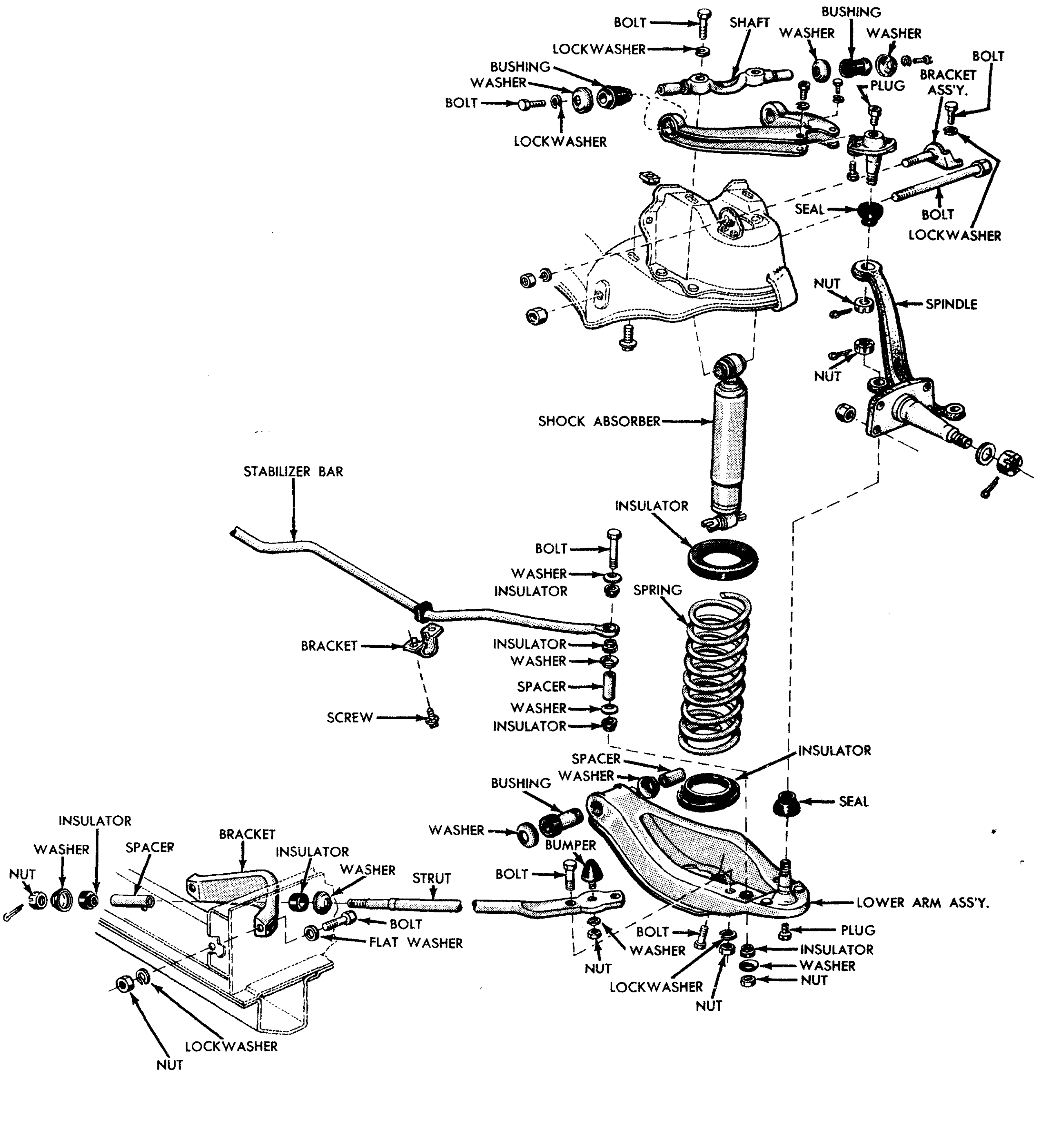


FIG. 3—Front Suspension Components

2. Place a jack under the outer end of the arm.

3. Tape the upper and lower spring insulators to the spring.

4. Compress the coil spring with tool 5310-A (Fig. 4) and place the spring and insulators in position. Be sure both ends of the spring are properly seated, and raise the arm. Guide the spindle boss over the ball joint stud.

5. Install the ball joint stud retaining nut and torque it to specification. Continue tightening the nut to line up the cotter pin hole. Install a new cotter pin.

6. Connect the stabilizer bar to the lower arm. Torque the nut to specification.

7. Connect the drag strut to the lower arm. Torque the nuts to specification.

8. Install the shock absorber.

9. Tighten the brake backing plate retaining nuts to specification.

10. Install the hub and drum, and the wheel and tire assembly. Torque the wheel nuts to specification. Adjust the wheel bearings. Remove the support stands.

11. With the front end weight of the car on the wheels, torque the lower arm to crossmember bolt retaining nut to specification.

UPPER ARM

REMOVAL

1. Place a jack under the outer end of the suspension lower arm and raise the arm. Refer to Fig. 3.

2. Remove the wheel and tire assembly.

3. Remove the cotter pin from the upper ball joint stud. Loosen the nut one or two turns. Pry upward on the upper arm and, using a brass hammer, tap the spindle at the stud boss until the ball joint stud loosens against the nut. Remove the nut.

4. Raise the upper arm to free the ball joint stud from the spindle. Wire the upper end of the spindle to the underbody to prevent damage to the brake hose.

5. Mark the position of the upper arm shaft on the underbody member to facilitate making caster and camber adjustments after installation of the upper arm.

6. Remove the suspension upper arm-to-underbody retaining bolts, lock washers, and retaining nuts. Then remove the upper arm.

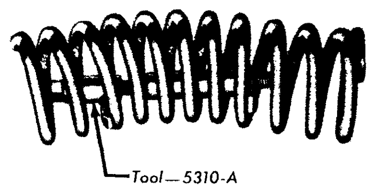


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FIG. 4—Coil Spring Compressed for Installation

INSTALLATION

1. Position the upper arm shaft on the underbody member. Line up the shaft with the marks made before removal of the arm.

2. Install the retaining bolts and lock washers. Fabricate a tool as shown in Fig. 5 to hold the nut in place while starting the retaining bolt into the nut. Remove the tool, then tighten the retaining bolts to specification.

3. Guide the ball joint stud into the spindle. Install the retaining nut and torque it to specification. Continue tightening the nut to line up the cotter pin hole. Install a new cotter pin.

4. Install the wheel and tire, and torque the wheel nuts to specification.

5. With the front end weight of the car on the wheels, torque the bolts at the ends of the upper arm shaft to specification if the bushings were replaced.

6. Check the front wheel alignment.

REAR SHOCK ABSORBER

REMOVAL

1. Lift the car and place support stands under the axle housing. Position the car with a hoist to relieve tension on the shock absorbers.

2. Remove the screws that retain the shock absorber mounting plate to the crossmember (Fig. 6).

3. Remove the retaining nut and washers from the lower end of the shock absorber.

4. Remove the shock absorber.

5. Remove the nut, outer washer, and insulator that retain the shock absorber to the mounting plate; then remove the plate.

6. Inspect the shock absorber for damage or leaks. If the bushing must

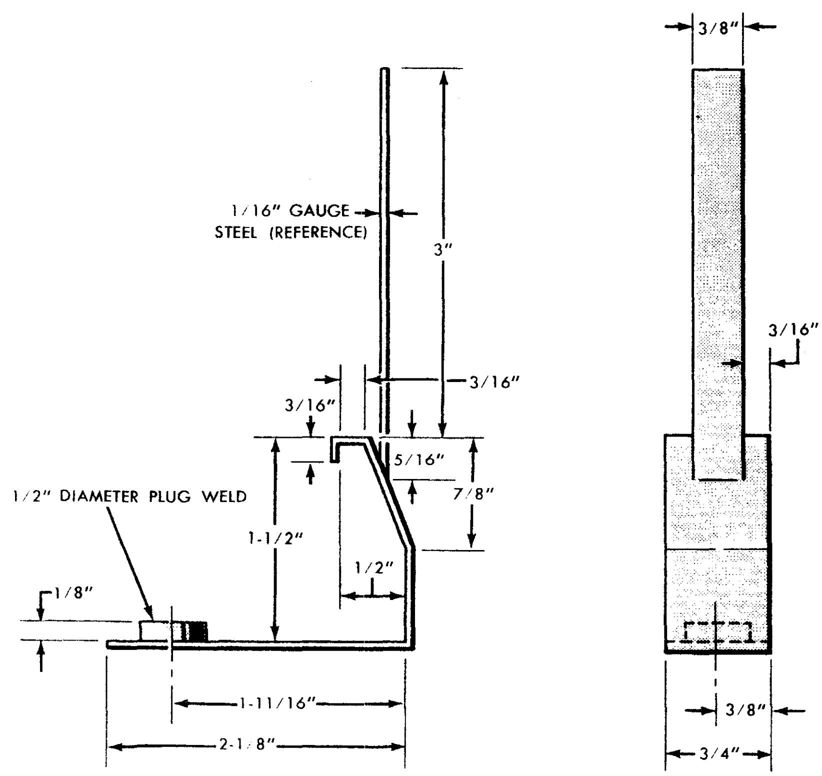

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FIG. 5—Upper Arm Shaft Installation Tool

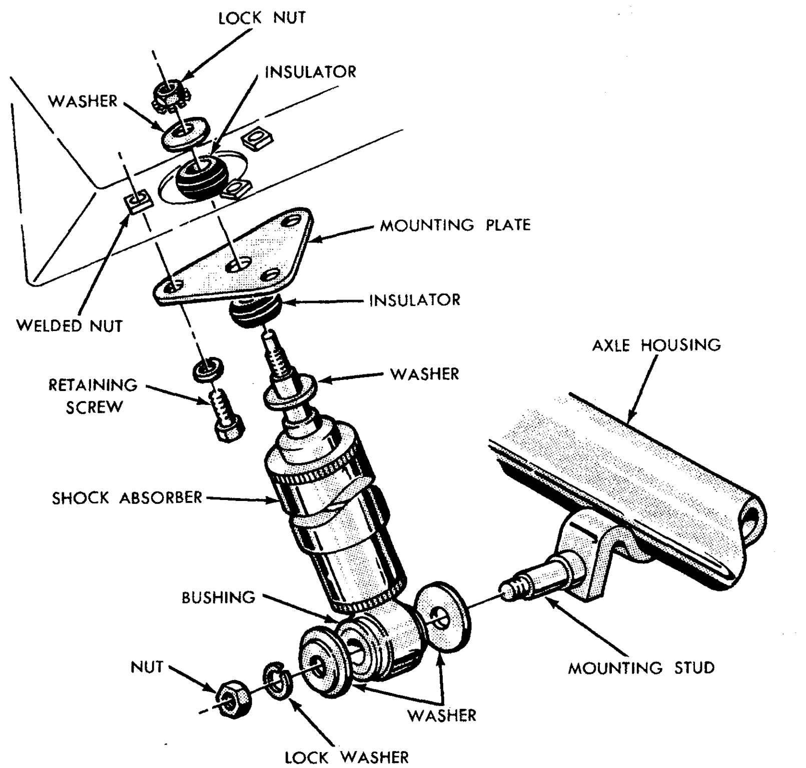

FIG. 6—Rear Shock Absorber Mounting

be replaced, the operation may be performed without the use of special tools. Wet the rubber bushing with brake fluid and press it into the shock absorber eye by hand. Replace the insulators if they appear worn or damaged.

INSTALLATION

1. Place the inner washer and insulator on the upper (stud) end of the shock absorber (Fig. 6).
2. Install the mounting plate, outer insulator, washer and nut on the stud. Torque the nut to specification.
3. Attach the mounting plate and shock absorber to the crossmember with the retaining screws and washers. Torque the screws to specification.
4. Connect the lower end of the shock absorber to the mounting stud with the washers and retaining nut. Torque the nut to specification.

LOWER MOUNTING STUD REPLACEMENT

If the shock absorber mounting stud is damaged, replace the stud as follows:

1. Cut off the old stud as close to the bracket as possible.
2. Grind off the weld at both ends of the stud and bracket face.
3. Drive out the balance of the stud with a brass drift. Do not enlarge the hole in the bracket.
4. Remove any weld remaining on the sides of the bracket.
5. Attach the service stud to the axle housing bracket with a nut. Torque the nut to specification.
6. Stake the nut to prevent loosening.

REAR SPRING

REMOVAL

1. Raise the car and place support stands under the sidemembers on the rear of each rear spring hanger.
2. Lower the rear axle slightly to reduce some of the spring load; then, remove the spring U-bolts.
3. Remove the nut and front mounting bolt. Refer to Fig. 2.
4. Remove the rear shackle nuts and mounting plate. Remove the lower, inner insulator. Remove the spring. **If the rear shackle insulators are to be replaced, it will be necessary to remove the rear hanger assembly. (Hanger attaching bolts must be torqued to specification when reinstalled.)**
5. Remove the insulators from the spring.
6. Examine all parts for wear or damage. Note the condition of the spring center bolt.
7. The spring center bolt can be replaced by clamping the spring in a vise, thus keeping the spring compressed during bolt removal and installation.

INSTALLATION

1. Install the spring to the rear shackle assembly with the insulators in position. **Do not tighten the nuts at this time.** Refer to Fig. 2.
2. Attach the spring to the front hanger with the insulators in position. **Do not tighten the nut at this time.**
3. Place the insulator and retainers in position on the spring.
4. Lower the axle housing onto the insulator and retainer assembly.

CAUTION: If a wedge was located between the upper retainer and mounting pad, reinstall the same thickness wedge with the taper in the original direction. Raise the axle until the spring is approximately horizontal with the floor.

5. Install the lower insulator retainer and U-bolts. **Do not tighten the U-bolt nuts at this time.** Torque the rear shackle nuts to specification.
6. Torque the front shackle nut to specification.
7. Tighten the U-bolt nuts evenly to the specified torque.
8. **Make sure the lower insulator retainer contacts the upper retainer.**

4 MAJOR REPAIR OPERATIONS

LOWER ARM OVERHAUL—ARM REMOVED

Inspect the lower arm, bushings and pivot bolt for cracks, bends, wear or other damage. Replace the arm if necessary.

Install the nut on the ball joint stud, and turn the stud in the ball joint with a torque wrench to check rotating torque. If the turning effort is not within specifications, replace the ball joint.

Note: Do not wash the ball joint with solvent. The solvent may attack parts within the joint.

BALL JOINT REPLACEMENT

See Section 2 for the complete in-car ball joint replacement procedure.

Refer to Section 3 for the lower arm removal procedure.

1. To remove the ball joint, if it requires replacement, remove the rivet heads with a chisel. Punch the remaining portion of the rivets from the holes.
2. Press the bushings out of the arm with tool 3069—details H, AA, and AA2 (Fig. 7).
3. Apply silicone or liquid soap to the shell of the new bushing. Place the bushing in the arm with the flange end (large end) of the bushing at the front of the arm.
4. Press the bushing into the arm until the shoulder on the bushing shell seats against the arm. Use tool 3069—details H, AA2, and M5 (Fig. 8).
5. If the ball joint was removed, install the new joint using the parts supplied in the ball joint kit. Torque the nuts to specification. Make sure the joint is completely filled with the specified lubricant.

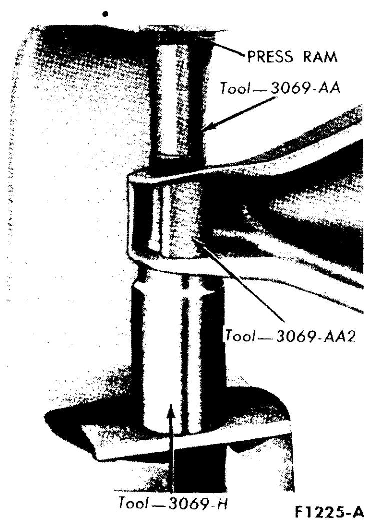

FIG. 7—Removing Lower Arm Bushing

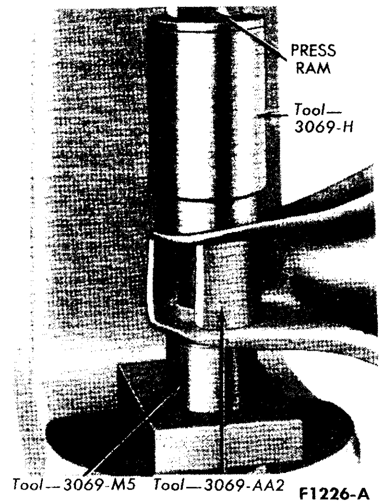

FIG. 8—Installing Lower Arm Bushing

UPPER ARM OVERHAUL—ARM REMOVED

Inspect the upper arm and the inner shaft for cracks, bends or other damage. Replace the parts as required.

Replacement arms come with the bushings, inner shaft, and ball joint installed. If the original arm is to be used, these components should be replaced on the bench.

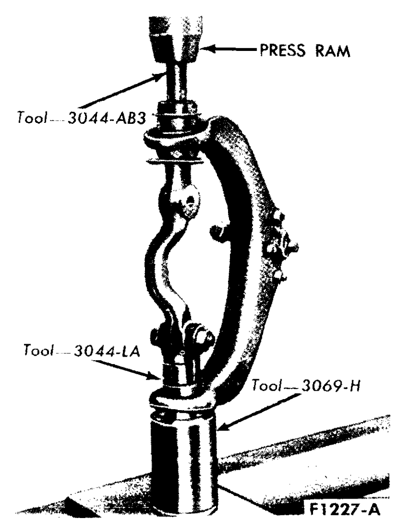

FIG. 9—Removing Upper Arm Front Bushing

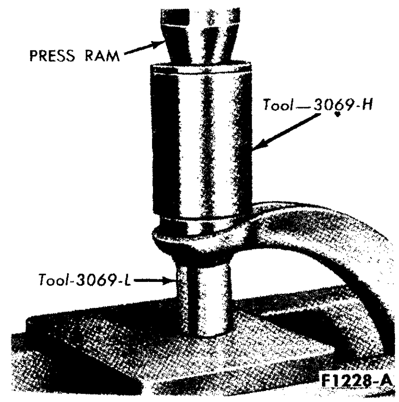

FIG. 10—Removing Upper Arm Rear Bushing

Note: Do not wash the ball joint with solvent. The solvent may attack parts within the joint.

BUSHING AND INNER SHAFT REPLACEMENT

Always replace both upper arm bushings, if either bushing is worn or damaged. Install only new bushings when replacing the inner shaft.

Refer to Section 3 for the upper arm removal procedure.

1. Remove the bolts, lockwashers, and cup washers from the ends of the upper arm shaft.
2. Assemble the remover, tool 3044-LA, to the shaft at the front bushing. Press the bushing out of the arm using the support cup, tool 3069-H, and the remover tool 3044-AB3 (Fig. 9).
3. Remove the shaft and rear bushing inner cup washer.
4. Remove the upper arm rear bushing using the support cup, tool 3069-H, and the remover, tool 3069-L (Fig. 10).

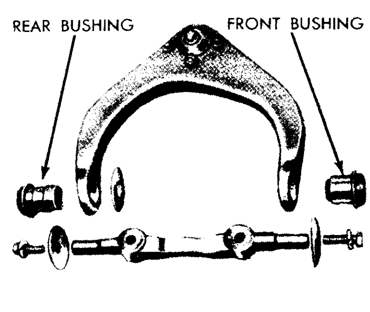

FIG. 11—Upper Arm, Shaft, and Bushing Assembly

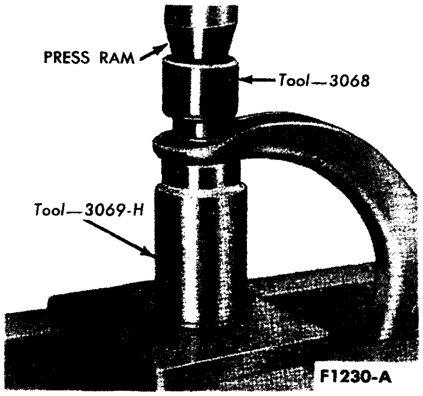

FIG. 12—Installing Upper Arm Rear Bushing

5. Both upper arm bushings are pressed into the arm from the outside toward the inside of the arm. To facilitate installation, use silicone or liquid soap as a lubricant. See Fig. 11 for proper assembly of the shaft and bushings.

6. Press the upper arm rear bushing into the arm using the support cup, tool 3069-H, and the replacer, tool 3068 (Fig. 12). Press the bushing in until the shoulder stop is reached.

7. With the rear bushing cup washer on the shaft, insert the end of the shaft into the rear bushing. Press the front bushing onto the shaft and into the arm using the replacer, tool 3068 (Fig. 13). Bottom the bushing flange against the flange in the arm.

8. Install the cup washers, lockwashers, and bolts at the ends of the upper arm shaft. **Do not tighten the bolts at this time. These must be tightened after the arm assembly has been installed, and when the front end weight of the car is on the wheels.**

CAUTION: These bolts are made of a special material. Use only the specified bolt if replacement is necessary.

BALL JOINT REPLACEMENT

Check the ball joint stud rotating torque as detailed in Section 2. If the turning effort is not within specifications, or the ball joint shows signs of wear or damage; then follow the ball joint replacement procedure as outlined in Section 2.

REAR SPRING OVERHAUL—SPRING REMOVED

FRONT HANGER ASSEMBLY

If the front hanger or bushings are to be replaced, proceed as follows.

1. Remove the nut and lock washer from the spring front mounting bolt (Fig. 2).

2. Tap the spring mounting bolt out of the bushing and hanger, then separate the hanger from the spring. Remove the bushings.

3. Position the bushings in the front eye of the spring. Assemble the front hanger to the spring eye and install the spring mounting bolt through the hanger, bushings, and spring eye as shown in Fig. 2.

4. Install the lockwasher and nut on the mounting bolt and tighten to the specified torque.

REAR SHACKLE AND HANGER ASSEMBLY

Inspect the rear shackle, bushings, and studs for wear or damage. Replace parts where necessary (Fig. 2).

If the rear shackle bushings are to be replaced, it will be necessary to remove the rear hanger assembly. Torque the hanger attaching bolts to specification when re-installed.

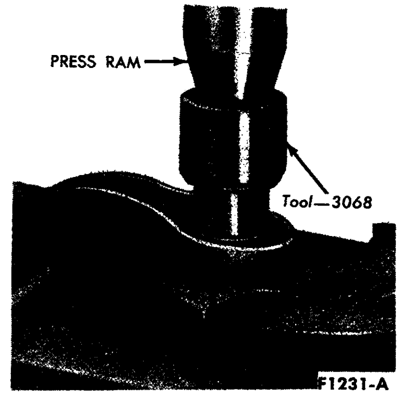

FIG. 13—Installing Upper Arm Front Bushing

SPRING LEAVES AND TIE-BOLT

Check for broken spring leaves. Inspect the anti-squeak inserts between the leaves, and replace them if they are worn. **The spring leaves must be dry and free of oil and dirt before new inserts are installed.**

Inspect the spring clips for worn or damaged threads (Fig. 2). Check the spring clip plate and insulator retainers for distortion.

If the spring center tie-bolt requires replacement, clamp the spring in a vise to keep the spring compressed during bolt removal and installation.

PART 3-3 STEERING

1 DESCRIPTION AND OPERATION

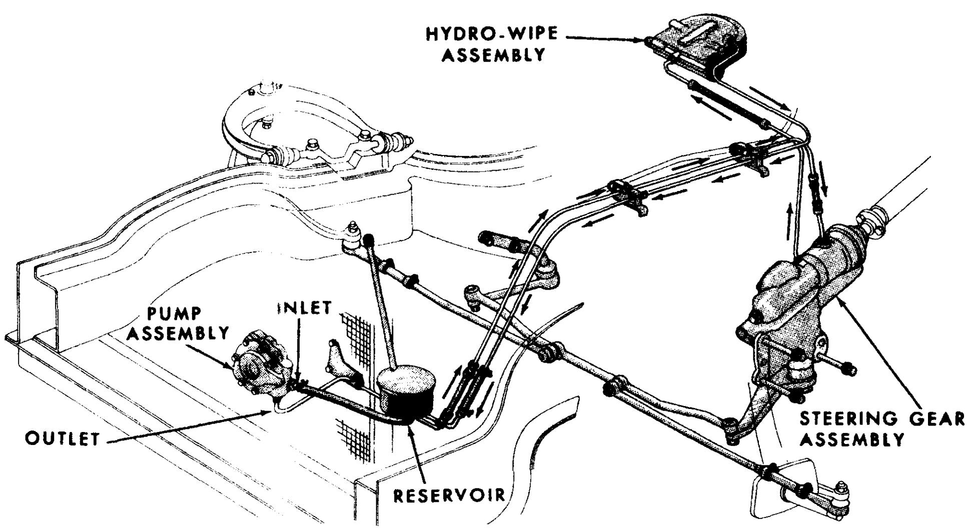

FIG. 1–Power Steering System G1198-A

POWER STEERING SYSTEM

The power steering system includes the crankshaft-driven pump, the torsion bar type steering gear, a fluid reservoir, pressure and return lines, and the steering linkage (Fig. 1).

The basic pump consists of a housing and cover, a rotor and rollers which rotate within a cam ring, and a pressure plate. A flow control valve in the pump housing governs the flow of fluid. Maximum pump pressure is controlled by a relief valve inside the flow control valve.

The major details of the power steering gear are the sector shaft, ball nut and worm shaft, torsion bar and control valve, and the power cylinder and piston. These details all are contained within a one-piece housing.

The movement of the control valve depends upon the twisting of the torsion bar. The resistance of the front wheels to being turned governs the amount of torsion bar twist. As the torsion bar twists, the control valve moves to direct fluid under pressure in the side of the piston which requires power assist.

The windshield wiper system obtains its operating oil pressure from the power steering hydraulic system.

TORSION BAR STEERING GEAR

The power steering unit is a torsion-bar type of hydraulic assisted system. This system furnishes power to reduce the amount of turning effort required at the steering wheel. It also reduces road shock and vibrations.

The torsion bar power steering unit includes a rack and piston, and a worm and ball nut assembly which is meshed to the gear on the steering sector shaft. The unit also includes a hydraulic valve, valve sleeve, and torsion bar assembly which are mounted on the end of the worm shaft and operated by the twisting action of the torsion bar.

The torsion-bar type of power steering gear is designed with all components in one housing (Fig. 2). This makes possible internal fluid passages between the valve and cylinder, thus eliminating all external lines and hoses, except the pressure and return hoses between the pump and gear assembly.

The power cylinder is an integral part of the gear housing. This piston is double acting, in that fluid pressure may be applied to either side of the piston. The one-piece piston and power rack is meshed to the sector shaft.

The operation of the hydraulic control valve is governed by the twisting of a torsion bar. All effort applied to the steering wheel is transmitted directly through the torsion bar to the ball nut and worm assembly. Any resistance to the turning of the front wheels results in twisting of the bar. The twisting of the bar increases as the front wheel turning effort increases. The control valve spool, actuated by the twisting of the torsion bar, directs fluid to the side of the piston where hydraulic assist is required.

The lower end of the torsion bar is splined to the lower end of the inside diameter of the worm shaft. The upper end of the worm shaft is coarsely splined to the inside diameter of the torsion bar and input shaft assembly upper end. This spline fit is sufficiently loose so that the upper end of the torsion bar

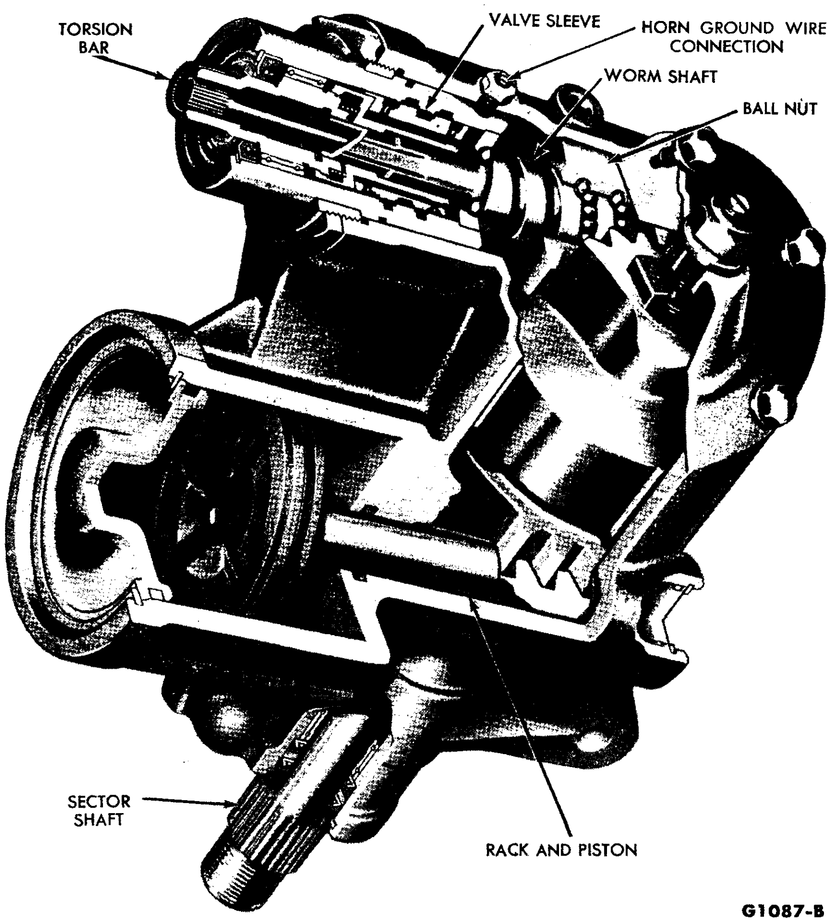

FIG. 2–Power Steering Gear

and input shaft assembly can twist in the actuator, and thus move it up and down. This movement results from a short length of helical splines on the inside diameter of the actuator which engage the outside diameter of the input shaft. The actuator is held in the spool by a snap ring. Therefore, as the torsion bar twists, its radial motion is transferred into axial motion by helical threads. Thus, the valve spool is moved off center, and fluid is directed to one side of the piston or the other (Fig. 3).

The restricting of the fluid flow to one side of the piston increases the fluid pressure proportionately to the reaction of turning the front wheels.

The resistance of the torsion bar gives the driver a feel of the road at all times. The more the torsion bar twists, the greater the feel of the road and at the same time the driver is receiving a greater power assist in steering.

STRAIGHT-AHEAD POSITION

When the power unit is not assisting in the steering effort, the valve spool is in the neutral (straight-ahead) position (Fig. 4). The fluid flows from the pump, through the open-center valve, and returns to the pump through the worm bearing. Therefore, no area of the valve spool or steering gear is under high pressure in this position. The amount of pressure in neutral position is approximately 30 psi at normal operating temperatures.

The pump has no influence on the valve spool, but the spool, housing, and power cylinder are full of fluid at all times when the pump operates.

RIGHT TURN

When the steering wheel is turned to the right, the ball nut on the worm resists being turned due to load on the sector shaft from the front end weight of the vehicle. Thus the torsion bar will start to twist (Fig. 4).

For a right turn the valve spool moves **up**, allowing fluid from the pump to enter against the upper side of the power piston. The fluid on the lower side of the piston is free to return through the valve to the pump. Therefore, the power assist is to the upper side of the piston, pushing it downward and providing assist in turning of the sector shaft.

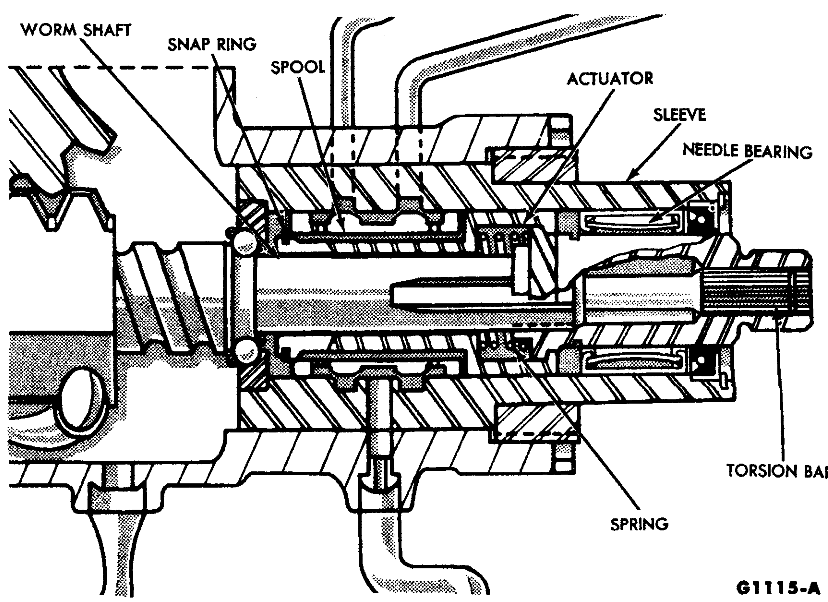

FIG. 3–Valve Detail

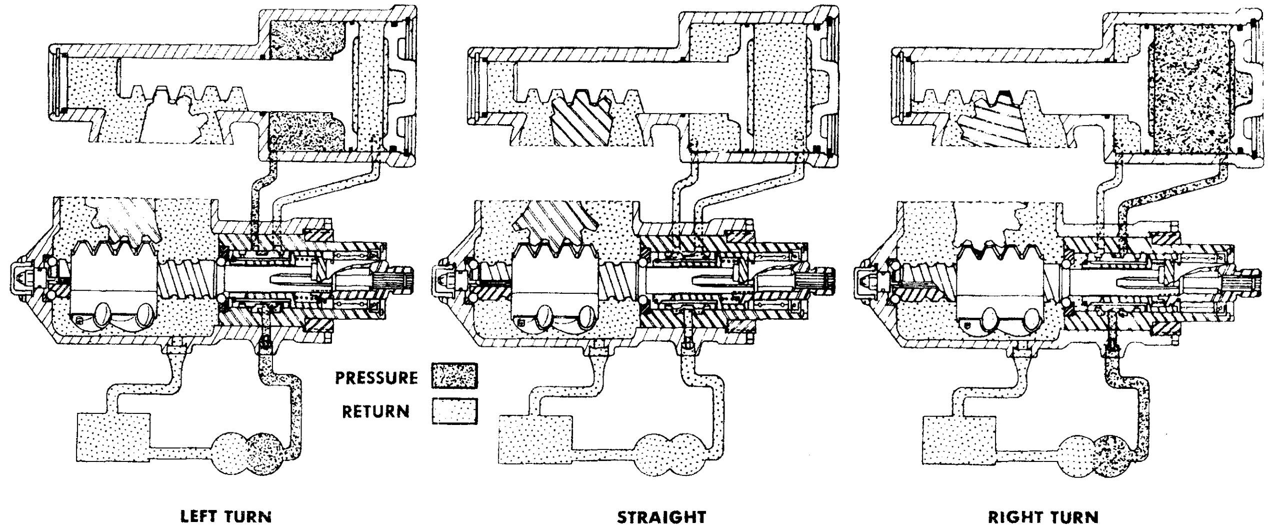

FIG. 4—Power Flows

LEFT TURN

If the steering wheel is turned to the left, it will cause a similar action but in the opposite direction (Fig. 4). The torsion bar twists to the left moving the valve spool **downward**, allowing fluid from the pump to enter against the lower side of the power piston. The fluid on the upper side of the piston is free to return through the valve to the pump. Therefore, the power assist is to the lower side of the piston, pushing it upward. The instant the driver stops applying steering effort to the steering wheel the valve spool is returned to its neutral position by the unwinding of the torsion bar. With the valve spool returning to neutral position, the torsion bar straightening also helps to return the wheels to the straight-ahead position.

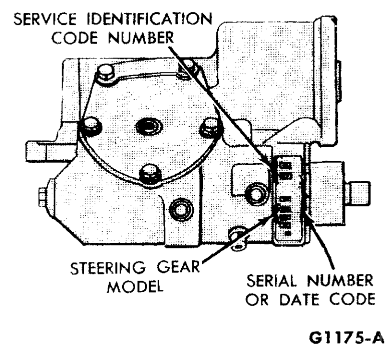

FIG. 5—Steering Gear Identification Tag

PUMP

The roller-type hydraulic pump, driven by the crankshaft, draws automatic transmission fluid from the reservoir and provides fluid pressure for the system. Steering gear lubrication is also provided by the same fluid from the reservoir. Within the pump itself is a flow-control and pressure-relief valve which governs the pressures within the steering system according to the varying conditions of operation. After fluid has passed from the gear, it returns to the reservoir.

An identification tag is attached to machined pad on top of the steering gear housing (Fig. 5) with a self-tapping screw.

2 IN-CAR ADJUSTMENTS AND REPAIRS

STEERING WHEEL SPOKE POSITION

See Part 3-1, Section 2, for this adjustment.

STEERING WHEEL REPLACEMENT

1. Remove the hub cap from the steering wheel.
2. Remove the steering wheel nut, and then remove the steering wheel as shown in Fig. 6.
3. Transfer all serviceable parts to the new steering wheel.
4. Position the steering wheel on the shaft so that the alignment mark on the hub of the wheel is adjacent to the one on the shaft. Install and torque the nut to specification. Stake the nut securely.
5. Install the hub cap.

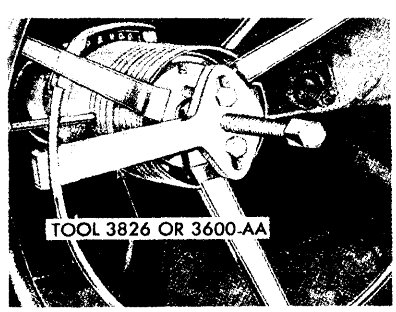

FIG. 6—Removing Steering Wheel G1199-A

STEERING COLUMN UPPER BEARING REPLACEMENT

REMOVAL

1. Disconnect the battery ground cable.
2. Loosen the Allen head screw that secures the flexible coupling to the steering shaft.
3. Remove the steering wheel.
4. Remove the turn signal lever from the column.
5. Remove the horn wire and turn signal switch attaching screws (Fig. 7). Lift the switch and horn wire from the flange and place them to one side.
6. Remove the upper bearing re-

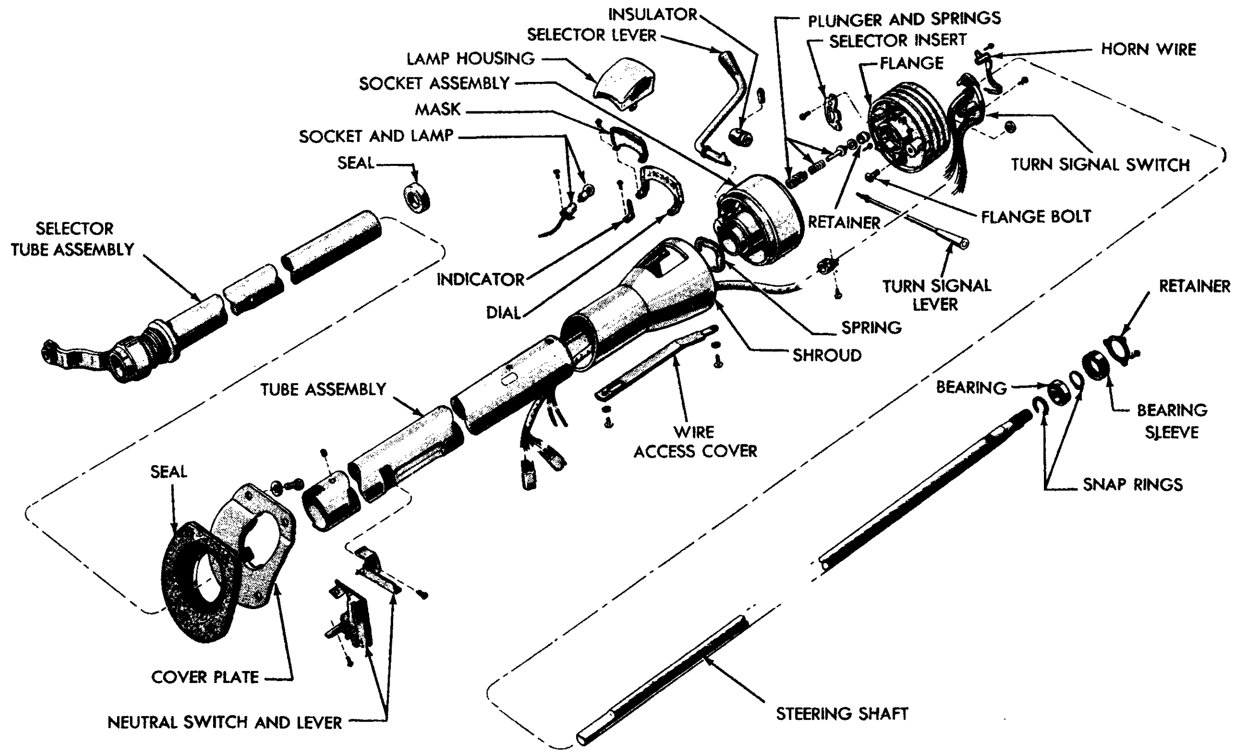

FIG. 7—Steering Column and Selector Lever Tube Details G1200-A

tainer attaching screws and remove the retainer.

7. Install the steering wheel attaching nut on the steering shaft.

8. Grasp the nut and pull the shaft from the column.

9. Remove the upper bearing snap ring and pull the bearing off the shaft.

10. Remove the rubber insulator from the bearing.

INSTALLATION

1. Pack the bearing with Lubriplate.

2. Install the rubber insulator on the bearing (Fig. 7).

3. Install the bearing and upper snap ring on the shaft.

4. Position the shaft and bearing in the column making sure that the flat on the lower end of the shaft enters the flex coupling.

5. Position the bearing retainer on the flange and secure it with the attaching screws.

6. Secure the turn signal switch and the horn wire to the flange.

7. Install the turn signal lever.

8. Install the steering wheel.

9. Secure the steering shaft to the flex coupling with the Allen head screw.

10. Connect the battery ground cable.

11. Check the turn signal operation and the horn.

STEERING COLUMN AND SELECTOR TUBE REPLACEMENT

REMOVAL

1. Disconnect the battery.

2. Disconnect the rod from the lever at the lower end of the selector tube. Loosen the clamp bolt that locks the flexible coupling to the steering shaft.

FIG. 8—Pressing Out Ball Stud G1201-A

3. Remove the cap from the steering wheel hub. Press downward on the cap and turn counterclockwise. Remove the steering wheel as shown in Fig. 6.

4. Disconnect the wires at the steering column. Remove the screws that hold the wire access cover to the underside of the column. Slide the cover toward the steering wheel to remove it (Fig. 7).

5. Remove the screws that hold the column cover plate to the dash panel.

6. Remove the column-to-instrument panel bracket clamp. Remove the column.

INSTALLATION

1. Position the steering column. Install the column-to-instrument panel bracket clamp.

2. Fasten the column cover plate to the dash panel.

3. Connect the wires at the steering column. Install the wire access cover.

4. Align the steering shaft and steering wheel hub index marks and install the steering wheel. Torque the retaining nut to specification and stake securely.

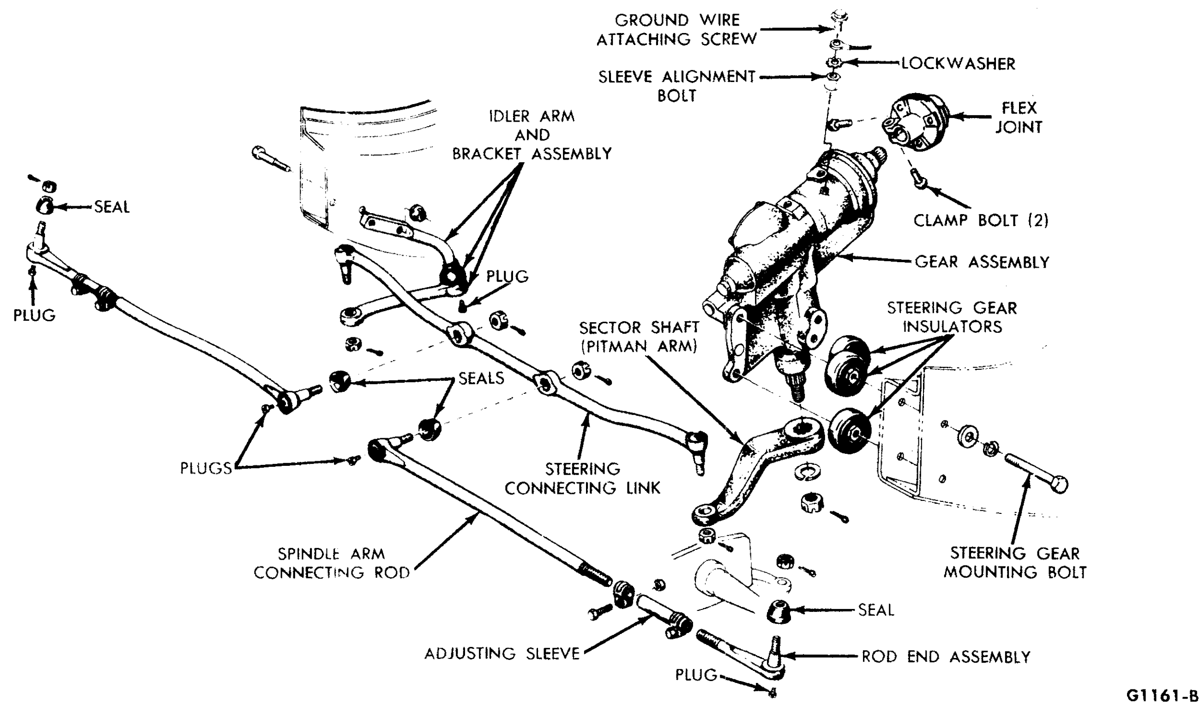

FIG. 9—Components of Steering Linkage

5. Install the steering wheel hub cap.

6. Connect the shift rod to the lever at the lower end of the selector tube.

7. Tighten the clamp bolt which locks the flexible coupling to the steering shaft.

8. Connect the battery.

STEERING LINKAGE REPLACEMENT

REMOVAL

1. Remove the cotter pins and nuts from the ball studs in the spindle arms and the steering gear (Pitman) arm. Install the thread protector on the ball stud as shown in the inset in Fig. 8. Install the remover detail making sure the end of the slot in the tool is against the ball stud. Press the ball stud from the arm. **Because of the special design of the ball stud seals, a wedge type ball stud separator must not be used.**

2. Remove the nuts and bolts that attach the idler arm bracket to the sidemember, and remove the linkage.

3. To disassemble the linkage use tool 3290-C to press the ball stud out of the steering connecting link and the idler arm (Fig. 9).

INSTALLATION

1. Install the seal over the ball stud of the center link, then assemble the connecting link to the idler arm and torque the ball stud retaining nut to specification. Install the cotter pin.

2. Install new ball stud seals and assemble the connecting rod ball studs to the spindles. Torque the stud retaining nuts to specification and install the cotter pins.

3. Attach the idler arm bracket to the body sidemember with the mounting bolts and tighten the nuts to the specified torque.

4. Install the connecting link ball stud seal on the ball stud, then assemble the connecting link ball stud to the steering arm. Torque the stud retaining nut to specification and install the cotter pin.

5. Make certain all the ball joints are full of lubricant.

6. Check toe-in and steering wheel spoke position.

STEERING GEAR

Worm Bearing Preload and Sector Mesh Adjustment.

1. Remove the fluid from the power steering reservoir with a suction gun.

2. Disconnect the fluid return line from the reservoir. Place the end of the return line in a container and turn the steering wheel in both directions as required to discharge the fluid from the gear.

3. Working from under the car, disconnect the Pitman arm from the steering gear.

4. Remove the hub cap from the steering wheel.

5. Attach an inch-lb torque wrench to the steering wheel attaching nut (Fig. 10).

6. Measure the force required to move the worm shaft approximately 20° away from the stop.

7. If reading is not within 6-8 in-lbs, loosen the adjuster lock nut and turn the bearing adjuster to obtain the proper reading. Tighten the lock nut, making sure the adjuster does not turn. Re-check pre-load.

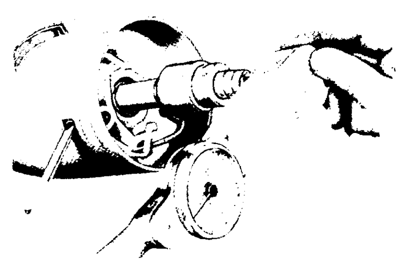

FIG. 10—Checking Steering Gear Pre-load G1202-A

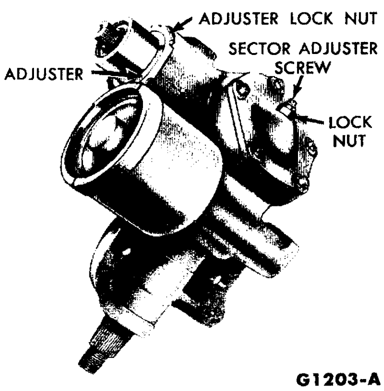

FIG. 11—Pre-load and Mesh Load Adjustments

8. Locate the mechanical center of the steering gear by rotating the steering wheel right or left to the stop, then back it off 1¾ turns.

9. Rotate the steering gear to the left stop. Using an inch-pound torque wrench, back it off at a constant pull, reading the torque at exact mechanical center.

Rotate the gear to the right stop and take the reading in the opposite direction.

If two slightly different readings are obtained, the larger should be recorded as total on-center meshload.

10. If total over-center meshload is not within 15-17 in-lbs, loosen the sector adjuster lock nut (Fig. 11) and turn the adjuster screw to obtain proper adjustment.

NOTE: 1/16 turn of the adjuster will increase the meshload approximately 2 in-lbs.

Tighten the adjuster lock nut making sure the adjusting screw does not turn. Re-check the meshload.

AIR BLEEDING

Air in the system (shown by bubbles in the fluid) should be purged. Furthermore, the power steering system should be purged after any part of it has been opened to the atmosphere or disconnected for repair or replacement.

1. Run the engine at idle speed. Check the fluid level in the pump reservoir. If necessary, add the specified automatic transmission fluid to bring the level to the "F" mark on the dipstick.

2. Turn on the windshield wipers. Rotate the steering wheel from stop to stop several times to bleed the air from the system. **Do not hold the wheels against the stops.** Recheck the fluid level in the reservoir.

3 REMOVAL AND INSTALLATION

STEERING GEAR

REMOVAL

1. Disconnect the pressure line and the return line from the steering gear housing. Plug the openings and cap the lines.

2. Disconnect the horn ground wire from the sleeve alignment bolt. Remove the bolt that secures the flexible coupling to the steering gear worm shaft (Fig. 9).

3. Raise the car. Remove the transmission linkage splash shield.

4. Remove the exhaust manifold to resonator pipe, and remove the front end crossmember.

5. Remove the Pitman arm from the sector shaft as shown in Fig. 12.

6. Remove the transmission linkage rods from the equalizer shaft. Force the shaft outward. This compresses a spring within the shaft which frees it from the inner ball joint.

7. Loosen (or remove) the retaining bolts at the lower edge of the fender splash shield to obtain clearance; then remove the gear housing-to-body member mounting bolts.

8. Pull the steering gear from the flexible coupling.

INSTALLATION

1. If a new gear is being installed, transfer the insulators from the old gear to the new one if they are in a serviceable condition.

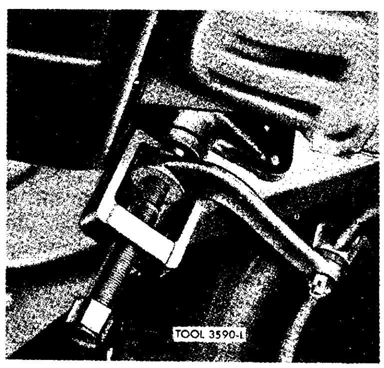

FIG. 12—Removing Pitman Arm G1204-A

2. Center the gear by turning the worm shaft to either stop, then, turn it back approximately two turns.

3. Center the steering wheel and insert the input shaft in the flexible coupling. Secure the steering gear to the body member with the attaching bolts. Torque the bolts to specification.

4. Position the Pitman arm on the sector shaft and secure it with a lock washer and nut. Torque the nut to specification.

5. Position the equalizer shaft and install the transmission linkage rods.

6. Install the manifold-to-resonator pipe.

7. Attach the front crossmember and the splash shield lower edge.

8. Lower the car. Connect the pressure and the return line to the steering gear.

9. Connect the horn ground wire to the sleeve alignment bolt. Install and torque the flexible coupling retaining bolt to specification.

10. Fill the fluid reservoir and start the engine. Cycle the steering wheel, with the windshield wipers operating, and check for oil leaks. Do not hold the wheels against their stops and cause the fluid to overheat.

11. If the gear has been overhauled, adjust the position of valve spool as detailed in "Assembly of Steering Gear," Section 4.

PUMP RESERVOIR—WITHOUT AIR CONDITIONING

REMOVAL

1. Remove the reservoir cover and gasket. Withdraw the fluid with a suction gun.

2. Remove the reservoir bracket to cylinder block upper cap screw and the lower cap screw and spacer.

3. Disconnect the reservoir inlet line and the outlet line at the reservoir, and remove the reservoir.

INSTALLATION

1. Connect the reservoir to pump line (outlet line) at the reservoir, but do not tighten the clamp.

2. Attach the reservoir and bracket to the cylinder block with the upper cap screw and the lower cap screw and spacer. Tighten the cap screws.

3. Tighten the outlet line clamp at the reservoir. Connect the reservoir inlet line to the reservoir.

4. Fill the reservoir with the specified automatic transmission fluid. Run the engine, and bleed the system by cycling the steering gear with the windshield wipers turned on. Check for leaks, and recheck the fluid level.

PUMP RESERVOIR—WITH AIR CONDITIONING

REMOVAL

1. Raise the front of the car. Remove the reservoir to pump line (outlet line) clamp at the reservoir, but do not disconnect the line at this time.

2. Disconnect the reservoir inlet line at the reservoir.

3. Remove the reservoir bracket to the cylinder block upper cap screw. Support the reservoir and remove the lower cap screw and spacer.

4. With a drain pan under the reservoir, disconnect the outlet line hose from the reservoir tube and allow the fluid to drain.

5. Remove the reservoir cover retaining nut and the cover. Position the cover and the reservoir out of the way and allow them to rest in the engine compartment.

6. Lower the front of the car. Remove the fan shroud.

7. Remove the reservoir and the cover by manipulating them through the opening between the radiator and the compressor drive belt.

INSTALLATION

1. Position the reservoir in the engine compartment. Loosely attach the reservoir and bracket to the cylinder block with the upper cap screw.

2. Install the fan shroud, then raise the front of the car.

3. Connect the reservoir to pump line (outlet line) at the reservoir.

4. Install the reservoir bracket to cylinder block lower cap screw and spacer. Tighten both the upper and the lower cap screws.

5. Connect the reservoir inlet line at the reservoir. Install the clamps on both lines. Lower the car, and install the reservoir cover and retaining nut.

6. Fill the reservoir with the specified automatic transmission fluid. Run the engine, and bleed the system by cycling the steering gear with the windshield wipers turned on. Check for leaks, and recheck the fluid level.

POWER STEERING PUMP

REMOVAL

1. Open the hood, and install fender covers.

2. If the car is equipped with air conditioning, loosen the compressor adjusting and support bracket bolts and remove the drive belt.

3. Loosen the generator adjusting and support bracket bolts, and remove the drive belts.

4. Remove the fan, pulley, and spacer.

5. Raise the car.

6. Remove the crankshaft damper bolt and washer. Remove the damper with tool 6306-AG. Remove the drive key.

7. Disconnect the pump inlet line at the pump, and plug the end of the line to prevent the loss of fluid. Disconnect the pump pressure line at the pump.

8. Remove the pump to engine front cover cap screws, and remove the pump. Remove the seal from the front cover.

INSTALLATION

1. Install a new seal on the engine front cover.

2. Align the slot in the pump rotor shaft with the drive key in the crankshaft, and slide the pump onto the shaft. Install the pump to engine front cover cap screws. Torque the cap screws to specification.

3. Connect the pump inlet line and the pressure line.

4. Install the damper drive key, damper, washer and bolt. Torque the bolt to specification.

5. Install the fan, pulley, and spacer. Install the generator drive belts. Adjust the belt tension, and tighten the adjusting and support bracket bolts.

6. If the car is equipped with air conditioning, install the compressor drive belt. Adjust the belt tension, and tighten the adjusting and support bracket bolts.

7. Run the engine at idle speed, and check the fluid level in the reservoir. If required, add the specified automatic transmission fluid. Turn on the windshield wipers. Rotate the steering wheel from stop to stop several times to bleed the air from the system. Recheck the fluid level.

4 MAJOR REPAIR OPERATIONS

STEERING GEAR DISASSEMBLY

Use only parts specified for the Lincoln steering gear.

1. Drain the hydraulic fluid from the ports, and thoroughly clean the exterior of the unit with a suitable solvent.

2. Mount the unit for disassembly on a stand adapter or in a vise.

3. After removing the cylinder plug snap ring, use compressed air to remove the cylinder plug from the piston rack bore.

4. After removing the snap ring, remove the cylinder cap from the piston bore (Fig. 13). Remove the cylinder cap O-ring.

5. Check the amount of backlash between the sector gear and the piston rack as follows:

a. Position a dial indicator against the piston. Locate the dial indicator shaft on the machined surface at the outside diameter of the piston, and set it at zero (Fig. 14).

b. While holding the sector shaft firmly, push the piston by hand as far as it will go first in one directon and then the other, to obtain total deflection of the needle (Fig. 14). Note the indicator reading.

c. The backlash should not exceed .004 inch. If the backlash is excessive, install a new piston or sector shaft as required when assembling the gear.

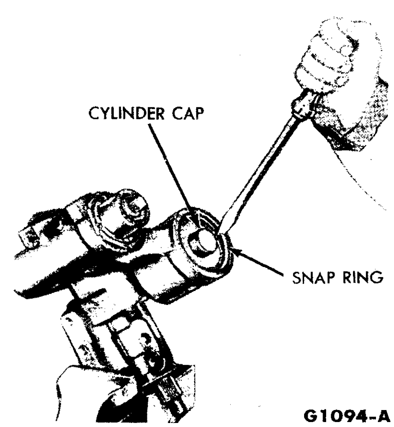

FIG. 13—Removing Cylinder Cap Snap Ring

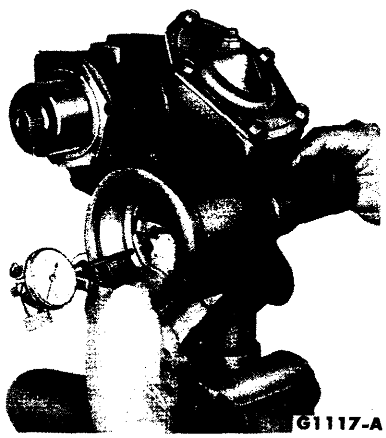

FIG. 14–Checking Piston Backlash

6. Turn the worm shaft all the way to the stop and back it off about one and three-quarters turns, using the tool shown in Fig. 15.

7. Loosen the sector shaft adjusting screw lock nut and adjusting screw. Remove the cap screws that attach the steering gear housing cover to the housing. Tap on the lower end of the sector shaft with a soft-faced hammer until the sector shaft and cover can be removed (Fig. 16). Remove and discard the housing cover gasket and cover bolts (not re-usable). Slide the cover to one side to release the adjusting screw from the sector shaft, and remove the adjusting screw from the cover.

8. Push the piston out of the housing. Remove the piston O-ring. Remove the piston rack bore O-ring as shown in Fig. 17.

9. Loosen the valve sleeve alignment bolt.

10. Remove the valve adjuster cap and remove the O-ring from the cap.

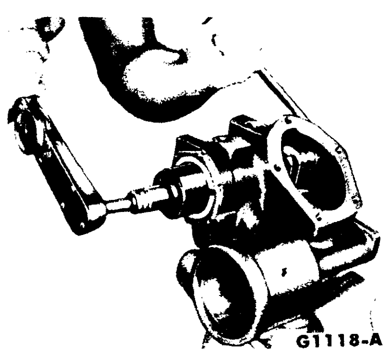

FIG. 15–Pre-load Check

FIG. 16–Removing Sector Shaft

11. Remove the bearing adjuster lock nut and the bearing adjuster.

12. Remove the torsion bar and sleeve assembly (Fig. 18) by lightly tapping on the lower end of the torsion bar with a soft-faced hammer.

13. Remove the sector shaft oil seal retaining snap ring (Fig. 21). Remove the outer seal with tool 1175-AE, then remove the spacer. Remove the inner seal with tool 1175-AE.

TORSION BAR AND SLEEVE DISASSEMBLY

1. Position the ball nut assembly in a vise. Use a clean cloth in the vise to protect the ball nut assembly. Remove the valve spool sleeve from the torsion bar assembly (Fig. 21). Remove the O-ring from the sleeve.

2. Remove the valve spool adjuster lock nut from the lower end of the torsion bar. Remove the valve spool adjuster from the torsion bar.

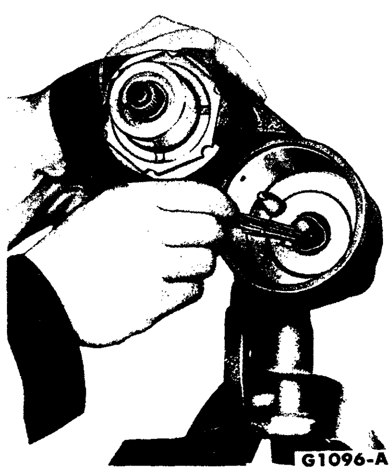

FIG. 17–Removing Piston O-Ring

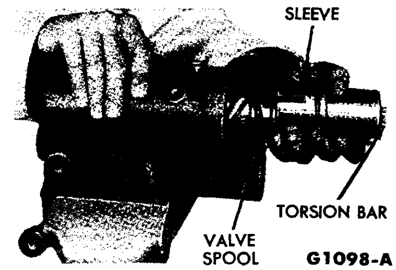

FIG. 18–Removing Torsion Bar and Sleeve

3. Remove the torsion bar, valve spool, actuator, seal, bearing and race from the worm shaft (Fig. 19). Tap the end of the torsion bar with a soft-faced hammer, if necessary. **The valve spool and the actuator assembly are spring-loaded.** Discard the lower bearing race seal. Separate the valve spool and the actuator assembly from the torsion bar by turning the valve spool and actuator while turning the torsion bar.

4. Remove the valve spool snap ring. Remove the valve spool from the actuator.

5. Check the ball nut assembly for evidence of binding or rough spots in the assembly itself. **Do not disassemble unless there is evidence of binding or rough spots. Be sure, however, that there is sufficient lubrication throughout the ball nut. The ball nut is not preloaded and should move freely throughout the entire travel. Do not rotate the ball nut against the end of the worm shaft as damage will result. To disassemble the ball nut proceed as follows.**

6. Remove the ball nut guide retainer and the ball guides. Turn the nut over and remove the balls by rotating the worm shaft from side to side. Catch the balls in a clean pan or a clean cloth. Remove the ball nut from the worm shaft. **Note the position of the ball nut on the worm shaft (Fig. 22).**

7. Wash all parts in clean solvent and dry them with compressed air.

8. Inspect the worm and ball nut grooves, and all of the balls for wear or scoring. If either the worm or ball nut needs replacing, both must be replaced as a matched assembly. Inspect the ball nut teeth for pitting, wear or scoring.

9. Make certain that the ball return guide ends are not damaged.

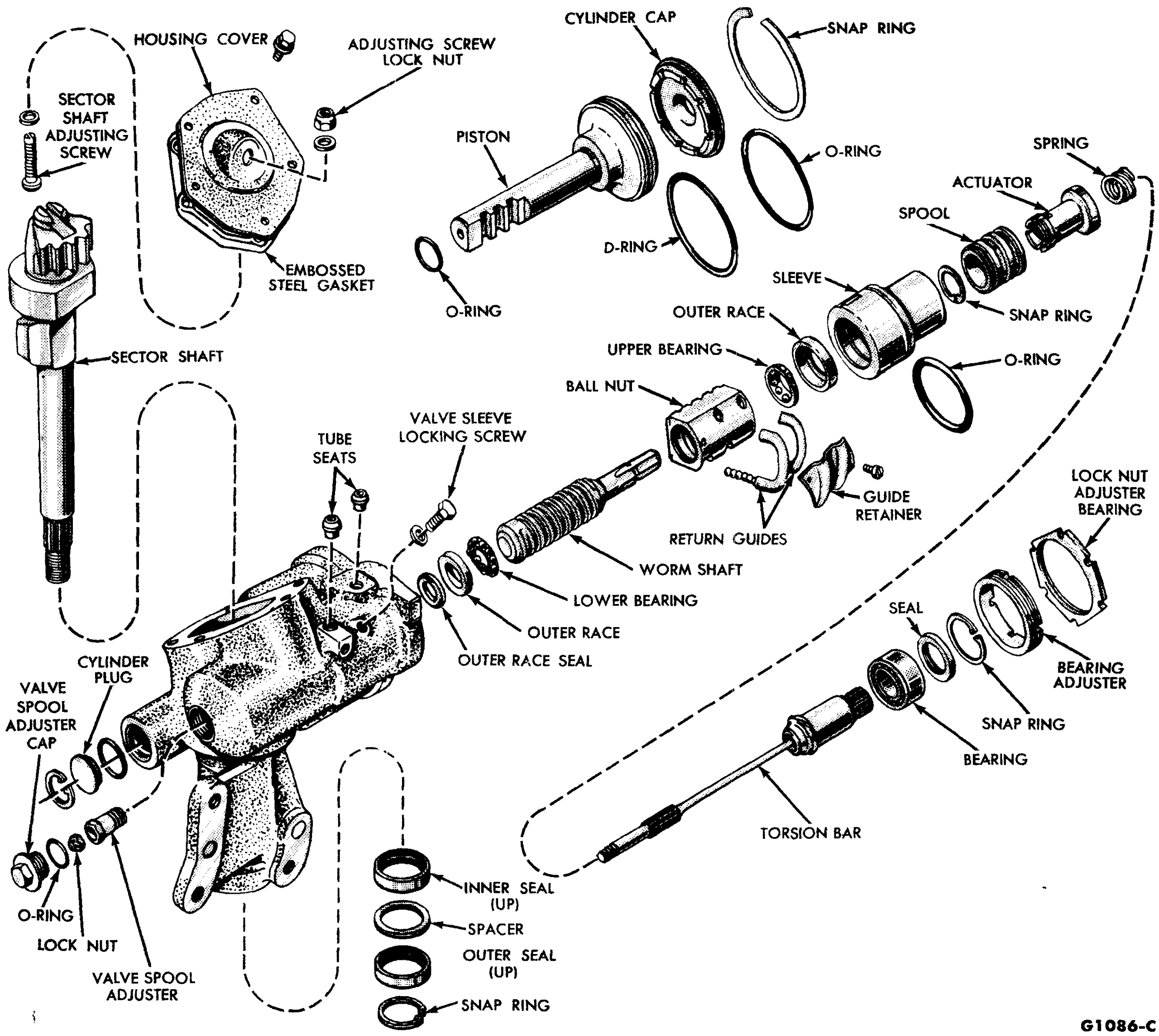

FIG. 19–Power Steering Gear Disassembled

TORSION BAR AND SLEEVE ASSEMBLY

1. Slide the ball nut over the worm. See Fig. 22 for the correct position.

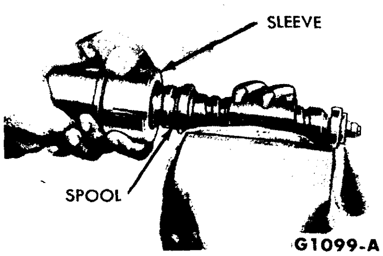

FIG. 20–Removing Valve Spool Sleeve

Align the ball return guide holes with the worm groove. Count 31 balls (one half the number of balls) into a suitable container This is the number of balls required to fill one circuit. Drop 21 of these balls into one guide hole to fill the one circuit in the ball nut. It may be necessary to oscillate the shaft slightly to circulate the balls. Make sure that none of the balls come out the other end of the circuit and enter the worm groove between the two circuits.

2. Coat the groove of one-half of a return guide with clean oil-soluble grease and place 10 balls in the guide. Place the other half of the guide over the balls. While holding the two halves together, push the guide into the guide holes in the ball nut. If the guide does not push all the

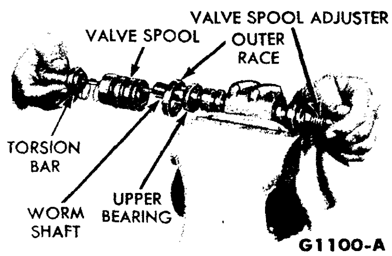

FIG. 21–Removing Valve Spool Adjuster

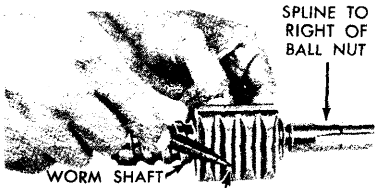

FIG. 22—Ball Nut Position

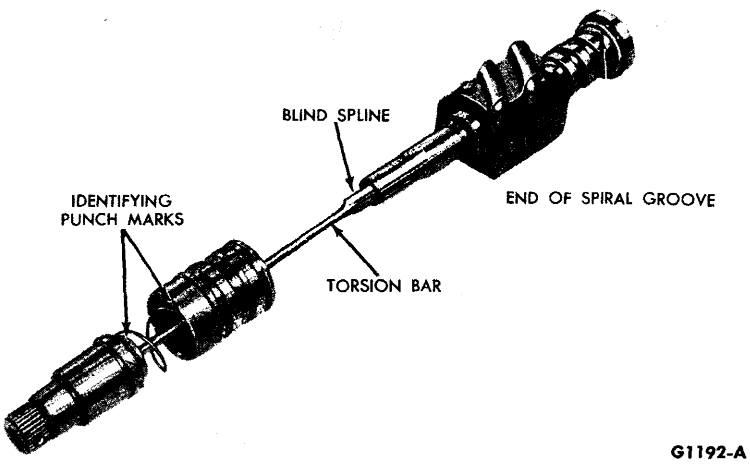

FIG. 24—Installing Torsion Bar

way down easily, tap it lightly with a soft-faced hammer to seat it. Fill the second circuit in the same manner and then attach the guide clamp with the lockwashers and retaining screws.

3. Inspect the torsion bar splines for nicks, pitting, wear or scoring. Make sure the blind spline on the torsion bar lines up with the punch dot on the upper end of the assembly (large splined end). If they do not line up, replace the torsion bar assembly.

4. Check the fit of the actuator on the torsion bar assembly, with the spring in place. Hold the torsion bar while turning the actuator. When the actuator is released, the spring should cause the actuator to pop off the threads. If it does not pop off, replace the spring and check the gear teeth for burrs. If there are any burrs that cannot be removed, replace the defective parts.

5. Check the sleeve ball bearing for freedom of rotation. If the bearing is satisfactory, remove the snap ring and replace the oil seal. If the bearing must be replaced, remove the seal, and then remove the bearing, using the tools shown in Fig. 23.

6. Install the bearing in the sleeve, using the tool shown in Fig. 23. **The bearing must be pressed in so that there is 0.035-0.045-inch between the upper surface of the bearing and the seal seat surface of the sleeve.** To install the seal, use the tool shown in Fig. 23. Install the snap ring and check bearing rotation.

7. Lubricate the parts with automatic transmission fluid.

8. Check the fit of the upper bearing race to insure that it is a slip fit in the sleeve. Install the bearing race and bearing on the worm shaft.

9. Install the valve spool on the actuator and retain with a new snap ring. Check the valve spool for free rotation.

10. Install the torsion bar spring and the actuator on the torsion bar. Turn the lower end of the shaft so that the two identifying punch marks are aligned (Fig. 24). Hold the assembly together and insert the torsion bar into the worm shaft, aligning the blind spline on the torsion bar with the end of the spiral groove on the lower end of the worm and shaft. **The torsion bar assembly is properly installed when the valve spool bottoms against the upper bearing and race.**

11. Hold the lower bearing, race and seal in position on the worm shaft and install the valve spool adjuster on the torsion bar, but do not tighten. Install the lock nut. Lubricate the lip of the input shaft seal with automatic transmission fluid.

12. Install the valve sleeve over the valve spool so that the upper bearing outer race is seated in the recess of the sleeve. Install a new O-ring seal on the sleeve.

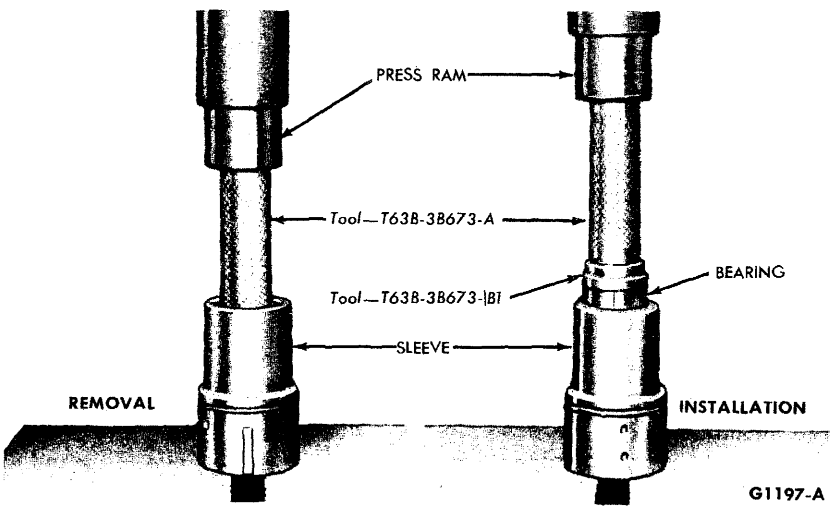

FIG. 23—Replacing Sleeve Seal and Bearing

ASSEMBLY OF STEERING GEAR

Refer to Fig. 19.

1. Align the slot in the sleeve with the lock screw in the housing, and install the torsion bar and sleeve assembly in the housing. **Be sure that the seal and the lower bearing outer race are properly seated.** Tap on the sleeve until it bottoms. Torque the lock screw to 15-20 ft-lbs. **The lock screw and the brass washer must be seated against the housing when they are properly installed.**

2. Install the bearing adjuster and lock nut.

3. Install the valve spool centering wrench (Fig. 25) on the valve

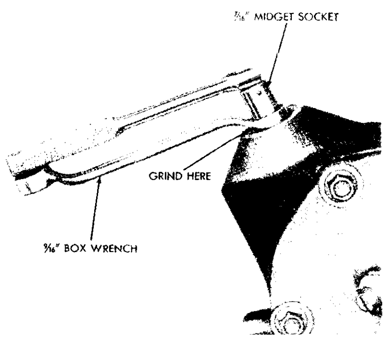

FIG. 25—Valve Spool Preliminary Centering G1205-A

spool adjuster, and locate the valve spool so that the valley between the lands can be seen through the pressure port. Lock the adjuster with the lock nut, as shown in Fig. 25. **This is only a preliminary adjustment.**

4. Center the ball nut with the centerline of the sector shaft opening.

5. Install a new O-ring in the piston rack bore of the housing, and lubricate the parts.

6. Carefully hone the edges of the piston rack teeth with a hand stone to prevent cutting the piston rack bore O-ring during installation.

7. Install a new O-ring on the piston and install the piston in the housing. **Lubricate the parts thoroughly and rotate the piston while inserting it.** Align the center rack teeth with the sector bore in the housing.

8. Grease the sector shaft splines and install the shaft. Make sure that the sector shaft is centered by rotating the worm shaft. Count the turns from one stop to the other. There should be at least 3½ turns. If there are fewer than 3½ turns, remove the sector shaft and install correctly.

9. Position the sector shaft inner seal in the steering gear housing with the rubber sealing lip facing inward. Seat the seal in the housing with tool T61B-3576-A and adapter T62B-3576-A as shown in Fig. 26. **The long flange of the adapter should press against the seal.**

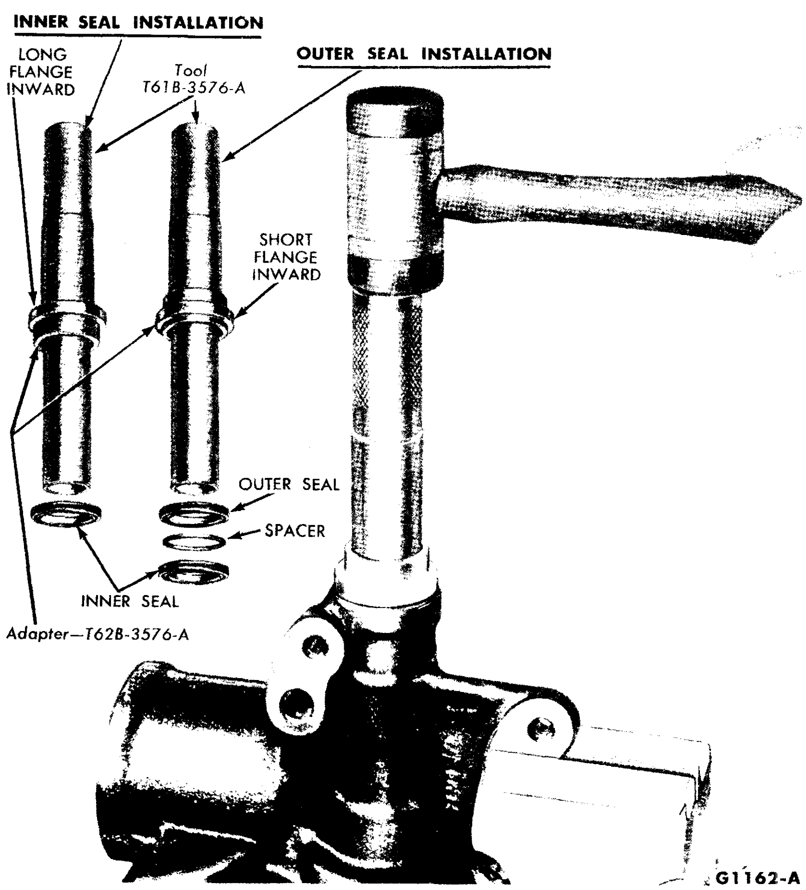

FIG. 26—Installing Sector Shaft Oil Seals

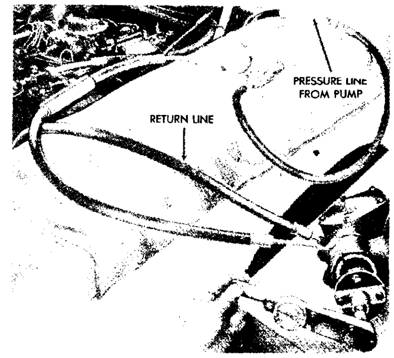

FIG. 27—Pressure Gauge Installed G1206-A

10. Install the metal spacer against the inner seal, then position the sector shaft outer seal with the sealing lip facing inward against the spacer. Seat the seal with the tool and adapter (Fig. 26). **The short flange of the adapter should press against the outer seal.**

11. Install the seal retaining snap ring. If the outer seal has blocked off the snap ring retaining groove in the casting, tap the tool and adapter against the snap ring so that the snap ring will seat into the groove of the casting.

12. Install the sector shaft adjusting screw with the proper shim to obtain proper clearance (0.002). Shims are available in thicknesses of 0.063, 0.065, 0.067 and 0.069. Place the housing cover, with a new gasket in place, over the adjusting screw, and turn the screw until the cover is seated. Install new cover attaching screws, and torque them to specification.

13. Adjust the worm bearing preload and the sector mesh as detailed in Section 2. This adjustment can be accomplished with the steering gear out of the car by attaching a ¾-inch socket (12 point) and an in-lb torque wrench to the input shaft instead of the steering wheel attaching nut.

14. Check the piston rack backlash as detailed under "Steering Gear Disassembly" in this Section.

15. Install a new cylinder plug O-ring and the cylinder plug in the piston rack bore. Secure the cylinder plug with a snap ring.

16. Install a new cylinder cap O-ring in the piston bore, then install the cylinder cap and snap ring.

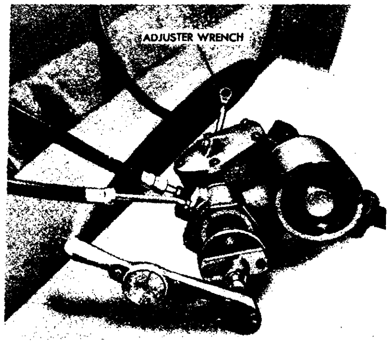

FIG. 28—Adjusting Centering Spool G1207-A

17. To adjust the centering spool, connect a 0-2000 psi pressure gauge between the car pump pressure line and the inlet port (upper hole) in the gear (Fig. 27).

18. Connect the return hose to the outlet port (lower hole) in the gear.

19. Make certain that the gauge hand valve is in the fully open position.

20. Fill the power steering pump reservoir to the correct level with the specified fluid.

21. Start the engine and cycle the steering gear from stop-to-stop until the fluid reaches normal operating temperature. Recheck the reservoir and add fluid as necessary.

22. Using an inch-pound torque wrench with a ¾-inch socket at the input shaft, rotate the gear to the left stop, adding sufficient torque to the torque wrench to simultaneously obtain 300 psi on the pressure gauge, and the required torque on the torque wrench gauge.

Repeat this process again in the opposite direction.

The torque required to obtain a gauge reading of 300 psi in both directions should not differ more than 3 inch-pounds.

23. If the torque wrench reading is more than 3 inch-pounds between the right and left turns, loosen the valve spool adjuster lock nut and rotate the adjuster in the direction of the low reading (Fig. 28). Only a slight movement of the adjuster is required to move the valve spool. Tighten the adjuster lock nut before each reading is made.

24. Install the steering gear in the car.

25. Recheck the torque in both directions as in step No. 22. If the readings are within 3 inch-pounds of each other, install the adjuster cap. Disconnect the test gauge.

POWER STEERING PUMP DISASSEMBLY

A clean working area should be used when overhauling the power steering pump. Foreign matter picked up on working parts may cause damage or failure of the unit. Clean containers should be used for parts.

1. Drain the fluid from the pump. Remove the pump cover to housing cap screws (Fig. 29). Place the pump on the bench, cover side down. Lift the housing from the cover.

2. Remove the large and the small O-rings from the pump cover. Remove the O-ring from the pressure plate hub.

3. Remove the pressure plate to cover screws, and remove the plate. Lift the cam ring off the dowel pins.

4. Remove the rollers. Lift the rotor off the shaft, and remove the drive key from the shaft. Remove the dowel pins from the cover.

5. Remove the rotor shaft from the cover. **Do not remove the snap ring from the shaft unless it, or the shaft, is damaged.**

6. Pry the rotor shaft seals out of the cover and the housing.

7. **Do not disturb the control valve unless diagnosis indicated a control valve problem or foreign matter in the valve.** To remove the valve, drive the roll pin out of the housing. Remove the plug and O-ring, control valve, and the spring. If the plug or valve is stuck, tap the end of the housing on a piece

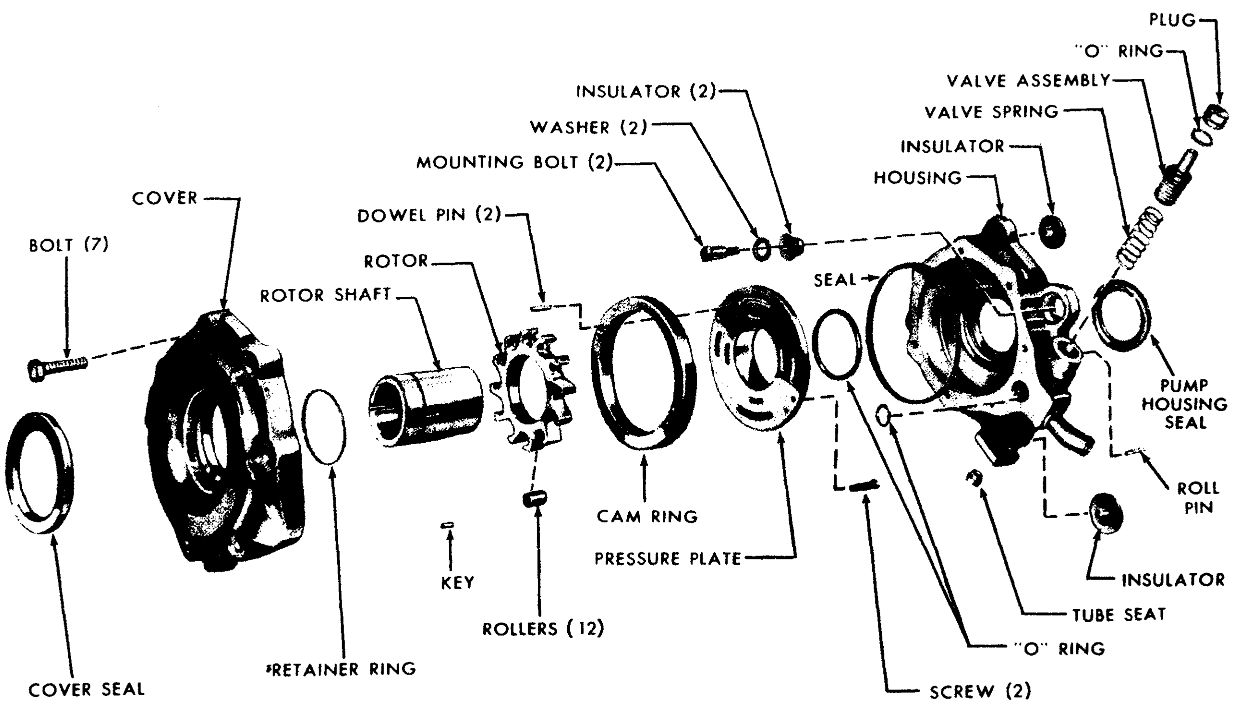

FIG. 29—Power Steering Pump G1208-A

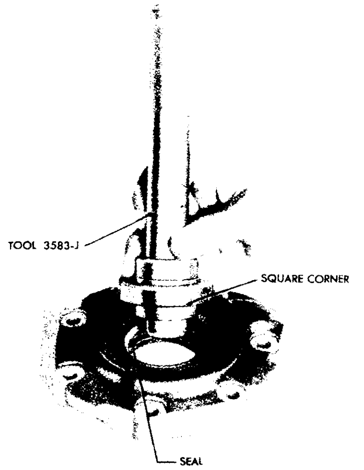

FIG. 30—Preparation for Installing Rotor Shaft Seals G1209-A

of wood or tap it with a soft-faced hammer. Remove the O-ring from the plug.

POWER STEERING PUMP ASSEMBLY

Apply automatic transmission fluid to all parts as they are assembled. Always use new seals and O-rings.

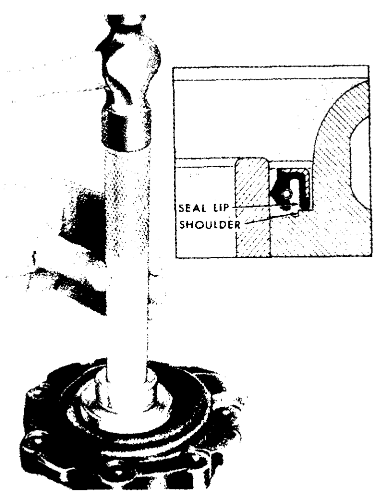

FIG. 31—Installing Rotor Shaft Seal G1210

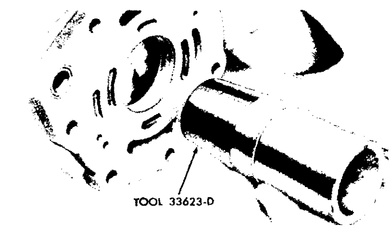

FIG. 32—Installing Rotor Shaft in Cover G1211

1. Install the control valve spring in the housing. Install the valve with the small sensing hole in the end of the valve toward the spring. Install a new O-ring on the plug. **The plug O-ring is 1/8 inch smaller in diameter than the bypass O-ring. Make sure the proper O-ring is used.** Install the plug and a new roll pin (Fig. 29).

2. The rotor shaft oil seals are installed in the cover and the housing with tool 3583-J, which consists of a driver and an adapter. The procedure is as follows:

   a. Support the cover on wood blocks (Fig. 30) to provide tool clearance. **Use clean blocks that will not nick or damage the inner face of the cover.**

   b. Start the seal (metal shell upward) squarely into the bore with finger pressure. Place the adapter on the driver with the square corner of the adapter toward the seal (Fig. 30). Drive the seal into the cover, as shown in Fig. 31 until it bottoms.

   Driving the seal beyond this point can damage it. Install the seal in the pump housing in the same manner.

3. Install the rotor shaft in the cover as shown in Fig. 32 to prevent damage to the seal.

4. Install the dowel pins in the cover. Place the rotor drive key in the shaft. Install the rotor on the shaft with the drive key groove aligned with the key and the counterbored side of the rotor toward the cover so that it goes over the snap ring.

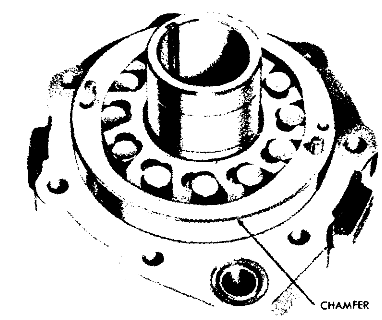

FIG. 33—Cam Ring Installation G1212

5. Place the cam ring on the dowel pins with the chamfered edge upward (Fig. 33). Place the rollers in the rotor.

6. Place the pressure plate on the dowel pins. Install and tighten the screws to 20 in-lbs torque. Install the O-ring on the pressure plate hub. Install O-rings in the groove at the oil bypass hole and around the cam ring (Fig. 34).

7. Place the tool shown in Fig. 32 in the rotor shaft to prevent damage to the oil seal, then install the housing on the cover. Install and torque the cap screws to 15-20-ft-lbs.

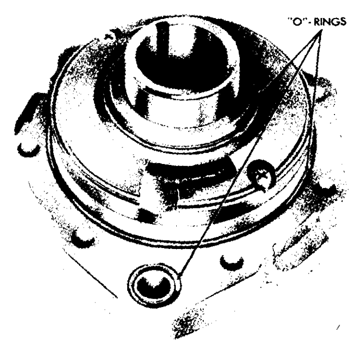

FIG. 34—O-Ring Installation G1213

PART 3-4 WHEELS AND TIRES

1 DESCRIPTION AND OPERATION

FRONT WHEEL ASSEMBLY

Each front wheel and tire assembly is bolted to its respective front hub and brake drum assembly. Two opposed, tapered roller bearings are installed in each hub. A grease retainer is installed at the inner end of the hub to prevent lubricant from leaking into the drum. The entire assembly is retained to its spindle by the adjusting nut, nut lock and cotter pin (Fig. 1). The front wheel assemblies rotate freely on their respective spindles and are driven by the motion of the car.

REAR WHEEL ASSEMBLY

The rear wheel hub and brake drum assembly is retained to studs on the rear axle shaft flange by three speed nuts. The wheel and tire assembly mounts on the same rear axle shaft flange studs and is held against the hub and drum by the wheel nuts. The rear wheel bearing is pressed onto the axle shaft just inside the shaft flange, and the entire assembly is retained to the rear axle housing by the bearing retainer plate which is bolted to the housing flange.

The inner end of each axle shaft is splined to the engine powered differential. The rear wheels are, therefore, driven by the engine.

2 IN-CAR ADJUSTMENTS AND REPAIRS

FRONT WHEEL BEARING ADJUSTMENT

The front wheel bearings should be adjusted if the wheel is loose on the spindle or if the wheel does not rotate freely. The following procedure will bring the end play to specification.

1. Raise the car until the wheel and tire clear the floor.
2. Pry off the wheel cover and remove the grease cap (Fig. 1) from the hub.
3. Wipe the excess grease from the end of the spindle, and remove the adjusting nut cotter pin and nut lock.
4. While rotating the wheel, hub, and drum assembly, torque the adjusting nut to 15-20 ft-lbs to seat the bearings (Fig. 2).
5. Locate the nut lock on the adjusting nut so that the castellations on the lock are aligned with the cotter pin hole in the spindle.
6. Back off both the adjusting nut and the nut lock together until the next castellation on the nut lock aligns with the cotter pin hole in the spindle.
7. Install a new cotter pin, and bend the ends of the cotter pin around the castellated flange of the nut lock (Fig. 2).
8. Check the front wheel rotation. If the wheel rotates properly, install the grease cap and the hub cap or

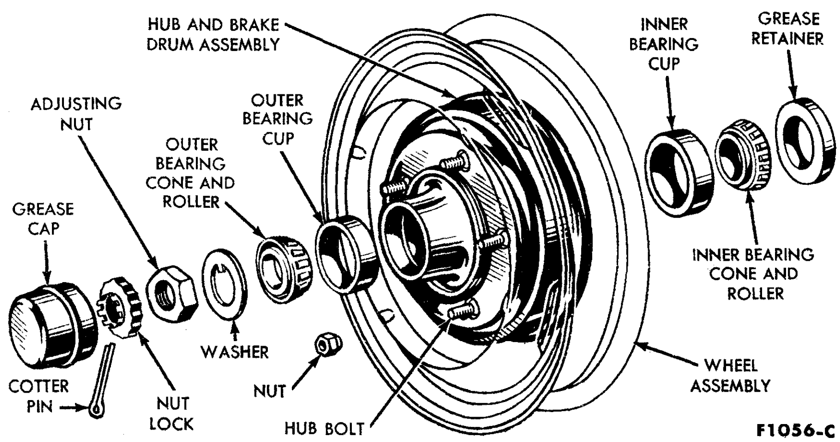

FIG. 1—Front Hub, Bearings & Grease Retainer

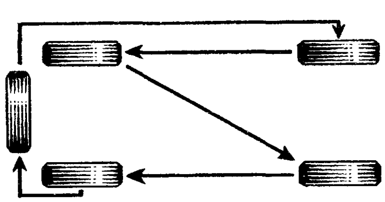

FIG. 3—Tire Cross-Switching Diagram

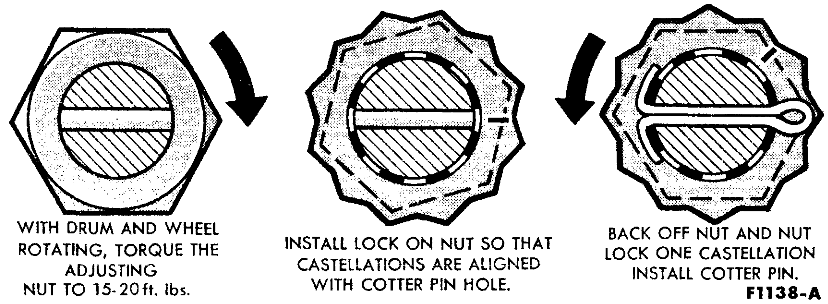

FIG. 2—Front Wheel Bearing Adjustment

wheel cover. If the wheel still rotates roughly or noisily, clean or replace the bearings and cups as required.

TIRE ROTATION

For longer tire life, all five tires should be cross-switched as shown in Fig. 3. See Group 19 for the specified intervals.

3 REMOVAL AND INSTALLATION

WHEEL AND TIRE ASSEMBLY

REMOVAL

1. Pry off the wheel hub cap or cover. Loosen but do not remove the wheel hub nuts.

2. Raise the car until the wheel and tire clear the floor.

3. Remove the wheel hub nuts from the bolts, and pull the wheel and tire assembly from the hub and drum.

DEMOUNTING TIRE FROM WHEEL

The tire can be demounted on a mounting machine. **Be sure that the outer side of the wheel is positioned downward.** If tire irons are used follow the procedure given here.

1. Remove the valve cap and core, and deflate the tire completely.

2. With a bead loosening tool, break loose the tire side walls from the wheel (Fig. 4).

3. **Position the outer side of the wheel downward,** and insert two tire irons about 8 inches apart between the tire inner bead and the back side of the wheel rim. **Use only tire irons with rounded edges or irons designed for demounting tubeless tires.**

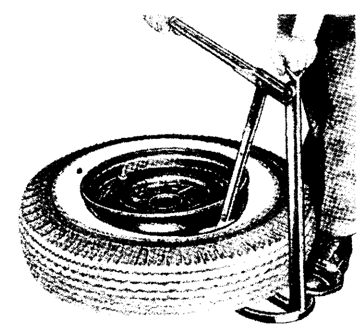

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FIG. 4—Bead Loosening Tool

4. Leave one tire iron in position, and pry the rest of the bead over the rim with the other iron. Take small "bites" with the iron around the tire in order to avoid damaging the sealing surface of the tire bead.

5. Stand the wheel and tire upright with the tire outer bead in the drop center well at the bottom of the wheel. Insert the tire iron between the bead and the edge of the wheel rim, and pry the wheel out of the tire.

MOUNTING TIRE TO WHEEL

1. If a used tire is being installed remove all dirt from the tire.

If a tire is being mounted to the original wheel, clean the rim with emery cloth or fine steel wool. Check the rim for dents.

If a new wheel is being installed, coat a new valve with RUGLYDE or similar rubber lubricant and position the valve to the new wheel. Use a rubber hammer or a valve replacing tool to seat the valve firmly against the inside of the rim.

2. Apply RUGLYDE or a similar rubber lubricant to the sealing surface on both tire beads. With the outer side of the wheel down, pry the beads over the wheel rim with two tire irons. **Do not use a hammer or mallet to force the beads over the rim.**

3. Align the balance mark on the tire with the valve on the wheel.

4. Hold the beads against the rim flanges by positioning a tire mounting band over the tire (Fig. 5). If a mounting band is not available, tie a tourniquet of heavy cord around the circumference of the tire. Tighten the cord with a tire iron. Center the tire on the wheel with a rubber mallet.

5. Give the tire a few quick bursts of air to seat the beads properly, then inflate the tire to 40 pounds pressure. Check to see that the bead positioning rings (outer rings near the side walls) are evenly visible just above the rim flanges all the way around the tire. If the rings are not even, deflate the tire completely and inflate it again.

6. When the rings are properly positioned, deflate the tire to the recommended pressure.

INSTALLATION

1. Clean all dirt from the hub and drum.

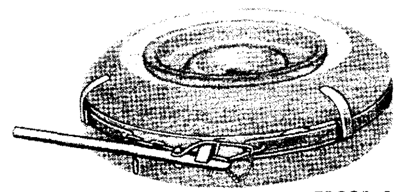

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FIG. 5—Tubeless Tire Mounting Band

2. Position the wheel and tire assembly on the hub and drum. Install the wheel hub nuts and tighten them alternately in order to draw the wheel evenly against the hub and drum.

3. Lower the car to the floor, and torque the hub nuts to specification.

4 MAJOR REPAIR OPERATIONS

FRONT WHEEL GREASE SEAL AND BEARING REPLACEMENT AND/OR REPACKING

If bearing adjustment will not eliminate looseness or rough and noisy operation, the hub and bearings should be cleaned, inspected, and repacked. If the bearing cups or the cone and roller assemblies are worn or damaged, they should be replaced.

1. Raise the car until the wheel and tire clear the floor.

2. Insert a narrow screwdriver through the brake adjusting hole at the inner side of the brake adjusting plate, and disengage the adjusting lever from the adjusting screw. While

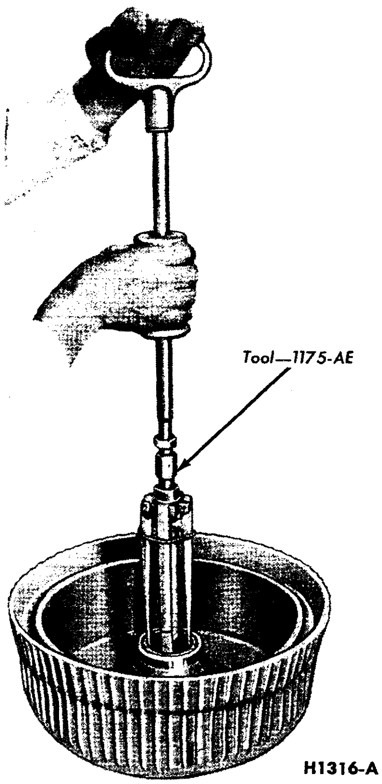

FIG. 6—Removing Grease Retainer

holding the adjusting lever away from the screw, back off the adjusting screw with the brake adjusting tool. **Be very careful not to burr, chip, or damage the notches in the adjusting screw; otherwise the self-adjusting mechanism will not function properly.**

3. Remove the wheel cover or hub cap. Remove the grease cap from the hub. Remove the cotter pin, nut lock, adjusting nut, and flat washer from the spindle. Remove the outer bearing cone and roller assembly (Fig. 1).

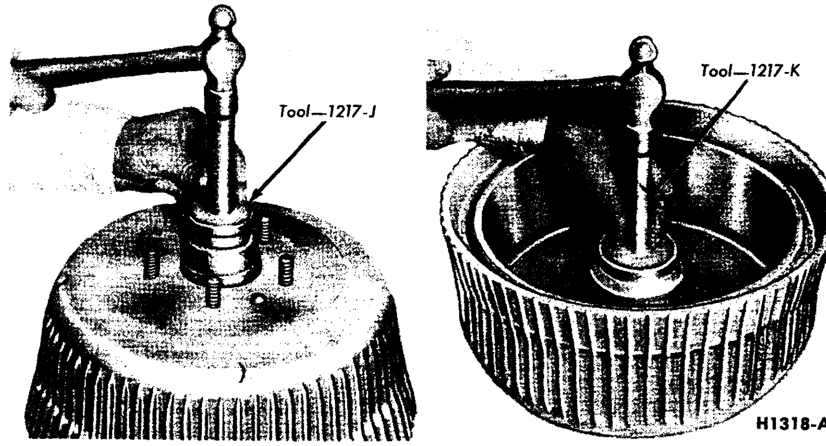

FIG. 8—Front Wheel Bearing Cup Installation

4. Pull the wheel, hub, and drum assembly off the wheel spindle.

5. Remove the grease retainer (Fig. 6) and the inner bearing cone and roller assembly from the hub.

6. Clean the lubricant off the inner and outer bearing cups with solvent and inspect the cups for scratches, pits, excessive wear, and other damage. If the cups are worn or damaged, remove them with the tools shown in Fig. 7.

7. Soak a new grease retainer in light engine oil at least 30 minutes before installation. Thoroughly clean the inner and outer bearing cones and rollers with solvent, and dry them thoroughly. **Do not spin the bearings dry with compressed air.**

Inspect the cones and rollers for wear or damage, and replace them if necessary. The cone and roller assemblies and the bearing cups should be replaced as a set if damage to either is encountered.

8. Thoroughly clean the spindle and the inside of the hub with solvent to remove all old lubricant.

Cover the spindle with a clean cloth, and brush all loose dust and dirt from the brake assembly. **To prevent getting dirt on the spindle, carefully remove the cloth from the spindle.**

9. If the inner and/or outer bearing cup(s) were removed, install the replacement cup(s) in the hub with the tools shown in Fig. 8. **Be sure to seat the cups properly in the hub.**

10. Pack the inside of the hub with specified wheel bearing grease. Add lubricant to the hub only until the grease is flush with the inside diameter of both bearing cups.

11. Pack the bearing cone and roller assemblies with wheel bearing grease. A bearing packer is desirable for this operation. If a packer is not available, work as much lubricant as possible between the rollers and cages. Lubricate the cone surfaces with grease.

12. Place the inner bearing cone

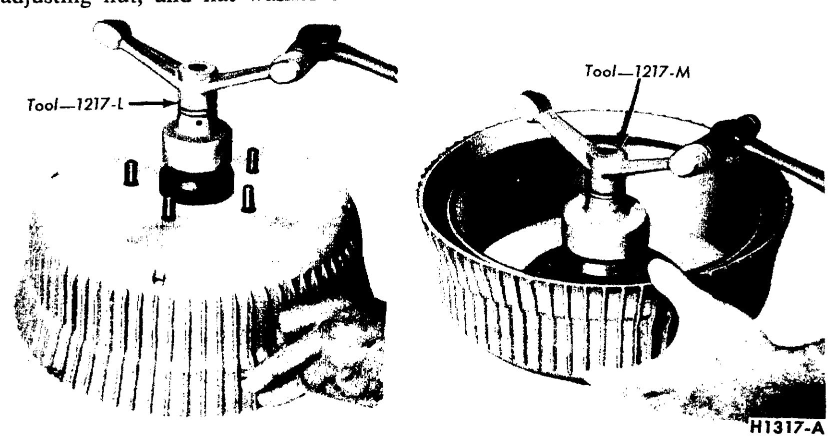

FIG. 7—Front Wheel Bearing Cup Removal

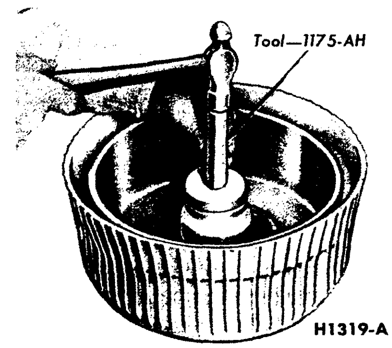

FIG. 9—Grease Retainer Installation

and roller assembly in the inner cup, and install the new grease retainer with the tool shown in Fig. 9. **Be sure the retainer is properly seated.**

13. Install the wheel, hub, and drum assembly on the wheel spindle. **Keep the hub centered on the spindle to prevent damage to the grease retainer or the spindle threads.**

14. Install the outer bearing cone and roller assembly and the flat washer on the spindle, then install the adjusting nut.

15. Adjust the wheel bearings as outlined in Section 2, and install a new cotter pin. Bend the ends of the cotter pin around the castellations of the nut lock to prevent interference with the radio static collector in the grease cap. Install the grease cap.

16. Adjust the brake shoes. Install the wheel cover.

NOTE: All old grease should be completely cleaned from the bearings before repacking with new grease.

FRONT HUB AND DRUM ASSEMBLY REPLACEMENT

When the hub and drum assembly is replaced, new bearings, cups, and grease retainer must be installed in the new assembly. The new grease retainer should be soaked in light engine oil at least 30 minutes before installation.

1. Raise the car until the wheel and tire clear the floor. Pry off the hub cap or wheel cover, and remove the wheel and tire assembly from the hub and drum assembly.

2. Back off the brake shoe and remove the old hub and drum assembly from the wheel spindle.

3. Remove the protective coating from the new hub and drum with carburetor degreaser. Install new inner and outer bearing cups in the new hub with the tool shown in Fig. 8. **Be sure to seat the cups properly in the hub.**

4. Grease and install the inner bearing cone and roller assembly in the inner bearing cup. Install the grease retainer.

5. Install the new hub and drum assembly to the wheel spindle. **Keep the hub centered on the spindle to prevent damage to the grease retainer.**

6. Install the outer bearing cone and roller assembly and the flat washer on the spindle, then install the adjusting nut.

7. Position the wheel and tire assembly on the new hub and drum assembly. Install the wheel hub nuts and tighten them alternately in order to draw the wheel evenly against the hub and drum.

8. Adjust the wheel bearings as outlined in Section 2, and install a new cotter pin. Bend the ends of the cotter pin around the castellations of the nut lock to prevent interference with the radio static collector in the grease cap. Install the grease cap.

9. Adjust the brake shoes as outlined in Part 2-2, Section 2.

10. Install the hub cap or wheel cover.

PART 3-5 SPECIFICATIONS

TIRES

Inflation Pressure (P.S.I.) (Cold)	24
Size	9.15 x 15

FRONT WHEEL ALIGNMENT

Caster (Degrees) (Within ½° one Side of Car to Other, ¼° preferred)		−¾° to −2¼°
Camber (Degrees) (Within ½° One Side of Car to Other, ¼° Preferred)		0° to Plus ¾°
Kingpin Inclination—Theoretical (at +¾° camber)		7°
Angle of Outside Wheel When Inside Wheel is at 20°		17° 42′
Riding Height: Allowable Difference—One Side of Car to Other		½
Toe-In Maximum / Minimum		3/16 / 1/16
Tread	Rear—61.0	Front—62.1
Turning Circle (Feet) (Curb to Curb to Outside of Tire)		45.7

FRONT SUSPENSION TORQUE LIMITS

Description	Ft-lbs
Brake Backing Plate to Spindle—Upper	25-35
—Lower	70-95
Front Wheel Spindle Nut (Back off one Slot after Torque Check)	15-20
Jounce Bumper to Drag Strut	22-28
Lower Ball Joint to Lower Arm	22-28
Lower Suspension Arm to No. 2 Crossmember	110-140
Shock Absorber Bracket to No. 2 Crossmember	20-30
Shock Absorber to Lower Suspension Arm	20-30
Shock Absorber to Shock Bracket Stud	40-55
Spindle Arm Connecting Rod Ball Stud to Spindle Arm	40-55
Spindle Connecting Rod Adjusting Sleeve Clamp Nut	22-28
Spindle to Lower Ball Joint Stud	70-90
Spindle to Upper Ball Joint Stud	55-75
Stabilizer Bar to Lower Suspension Arm	8-13
Upper Arm Bushings to Shaft	70-90
Upper Ball Joint to Upper Arm	21-29
Upper Arm Shaft to No. 2 Crossmember	100-125
Wheel Nuts	75-110
Ball Joint Stud Torque Check (Minimum Acceptable Torque Required to Turn the Ball Joint Stud)	12 in-lbs

REAR SUSPENSION TORQUE LIMITS

Description	Ft-lbs
Rear Shock Absorber to Axle	30-40
Rear Shock Absorber Bracket to Crossmember	17-25
Rear Shock Absorber Stud to Rear Axle (Service Only)	65-80
Rear Spring to Shackle	16-22
Rear Spring Front Bracket to Sidemember	50-90
Rear Spring Front Eye Bolt (Front Shackle Nut)	50-70
Rear Spring Leaves Retaining Bolt	40-50
Rear Spring U-Bolts	50-60
Shackle to Mounting Hanger	16-22
Shackle Mounting Hanger to Side Rail	40-62

STEERING CHECKS AND ADJUSTMENTS

Description	
Sector Shaft Mesh—Total Center Mesh Load (Measure with torque wrench at mechanical center)	in-lbs 15-17
Worm Bearing Pre-Load (Measure with torque wrench 20° off either stop)	in-lbs 6-8
Piston Backlash (Maximum)	0.004
Ratios: Overall / Steering Gear	20.5:1 / 17.0:1
Steering Wheel: Diameter / Number of Turns (Full Left to Right)	16 / 3¾-4
Thrust Screw to Sector Slot Clearance (Maximum)	0.002
Fluid (M2C33-C-D)	C1AZ-19582

STEERING TORQUE LIMITS

Description	Ft-lbs
Gear Cover to Gear Housing	18-22
Control Valve Spool Lock Nut	5-9
Control Valve Spool Adjuster Cap	10-15
Mesh Load Adjusting Screw Lock Nut	25-30
Sleeve Adjusting Lock Nut	60-80
Ball Return Guide Clamp Screw	18-36
Pressure Line to Gear	10-15
Return Line to Gear	20-30
Connecting Link Ball Stud to Idler Arm	40-55
Connecting Link Ball Stud to Pitman Arm	40-55
Crankshaft Damper Attaching Bolt	75-90
Gear Housing to Sidemember	35-50
Idler Arm Bracket to Sidemember	20-30
Lock Screw to Sleeve	15-20
Pitman Arm to Shaft	100-130
Pump to Engine Front Cover	8-11
Spindle Arm Connecting Rod Ball Stud to Connecting Link	40-55
Spindle Arm Connecting Rod Ball Stud to Spindle Arm	40-55
Steering Wheel Nut* *Stake nut after tightening.	18-24

REAR AXLE

GROUP 4

PART 4-1 GENERAL AXLE SERVICE

1 DIAGNOSIS AND TESTING

Certain rear axle trouble symptoms are also common to the engine, drive line, transmission, tires, and other parts of the car. For this reason, be sure that the cause of the trouble is in the rear axle before adjusting, repairing, or replacing any of the axle parts.

REAR AXLE TROUBLE DIAGNOSIS GUIDE

EXCESSIVE REAR AXLE NOISE (ALL REAR AXLES)	Since gears are in mesh, some rear axle noise is normal. However, excessive noise often indicates the beginning of other troubles in the axle. A road test can help determine whether the noise is being caused by trouble in the rear axle or in other parts of the car. **Before road-testing the car, make sure that the tire pressures and the rear axle lubricant level are normal. Then drive the car far enough to warm the axle lubricant to its normal operating temperature.** With the car stopped and the transmission in neutral, run the engine at various speeds. If the noise still exists during this test, it probably comes from the engine or the exhaust system. To determine if the noise is being caused by the rear axle or the tires, drive the car over several different types of road surfaces. Smooth asphalt or black-top roads minimize tire noises. Tire noises may be eliminated by cross-switching the tires. Snow tires often cause noises not heard with conventional tires. Noise caused by a worn or damaged wheel bearing is often loudest when the car is coasting at low speeds, and it usually stops when the brakes are gently applied. To find the noisy bearing, jack up each wheel and check each bearing for roughness while the wheel is rotating, provided that the car is equipped with a conventional differential. If all possible external sources of noise have been checked and eliminated, and the noise still exists, road-test the rear axle under all four driving conditions: 1. **Drive:** Higher than normal road-load power, where the speed gradually increases on level road acceleration. 2. **Cruise:** Constant speed operation at normal road speeds. 3. **Float:** Using only enough throttle to keep the car from driving the engine. Car will slow down (very little load on rear axle gears). 4. **Coast:** Throttle closed—engine is braking the car. (Load is on the coast side of the gear set.) Any noise produced by the side-gears and pinions in the differential case will be most pronounced on turns. A continuous whine under a light load between 20 and 35 miles per hour indicates rough or brin-

CONTINUED ON NEXT PAGE

REAR AXLE TROUBLE DIAGNOSIS GUIDE (Continued)

EXCESSIVE REAR AXLE NOISE (ALL REAR AXLES)	nelled pinion bearings. If the tone of drive, coast and float noise differs with speed and if the noise is very rough and irregular; worn, rough or loose differential or pinion shaft bearings are indicated.
EXCESSIVE REAR AXLE BACKLASH (ALL REAR AXLES)	Excessive backlash in the axle driving parts may be caused by worn axle shaft splines, loose axle shaft flange nuts, loose U-joint flange mountings, excessive backlash between the drive pinion and drive gear, excessive backlash in the differential gears, or bearings which are worn or out of adjustment.
DIFFERENTIAL CHATTERS (DIRECTED POWER ONLY)	Before removing the "Directed Power" differential for overhaul, change the lubricant as described in the following procedure and operate the car for 200 miles. 1. Operate the vehicle enough to thoroughly warm the rear axle lubricant. 2. Thoroughly clean the area around the rear axle housing cover. 3. Remove the housing cover bolts and cover. Drain the lubricant. 4. Rotate the wheels by hand to allow the lubricant in the unit to drain. 5. Syphon or wipe out all lubricant that did not drain. **Flushing the unit with solvents is not recommended due to the undesirable effect the solvents may have on the new lubricant.** 6. Clean the gasket surfaces. Install a new gasket, and install the cover and bolts. 7. Torque the cover bolts to specifications. 8. Refill with the specified lubricant. If the chatter is still evident after 200 miles of operation, remove and overhaul the "Directed Power" differential.
AXLE WILL NOT DRIVE WITH POOR TRACTION AT ONE WHEEL (DIRECTED POWER ONLY)	The pulling power of each rear wheel should be tested separately. Place one wheel on good traction such as dry cement and the other wheel on ice, snow, mud, gravel, or grease. Try to drive the car either forward or backward. To avoid "break-away" of the good traction wheel, apply the throttle lightly. If the car does not move and the poor traction wheel spins, the parking brake should be applied to cause a slight drag. This light brake application should provide the resistance required to apply the clutch at the poor traction wheel. Now, the car should move. Turn the car around and test the opposite wheel. If either wheel continues to spin even with the light brake application, remove and overhaul the differential. **Do not test the "Directed Power" differential while one wheel is on a jack. The unit could cause the car to jump off the jack. This could also occur during "on car" rear wheel balancing. Wheels should, therefore, be balanced off the car.**

2 COMMON ADJUSTMENTS AND REPAIRS

PINION AND RING GEAR TOOTH CONTACT ADJUSTMENT

Two separate adjustments affect pinion and ring gear tooth contact. They are pinion location and backlash (Fig. 1). Painting the ring gear teeth with marking compound and rolling a pattern, as described under "Inspection Before Disassembly of Carrier" in Section 3, will indicate what adjustments should be made on a particular gear set.

PINION LOCATION

Individual differences in machining the carrier housing and the gear set require a shim pack between the pinion rear bearing cup and the carrier housing to locate the pinion for correct contact with the ring gear. The original factory installed shim pack is of the correct thickness for a given original carrier and gear set assembly. In service, shims should be added or removed from the original pack only as indicated by the tooth pattern check (Fig. 2). Adding shims moves the pinion toward the ring gear; removing shims moves the pinion away from the gear (Fig. 1).

BACKLASH BETWEEN RING GEAR AND PINION

The tooth pattern check also indicates whether the ring gear should be adjusted away from or toward the pinion to increase or decrease backlash between the gears. The shims installed behind the differential side bearings locate the differential case and ring gear assembly in the carrier housing. To increase the backlash between the ring gear and pinion (move ring gear away from pinion), remove the necessary shims from behind the bearing on the ring gear side of the differential case and install them behind the bearing on the pinion side of the case (Fig. 1). To decrease backlash (move ring gear toward pinion), remove the necessary shims from behind the bearing on the pinion side of the case and install them behind the bearing on the ring gear side of the case.

PINION BEARING PRELOAD

Any load applied to the pinion exerts a great amount of end thrust on the pinion shaft. On pull (engine driving rear wheels), the pinion tends to "walk" away from the ring gear, and the rear bearing takes the thrust (Fig. 1). On coast (rear wheels driving engine), the pinion tends to "walk" toward the ring gear, and the front bearing takes the thrust. If this end-play or "walk" were allowed, pinion and ring gear tooth contact would change every time the end thrust on the pinion changed. The pinion, therefore, must be held firmly in one place (zero end play) to maintain correct tooth contact.

Any change in the **pinion locating** shim pack requires a corresponding change in the **bearing preload** shim pack (Fig. 1). The bearing cups are fixed in the housing and the cones are fixed to the pinion shaft; therefore, if the rear bearing cup position were changed by adding or removing shims, not only would the pinion shaft move in or out, but the cones moving with the shaft would move into or out of their cups to increase or decrease tension. The preload shim pack must be changed to compensate for this change of bearing cone tension against the cups.

For example, if a 0.002 inch shim

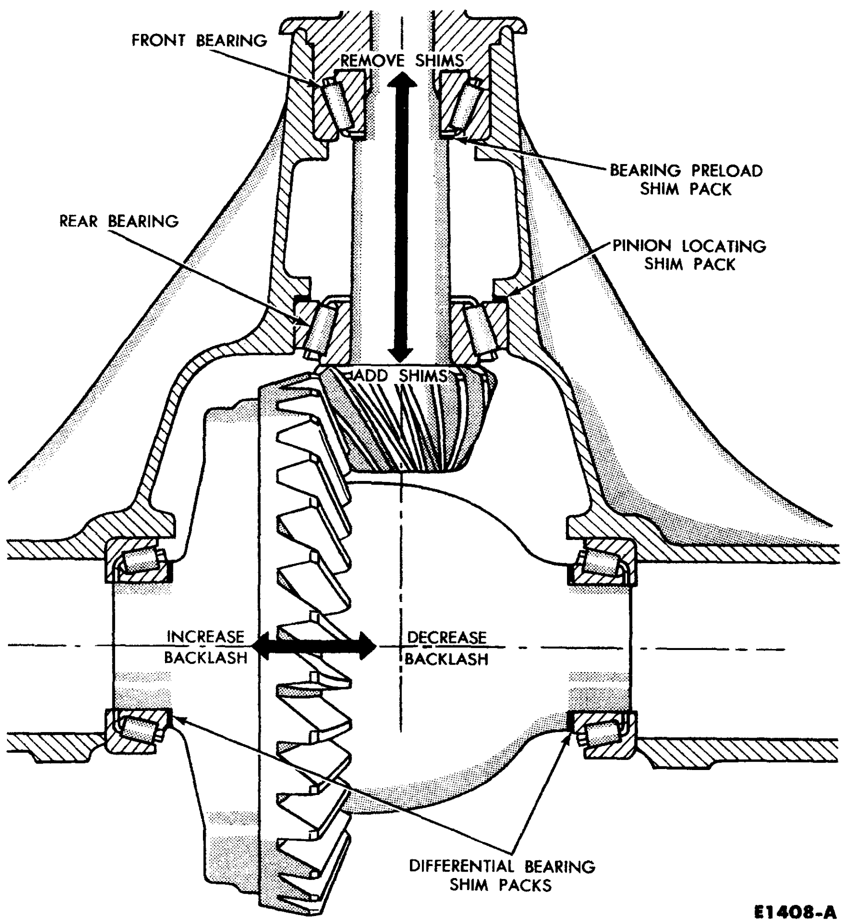

FIG. 1—Pinion and Ring Gear Tooth Contact Adjustments

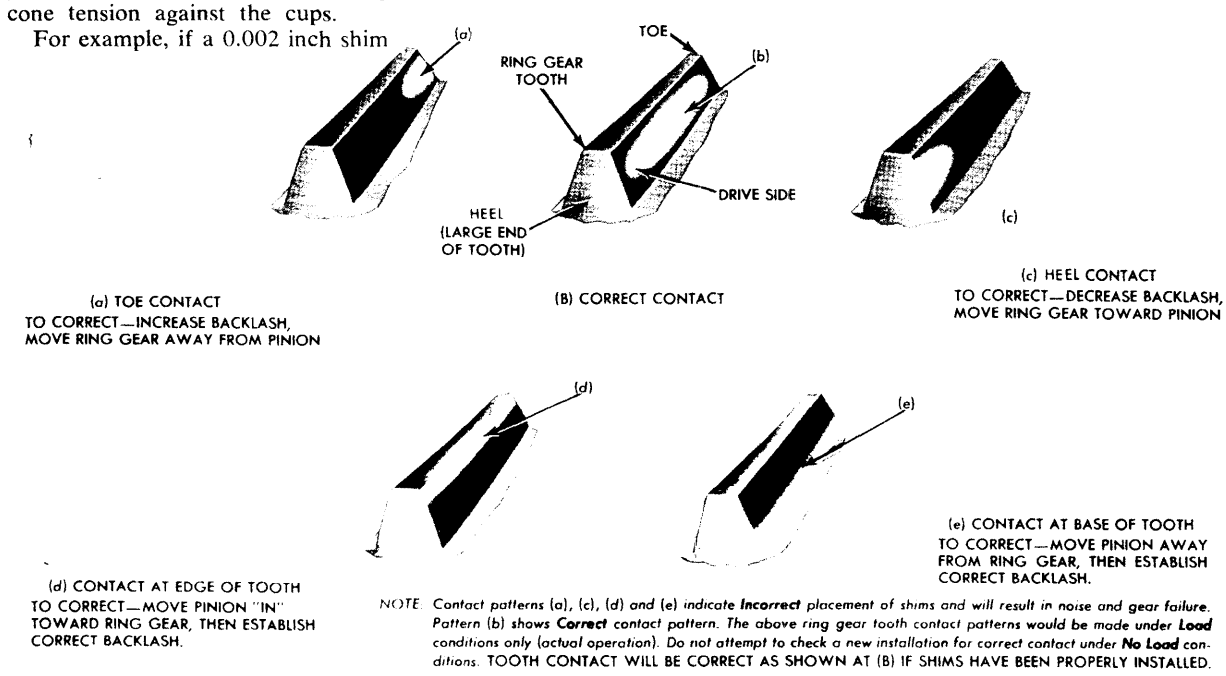

FIG. 2—Tooth Contact Pattern Check

were **removed** from the locating shim pack to move the pinion 0.002 inch farther away from the ring gear, the rear bearing cup would move closer to the front bearing cup by 0.002 inch. As the pinion shaft and rear bearing cone shifted with the rear bearing cup, the front bearing cone would move 0.002 inch out of its cup thus decreasing preload. A 0.002-inch shim, therefore, must be **removed** from the preload shim pack also so that the front bearing cone can move the 0.002 inch back into its cup to restore the original preload.

Similarly, if a 0.002-inch shim were **added** to the locating shim pack to move the pinion 0.002 inch closer to the ring gear, the rear bearing cup would move farther away from the front bearing cup by 0.002 inch. As the pinion shaft and rear bearing cone shifted rearward with the rear bearing cup, the front bearing cone would move 0.002 inch farther into its cup thus increasing tension. A 0.002-inch shim, therefore, must be **added** to the preload shim pack also so that the front bearing cone will move the 0.002 inch out of its cup to relieve the tension and restore original preload.

DETERMINING THE SHIM PACKS

To make any of the foregoing adjustments, the differential case, drive pinion, and pinion bearings will have to be removed from the housing as outlined under "Disassembly" in Part 4-2. The correct thickness for the four shim packs shown in Fig. 1 can then be determined by following the "Installation of Pinion, Bearings, and Differential Case" procedure outlined under "Assembly" in Part 4-2.

3 CLEANING AND INSPECTION

INSPECTION BEFORE DISASSEMBLY OF CARRIER

The differential carrier should be inspected before any parts are removed from it. The checks given in the following procedure can help to find the cause of the trouble and to determine the corrections needed.

1. Place the housing assembly in a holding fixture, tool 4005 as shown in Fig. 3.

2. Thoroughly clean the housing and cover assembly, and then remove the cover-to-housing bolts.

3. Using a suitable solvent, clean the lubricant from the internal working parts and visually inspect the parts for wear or damage. Rotate the gears to see if there is any roughness which would indicate defective bearings or chipped gears. Check the gear teeth for scoring or signs of abnormal wear.

4. Set up a dial indicator (Fig. 4), and check the backlash between the drive gear and pinion at four equally spaced points around the drive gear. Backlash should be within specifications.

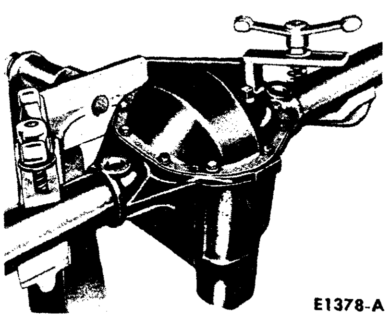

FIG. 3—Axle Housing Assembly in Holding Fixture

5. If no obvious defect is noted, check the gear tooth contact. Paint the gear teeth with suitable gear marking compound, such as a paste made with dry red lead and oil. A mixture that is too wet will run and smear. Too dry a mixture cannot be pressed out from between the teeth. Wrap a cloth or rope around the drive pinion flange to act as a brake. Rotate the ring gear back and forth (use a box wrench on the ring gear attaching bolts for a lever) until a clear tooth contact pattern is obtained.

Certain types of gear tooth contact patterns on the drive gear indicate incorrect adjustment. Noise caused by incorrect adjustment can often be corrected by readjusting the gears as outlined in Section 2. Typical patterns and the necessary corrections are shown in Fig. 2.

6. Gear tooth runout can sometimes be detected by an erratic pattern on the teeth. However, a dial indicator should be used to measure the runout of the back face of the ring gear, as shown in Fig. 5. With the indicator at zero setting, revolve the ring gear one revolution and note the total runout. If the total indicator reading exceeds specifications, it may indicate a loose ring gear or a sprung differential case or housing. Disassemble the carrier and replace necessary parts as indicated in Part 4-2, Section 4.

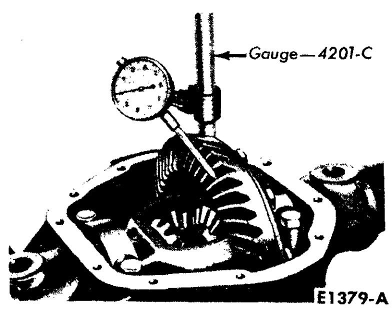

FIG. 4—Backlash Check

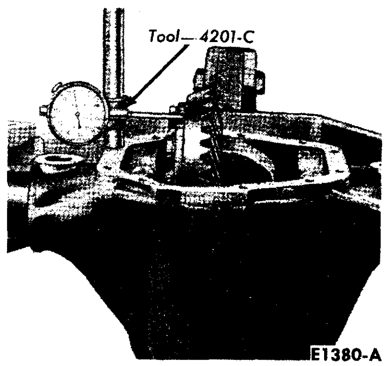

FIG. 5—Ring Gear Runout Check

7. Check the clearance between the side bearing caps and bearing cups. If the clearance is 0.003 inch or more, it could indicate that the bearing is turning in the housing. Visually check to determine that the cap is properly seated against its mating surface on the housing. If the clearance exists with the cap properly seated and the bolts properly torqued, check the mating surfaces of the housing and caps for damage. Replace the housing and/or caps as necessary.

INSPECTION AFTER DISASSEMBLY

Thoroughly clean all parts (Fig. 6) except wheel bearings in clean sol-

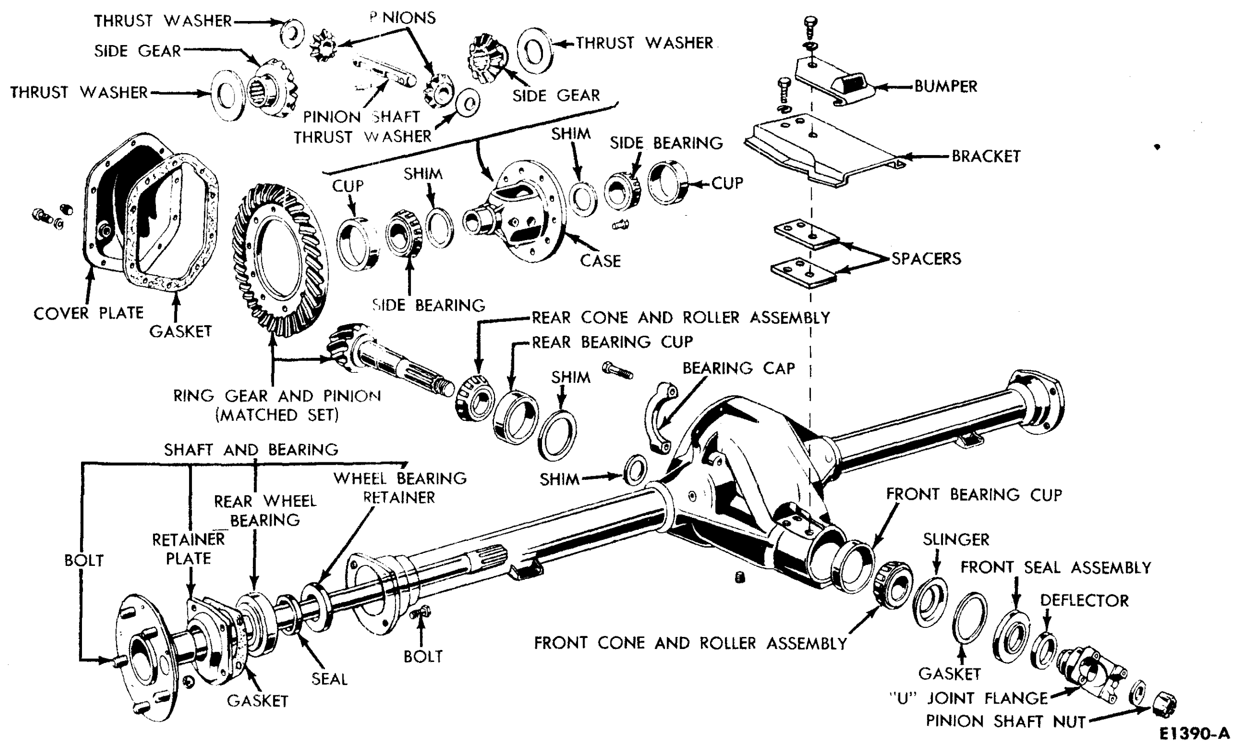

FIG. 6—Rear Axle Disassembled

vent, and dry them with compressed air. Inspect the parts for defects. Clean the inside of the carrier before rebuilding it. **When a scored gear set is replaced, the axle housing should be washed thoroughly and steam cleaned.** This should be done only after the axle shafts, wheel bearings, and seals are removed from the housing. Inspect individual parts as outlined below.

GEARS

Examine the pinion and ring gear teeth for scoring or excessive wear. The pattern taken before disassembly should be helpful in judging if gears can be re-used. Worn gears cannot be rebuilt to correct a noisy condition. Gear scoring is the result of excessive loading or the use of incorrect lubricant. Scored gears cannot be re-used.

Examine the teeth and thrust surfaces of the differential gears. Wear of splines, thrust surfaces, or thrust washers can contribute to excessive drive line backlash.

BEARING CUPS AND CONE AND ROLLER ASSEMBLIES

Check the bearing cups for rings, scores, galling, or excessively worn wear patterns. Pinion cups must be solidly seated. Check by attempting to insert a 0.0015-inch feeler between these cups and the bottoms of their bores.

When operated in the cups, cone and roller assemblies must turn without roughness. Examine the roller ends for wear. Stepwear on the roller ends indicates the bearings were not preloaded properly or the rollers were slightly misaligned.

If inspection reveals either a defective cup or a defective cone and roller assembly **both parts** should be replaced to avoid early failure.

U-JOINT FLANGE

Be sure that the ears of the flange have not been damaged in removing the drive shaft or in removing the flange from the axle. The end of the flange that contacts the oil slinger as well as the flat surface of the pinion nut counterbore must be smooth. Polish these surfaces if necessary. Roughness aggravates backlash noises, and causes wear of the slinger and pinion nut with a resultant loss in pinion bearing preload.

CARRIER HOUSING

Make sure that the differential bearing bores are smooth and that the threaded holes are not damaged. Remove any nicks or burrs from the mating surfaces of the carrier housing.

DIFFERENTIAL CASE

Make sure that the hubs where the bearings mount are smooth. Carefully examine the differential case bearing shoulders, which may have been damaged when the bearings were removed. The bearing assemblies will fail if they do not seat firmly against the shoulders. Check the fit (free rotation) of the differential side gears in their counterbores.

DIRECTED POWER DIFFERENTIAL

Inspect all parts, particularly the spring plates and discs, the clutch plates and discs, the plate surfaces of the case halves, and the side gear rings for excessive wear or scoring (Part 4-2, Fig. 23). Replace any parts that are worn or damaged.

If one or more of the plates or discs in a clutch pack on one of the sides need replacing, the entire stack of plates and discs on that side should be replaced.

PART 4-2 REAR AXLE

1 DESCRIPTION AND OPERATION

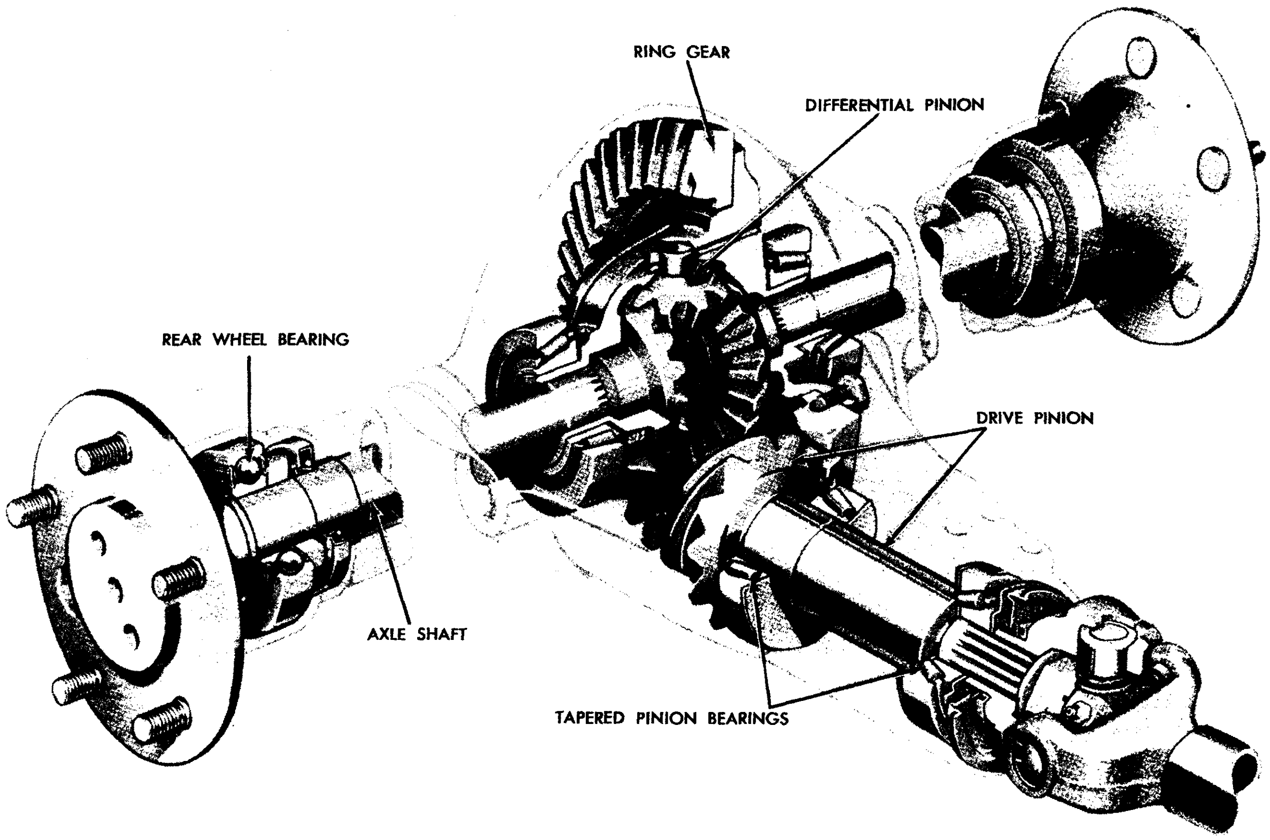

FIG. 1–Rear Axle Assembly

CONVENTIONAL AXLE

DESCRIPTION

The rear axle is of the integral carrier-housing, hypoid gear type, in which the centerline of the drive pinion is mounted below the centerline of the ring gear (Fig. 1).

The integral pinion gear and shaft is supported by two opposed tapered roller bearings which are assembled in the forward side of the carrier housing. Pinion locating shims, installed between the rear bearing cup and the cup seat, control the drive pinion depth adjustment. The pinion bearing preload is controlled by shims located between the pinion front bearing and the shoulder on the drive pinion shaft.

The differential case assembly is supported by two opposed tapered roller (side) bearings and cups, which are retained in the housing by removable caps. Shims, installed between each differential side bearing and the shoulder on the case, perform three functions: they take up the differential case side clearance; they adjust the backlash between ring gear and pinion; and they establish differential side bearing preload.

A cover on the rear of the carrier housing provides access for inspection, removal and installation of the differential assembly and drive pinion. A metal tag, stamped with the gear ratio plus the number of teeth on the ring gear and pinion, is secured to the housing by one of the cover bolts.

Cars equipped with "Directed Power" differential assemblies will have an additional metal tag identification attached to one of the cover bolts.

Ball bearing assemblies (rear wheel bearings) are pressed onto the outer ends of the axle shafts and set in the outer ends of the axle housing. These bearings support the semi-floating axle shafts at the outer ends. The inner ends of the shafts spline to the differential side gears. Bearing retainer plates hold the shafts in the housing. The axle shafts are equal in length and are, therefore, interchangeable.

OPERATION

The rear axle drive pinion receives its power from the engine through the transmission and drive shaft. The pinion gear rotates the differential case through engagement with the drive gear, which is bolted to the case outer flange. Inside the case, two different pinion gears are mounted on the differential pinion shaft which is pinned to the case. These pinion gears are engaged with the side gears, to which the axle shafts are splined. Therefore, as the differential case turns, it rotates the axle shafts and rear wheels. When it is necessary for one wheel and axle shaft to rotate faster than the other, the faster turning side gear causes the pinions to roll on the slower turning side gear to allow differential action between the two axle shafts.

"DIRECTED POWER" AXLE

DESCRIPTION

The "Directed Power" axle is the same as the conventional axle with respect to the ring gear and pinion, the bearings, the housing, and the axle shafts. The difference is in the differential assembly.

The differential is of a two-piece case design (Fig. 23). Each case half has an identical clutch assembly which connects one of the axle shafts directly to the case half as driving conditions demand. Each clutch pack consists of five steel plates set between the case and the side gear ring. The two outer plates and the center plate are locked to the differential case half by external lugs. The remaining two plates (discs) have internal spline teeth which lock to the splined hub on the side gear ring. The external lug plate and the spline disc plate that are located next to the case half are spring plates, which are installed with the convex (bowed) side against the case. The side gear ring is internally splined to the axle shaft and acts as a pressure plate against the clutch pack.

Unlike the single pinion shaft of the conventional unit, the two pinion mate shafts are not rigidly attached to the differential case, nor are they attached to each other. At both ends of the mate shafts, there are two flat surfaces so arranged that they form a "V" which mates with corresponding "V" shaped surfaces (ramps) cut in the shaft openings of the differential case.

OPERATION

The "Directed Power" axle has a power flow identical to the conventional rear axle, plus a more direct power flow which automatically takes effect as driving conditions demand. This more direct power flow is from the differential case to each axle shaft through clutches.

The mate shafts are assembled in the case with enough clearance so that when the case tries to rotate the mate shafts and the mate shafts resist rotation, they will be forced to bear against one side of their "V" ramps. Since the two "V" ramps of one mate shaft point in a direction opposite to that of the two "V" ramps of the other mate shaft, the two shafts with their pinions will be forced apart as they resist rotation. This mate shaft movement compresses the clutch pack through the pinion gears and side gear rings.

When the differential case rotates in the opposite direction, the mate shafts will be forced to bear against the opposite side of their "V" ramps and will again be forced apart to apply against the clutch packs. Therefore, since the ramps are "V" shaped, the clutches will apply during either forward or reverse operation. Likewise, the clutches will apply whether the power flow is from the differential case to the axle shafts, or from the axle shaft to the differential case.

The amount of compression on the clutch plates will be proportionate to the load applied to the differential case and the resistance to turning offered by each mate shaft. For example, if the car is driven straight ahead and the traction or load on both wheels is equal, both mate shafts will give equal resistance to the rotating differential case and will thus bear against their respective ramps with equal force. This equal movement of the mate shafts will cause them to exert equal pressure against both right and left-hand clutch packs. Both axle shafts will, therefore, be locked directly to the case with equal force.

Clutch application prevents momentary spinning of one of the wheels when it leaves the road because of a bump, or encounters poor traction because of a slippery road. Under these conditions, even though the traction load is relieved on the one wheel, the acceleration load is simultaneously applied to the differential case as the engine tries to spin the wheel.

When the rear axle is in a turn, the appropriate clutch releases automatically to allow normal differential operation as required. In the straight ahead position, the differential case is driving both wheels and thus applies an equal load against both mate shafts. Since both mate shafts offer resistance to this load, both clutches are applied. On a turn, however, the outside wheel turns faster than the inside wheel. The outside wheel, instead of being driven by the case, now tends to drive the case. With the power thus relieved, the differential case releases its load against the outside wheel mate shaft which, in turn, releases its pressure against the outside wheel clutch pack. With the clutch released, normal differential action will take effect.

2 IN-CAR ADJUSTMENT AND REPAIR

REAR AXLE SHAFT, WHEEL BEARING, AND OIL SEAL REPLACEMENT

The rear axle shafts, wheel bearings and oil seals can be replaced without removing the axle assembly from the car.

1. Remove the wheel and tire from the brake drum.
2. Remove the Tinnerman nuts that secure the brake drum to the axle shaft flange, and then remove the drum from the flange.
3. Working through the hole provided in the axle shaft flange, remove the nuts that secure the wheel bearing retainer to the axle housing (Fig. 2).
4. Pull the axle shaft assembly out of the axle housing (Fig. 3). **Install one nut to hold the brake backing plate in place after the axle shaft is removed.**
5. Check the bearing for smooth free rotation. Check the axle shaft splines for burrs, wear or damage. Replace worn or damaged parts.
6. If the rear wheel bearing is to be replaced, loosen the inner retainer ring by nicking it deeply with a cold chisel in several places (Fig. 4). It will then slide off easily.
7. Press the bearing from the axle shaft with the tool shown in Fig. 5.
8. Inspect the machined surface of the axle shaft and the axle housing for rough spots or other irregularities which would affect the sealing action of the oil seal. Carefully remove any burrs or rough spots.
9. Lightly coat the wheel bearing bores with ball joint grease.
10. Place the retainer plate on the axle shaft, and press the wheel bearing on the shaft with tool 4621-A as shown in Fig. 6.

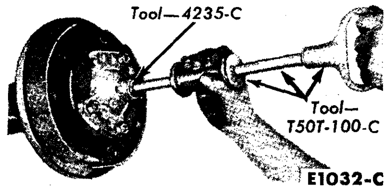

FIG. 3—Axle Shaft Removal

11. Press on a new wheel bearing retainer ring with tool 4621-A. **Do not attempt to press on both the wheel bearing and retainer ring at the same time.**
12. **Whenever a rear axle shaft is removed, the oil seal must be replaced.** Remove the seal with the tool shown in Fig. 13.
13. Soak new seals in SAE 10 oil for ½ hour before use. Install the new seal with tool 4245-B as shown in Fig. 14. Wipe a small amount of an oil resistant sealer on the outer edge of the seal before it is installed. **Do not put sealer on the sealing lip.** Install the seal with its sealing lips toward the axle housing.
14. Place a new gasket on each side of the brake backing plate, and then carefully slide the axle shaft into the housing so that the rough forging of the shaft will not damage the oil seal. Start the axle splines into the side gear, and push the shaft in until the bearing bottoms in the housing.

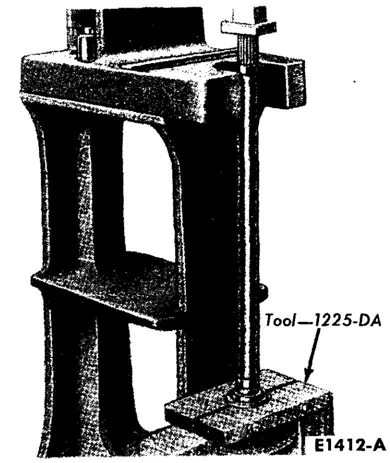

FIG. 5—Rear Wheel Bearing Removal

15. Install the bearing retainer plate and the nuts that secure it. Torque the nuts to specification (Fig. 2).
16. Install the brake drum and the drum retaining nuts.
17. Install the wheel and tire on the drum.

DRIVE PINION OIL SEAL REPLACEMENT

The drive pinion oil seal can be replaced without removing the rear axle assembly from the car. Soak the new seal in SAE 10 oil for ½ hour before use.

1. Raise the car on a hoist, or the rear of the car on a suitable jack.

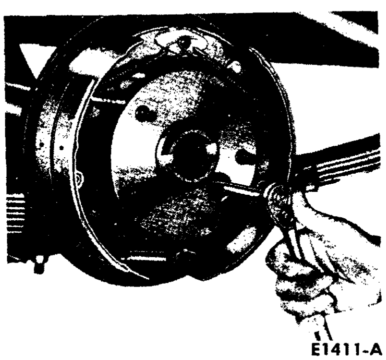

FIG. 2—Wheel Bearing Retainer Plate Removal or Installation

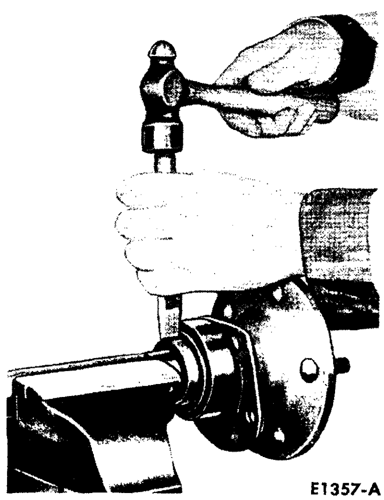

FIG. 4—Wheel Bearing Retainer Ring Removal

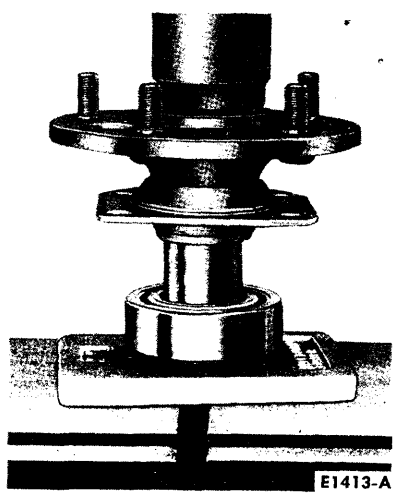

FIG. 6—Rear Wheel Bearing Installation

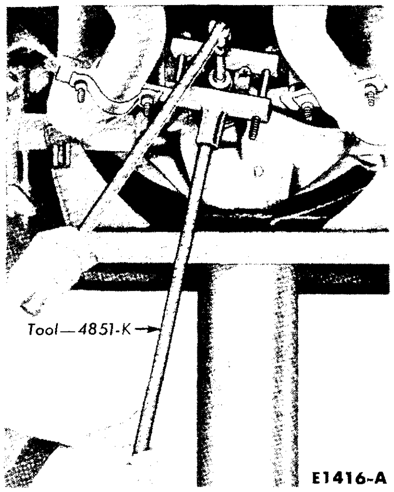

FIG. 7—Pinion Shaft Nut Removal or Installation—Axle in Car

2. Remove the retaining bolts and washers, and then remove the bumper, bracket, and spacers from the housing.

3. To maintain proper drive line balance, the drive shaft should be installed in its original position. To insure proper installation at assembly, make scribe marks on the drive shaft rear end yoke and the axle U-joint flange (Fig. 12). Also, make chalk marks on the drive shaft front slip yoke and the transmission extension housing.

4. Disconnect the rear end of the drive shaft by removing the U-joint bearing caps that hold the spider to the axle U-joint flange. **Be careful to avoid dropping the loose universal joint bearing cups.** Slide the drive shaft forward, and remove it from the transmission extension housing. Install tool 7657-J in the transmission housing to prevent leakage.

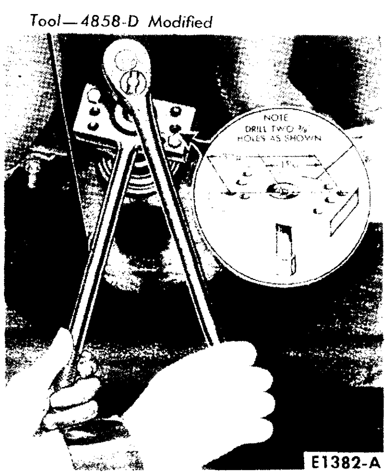

FIG. 8—U-Joint Flange Removal —Axle in Car

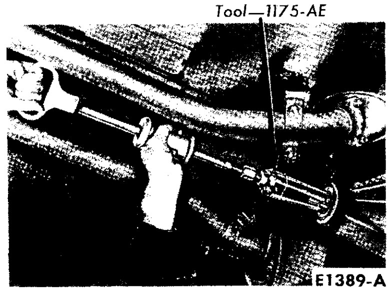

FIG. 9—Pinion Shaft Oil Seal Removal

5. While holding the flange with tool 4851-K, remove the pinion shaft nut (Fig. 7).

6. Clean the carrier-housing around the oil seal. Place a drain pan under the seal, or raise the front of the car higher than the rear.

7. The U-joint flange removing tool 4858-D must be modified to fit the larger 1961-64 U-joint flange. This can be easily accomplished by drilling two additional ⅜-inch diameter holes through the flat plate portions of the tool to correspond to the opposing diagonal holes in the flange. See Fig. 8 for drilling dimensions.

8. Use reworked tool 4858-D to remove the U-joint flange from the drive pinion, as shown in Fig. 8. Remove the dust deflector if damaged.

9. Remove the pinion shaft seal assembly using tool 1175-AE, as shown in Fig. 9.

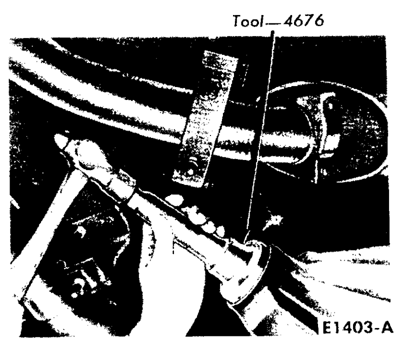

FIG. 10—Pinion Shaft Oil Seal Installation

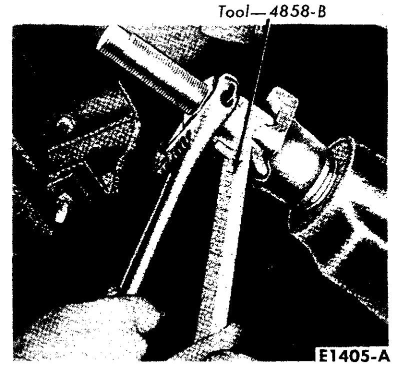

FIG. 11—U-Joint Flange Installation on Car

10. Inspect the parts. Replace any that are worn or damaged.

11. Clean the pinion oil seal seat. Coat the outer edge of the new seal with a small amount of oil resistant sealer. **Do not put sealer on the sealing lip.** Drive the seal into the housing, using the tool shown in Fig. 10.

12. Start a new dust deflector over the U-joint flange and drive the deflector into position on the flange as shown in Fig. 38.

13. Coat the inside of the U-joint flange with specified lubricant, and press the flange into position with tool 4858-B as shown in Fig. 11.

14. Remove the flange installing tool, and install the pinion shaft washer and nut. While holding the flange with the tool shown in Fig. 7, torque the pinion shaft nut to specifications.

15. Remove tool 7657-J from the transmission extension housing. Install the drive shaft to the transmis-

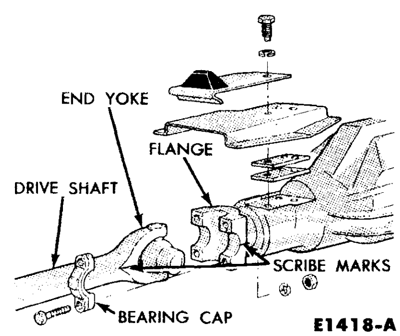

FIG. 12—Drive Shaft-to-Axle U-Joint Flange Connection

sion, so that the chalk marks on the slip yoke and the transmission extension housing are aligned.

16. Position the drive shaft to the axle U-joint flange, aligning the scribe marks made on the drive shaft rear end yoke and the axle U-joint flange during the removal procedure (Fig. 12). Connect the shaft to the flange by installing the U-joint bearing caps that hold the spider to the flange. Install the bearing cap retaining bolts and torque to specifications.

17. Install the spacers, bumper bracket, and bumper on the housing, and secure with the retaining bolts and lockwashers.

18. Check the lubricant level, and add whatever amount of specified lubricant is necessary. Lower the car.

3 REMOVAL AND INSTALLATION

REAR AXLE HOUSING ASSEMBLY

REMOVAL

1. Raise the car on a hoist or the rear of the car on a suitable jack. Place a jack stand under each side, at the rear of the spring hangers.

2. Lower the car until the weight is supported by the jack stands.

3. Drain the axle housing by loosening the rear cover bolts.

4. Remove the retaining bolts and washers, and remove the bumper, bracket and spacers from the housing.

5. To maintain proper drive line balance, the drive shaft should be installed in its original position. To insure proper installation at assembly, make scribe marks on the drive shaft rear end yoke and the axle U-joint flange (Fig. 12). Also, make chalk marks on the drive shaft front slip yoke and the transmission extension housing.

6. Disconnect the rear end of the drive shaft by removing the two U-joint bearing caps that hold the spider to the axle U-joint flange. **Be careful to avoid dropping the loose universal joint bearing cups.** Slide the drive shaft forward, and remove it from the transmission extension housing. Install tool 7657-J in the transmission housing to prevent leakage.

7. Remove the two rear wheel and tire assemblies.

8. Remove the Tinnerman nuts that secure each brake drum to the axle shaft flange, and then remove the drum from the flange.

9. Working through the hole provided in each axle shaft flange (Fig. 2), remove the nuts that secure the wheel bearing retainer to the axle housing. Pull each axle shaft and bearing assembly out of the axle housing using the tool shown in Fig. 3.

10. Remove both wheel bearing oil seals (Fig. 13).

11. Disconnect the rear shock absorbers from the mounting studs on the axle housing.

12. Remove the brake line-to-axle housing retaining clips and the retaining bolt holding the junction block to the axle housing.

13. Remove the parking brake cable retainers from the U-bolts.

14. Remove the brake backing plates and wire them to the underbody. Do not disconnect the brake lines.

15. Remove the axle U-bolt retaining nuts.

16. Remove the U-bolts, the spring center mounting, insulator retainers and the insulators.

17. Remove the axle housing assembly.

INSTALLATION

1. Clean the axle housing and shafts using kerosene and swabs. To avoid contamination of the grease in the sealed ball bearings, do not allow any quantity of solvent directly on the wheel bearings.

If the axle housing is being replaced, disassemble the drive pinion and differential case assembly from the old housing and assemble them in the replacement housing as described in Part 2-2, Section 4. Remove the bolts that retain the brake backing plate and wheel bearing retainer from the old housing flanges. Position the bolts in the replacement housing flanges.

2. Soak two new rear wheel bearing oil seals in SAE 10 oil for ½ hour before installation. Wipe a small amount of an oil resistant sealer on the outer edge of each seal before it is installed. **Do not put sealer on the sealing lip.** Install the oil seals in the ends of the rear axle housing with the sealing lip toward the housing (Fig. 14).

3. Position the rear axle housing on the rear springs. Position the spring center mounting upper and lower insulators and retainers, the shim wedge, and the U-bolts.

4. Install the U-bolt retaining nuts and torque to specifications. Make sure that the spring lower insulator contacts the upper retainer.

5. Install the brake backing plates with new gaskets on the axle housing flanges.

6. Connect the parking brake cables to the U-bolts with the hook type retainers.

7. Install the junction block on the axle housing and secure with the retaining bolt. Position the brake line to the axle housing, and secure with the retaining clips.

8. Raise the rear axle housing and springs enough to allow connecting the rear shock absorbers to the

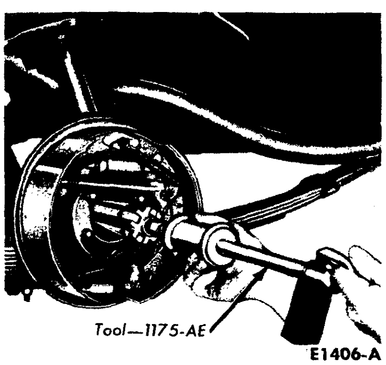

FIG. 13—Rear Wheel Bearing Oil Seal Removal

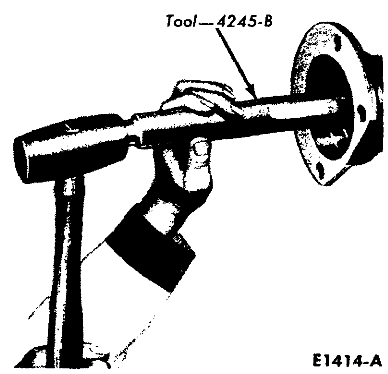

FIG. 14—Rear Wheel Bearing Oil Seal Installation

mounting studs on the axle housing. Install the washers and nuts on the studs and torque to specifications.

9. Install the two axle shaft assemblies in the axle housing. Carefully slide each axle shaft into the housing so that the rough forging of the shaft will not damage the oil seal. Start the axle splines into the side gear, and push the shaft in until the bearing bottoms in the housing.

10. Install the bearing retainer plates and the nuts that secure them. Torque the nuts to specifications (Fig. 2).

11. Install the brake drums and the (Tinnerman) drum retaining nuts.

12. Install the wheel and tire assemblies on the drums.

13. Remove tool 7657-J from the transmission extension housing. Install the drive shaft to the transmission, so that the chalk marks on the slip yoke and the transmission extension housing are aligned.

14. Position the drive shaft on the axle U-joint flange, aligning the scribe marks made on the drive shaft rear end yoke and the axle U-joint flange during the removal procedure (Fig. 12). Connect the shaft to the flange by installing the U-joint bearing caps that hold the spider to the flange. Install the bearing cap retaining bolts, and torque to specifications.

15. Install the spacers, bumper bracket, and bumper on the housing and secure with the retaining bolts and lock washers.

16. Fill the rear axle with specified lubricant. Remove the jack stands and lower the car.

4 MAJOR REPAIR OPERATIONS

DISASSEMBLY

Mount the axle housing in the holding fixture tool 4005 (Fig. 3, Part 4-1), and perform the "Inspection Before Disassembly of Carrier" as explained in Part 4-1, Section 3. Then disassemble the carrier as outlined in the following procedures.

REMOVAL OF DIFFERENTIAL CASE, PINION, AND BEARINGS

1. Remove the attaching bolts and the differential side bearing caps (Fig. 15). Note the identification marks stamped on the bearings and housing for proper assembly.

2. Install the carrier spreader so that the dowels on the tool enter the openings in the housing (Fig. 16). Tighten the hold-down clamp screws.

3. Release the wing nuts on the holding fixture, and spread the carrier housing by rotating the turnbuckle on the spreading tool. Spread the housing until the differential assembly can be forced out with a pry bar or long screwdriver. **Do not spread the housing more than 0.020 inch to remove the differential. Loosen the spreader turnbuckle immediately after lifting out the differential assembly to prevent springing the housing.**

Place each differential bearing cup with its respective bearing for proper assembly.

4. Remove the spreader tool, and turn the housing in the holding fixture so that the drive pinion shaft is in a vertical position. Remove the nut from the pinion shaft as shown in Fig. 17.

5. Remove the U-joint flange from the pinion shaft using the modified tool shown in Fig. 8.

6. Turn the housing in the holding fixture so that the drive pinion is in a horizontal position, and then remove the pinion shaft oil seal with the tool shown in Fig. 9. Lift out the gasket and slinger.

7. Turn tool 4201 onto the pinion shaft threads and drive against the tool until the pinion shaft and rear bearing are loosened from the housing (Fig. 18). Remove the tool from the pinion shaft, withdraw the pinion and rear bearing assembly from the rear of the housing, and remove the front bearing and preload shims from the front of the housing. **Tie all the shims together for assembly. Record the thickness of the shims in case they should be lost.**

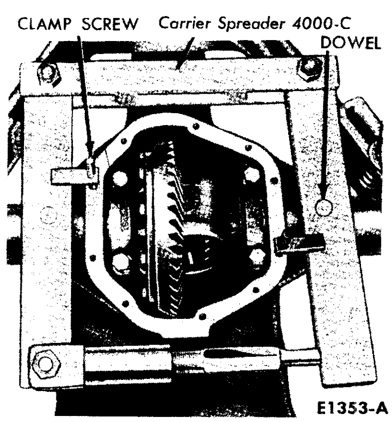

FIG. 16—Spreading Carrier Housing

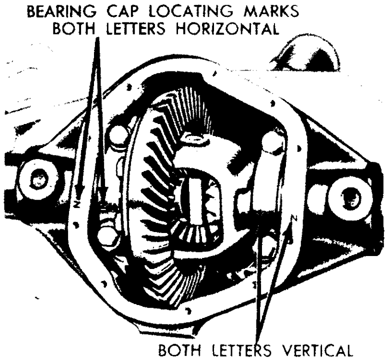

FIG. 15—Differential Bearing Cap Locating Marks

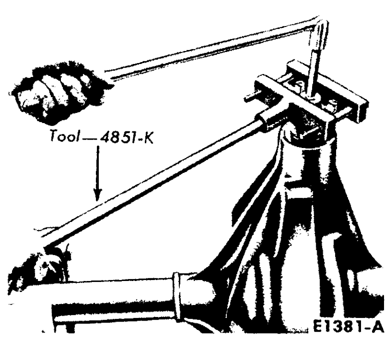

FIG. 17—Pinion Shaft Nut Removal

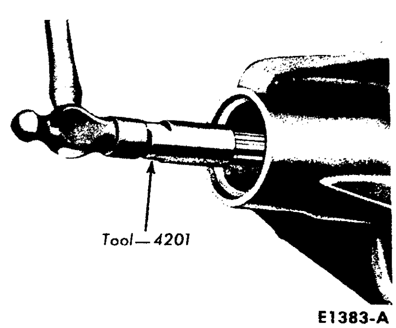

FIG. 18—Pinion and Bearing Assembly Removal

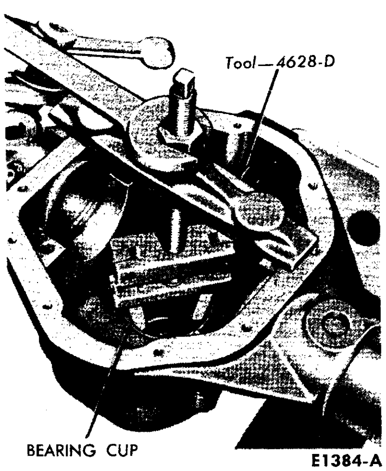

FIG. 19—Pinion Rear Bearing Cup Removal

8. Remove the pinion rear bearing cup as shown in Fig. 19. Remove the pinion locating shims and tie them together. **Record the thickness of the shims in case they should be lost.**

9. With the forward end of the housing up, remove the pinion front bearing cup (Fig. 20).

10. If necessary, the pinion rear bearing may be pressed off the drive pinion. Use tool 4621-BA.

If inspection before disassembly showed excessive ring gear runout, do not proceed to the disassembly of the differential case at this point. First, determine which parts should be replaced (differential case, bearings, or ring gear) as explained under "Parts Repair or Replacement" in this section.

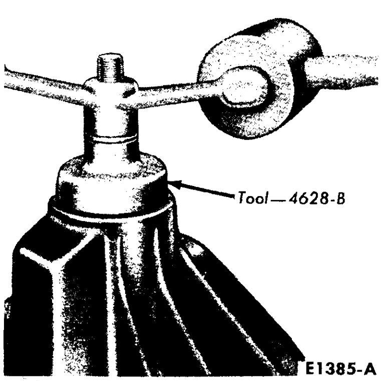

FIG. 20—Pinion Front Bearing Cup Removal

CONVENTIONAL DIFFERENTIAL CASE DISASSEMBLY

1. Position the differential case in the holding fixture, locate the fingers of the puller tool in the cast recesses of the differential case, and pull one of the differential side bearings (Fig. 21). **Tie the shims together for assembly and label "ring gear side" or "pinion side." Record the thickness of the shims in case they should be lost.**
2. Reverse the differential case in the holding fixture, and remove the second side bearing and shim pack as directed in step 1.
3. Remove the ring gear-to-differential case bolts, and remove the gear from the case.
4. With a punch, drive out the differential pinion shaft lock pin. Remove the differential pinion shaft, pinions, and thrust washers. Remove the side gears and thrust washers. Refer to Fig. 6, Part 4-1.

"DIRECTED POWER" DIFFERENTIAL CASE DISASSEMBLY

1. Mark the differential case halves for correct alignment at assembly. See the "Case Markings" in Fig. 22.
2. Mark one end of each mate shaft exactly as shown in Fig. 22 so that the "V" shaped end of each shaft will match the same "V" ramp in the case when the unit is assembled.

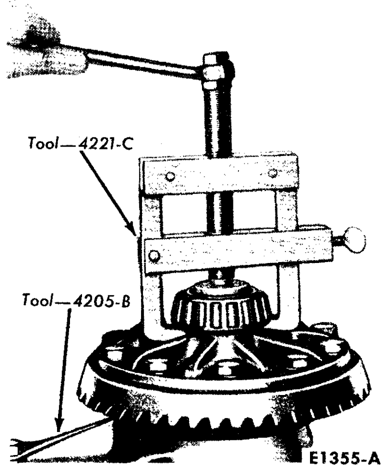

FIG. 21—Differential Bearing Removal

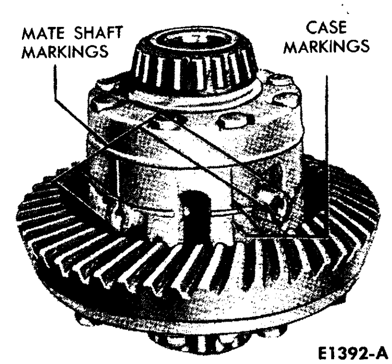

FIG. 22—Alignment Marks for Proper Assembly

3. Place the assembly in holding fixture 4205-B shown in Fig. 21. **If the side bearings and/or ring gear do not require replacement, skip steps 4 and/or 5 and proceed with step 6.**
4. Using the puller tool shown in Fig. 21, remove one of the differential side bearings. **Tie the shims together for assembly, and label "Ring Gear Side" or "Pinion Side." Record the thickness of the shims in case they should be lost.** Reverse the differential case in the fixture, and repeat the procedure for the opposite side bearing and shims.
5. Remove the ring gear-to-differential case bolts and remove the gear from the case.
6. Loosen but do not remove the eight bolts that hold the differential case halves together. Remove the differential case from the holding fixture and set the case on the bench with the ring gear half of the case **down** as in Fig. 22.
7. Remove the case attaching bolts and the cover half of the case. Remove the upper clutch plates and discs, side gear ring, side gear, and upper mate shaft and pinions (Fig. 23). Keep these parts with the cover half of the case so that they will be installed in their original positions during assembly.
8. Remove the corresponding parts from the ring gear half of the case (Fig. 23), and keep the parts with the ring gear half for proper assembly.

PARTS REPAIR OR REPLACEMENT

Clean and inspect all the parts as outlined in Part 4-1, Section 3. Before assembling the rear axle, repair or replace all parts as indicated by the inspection.

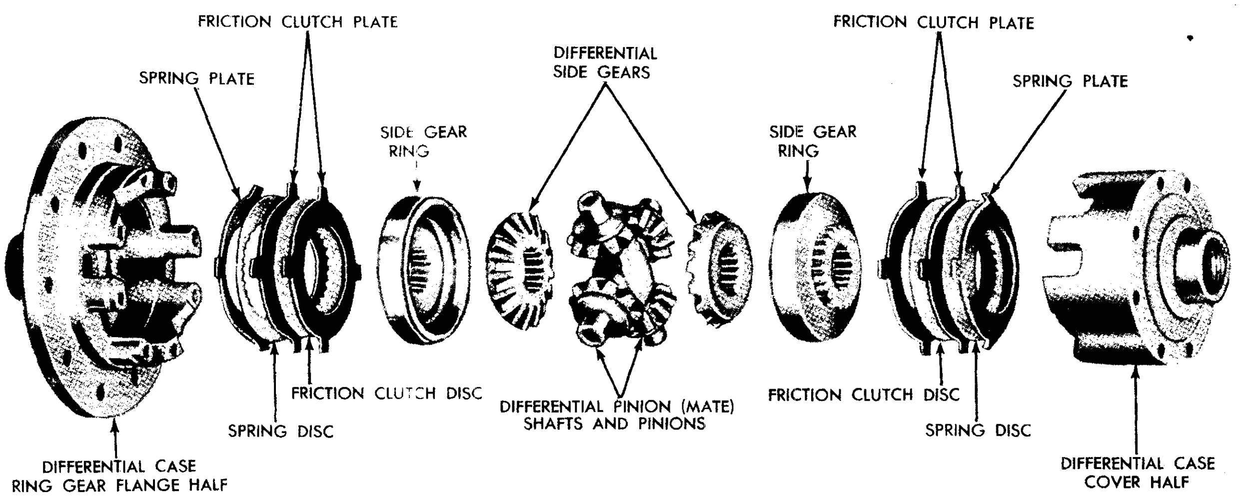

FIG. 23—"Directed Power" Differential—Disassembled

The principal replacement operations are covered in the following procedures. All other repair or replacement operations are performed during "Cleaning and Inspection" Part 4-1, Section 3, or during the "Assembly" procedures in this section.

DRIVE PINION AND RING GEAR SET

When replacing a ring gear and pinion, note that the original factory installed (pinion locating) shim is of the correct thickness to adjust for individual variations in both the carrier housing dimension and in the original gear set dimension. Therefore, to select the correct shim thickness for the new gear set to be installed, follow these steps:

1. Measure the thickness of the **original pinion locating shim** with a micrometer.

2. Note the shim adjustment number on both the old pinion and the new pinion. Each pinion gear is marked with an adjustment number such as the −1 marking in Fig. 24.

3. Refer to the table in Part 4-3 for the correct amount of shim thickness change. The amount that is shown under the new pinion shim adjustment number and in line with the old pinion number is the amount of **change** that should be made to the **original** shim thickness.

If the old pinion is marked +4, for example, and the new pinion is marked −2, the table indicates that 0.006 inch of shim stock should be added to the **original** shim pack.

If the **original** shim pack was lost or if a new axle housing is being installed, substitute a **nominal** 0.030 inch shim for the **original**, and repeat the foregoing steps for a trial build-up. If any further shim change is necessary, it will be indicated in the tooth pattern check.

A new ring gear and pinion should always be installed in an axle as a matched set (never separately). **Be sure that the same matching number appears on both the drive pinion and the ring gear.** Note the number "666F" in Fig. 24.

4. Start the rear bearing on the drive pinion with its tapered end up, then press the bearing on the pinion

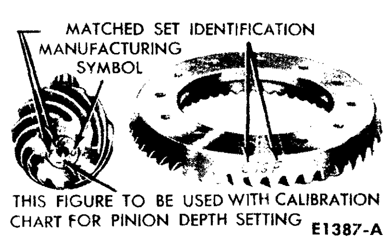

FIG. 24—Pinion and Ring Gear Markings

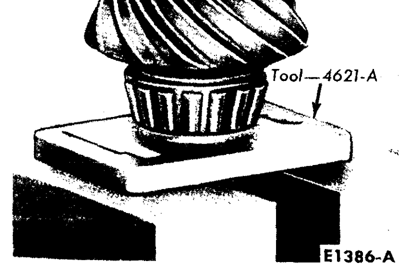

FIG. 25—Pinion Rear Bearing Installation

shaft as shown in Fig. 25. Use a 0.0015-inch feeler gauge between the bearing and the pinion gear to be sure that the bearing is fully seated.

5. After determining the correct shim thickness and installing the rear bearing as explained in the foregoing steps, install the new pinion and ring gear as outlined under "Assembly."

DIFFERENTIAL CASE, BEARINGS, AND RING GEAR

If the ring gear runout check before disassembly exceeded specifications, the condition may be caused by a warped ring gear, a defective case, or by excessively worn differential side bearings.

To determine the cause of excessive runout proceed as follows:

1. Remove the ring gear from the case, and install the case back in the housing with side bearings and cups still installed.

2. Check the runout of the case flange with a dial indicator. If the runout does **not now** exceed specifications, install a new ring gear to the case during assembly. If the runout still exceeds specifications, the ring gear is true and the trouble is due to either a defective case or worn bearings. Continue with steps 3 through 5.

3. Remove the differential case from the carrier housing and remove the side bearings from the case, using the tool shown in Fig. 21.

4. Press **new** bearings on the case hubs with tool 4222-H, and again install the differential case assembly in the housing without the ring gear.

5. Check the case runout again with the new bearings. If the runout is **now** within specifications, the old bearings were excessively worn. Use new bearings for assembly. If the runout is still excessive, the case is defective and should be replaced.

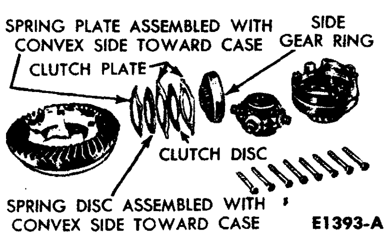

FIG. 26—Positioning of Parts for Assembly

ASSEMBLY

CONVENTIONAL DIFFERENTIAL CASE ASSEMBLY

1. Place a thrust washer over each pinion and side gear. Assemble the pinion and side gears in the differential case and secure them with the pinion shaft (Fig. 6, Part 4-1). **Lubricate all differential parts liberally with axle lubricant during assembly.**

2. Slide the side gears and thrust washers tightly against the pinion gear. Then, using a feeler ribbon, check the clearance between the case and the thrust washers. If the clearance exceeds 0.015 inch, new thrust washers must be installed.

3. Align the lock pin hole in the pinion shaft with the hole in the case and install the lock pin. Peen the case metal over the lock pin.

4. Place the differential case assembly in a holding fixture, tool 4205-B. Install the ring gear and secure it with bolts. Torque the bolts to specifications.

"DIRECTED POWER" DIFFERENTIAL CASE ASSEMBLY

1. Select the side gear ring and the clutch pack that pertains to the ring gear half of the differential case (Fig. 26). Assemble to the side gear ring in order: a **flat** clutch plate (with external lugs), a clutch disc (with internal splines), a clutch plate, the spring disc (with convex side toward the case), and the spring plate (with convex side toward the case).

2. Assemble the remaining clutch plates and discs to the side gear that pertains to the cover half of the case. Follow the same order of assembly as in the foregoing step.

3. Hold each differential case half on its side and install the pertinent side gear ring with plates and discs assembled. Make sure that the clutch plate lugs are aligned and that they enter the slots in the case (Fig. 27). **The side gear ring will rotate with a slight drag when properly seated in the case.**

4. With the ring gear half of the case in an upright position, as in Fig. 28, place the proper side gear on the side gear ring. Place the lower (ring gear half) mate shaft and pinions on the side gear ring so that the locating marks on the

FIG. 27—Installation of Side Gear Ring, Discs, and Plates in Case

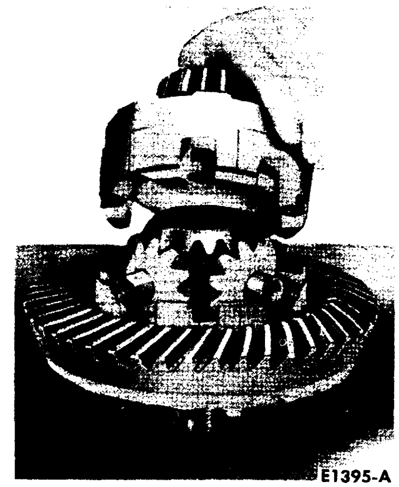

FIG. 28—Assembly of Differential Case Halves

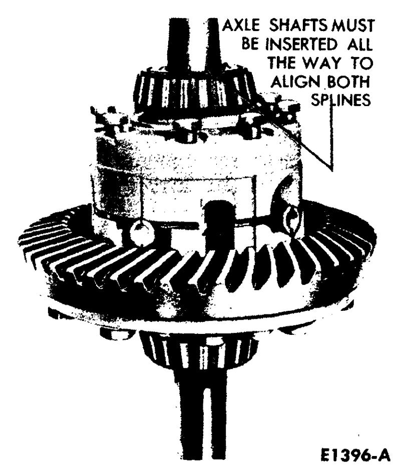

FIG. 29—Spline Alignment of Side Gear and Side Gear Ring

mate shaft are aligned with the corresponding marks on the case. Position the upper (cover half) mate shaft and pinions with marks aligned, and set the cover half side gear on top of the four pinions (Fig. 28).

5. While holding the side gear and clutch pack in the cover half of the case, install the cover half on the ring gear half so that the locating marks on each differential case half are in alignment (Fig. 28).

6. Install the differential case bolts and turn them in a few threads.

7. Align the splines of the side gears and side gear rings by inserting the axle shaft on each side of the case. Be sure the shaft goes all the way in to engage both side gear and side gear ring splines (Fig. 29).

8. With the axle shafts in position, torque the differential case bolts evenly and alternately to specifications.

9. Remove the axle shafts and check for proper assembly. **If the differential has been properly assembled, each mate shaft should be tight in its ramp; or, if there is clearance between the shaft and the ramp, the clearance should be equal at all four mate shaft ends.**

INSTALLATION OF PINION, BEARINGS, AND DIFFERENTIAL CASE

1. Before installing the pinion and bearings, measure the differential case side clearance as outlined in the following steps.

(a) Turn the axle housing assembly in the fixture so that the front end is down. Place dummy bearings (tool 4205-C) on the differential case hubs, and install the case in the housing.

(b) Install the bearing caps in their correct position as indicated by the identification marks, and install the cap retaining bolts finger tight.

(c) Set up a dial indicator with its contact point against the back face of the ring gear as shown in Fig. 30. Grasp both sides of the ring gear firmly as shown, and with a steady pressure move the entire differential assembly in one direction to the limit of its travel. Adjust the indicator to zero.

(d) In the same manner, move the differential assembly as far as it will go in the opposite direction. Note the reading on the dial indicator. This reading indicates the amount of shims needed behind the differential side bearings to take up the **total** clearance between the bearing caps and the case. **Record this reading for use later in the assembly procedure.**

(e) Remove the differential case from the housing, and remove the dial indicator and dummy bearings.

2. Install the pinion locating shim pack, and then install the rear bearing cup (Fig. 31). If the original ring gear and pinion is being installed, use the original shim pack. If a new gear set is being installed, use a corrected shim pack as explained under "Parts Replacement and Repair" in this section.

3. Turn the front end of the axle housing up, and install the front bearing cup (Fig. 32).

4. The rear face of the pinion gear (either new or old) should be lightly stoned to remove any irregularities or burrs before attempting a pinion gear depth reading.

Turn the housing to a horizontal

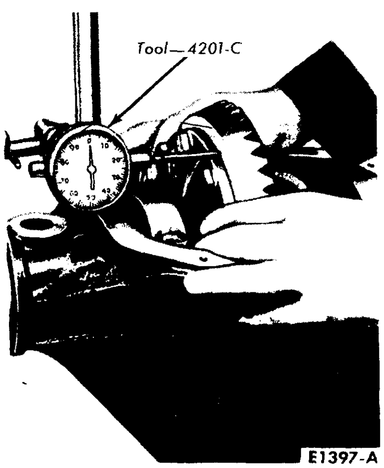

FIG. 30—Measuring Differential Case Side Clearance

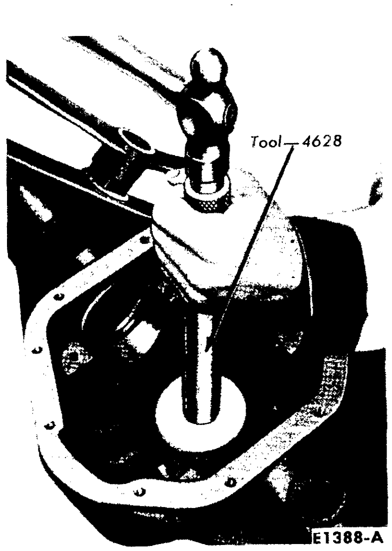

FIG. 31—Pinion Rear Bearing Cup Installation

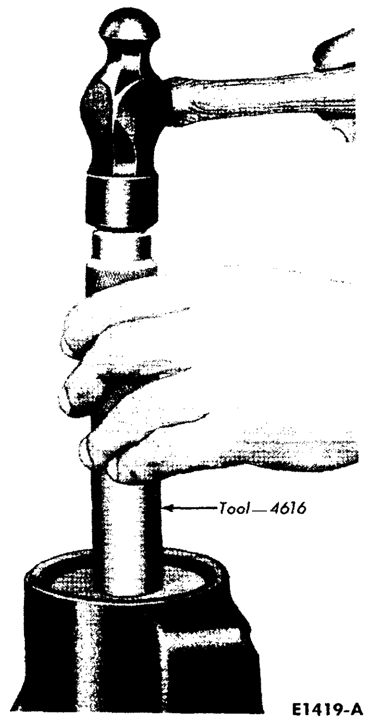

FIG. 32—Pinion Front Bearing Cup Installation

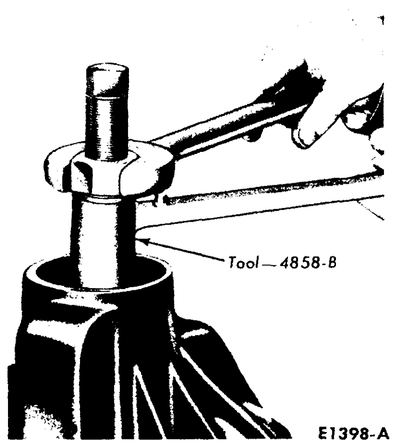

FIG. 33—Drive Pinion and Bearing Assembly Installation

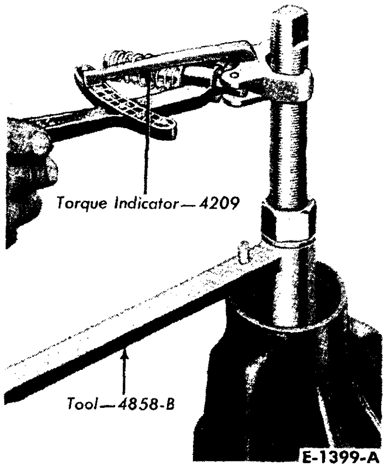

FIG. 34—Measuring Pinion Bearing Preload

position, and install the drive pinion and rear bearing assembly by inserting it from the rear side of the housing. Install the front bearing (without preload shims) and tool 4858-B on the pinion shaft, then turn the housing to an upright position. Draw these parts together in the housing by turning the nut on the tool (Fig. 33).

5. Tighten the nut on tool 4858-B until the torque required to rotate the drive pinion in the housing is 15 in-lbs as shown on the torque indicator (Fig. 34).

6. To verify the selection of the pinion locating shim, measure the pinion depth as outlined in the following steps:

(a) Check the micrometer accuracy of the pinion depth gauge (tool 4020-B). The zero setting on the

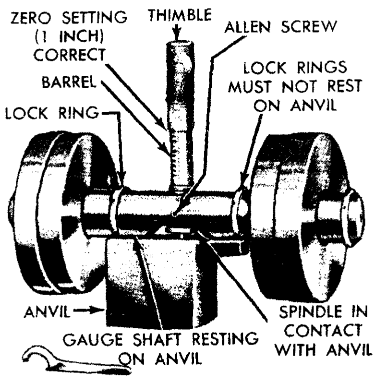

FIG. 35—Pinion Depth Gauge Adjustment

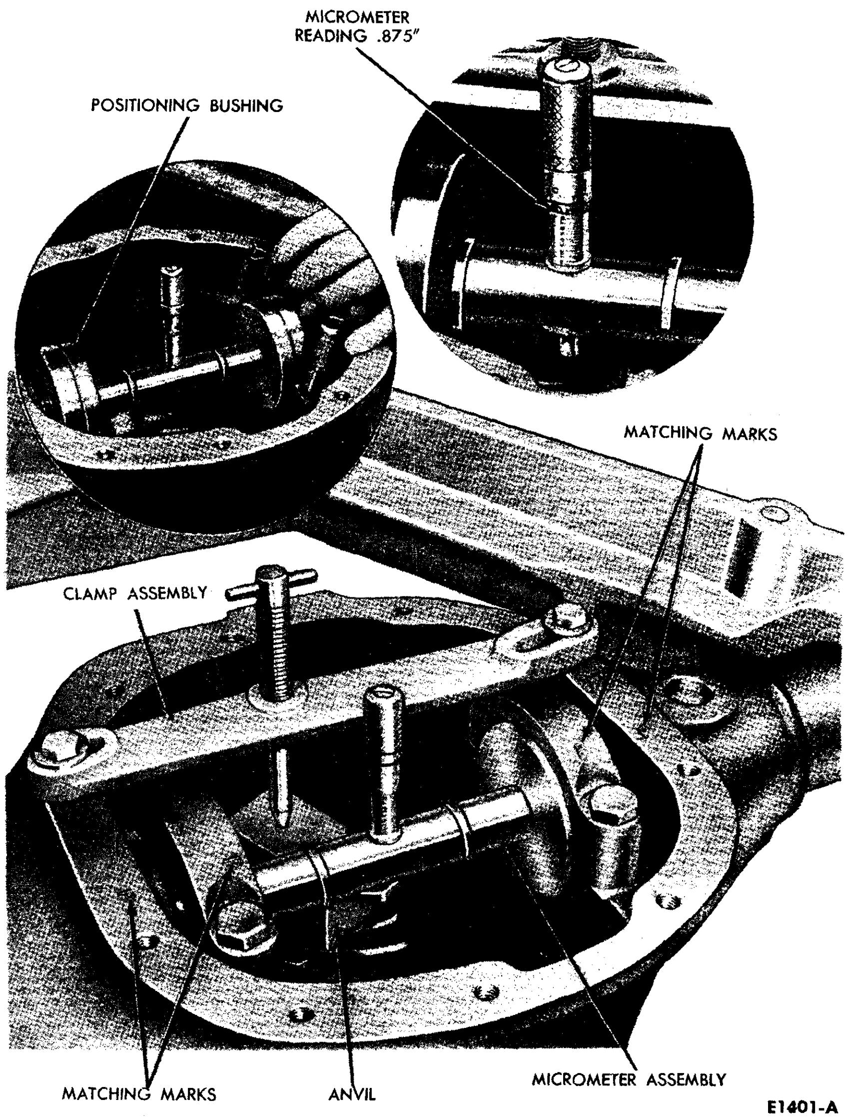

FIG. 36—Measuring Pinion Depth

barrel should coincide with the 1-inch mark on the thimble (Fig. 35). If the micrometer adjustment is out 0.003 inch or more, loosen the Allen screw and turn the barrel until the zero mark reaches the 1-inch mark on the thimble. When the adjustment is set, tighten the Allen screw. For errors smaller than 0.003 inch turn the barrel with the spanner wrench until the error is corrected.

(b) Remove the outer lock rings from the gauge shaft (Fig. 35). Position the aligning bushings as shown in the insert in Fig. 36.

(c) Install the gauge shaft and micrometer assembly in the housing as shown in Fig. 36. Install the bearing caps and bolts. Torque the bolts to specifications. Attach the anvil clamp assembly to the differential housing. **The anvil clamp should be positioned, as shown, with the embossed letters facing downward.** Place the anvil block on the pinion, as shown. Tighten the clamping screw against the anvil block.

(d) Refer to the calibration chart in Table 1 to determine the correct shim thickness for the pinion that is installed. Check the pinion marking (Fig. 24). The micrometer reading shown in the calibration chart under the pinion marking of the pinion being used indicates the correct shim thickness.

TABLE 1—Calibration Chart (Gauge 4020-B)

Pinion Marking	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	0	−1	−2	−3	−4	−5
*Micrometer Reading	.865	.866	.867	.868	.869	.870	.871	.872	.873	.874	.875	.876	.877	.878	.879	.880

*Allowable Tolerance: ±0.001 inch.

(e) Turn the micrometer thimble until the spindle just contacts the anvil of the gauge tool, and take the micrometer readings. (Figs. 35 and 36.) If the micrometer reading varies more than 0.001 inch from the specifications in the calibration chart, the pinion shim pack will require an adjustment. If the micrometer reading obtained is greater than that specified in the chart, it will be necessary to remove 0.001 inch in shim stock for each 0.001 inch difference between the micrometer reading and that specified in the chart.

Conversely, if the micrometer reading is less than that specified in the chart, it will require the installation of 0.001 inch in shim stock for each 0.001 inch difference between the micrometer reading and that specified in the chart.

7. Remove the gauge tool. If the micrometer reading was within specifications, proceed with step 9. If shim adjustment is required, remove the pinion and rear bearing assembly (Fig. 18). Then remove the pinion rear bearing cup. (Fig. 19). When adding or removing shims, measure each shim separately. **Check the bearing bore for burrs or upset metal. If any is present, it must be removed. Make sure that the bearing cup and shim pack are fully seated in the bore.** Install the pinion **rear** bearing

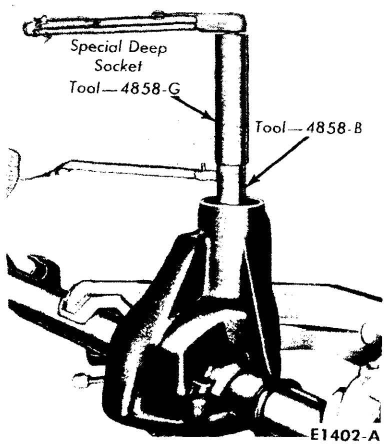

FIG. 37—Establishing Pinion Bearing Preload

cup (Fig. 31), then install the pinion and bearing assembly in the housing (Fig. 33).

8. If shims were installed or removed, recheck the pinion depth as outlined in step 6.

9. Establish the pinion bearing preload as outlined in the following steps.

(a) With the drive pinion set at its correct depth, remove the pinion and the pinion front bearing (Fig. 18).

(b) Install the drive pinion again, and place the bearing preload shims over the forward end of the pinion shaft. If the pinion location shim pack behind the rear bearing cup was **not** changed, install the **original** preload shim pack. If the pinion location shim pack **was changed,** add or subtract the same number of shims from the preload pack as was added or subtracted from the pinion location pack.

(c) Start the front bearing over the shaft with its tapered end down. Press the bearing on the shaft with the tool shown in Fig. 33. Using tool 4858-G, torque the nut on the tool to 200-220 ft-lbs (Fig. 37).

(d) With the pinion shaft in a vertical position, and using tool 4209 as shown in Fig. 34 check the torque required to rotate the drive pinion. Correct preload will be obtained when the torque required to rotate the pinion is as specified in Part 4-3.

(e) If the torque is less than the minimum specified, remove the front pinion bearing and remove shims. If the torque exceeds the maximum specified, install shims. Install the front bearing again, and recheck the preload.

10. Place the oil slinger over the drive pinion and against the bearing with its concave side up (Part 4-1, Fig. 6).

11. Install the oil slinger gasket.

12. Start the new seal over the drive pinion with the sealing edge pointing down; then, using the tool shown in Fig. 10, drive the seal into position.

13. Start a new seal deflector over the companion flange and drive the deflector into position on the

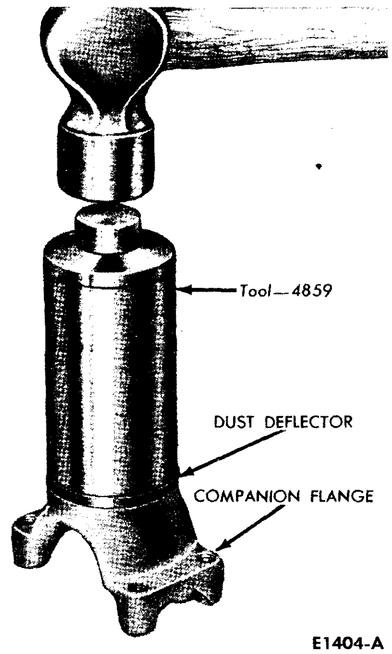

FIG. 38—U-Joint Flange Deflector Installation

flange (Fig. 38). Start the companion flange over the drive pinion and press the flange into position as shown in Fig. 39.

14. Install the washer and lock nut on the pinion shaft. While holding the flange with the tool shown in Fig. 17, torque the nut to specifications.

15. Refer back to the reading recorded in step 1. This reading (taken before the pinion was installed) represents the total clearance between the differential side bearing cups and the case. Perform the following steps for determining the number of shims required at each bearing to take up

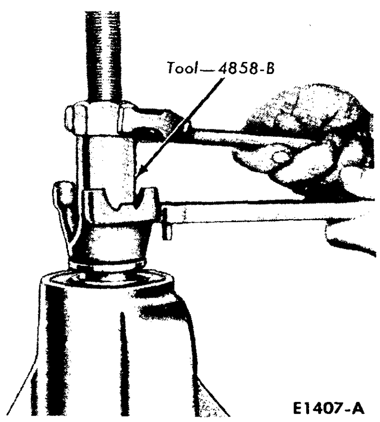

FIG. 39—U-Joint Flange Installation—On Bench

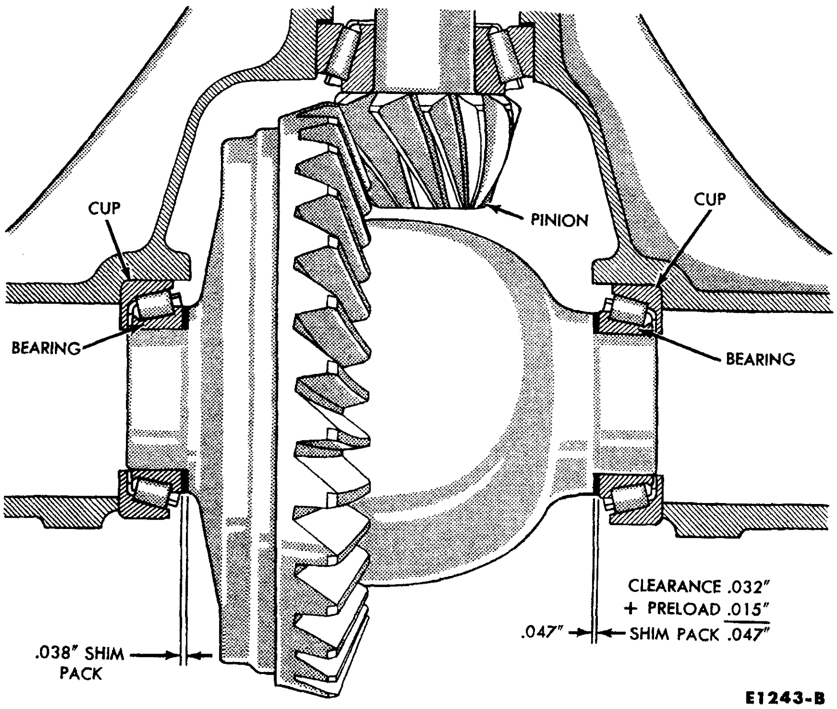

FIG. 40—Differential Bearing Preload and Ring Gear Backlash Adjustment

the clearance and establish preload and backlash:

(a) Place the dummy bearings (tool 4205-C) on the differential hubs, and again install the differential assembly in the housing (this time with the pinion installed). Install the bearing caps in their proper positions. Install and tighten the retaining bolts finger tight. Install the dial indicator with the contact point against the back face of the ring gear as shown in Fig. 30. Move the differential and ring gear assembly tight against the pinion gear, and then set the dial indicator to zero. Move the differential and ring gear assembly away from the pinion as far as possible, and note the reading.

(b) This reading indicates the amount of shims necessary to take up the clearance between the bearing cup and the case at the **ring gear side** of the differential assembly. Subtract this reading from the previously recorded total reading to obtain the amount of shims necessary to take up the clearance between the bearing cup and the case at the **pinion side** of the differential. Increase this pinion side shim pack by an additional 0.015 inch in order to provide correct bearing preload and backlash.

EXAMPLE (Fig. 40):

Total Clearance
previously recorded ... **0.070 inch**
Less reading in foregoing step (a)
(Amount of shims necessary to take up clearance at ring gear side) .... **0.038 inch**
Shims necessary to take up clearance at pinion side .... **0.032 inch**
Plus 0.015 inch shims for preload and backlash.. **0.015 inch**
Total amount of shims at pinion side .... **0.047 inch**

16. Remove the dial indicator, bearing caps and differential case from the housing. Remove the dummy bearings from the differential case.

17. Install the required number of shims on the bearing case. Using tool 4222-H, press the side bearings on the case.

18. Attach the spreader tool to the housing, as shown in Fig. 16, making certain the dowels on the tool enter the openings in the housing. Spread the housing enough to permit installation of the differential case and bearing assembly. **Do not spread the housing more than 0.020 inch.**

19. Install the bearing caps in their respective positions as indicated by the markings on the caps and housing (Fig. 15). Remove the spreader. Place some sealing compound on the bearing cap bolts. Install and torque the bolts to specifications.

20. With the dial indicator attached to the housing, as shown in Fig. 4, Part 4-1, check the backlash between the ring gear and pinion at four equally spaced points around the ring gear.

The backlash should not be less than 0.003 inch or exceed 0.008 inch, and must not vary more than 0.002 inch between the positions checked.

21. Attach a dial indicator to the differential housing as shown in Fig. 5, Part 4-1. With the indicator set at "zero", revolve the ring gear at least one revolution and check the total ring gear runout. The total indicator reading, or runout, should not exceed 0.006 inch.

22. Make a final tooth contact pattern check.

23. Install the gasket and differential cover with the gear identification tag beneath one of the cover bolts. Torque the bolts to specifications.

24. Refill the axle with specified lubricant.

PART 4-3 SPECIFICATIONS

REAR AXLE

ADJUSTMENTS

Description	Inches
Backlash Between Ring Gear and Pinion	0.003-0.008
Maximum Backlash Variation Between Teeth	0.002
Maximum Runout of Backface of Ring Gear as Assembled	0.006
Nominal Pinion Locating Shim	0.030
Available Pinion Locating Shims (Inches)	0.0025, 0.0035, 0.0045, 0.0055, 0.009, 0.011, 0.027, and 0.033
Available Pinion Bearing Preload Shims	0.003, 0.005, 0.010 and 0.030
Maximum Carrier Housing Spread	0.020

PINION AND DRIVE GEAR IDENTIFICATION

Ratio	Number of Teeth	
	Ring Gear	Pinion
2.89:1	55	19
3.11:1	59	19

LUBRICANT

Capacity	4.8 Pints

TORQUE LIMITS (Ft-lbs)

Differential Bearing Cap Retaining Bolts	70-90
Ring Gear to Differential Case	50-60
"Directed Power" Differential Case Half Retaining Bolts	35-45
Carrier Rear Cover Retaining Bolts	15-25
Bumper Bracket to Carrier Housing Retaining Bolts	20-30
U-Joint Flange to Drive Pinion Shaft Nut	200-220
Drive Shaft to Axle U-Joint Flange (Bearing Cap Bolts)	15-20
Minimum Pinion Nut Torque Required to Obtain Correct Pinion Bearing Preload	200-220
Rear Spring U-Bolt Nuts	50-60
Rear Wheel Bearing Retainer Plate to Axle Housing	50-65
Rear Shock Absorber to Axle Mounting Stud Nuts	30-40

PINION BEARING PRELOAD ADJUSTMENT

Description	Inch Pounds
With Seal (New Bearings)	22-24
With Seal (Old Bearings)	12-16
Without Seal (New Bearings)	18-20
Without Seal (Old Bearings)	8-12

DRIVE PINION ADJUSTING SHIM THICKNESS CHANGES (Inches)

Old Pinion Marking	New Pinion Marking								
	−4	−3	−2	−1	0	+1	+2	+3	+4
+4	+0.008	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0
+3	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001
+2	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002
+1	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003
0	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004
−1	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005
−2	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006
−3	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007
−4	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007	−0.008

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DRIVE LINE

GROUP 5

PART 5-1 DRIVE LINE

1 DESCRIPTION

The drive shaft assembly is a Hotchkiss type which incorporates two universal joints, a centering socket yoke, and a center yoke at the transmission end of the shaft (Fig. 1). A single universal joint is used at the rear axle end of the shaft.

The three universal joints are of the needle bearing type and are equipped with lubrication plugs. Fig. 2 illustrates the special needle nose quick disconnect fitting that is required to lubricate the drive shaft. The centering socket yoke, which forms part of the front universal joint, consists of a yoke and socket with a centering ball supported by roller bearings. The ball, socket, and bearings are lubricated through a special fitting in the yoke.

The slip yoke at the front universal joint contains two caged needle bearing assemblies which operate in two grooves in the transmission output shaft. Torque from the output shaft is transmitted through the needle bearings to the slip yoke. The slip yoke also is free to move fore and aft on the output shaft to compensate for movement of the rear axle. The needle bearings are lubricated by fluid in the transmission. **When applying undercoat, cover the drive shaft. An accumulation of undercoat on the drive shaft may cause it to become unbalanced. Vibration can cause excessive wear of drive line parts.**

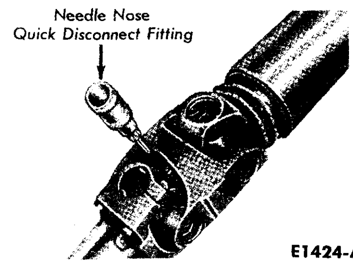

FIG. 2–Lubrication Tool

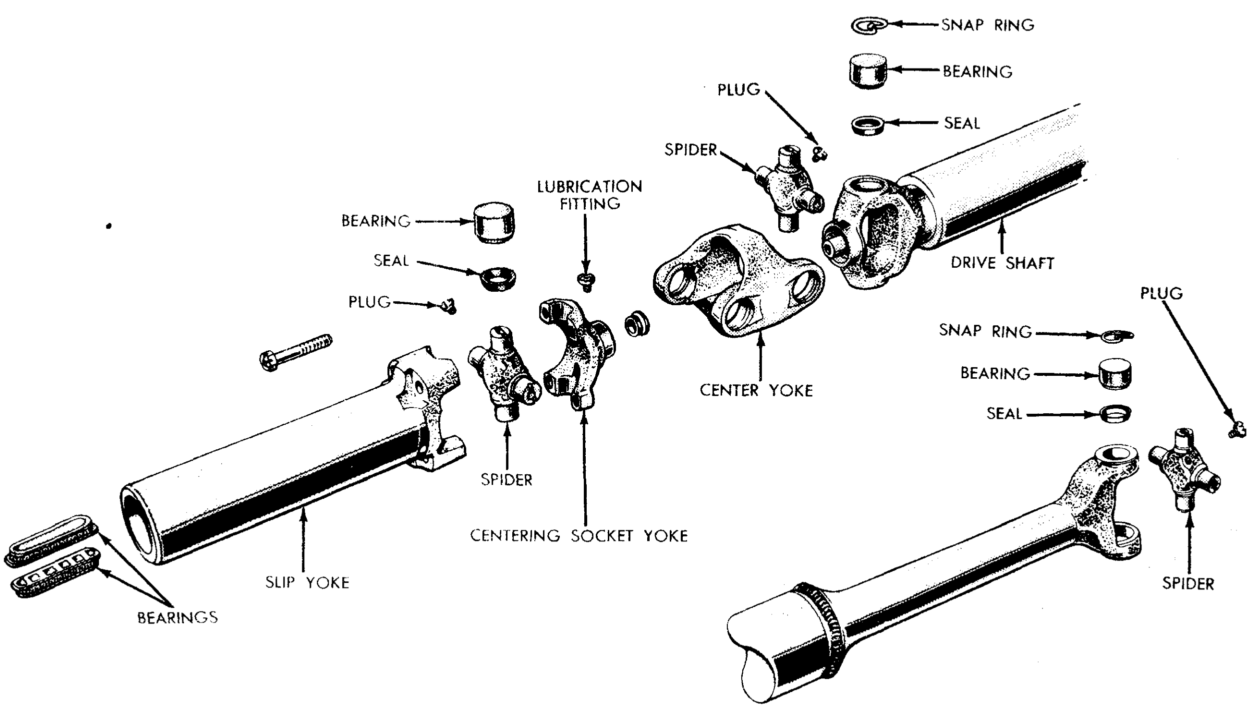

FIG. 1–Drive Shaft Disassembled

2 DIAGNOSIS AND TESTING

DRIVE LINE BALANCE

If detailed parts of the drive shaft are replaced and shaft vibration is encountered after installation, disconnect the shaft at the slip yoke. Rotate the slip yoke and transmission output shaft 180 degrees; then, reconnect the shaft to the slip yoke. If the vibration persists, disconnect the shaft at the rear axle companion flange. Rotate the flange and drive pinion 180 degrees and reconnect the shaft to the flange.

DRIVE LINE ANGLE CHECK

Vibration or "shudder" which is noticeable either on fast acceleration or when coasting, using the engine for a brake, may be caused by the rear axle housing being loose on the rear springs or by excessive drive line angles. If the rear axle "U" bolts are loose, torque the nuts to 50-60 ft-lbs.

Drive line angles may be corrected by tilting the rear axle pinion nose up or down as required. Tapered shims (wedges) are available in three angles: ½, 1, and 1½ degrees with no more than one wedge to be used on a side. To determine if shimming or a change in shimming is required, check the pinion nose angle as related to the rear riding height of the car. The procedure for checking the riding height is outlined under "Riding Height Measurement" in Steering, Group 3, Part 3-1. **Pinion nose angle will vary with different riding heights.** After checking and recording the rear riding height, check the pinion nose angle as follows:

1. Place the car on a known level surface, such as a drive-on front suspension alignment fixture, which will allow access to the rear axle pinion nose.
2. With a protractor and plumb line, measure the pinion nose angle, as shown in Fig. 3. **To make this tool, obtain a common protractor and drill a small hole at the exact center of the base (0°) line. Insert a short length of thread or fine fishing line through the drilled hole and attach a weight to act as a plumb bob.**
3. Compare the riding measurement and the pinion nose angle reading with those shown in Table 1.
4. If the pinion nose angle does not compare to the related riding height, remove the "U" bolt nuts. Install the appropriate wedges between each spring insulator upper retainer and the axle housing mounting pad.
5. Install and torque the "U" bolt nuts to 50-60 ft-lbs.

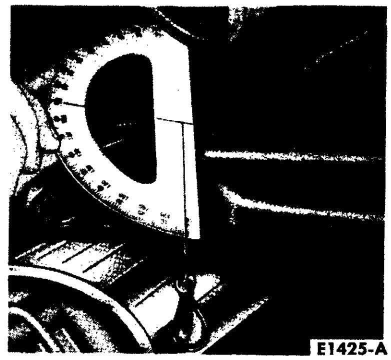

FIG. 3—Checking Pinion Nose Angle—Typical

TABLE 1

Riding Height	*Pinion Nose Angle
6 inches	4° Down
7 inches	3½° Down
8 inches	3° Down
9 inches	2½° Down

*Tolerance ± ¼°

3 REMOVAL AND INSTALLATION

REMOVAL

To maintain proper drive line balance, mark the drive shaft, universal joints, slip yoke, and companion flange before removing the shaft assembly, so it can be reinstalled in its original position.

1. To remove the drive shaft assembly, remove the cap screws or attaching bolts attaching the slip yoke to the front universal joint.
2. Push the slip yoke forward on the transmission output shaft and lower the front of the drive shaft.
3. Remove the nuts, lock washers, bolts and caps attaching the rear universal joint to the differential drive pinion companion flange. **Do not drop the loose bearing cups.**
4. Remove the shaft assembly.
5. Pull the slip yoke off the transmission output shaft. Install Tool 7657-J in the transmission extension housing to prevent fluid loss.
6. Using a long screwdriver, snap the two roller bearing assemblies off the spline teeth inside the slip yoke.

INSTALLATION

1. Align the index marks on the rear universal joint with the one on the companion flange and install the caps, bolts, lock washers and nuts.
2. Torque the bolts to 15-18 ft-lbs.
3. Install the bearing assemblies by snapping them over the spline teeth using a hammer handle.
4. Slide the slip yoke into place on the transmission output shaft.
5. Align the index marks on the front U-joint with the one on the slip yoke.
6. Install the cap screws or attaching bolts and lock washers. Tighten them to 15-18 ft-lbs.

4 MAJOR REPAIR OPERATIONS

DISASSEMBLY

1. Mark the position of the spiders, the center yoke, and the centering socket yoke as related to the yoke which is welded to the front of the drive shaft tube. **The spiders must be assembled with the lubrication plugs in their original position to provide proper clearance.**
2. Remove the lubrication plugs. Apply pressure on the centering socket yoke, and remove one bearing cup, as shown in Fig. 4. Remove the opposite bearing cup in the same manner.
3. Remove the snap rings which retain the bearing cups in the front of the center yoke. As a remover tool, use a piece of round bar stock or a socket about one inch in diameter. As a receiver tool, use a section of pipe or a socket with an inside diameter of about 1¼ inches. Clamp these details and the center yoke in a vise, as shown in Fig. 5.
4. Close the vise to press the bearing cup approximately ⅜ *inch* out of the center yoke and into the receiver. **The bearing cup cannot be**

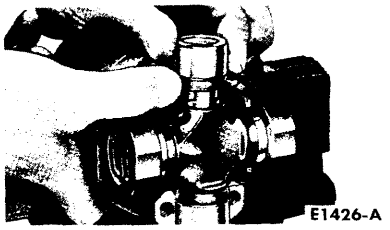

FIG. 4–Removing Bearing Cup from Centering Socket Yoke

pressed out of the yoke more than approximately ⅜ inch without causing damage.

5. Tightly clamp the exposed bearing cup in the vise and drive the yoke from the cup using a brass drift, as shown in Fig. 6.

6. Using the same removing tools, press on the exposed spider end to press the opposite bearing cup approximately ⅜ inch out of the yoke (Fig. 7).

7. Remove the loose spider, and remove the exposed bearing cup using a brass drift, as shown in Fig. 5.

8. Pull the centering socket yoke assembly off the centering stud, as shown in Fig. 8. Remove the rubber seal from the centering ball stud.

9. Remove the snap rings from the rear of the center yoke and the drive shaft yoke.

10. Partially press a bearing cup out of the drive shaft yoke, as shown in Fig. 9. **Stop the pressing operation when the inside of the center yoke almost contacts the slinger ring at the front of the drive shaft yoke; otherwise, the ring can be distorted.** The arrow in Fig. 9 indicates the interference point. Clamp the exposed bearing cup in the vise and drive the yoke from the cup. Remove the opposite bearing cup from the drive shaft yoke in the same manner.

11. Remove the remaining bearing cups from the center yoke and remove the spider.

12. Remove the lubrication fitting from the rear universal joint spider.

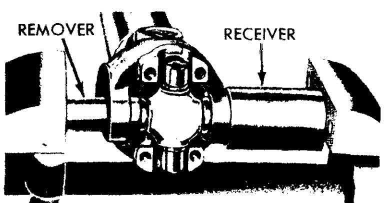

FIG. 5–Partially Removing Bearing Cup from Center Yoke

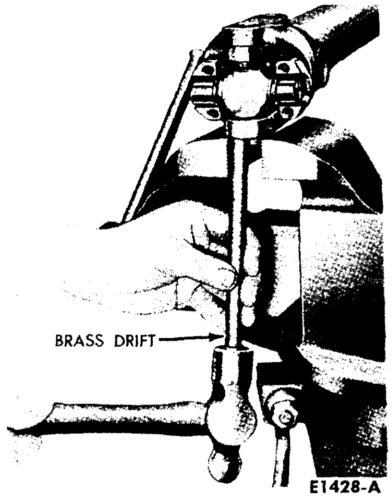

FIG. 6–Removing Bearing Cup from Center Yoke

Remove the bearing cup retaining snap rings.

13. With the same tools that were used to remove the front universal joint bearing cups, press one bearing out of the yoke.

14. Change the position of the tools and press on the exposed spider end until the opposite bearing cup is free. Remove the spider.

15. Clean those parts which are to be re-used with a suitable cleaning solvent. When replacement parts are available in a repair kit, install all the parts supplied in the kit. If the drive shaft is damaged, replace the complete drive shaft assembly to be assured of a balanced assembly.

ASSEMBLY

1. To assemble the rear universal joint, start a new bearing cup and seal in the yoke. Insert the spider and press the bearing cup approximately ¼ inch below flush with the yoke.

2. Start a new bearing cup and seal over the opposite spider journal and into the yoke. Press the bearing

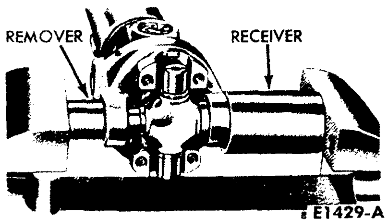

FIG. 7–Partially Removing Second Bearing Cup from Center Yoke

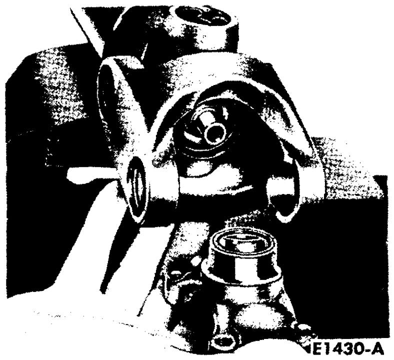

FIG. 8–Removing Center Socket Yoke

cup into the yoke far enough to install the snap ring. Install the snap ring in the opposite side of the yoke. Make certain both snap rings are properly seated. Install the lubrication fitting.

3. To assemble the front universal joints, position the spider in the drive shaft yoke. **Make sure the lubrication plugs will be in the same position as originally installed.** Press in the bearing cups and seals. Install the snap rings.

4. Position the center yoke over the spider ends and press in the bearing cups and seals. Install the snap rings.

5. Install a new seal on the centering ball stud. Position the centering socket yoke on the stud.

6. Place the front spider (with the lubrication fitting hole properly positioned) in the center yoke. Press in the bearing cups and seals, and install the snap rings.

7. Apply pressure on the centering socket yoke and install the remaining bearing cup and seals.

8. Install the plugs and lubricate the front and rear joints and the centering yoke.

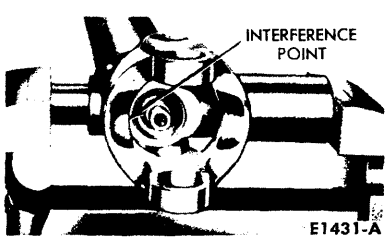

FIG. 9–Bearing Cup Removal and Interference Point

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AUTOMATIC TRANSMISSION

GROUP 7

PART 7-1 GENERAL TRANSMISSION SERVICE

1 DIAGNOSIS AND TESTING

The following preliminary checks should be made on the transmission before proceeding with any other diagnosis checks.

TRANSMISSION FLUID LEVEL CHECK

Check the transmission fluid level. Low fluid level can affect the operation of the transmission, and may indicate fluid leaks that could cause transmission damage.

A fluid level that is too high will cause the fluid to become aerated. Aerated fluid will cause a low control pressure, and the aerated fluid may be forced out the vent at the front of the transmission case.

TRANSMISSION FLUID LEAKAGE CHECKS

Check the speedometer cable connection at the transmission for oil leakage. Check the governor inspection plate for leakage. Install a new gasket if needed. Leakage at the oil pan gasket often can be stopped by tightening the attaching bolts to the proper torque. If necessary, replace the gasket.

Check the fluid filler tube connection at the transmission. Check the fluid lines and fittings between the transmission and the cooler in the radiator tank for leakage, looseness, wear, or damage. If leakage cannot be stopped by tightening a fitting, replace the leaking parts.

Check the engine coolant in the radiator. If transmission fluid is present in the coolant, the cooler in the radiator tank is probably leaking.

The cooler can be further checked for leaks by disconnecting the lines at the cooler fittings and applying 5 psi air pressure to the fittings. If the cooler is leaking and will not hold this pressure, the radiator must be replaced. **The cooler cannot be replaced separately.**

If leakage is found at either the transmission throttle lever (kickdown lever) shaft or the manual lever shaft, replace either or both seals.

Inspect the pipe plugs in the transmission case. If a plug shows leakage, torque the plug to specification. If tightening does not stop the leak, replace the plug.

When converter drain plugs leak, remove the two drain plugs with a sixpoint wrench. Coat the threads with FoMoCo Perfect Seal Sealing Compound or its equivalent, and install the plugs. Torque the drain plugs to specification. **Fluid leakage from the converter housing may be caused by engine oil leaking past the rear main bearing or from oil gallery plugs, or power steering oil leakage from the steering or hydro-wipe system. Be sure to determine the exact cause of the leak before repair procedures are started.**

Oil-soluble aniline or fluorescent dyes premixed at the rate of ½ teaspoon of dye powder to ½ pint of transmission fluid have proved helpful in locating the source of the fluid leakage. Such dyes may be used to determine whether an engine oil or transmission fluid leak is present, or if the fluid in the oil cooler leaks into the engine coolant system. A black light, however, must be used with the fluorescent dye solution.

CONVERTER AREA OIL LEAKAGE

In diagnosing and correcting fluid leaks in the front pump and converter area, the following procedures are to be used to facilitate locating the exact cause of oil leakage. Leakage at the front of the transmission, as evidenced by oil around the converter housing, may have several sources. By careful observation, it is possible, in many instances, to pinpoint the source of the leak before removing the transmission from the car. The paths the fluid takes to reach the bottom of the converter housing are shown in Fig. 1. Figure 2 shows the location of the hole in the front of the case that can cause oil leakage at the converter area, if the transmission oil level is too high. Check the oil level first, then check the following items:

1. Fluid that leaks by the seal lip will tend to move along the drive hub and onto the back of the impeller housing. Except in the case of a total seal failure, fluid leakage by the lip of the seal will be deposited on the inside of the converter housing only, near the outside diameter of the housing (Fig. 1).
2. Fluid leakage by the outside diameter of the seal and front pump body will follow the same path as shown in Fig. 1.
3. Fluid that leaks by a front pump

to case bolt will be deposited on the inside of the converter housing only. Fluid will not be deposited on the back of the converter (Fig. 1).

4. Leakage by the front pump to case gasket may cause fluid to be deposited inside the converter housing, or it may seep down between the front of the case and converter housing. Fluid on the front of the case, above the pan gasket, is evidence that the front pump to case gasket could be leaking.

5. Fluid leakage from the converter drain plugs will appear at the outside diameter of the converter on the back face of the flywheel, and in the converter housing only, near the flywheel (Fig. 1).

6. Engine leaks are sometimes improperly diagnosed as front pump seal leaks.

The following leakage areas should also be checked to determine if other oil leakage is causing the problem.

1. Leakage at the rocker arm cover (valley cover) may allow oil to flow over the converter housing or seep down between the converter housing and engine block causing oil to be present in or at the bottom of the converter housing.

2. Oil gallery plug leaks will allow oil to flow down the rear face of the block to the bottom of the converter housing.

3. Leakage by the crankshaft seal will work back to the flywheel, and from there into the converter housing (Fig. 1).

Oil leakage from other areas such as the power steering or from the hydro-wipe motor, lines or connections, forward of the transmission, could cause oil to be present around the converter housing due to blow back or road draft.

The following procedure should be used to determine what is causing the oil leakage before any repairs are made:

1. Remove the transmission dipstick and note the color of the fluid. Original factory fill fluid is dyed red to aid in determining if leakage is from the engine or transmission. Unless a considerable amount of "make-up" fluid has been added, or the fluid has been changed, the red color should assist in pinpointing the leak. Fluid used in the power steering and hydro-wipe system is also dyed red. This source of leakage should be eliminated, if present, before performing work on the transmission

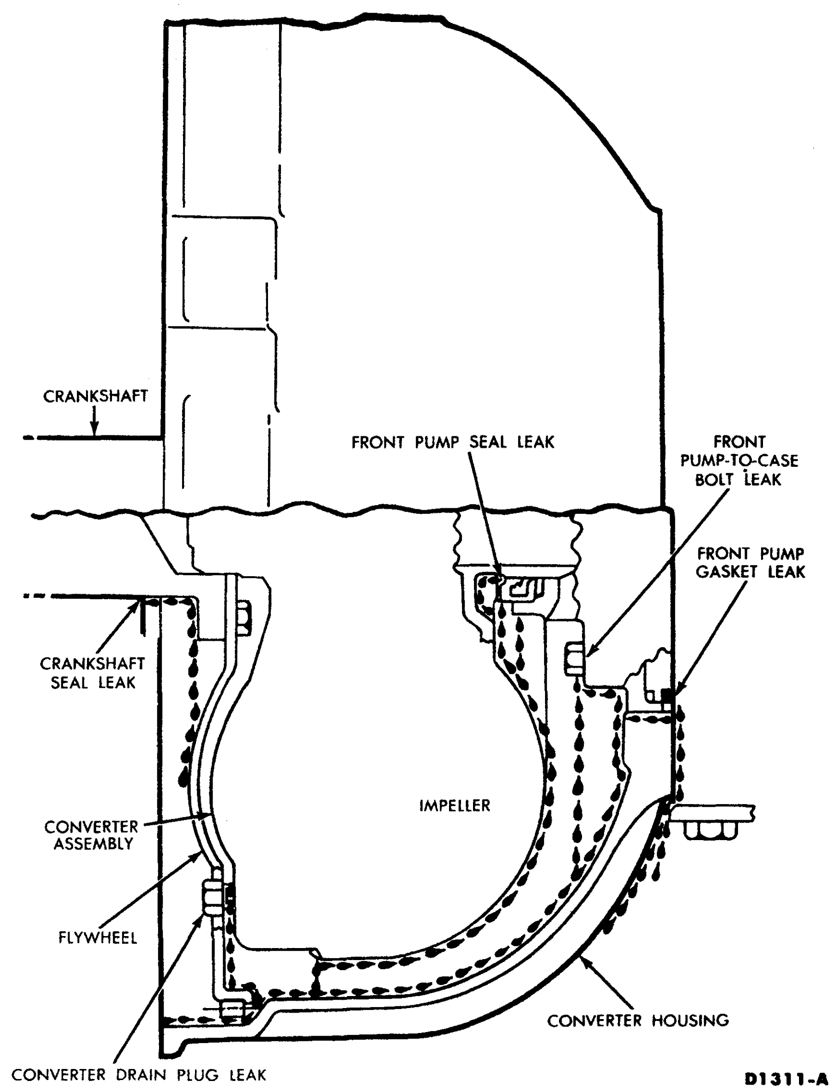

FIG. 1–Converter Area Oil Leakage Checks

since road draft may cause power steering fluid to be present on the transmission.

2. Remove the lower converter housing cover. Clean off any fluid from the top and bottom of the converter housing, front of the transmission case, and rear face of the engine and engine oil pan. Clean by washing with suitable non-flammable solvent, and blow dry with compressed air.

3. Wash out the converter housing, the front of the flywheel, and the converter drain plugs. The converter housing may be washed out using cleaning solvent and a squirt type oil can. Blow all washer areas dry with compressed air.

4. Start and run the engine until the transmission reaches operating temperature. Observe the back of the block and the top of the converter housing for evidence of oil leakage. Raise the car on a hoist and run the engine at fast idle, then at engine idle, and occasionally shift to the drive and reverse ranges to increase pressures within the transmission. Observe the front of the flywheel, back of the block, inside the converter housing and the front of the transmission case. Run the engine until oil leakage is evident and the probable source of leakage can be determined.

CONVERTER LEAKAGE CHECK

If there are indications that the welds on the torque converter housing are leaking, the following check

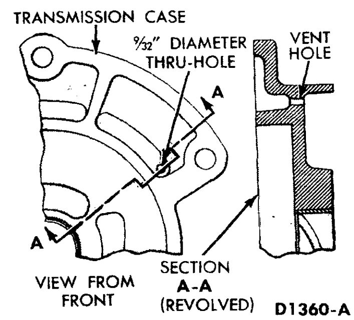

FIG. 2—Transmission Vent at Front of Transmission Case

should be made before the unit is replaced. A leak checking tool (Fig. 3) can be made from standard parts.

1. Install the plug in the converter (Fig. 4) and expand it by tightening the wing nut. Attach the safety chains.
2. Install the air valve in one of the drain plug threads.
3. Introduce air pressure into the converter housing. Check the pressure with a tire gauge and adjust it to 20 psi.
4. Place the converter in a tank of water. Observe the weld areas for bubbles. If no bubbles are observed, it may be assumed that the welds are not leaking.

ENGINE IDLE SPEED CHECK

Check and, if necessary, adjust the engine idle speed, using the procedure given in Group 10.

If the idle speed is too low, the engine will run roughly. An idle speed that is too high will cause the car to creep, have harsh engagements and harsh closed throttle downshifts.

MANUAL LINKAGE CHECKS

Correct manual linkage adjustment is necessary to position the manual valve for proper fluid pressure direction to the different transmission components. Improperly adjusted manual linkage may cause cross-leakage and subsequent transmission failure. Refer to Linkage Adjustments in this Group of the manual for detailed manual linkage adjustment procedure.

CONTROL PRESSURE, VACUUM DIAPHRAGM UNIT, AND DOWNSHIFT LINKAGE

When the vacuum diaphragm unit is operating properly and the downshift linkage is adjusted properly, all the transmission shifts (automatic and kickdown) should occur within the road speed limits given in the Specification Section of Group 7.

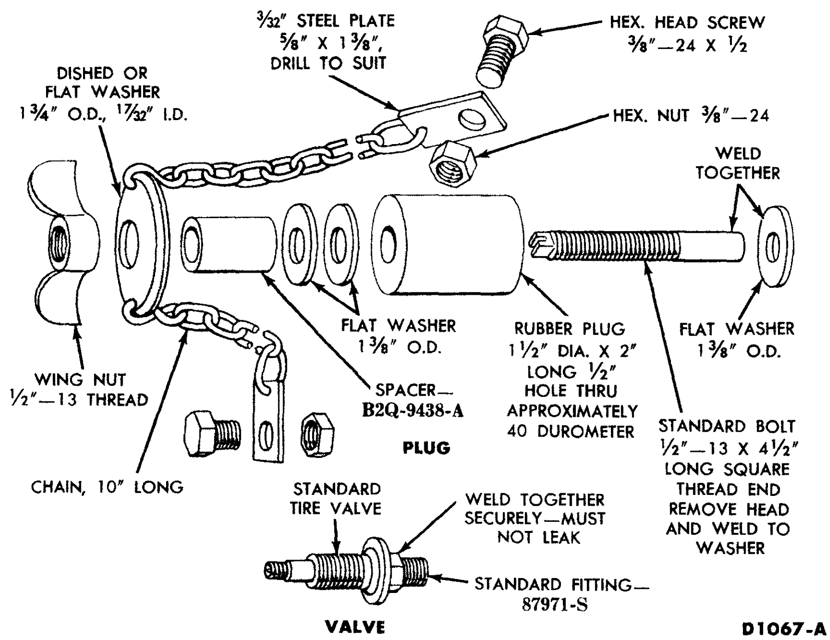

FIG. 3—Converter Leak Checking Tool

Automatic Shifts (Control Pressure and Diaphragm Unit Checks). If the automatic shifts do not occur within limits, the following procedure is suggested to separate engine, transmission, linkage, and diaphragm unit troubles:

1. Attach a tachometer to the engine and a vacuum gauge to the transmission vacuum line, at the transmission.
2. Attach a pressure gauge to the control pressure outlet at the left side of the transmission.
3. Firmly apply the parking brake and start the engine.
4. Adjust the engine idle speed to the specified rpm in D1 or D2. If the engine idle speed cannot be brought within limits by adjustment at the carburetor idle adjustment screw, check the throttle and downshift linkage for a binding condition. If the linkage is satisfactory, check for vacuum leaks in the transmission diaphragm unit and its connecting tubes and hoses. Check all other vacuum operated units (such as the power brake or distributor advance diaphragm) for vacuum leaks.
5. At engine idle speed, read the engine vacuum gauge and the transmission control pressure gauge.

The engine vacuum gauge should read a minimum of 18.0 inches. If the vacuum gauge reading is lower than 18.0 inches, an engine or vacuum line problem is indicated. Repair as necessary.

The transmission control pressure should agree with the control pressures as outlined in the Specification Section of Group 7. If transmission control pressure is within limits, shift the transmission into D1 or D2 and firmly apply the service brakes. Advance the throttle until the engine vacuum gauge reading falls below 16-13.7 inches. As the vacuum gauge reading passes through the 16-13.7 inches range, transmission control pressure should start to rise and con-

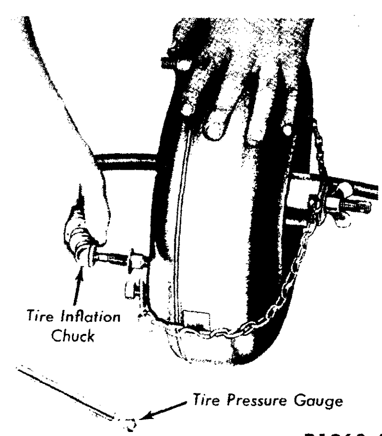

FIG. 4—Converter Leak Checking Tool Installation

tinue to rise with throttle opening, until maximum control pressure for stall in D1 and D2 is obtained. When the selector lever is shifted into R or L and the engine rpm is increased, control pressure should rise immediately and reach its maximum before engine speed reaches stall rpm. If the vacuum and pressure gauge readings follow the pattern described above, the diaphragm unit and transmission control pressure regulation system are operating properly.

If transmission control pressure at idle is too low, too high, fails to rise with throttle opening, or is extremely erratic, follow the procedure given under the following appropriate heading.

CONTROL PRESSURE IS LOW

If control pressure at engine idle is low in all selector lever positions, trouble other than the diaphragm unit is indicated.

Transmission control pressure in R is regulated entirely by the control pressure regulator valve and its spring. When control pressure at engine idle is low in all ranges, check for excessive leakage in the front oil pump, case, pressure regulator and control valve body.

CONTROL PRESSURE IS HIGH

If transmission control pressure at engine idle is too high in D1, D2 and L, the trouble may be in the diaphragm vacuum unit or its connecting tubes and hoses.

With the engine idling, disconnect the hose from the diaphragm unit and check the engine manifold vacuum. Hold a thumb over the end of the hose and check for vacuum. If the engine speeds up when the hose is disconnected and slows down as the thumb is held against the end of the hose, the vacuum hose is capable of holding vacuum.

To check the vacuum unit for diaphragm leakage, remove the vacuum unit from the transmission. Use a distributor tester equipped with a vacuum pump (Fig. 5). Set the regulator knob so the vacuum gauge reads 18 inches with the end of the vacuum hose blocked to obtain a maximum vacuum reading of 18 in. Hg.

Then, connect the vacuum hose to the transmission vacuum unit. If the vacuum gauge still reads 18 inches, the vacuum unit diaphragm is not leaking. As the hose is removed from the transmission vacuum unit, hold one finger over the end of the control rod. When the hose is removed, the internal spring of the vacuum unit should push the control rod outward.

FIG. 5–Testing Transmission Vacuum Unit for Leakage

CONTROL PRESSURE DOES NOT RISE WITH THROTTLE OPENING

If transmission control pressure does not rise in D1 and D2 as engine vacuum falls below 16-13.7 inches, check the transmission's pressure rise capacity by shifting to R. In this position, maximum control pressure should be obtained at not more than engine stall rpm.

If pressure rise is normal in R, remove the hose from the diaphragm unit and check the hose and tubes as given above. If the vacuum reading at the diaphragm end of the hose is 18 in. Hg or greater, check the diaphragm unit and again check for a pressure rise with the throttle opening in D1 and D2. If control pressure does not rise now, the trouble is in the transmission hydraulic circuits. Check for excessive leakage in those components which have control pressure in them in D1 and D2 but do not have control pressure in them in R.

CONTROL PRESSURE IS EXTREMELY ERRATIC

If transmission control pressure is extremely erratic in D1 and D2, check the diaphragm unit tubes, hoses, and diaphragm push rod as given under **Control Pressure Is High.** If the vacuum source is satisfactory, check the diaphragm unit and repeat the tests for transmission control pressure. If control pressure is still extremely erratic, the trouble is in the transmission hydraulic regulating circuits. Clean and inspect the pressure regulator and control valve body.

KICKDOWN SHIFTS

With the linkage properly adjusted the transmission still might not downshift when it is road-tested because of an improperly adjusted or bent downshift control rod. Check for restricted transmission throttle lever travel at the transmission or kickdown rod.

STALL TEST

The stall test is made in D1, D2, L1, L, or R (at full throttle only) to determine if the bands and clutches are holding properly. **While making this test, do not hold the throttle open for more than five seconds at a time.** Then move the selector lever to N for about one minute and run the engine at fast idle to cool the converter before making the next test.

Connect a tachometer, and start the engine to allow it to reach its normal temperature. **Apply both the parking and service brakes.**

With the selector lever at D2, press the accelerator to the floor. Note the engine speed. Stall speeds are given in the Specification Section of Group 7.

In D1 (car standing still), the front clutch and the one-way clutch are engaged at all accelerator pedal positions.

In D2 (car standing still), the front clutch and front band are engaged at all accelerator pedal positions.

In L, the front clutch and rear band are applied.

In R, the rear clutch and rear band are applied.

If the engine speed exceeds the maximum limits, release the accelerator immediately because clutch or band slippage is indicated.

The band or clutch that is causing the slippage can be found by testing in another selector lever position. For example, should the transmission slip in D1 (low gear) but not in D2 (intermediate gear) the probable cause is the planet one-way clutch.

PERFORMANCE CHECKS

Performance checks should be made only after all preliminary checks have been completed. If an unsatisfactory operating condition is found during these checks, stop the checks and proceed to the final diagnosis and correction of the trouble.

INITIAL ENGAGEMENT CHECKS

Initial engagement checks are made to determine if initial band and clutch engagements are correct.

Run the engine until the normal operating temperature is reached. With the engine at the correct idle speed, shift the selector lever from N to D2, and from N to D1. Observe the initial band and clutch engagements. Band and clutch engagements should be smooth in all positions. Rough initial engagements in D1, D2, L or R are caused by high engine idle speed, bands out of adjustment, high control pressure, and faulty operation of the vacuum unit, pressure regulator valve or main control valve.

SHIFT POINT CHECKS

Check the light throttle upshifts in D1. The transmission should start in first gear and shift to second and then shift to third within the shift points as outlined in the Specification Section of Group 7.

While the transmission is in third gear, depress the accelerator pedal through the detent (to the floor) position. The transmission should shift from third to second or third to first, depending on the car speed as outlined in the Specification Section of Group 7.

Check the closed throttle downshift from third to first by coasting down from about 30 mph in third gear. The shift should occur within the limits given in the Specification Section of Group 7. A 3-2-1 shift may be experienced under certain conditions.

Partial-throttle downshifts in D1 may be checked by using the service brakes as a load. With the transmission in third gear, D1, and car speed at about 30 mph, depress and hold the accelerator at a half-throttle position. At the same time, apply the service brakes to the point that road speed is slowly reduced. The third to second and then second to first shifts should occur as road speed decreases.

When the selector lever is at D2, the transmission can operate only in second and third gears. Shift points for second to third and third to second are the same in both D2 and D1.

If the transmission is in third gear and road speed is above about 30 mph, the transmission should shift

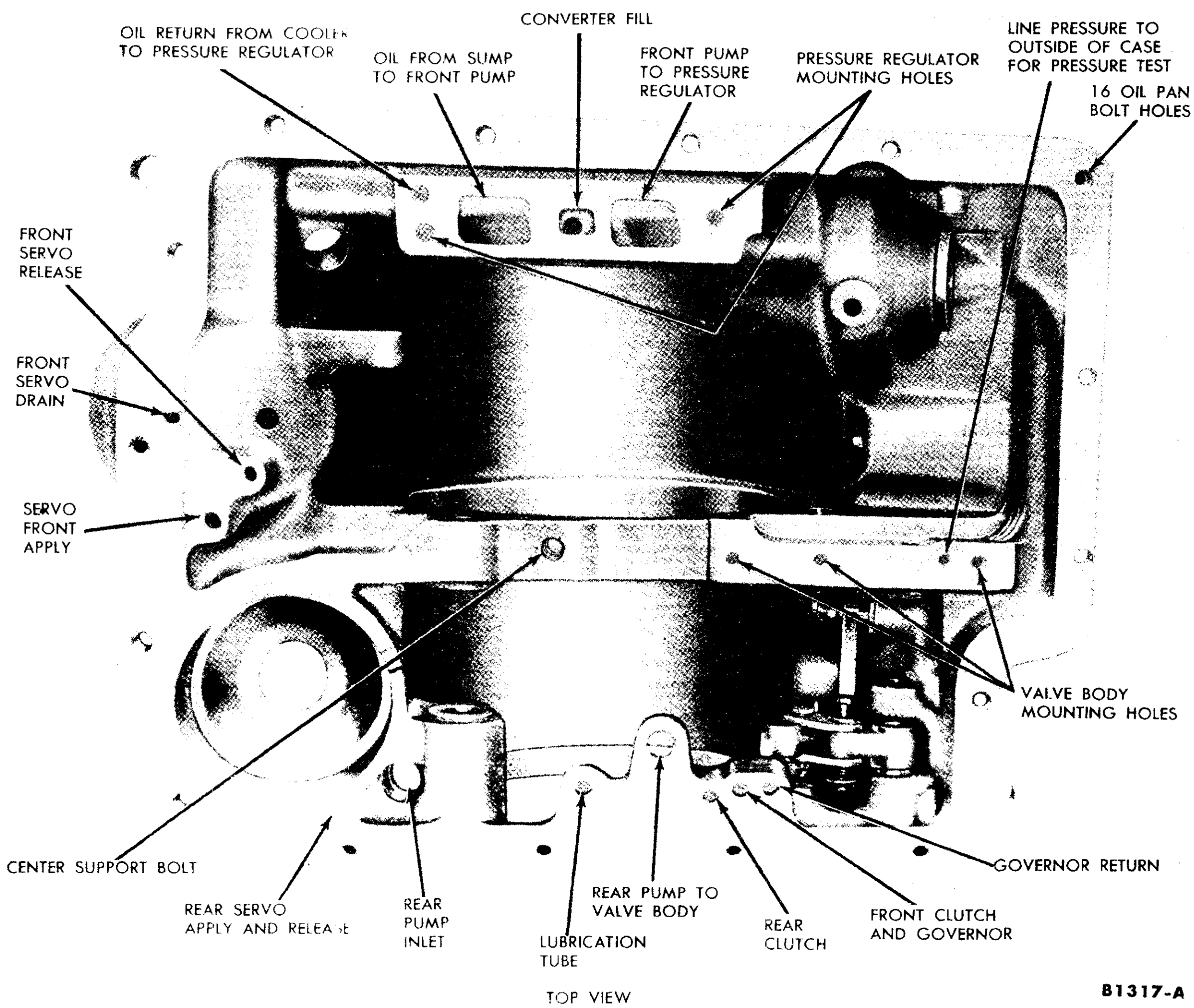

FIG. 6—Transmission Case Hydraulic Passages

to second gear when the selector lever is moved from D2 or D1 to L. When the same manual shift is made below about 25 mph, the transmission will shift from second or third to first. This check will determine if the governor pressure and shift control valves are functioning properly.

CONVERTER CHECK

When the stall test speeds are low and the engine is properly tuned, converter stator clutch problems are indicated. A road test must be performed to determine the exact cause of the trouble.

If the stall test speeds are 300 to 400 rpm below the values shown in the Specification Section of Group 7, and the car cruises properly but has very poor acceleration, the stator clutch is slipping.

Remove the converter and check the stator clutch as described in "Cleaning and Inspection," Part 7-1.

If the stall test speeds are 300 to 400 rpm below the values, and the car drags at cruising speeds and has poor acceleration, the stator clutch is installed backwards.

When the stall test shows normal speeds and the acceleration is good, but the car drags at cruising speeds, the difficulty is due to a seized stator assembly. If the stator is defective, replace the converter.

AIR PRESSURE CHECKS

A "NO DRIVE" condition can exist, even with correct transmission fluid pressure, because of inoperative clutches or bands. The inoperative units can be located through a series of checks by substituting air pressure for the fluid pressure to determine the location of the malfunction.

When the selector lever is at D2, a "NO DRIVE" condition may be caused by an inoperative front clutch. A "NO DRIVE" condition at D1 may be caused by an inoperative front clutch or one-way clutch. When there is NO DRIVE in L, the difficulty could be caused by improper functioning of the front clutch. Failure to drive in reverse range could be caused by a malfunction of the rear clutch or rear band. Erratic shift points could be caused by a malfunction of the governor.

To make the air pressure checks, drain the transmission fluid, then remove the oil pan, the control valve assembly and necessary oil tubes.

The inoperative units can be located by introducing air pressure into the transmission case passages leading to the clutches, rear servo, and governor, and into the front servo apply and release pressure holes (Fig. 6).

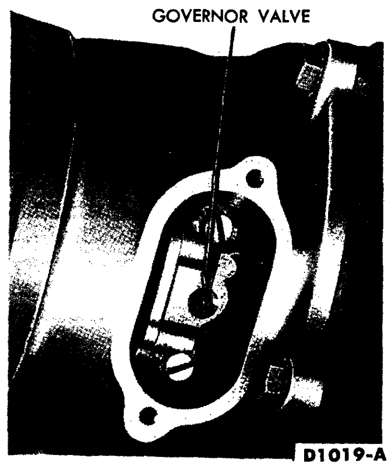

FIG. 7—Governor Valve

FRONT CLUTCH

Apply air pressure to the transmission case front clutch passage (Fig. 6). A dull thud can be heard when the clutch piston is applied. If no noise is heard, place the finger tips on the drum and again apply air pressure to the front clutch passage. Movement of the piston can be felt as the clutch is applied.

GOVERNOR

Remove the governor inspection cover from the extension housing. Apply air pressure to the front clutch passage, listen for a sharp noise, and watch to see if the governor weight snaps inward (Fig. 7). Inward weight movement indicates correct governor valve operation.

REAR CLUTCH

Apply air pressure to the rear passage (Fig. 6). A dull thud indicates that the rear clutch piston has moved to the applied position. If no noise is heard, place the finger tips on the rear drum and again apply air pressure to detect movement of the piston.

FRONT SERVO

Hold the air nozzle in the front servo apply hole (Fig. 6). Operation of the front servo is indicated by a tightening of the front band around the drum. Continue to apply air pressure to the front servo apply hole, and introduce air pressure into the front servo release hole. **Hold a cloth over the release tube while applying the servo to catch the spray from the release tube.** The front servo should release the band against the apply pressure.

REAR SERVO

Apply air pressure to the rear servo apply passage (Fig. 6). The rear band should tighten around the drum if the rear servo is operating properly.

During the above air pressure checks, if the servo does not operate, disassemble, clean, and inspect the servo parts to locate the source of the trouble.

If air pressure applied to either of the clutch passages fails to operate a clutch or operates both clutches at once, remove the clutch units and with air pressure, check the fluid passages at the output shaft aluminum sleeve for correct indexing with the shaft holes. Check the primary sun gear shaft assembly passages with air pressure to detect obstructions (Fig. 8).

If the output shaft and primary sun gear shaft passages are clear, remove the clutch assemblies, and

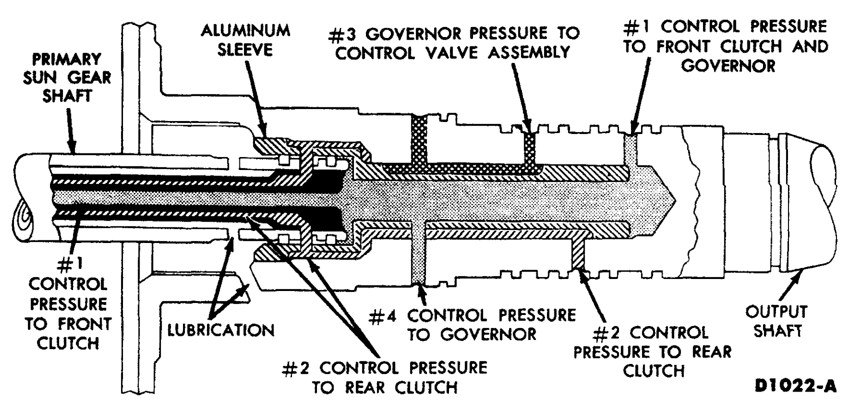

FIG. 8—Output and Primary Sun Gear Shafts Fluid Passages

clean and inspect the malfunctioning clutch to locate the trouble.

DIAGNOSIS GUIDE

The Diagnosis Guide lists the most common trouble symptoms that may be found and gives the items that should be checked to find the cause of the trouble.

The items to check are arranged in a logical sequence which should be followed for quickest results. The letter symbols for each item are explained in the key. If items A, B, C, K, and the stall test have already been checked during preliminary checks and adjustments, they need not be repeated.

DIAGNOSIS GUIDE

Trouble Symptom	Items to Check: Transmission in car	Items to Check: Transmission out of car
Rough Initial Engagement in D1 or D2	K B W F E	
1-2 or 2-3 Shift Points Incorrect	A B C D W E L	
Rough 2-3 Shift	B G F E	r j
Engine Overspeeds on 2-3 Shift	B G E F	r
No. 1-2 or 2-3 Shift	D E C G	b c f j
No. 3-1 Shift	K B E	
No Forced Downshifts	L W E	
Runaway Engine on Forced Downshift	G F E	c j
Rough 3-2 or 3-1 Shift at Closed Throttle	K B E	
Creeps Excessively in D1 or D2	K	
Slips or Chatters in First Gear, D1	A B W F E	a c f i
Slips or Chatters in Second Gear	A B G W F E	a c j
Slips or Chatters in R	A H W F E I	b c f
No Drive in D1	C E	i
No Drive in D2	G E R	a c f
No Drive in L	C H I E R	c f
No Drive in R	H I E R	b c f
No Drive in Any Selector Lever Position	A C W F E R	c
Lockup in D1	C I J	b g c
Lockup in D2	C H I	b g c i
Lockup in L	G J E	b g c
Lockup in R	G	a g c j
Parking Lock Binds or Does Not Hold	C	g
Engine Does Not Start by Pushing Car	A C F E	e c
Transmission Overheats	O F	n
Maximum Speed Too Low, Poor Acceleration		n
Transmission Noisy in N	F	a d
Transmission Noisy in First, Second, Third, or Reverse Gear	F	h a b d
Transmission Noisy in P	F	d
Transmission Noisy During Coast at 20-30 mph in N, Engine Stopped		e
Fluid Leak	M N O P Q S T U V X	j m p

Probable Trouble Sources
A. Fluid Level
B. Vacuum Diaphragm Unit or Tubes
C. Manual Linkage
D. Governor
E. Valve Body
F. Pressure Regulator
G. Front Band
H. Rear Band
I. Rear Servo (Air Check)
J. Front Servo (Air Check)
K. Engine Idle Speed
L. Downshift Linkage
M. Converter Drain Plugs
N. Oil Pan Gasket, Drain Plug or Tube
O. Oil Cooler and Connections
P. Manual or Throttle Lever Shaft Seal
Q. 1/8-inch Pipe Plug in Side of Case
R. Perform Air Pressure Check
S. Extension Housing to Case Gaskets and Lock Washers
T. Center Support Bolt Lock Washers
U. Extension Housing Rear Oil Seal
V. Governor Inspection Cover Gasket
W. Perform Control Pressure Check
X. Speedometer Driven Gear Adapter Seal
a. Front Clutch
b. Rear Clutch
c. Leakage in Hydraulic System
d. Front Pump
e. Rear Pump
f. Fluid Distributor Sleeve in Output Shaft
g. Parking Linkage
h. Planetary Assembly
i. Planetary One-Way Clutch
j. Engine Rear Oil Seal
m. Front Pump Oil Seal
n. Converter One-Way Clutch
p. Front Pump to Case Gasket
r. Rear Clutch Piston Air Bleed Valve

2 COMMON ADJUSTMENTS AND REPAIRS

TRANSMISSION FLUID LEVEL CHECK

The transmission fluid level should be checked using the following procedure:

1. Make sure that the car is standing level. Then firmly apply the parking brake.

2. Run the engine at normal idle speed. If the transmission fluid is cold, run the engine at fast idle speed (about 1200 rpm) until the fluid reaches its normal operating temperature. When the fluid is warm, slow the engine down to normal idle speed.

3. Shift the selector lever through all positions, and place the lever at P. Do not turn off the engine during the fluid level checks.

4. Clean all dirt from the transmission fluid dipstick cap before removing the dipstick from the filler tube.

5. Pull the dipstick out of the tube, wipe it clean, and push it all the way back into the tube.

6. Pull the dipstick out of the tube again, and check the fluid level. If necessary, add enough fluid to the transmission through the filler tube to raise the fluid level to the F (Full) mark on the dipstick. **Do not overfill the transmission.**

TRANSMISSION FLUID DRAIN AND REFILL

Normal maintenance and lubrication requirements do not necessitate periodic automatic transmission fluid changes.

If a major failure has occurred within the transmission such as a clutch, band, bearing, etc., the transmission will have to be removed for service. At this time the converter must be thoroughly flushed to remove any dirt.

When filling a dry transmission and converter, install 6 quarts of fluid. Start the engine; shift the selector lever as in step 5 below; check and add fluid as necessary.

Following is the procedure for partial drain and refill due to minor repairs.

1. Remove the reinforcement plate and loosen the oil pan bolts. When the fluid has stopped draining from the transmission, remove and thoroughly clean the oil pan. Discard the oil pan gasket. Remove the converter drain plugs. After the converter has drained, install the plugs. Place a new gasket on the oil pan, and install the filter-type screen and pan on the transmission.

2. Install the oil pan, and tighten the pan retaining bolts to specifications. Install the reinforcement plate under the oil pan.

3. Add about 6 quarts of fluid to the transmission through the filler tube.

4. Run the engine at idle speed for about two minutes, then run the engine at fast idle speed (about 1200 rpm) until it reaches its normal operating temperature. **Do not race the engine.**

5. Shift the selector lever through all the positions, place it at P, and check the fluid level. Add enough fluid to the transmission to raise the level to the F (full) mark on the dipstick. **Do not overfill the transmission.**

OIL COOLER FLUSHING PROCEDURE

When a clutch or band failure or other internal trouble has occurred in the transmission, any metal particles or clutch plate or band material that may have been carried into the cooler should be removed from the system by flushing the cooler before the transmission is put back into service.

1. Disconnect the fluid return line from the rear of the transmission.

2. Start the engine and drain about two quarts of fluid from the cooler into a pan. Discard the drained fluid. If there is no fluid flow or the fluid does not flow freely from the return line, shut off the engine and disconnect both lines at the cooler and transmission.

3. Use an air hose (with not more than 100 psi air pressure) to reverse flush the lines and the cooler.

4. Connect both lines at the cooler, and the pressure line at the transmission.

5. Start the engine and check the fluid flow. If the fluid flows freely, connect the return line at the transmission and fill the transmission with new fluid to the specified level. If there is no fluid flow or if the flow is restricted, replace the radiator. **Do not attempt to correct cooler or cooling line leaks by closing off the lines.**

3 CLEANING AND INSPECTION

Clean all parts with suitable solvent and use moisture free air to dry off all the parts and clean out oil passages.

CONVERTER CLEANING

The converter cannot be disassembled for cleaning. If there is reason to believe that the converter has an excessive amount of foreign material in it, the following cleaning procedure should be used:

1. With the converter on the bench, remove both drain plugs and tilt the converter in all directions to drain as much fluid as possible.

2. Install the drain plugs and fill the converter through the pump drive hub with a light-body oil such as kerosene, or a cleaning solvent suitable for transmission cleaning.

3. Install the tool shown in Fig. 9 in the converter. Expand the bushing in the turbine spline. Rotate the tool to circulate the fluid in the converter.

4. Remove both drain plugs and thoroughly drain the converter.

TURBINE AND STATOR END PLAY CHECK

1. Insert the tool into the converter pump drive hub until it bottoms (Fig. 9).

2. Install the guide over the converter pump drive hub.

3. Expand the split fiber bushing in the turbine spline by tightening the adjusting nut. Tighten the adjusting nut until the tool is securely locked to the spline.

4. Attach a dial indicator to the tool (Fig. 9). Position the indicator

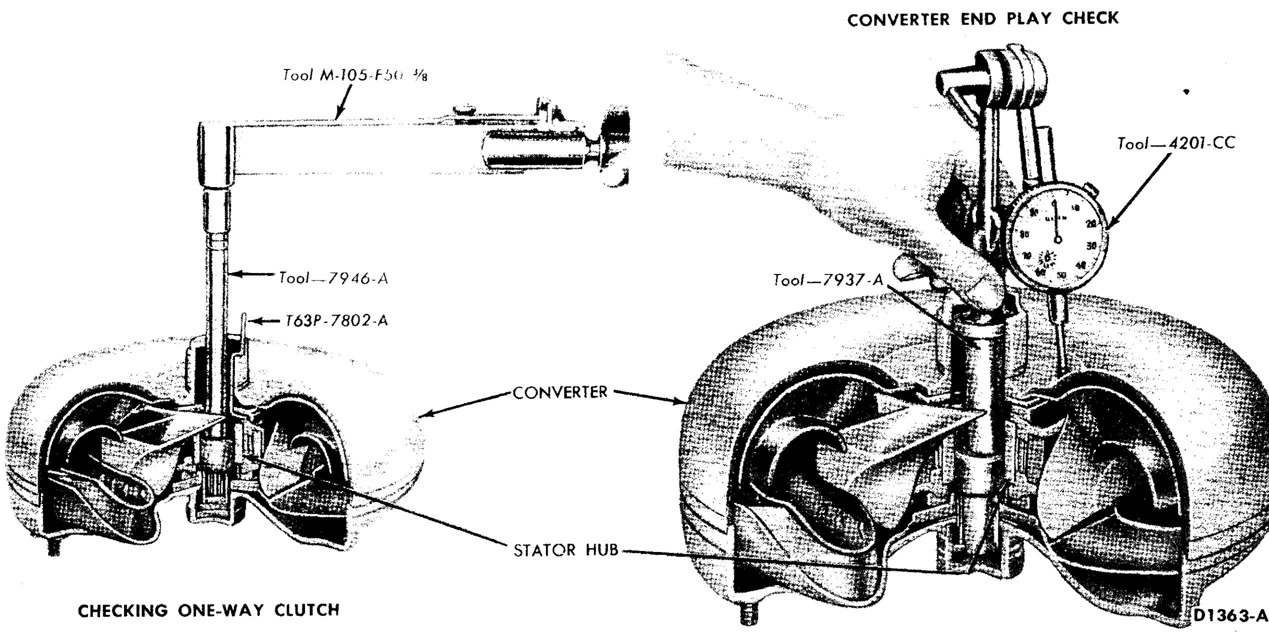

FIG. 9—Typical Converter Checking Tool

button on a converter pump drive hub lug, and set the dial face at 0 (zero).

5. Lift the tool upward as far as it will go and note the indicator reading. The indicator reading is the total end play which the turbine and stator share. If the total end play exceeds the limits as outlined in the Specification Section of Group 7, replace the converter unit.

STATOR ONE-WAY CLUTCH CHECK

1. Loosen the adjusting nut to free the split bushing, and then remove the tool from the converter.

2. Install the stator outer race holding tool in one of the openings in the stamped thrust washer provided in the stator (Fig. 9).

3. Insert the tool in the converter pump drive hub. As the tool enters the converter, the pins will engage the stator clutch inner race spline.

4. Place a torque wrench on the tool (Fig. 9). The tool (and stator inner race) should turn freely clockwise (from the pump drive hub side of the converter). It should lock up and hold a 10 ft-lb pull when the wrench is turned counterclockwise. Try the clutch for lockup and hold in at least five different locations around the converter.

5. If the clutch fails to lock-up and hold a 10 ft-lb torque, replace the converter unit.

STATOR TO IMPELLER INTERFERENCE CHECK

1. Position the front pump assembly on a bench with the spline end of the stator shaft pointing up (Fig. 10).

2. Mount a converter on the pump so that the splines on the one-way clutch inner race engage the mating splines of the stator support, and the converter hub engages the pump drive gear.

3. While holding the pump stationary, try to rotate the converter counterclockwise. The converter should rotate freely without any signs of interference or scraping within the converter assembly.

4. If there is an indication of scraping, the trailing edges of the stator blades may be interfering with the leading edges of the impeller blades. In such cases, replace the converter.

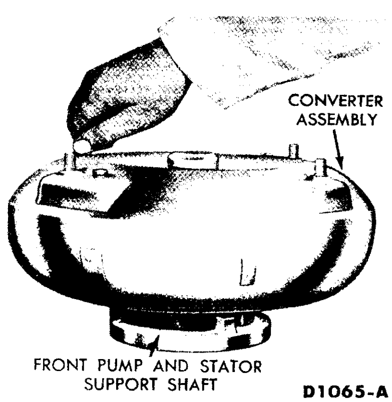

FIG. 10—Stator to Impeller Interference Check

STATOR TO TURBINE INTERFERENCE CHECK

1. Position the converter on the bench front side down.

2. Install a front pump assembly

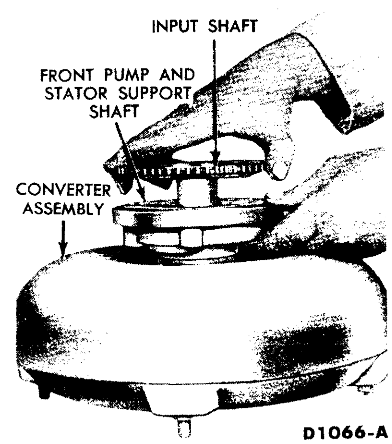

FIG. 11—Stator to Turbine Interference Check

to engage the mating splines of the stator support and stator, and pump drive gear lugs.

3. Install the input shaft, engaging the splines with the turbine hub (Fig. 11).

4. While holding the pump stationary, attempt to rotate the turbine with the input shaft. The turbine should rotate freely in both directions without any signs of interference or scraping noise.

5. If interference exists, the stator front thrust washer may be worn allowing the stator to hit the turbine. In such cases, the converter must be replaced.

OUTPUT SHAFT AND PRIMARY SUN GEAR SHAFT

1. Inspect the thrust surfaces and journals for scores. Inspect the internal gear for broken or worn teeth.

2. Inspect the aluminum sleeve for scores or leakage. Inspect the ring grooves for burrs.

3. Inspect the keyway and drive ball pocket for wear.

4. Inspect the output shaft sleeve for alignment with the governor drive ball (Fig. 12).

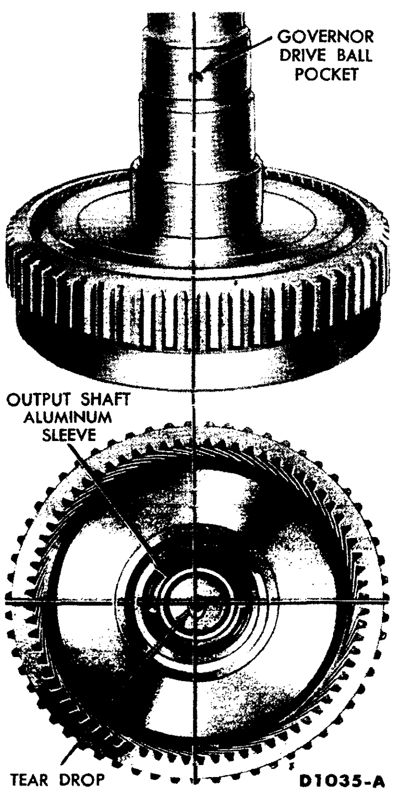

FIG. 12—Correct Position of Output Shaft Sleeve

5. Inspect the external parking gear teeth for damage and the speedometer drive gear teeth for burrs.

6. If either the output shaft or ring gear has been replaced, place the assembled unit with the gear face down on the bench, push the shaft downward, and check the clearance between the top of the snap ring and its groove (Fig. 13). If this clearance exceeds 0.002 inch, replace the snap ring with a thicker ring to reduce the clearance to less than 0.002 inch. Selective snap rings are available in several thicknesses for this purpose.

7. Inspect the primary sun gear for broken or worn teeth. Inspect all thrust surfaces and journals for scores. Check all fluid passages (Fig. 14) for obstructions and leakage. Inspect the seal ring grooves for burrs.

8. Inspect the sun gear shaft splines for burrs and wear. Check the front clutch lubrication valve for free movement.

9. Check the fit of the seal rings in the grooves of the shaft. The rings should enter the grooves freely without bind.

10. Check the fit of the seal rings in their respective bores. A clearance of 0.002-0.009 inch should exist between the ends of the rings.

11. Install the seal rings on the shaft, and check for free movement in the grooves.

DISTRIBUTOR SLEEVE

1. Inspect the distributor sleeve for scores or excessive ring wear. Inspect the distributor sleeve passages for obstructions.

2. Check the fit of the fluid tubes in the distributor.

PINION CARRIER, ONE-WAY CLUTCH AND CENTER SUPPORT

1. Inspect the clutch outer race, inner race, band surface, pinion gears, bearings, and thrust washer (Fig. 15) for roughness.

2. Inspect the center support bushing for roughness.

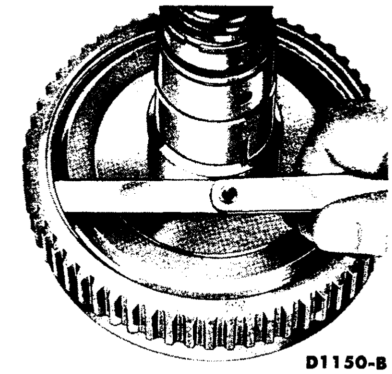

FIG. 13—Checking Output Shaft Snap Ring

3. Inspect the one-way, . clutch sprags and springs for excessive wear or damage.

EXTENSION HOUSING

1. Inspect the housing for cracks. Inspect the gasket surface for burrs or warpage. Check for leakage around the governor inspection cover and gasket. If leakage is found, install a new gasket.

2. Inspect the bushing for scores or wear.

3. Inspect the rear seal for hardness, cracks, or wear. If the seal shows wear or deterioration, replace the seals.

Inspect the seal counterbore and remove all burrs and scores with crocus cloth.

REAR CLUTCH

1. Inspect the drum band surface, the bushing, and thrust surfaces for scores. Minor scores may be removed with crocus cloth. **Badly scored parts must be replaced.**

2. Inspect the needle bearing for worn rollers. Inspect the clutch piston bore and the piston inner and outer bearing surfaces for scores.

Check the air bleed ball valve in the clutch piston for free movement. Check the orifice to make sure it is not plugged.

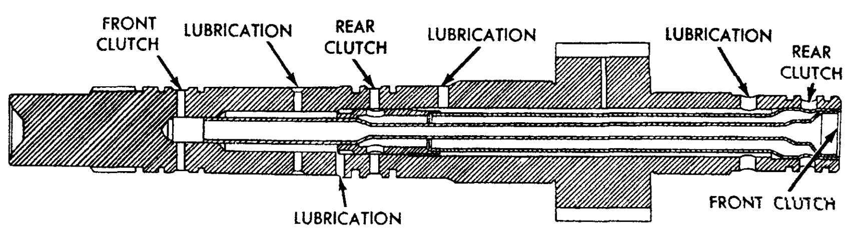

FIG. 14—Cross-Section of Primary Sun Gear Shaft

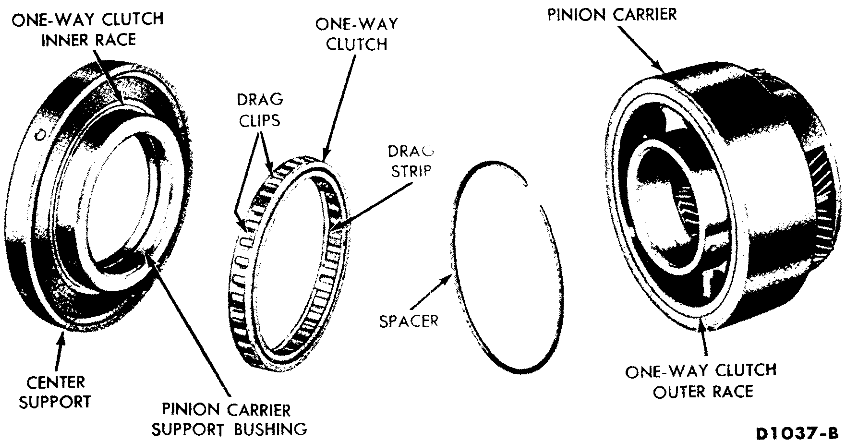

FIG. 15–Pinion Carrier, One-Way Clutch and Center Support

3. Check the fluid passages for obstructions. All fluid passages must be clean and free of obstructions.

4. Inspect the clutch plates for scores, and check the plates for fit on the clutch hub serrations. Replace all plates that are badly scored or do not fit freely in the hub serrations. **Front clutch plates differ in friction characteristics from rear clutch plates and are not interchangeable.**

5. Inspect the clutch pressure plate for scores on the clutch plate bearing surface. Check the clutch release spring for distortion.

FRONT CLUTCH

1. Inspect the clutch cylinder thrust surfaces, piston bore, and clutch plate serrations for scores or burrs. Minor scores or burrs may be removed with crocus cloth. Replace the clutch cylinder if it is badly scored or damaged.

2. Check the fluid passage in the clutch cylinder for obstructions. Clean out all fluid passages. Inspect the clutch piston for scores and replace if necessary.

Inspect the piston check ball for freedom of movement and proper seating (Fig. 16).

3. Check the clutch release spring for distortion and cracks. Replace the spring if it is distorted or cracked.

4. Inspect the composition clutch plates and the steel clutch plates and the clutch pressure plate for scored bearing surfaces. Replace all parts that are deeply scored.

5. Check the clutch plates for flatness and fit on the clutch hub serrations. Discard any plate that does not slide freely on the serrations or that is not flat. **Front clutch plates differ in friction characteristics from the rear clutch plates and are not interchangeable.**

6. Check the clutch hub thrust surfaces for scores and the clutch hub splines for wear.

7. Inspect the turbine shaft bearing surfaces for scores. If excessive clearance or scores are found, discard the unit.

8. Check the splines on the turbine shaft for wear and replace them if they are excessively worn. Inspect the bushing in the turbine shaft for scores.

FRONT PUMP

1. Inspect the mating surfaces of the pump body and cover for burrs.

2. Inspect the drive and driven gear bearing surface for scores, and check the gear teeth for burrs. Inspect the stator support splines for burrs and wear.

3. Check the fluid passages for obstructions.

4. If any parts other than the stator support are found defective, replace the pump as a unit. Minor burrs and scores may be removed with crocus cloth. The stator support is serviced separately.

REAR PUMP

1. Remove the drive and driven gears from the pump body.

2. Inspect the gear pockets and the crescent of the pump body for scores or pitting.

3. Inspect the inner bushing and the drive and driven gear bearing surfaces for scores.

4. Check all fluid passages for obstructions, and check mating surfaces and gasket surfaces of the pump body and cover for burrs.

5. Inspect the pump cover bearing surface for scores. Minor burrs or scores may be removed with crocus cloth.

6. If any pump parts, other than the pump cover, are defective, replace the pump as a unit. The pump cover can be replaced separately.

PRESSURE REGULATOR

1. Inspect the regulator body and cover mating surface for burrs.

2. Check all fluid passages for obstructions.

3. Inspect the control pressure and converter pressure valves and bores for burrs and scores. Remove all burrs carefully with crocus cloth.

4. Check free movement of the valves in their bores. The valves should fall freely into the bores when both the valve and bore are dry.

5. Inspect the valve springs and spacers for distortion.

6. Check the lube circuit check ball and spring for defects.

VALVE BODY

1. Inspect all valve and plug bores for scores. Check all fluid passages for obstructions. Inspect the check valve for free movement. Inspect all mating surfaces for burrs or distortion. Inspect all plugs and valves for

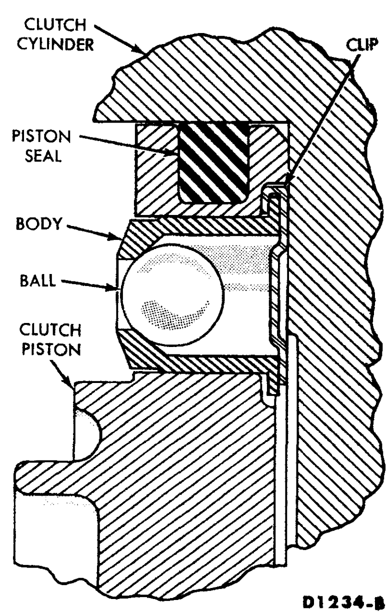

FIG. 16–Front Clutch Piston Check Valve

burrs and scores. **Crocus cloth can be used to polish valves and plugs if care is taken to avoid rounding the sharp edges of the valves and plugs.**

2. Inspect all springs for distortion. Check all valves and plugs for free movement in their respective bores. Valves and plugs, when dry, must fall from their own weight in their respective bores.

3. Roll the manual valve on a flat surface to check it for a bent condition.

GOVERNOR

1. Inspect the governor valve and bore for scores. Minor scores may be removed with crocus cloth. Replace the governor if the valve or body is deeply scored.

2. Check for free movement of the valve in the bore. Inspect fluid passages in the valve body and counterweight for obstructions. **All fluid passages must be clean.**

3. Inspect the mating surfaces of the governor body and counterweight for burrs and distortion. Mating surfaces must be smooth and flat.

FRONT SERVO

1. Inspect the servo casting area of the case for cracks and the piston bore and the servo piston for scores. Check fluid passages for obstructions.

2. Check the actuating lever for free movement, and inspect it for wear.

3. Check the servo spring and servo band strut for distortion.

REAR SERVO

1. Inspect the servo casting area of the case for cracks and the piston bore for scores.

2. Check the fluid passages for obstructions. Check the orifice in the servo piston for dirt. Inspect the check valve in the servo piston for freedom of movement and proper seating.

3. Inspect the accumulator piston stem for scores. Inspect the actuating lever socket for scores and wear. Check the actuating lever and shaft for wear.

4. Inspect the band and the struts for distortion. Inspect the band ends for cracks.

5. Inspect the servo spring for distortion.

6. Inspect the servo band lining for excessive wear and bonding to the metal band. **The band should be replaced if worn to a point where the grooves are not clearly evident.**

CASE

Inspect the case for cracks and stripped threads. Inspect the gasket surfaces and mating surfaces for burrs. Check the vent at the front of the case for obstructions, and check all fluid passages for obstructions and leakage (Fig. 6).

Inspect the case bushing and center support bushing for scores. Inspect the torsion lever pin for wear. Check all parking linkage parts for wear or damage.

PART 7-2 TURBO-DRIVE AUTOMATIC TRANSMISSION

1 DESCRIPTION AND OPERATION

DESCRIPTION

The Turbo-Drive transmission (Fig. 1) has a hydraulic torque converter combined with a hydraulically controlled automatic planetary gear train. A conventional selector lever and quadrant is used to obtain the desired gear ratio.

The identification tag (Fig. 2) identifies the transmission model used. The tag attached by one oil pan bolt includes the model prefix and suffix, as well as the service identification number, and serial number.

The service identification number indicates changes to service parts which affect interchangeability when the transmission model identification is not changed.

PRINCIPLES OF OPERATION

TO START THE ENGINE

Move the transmission selector lever to either the Neutral (N) or Park (P) position. These are the

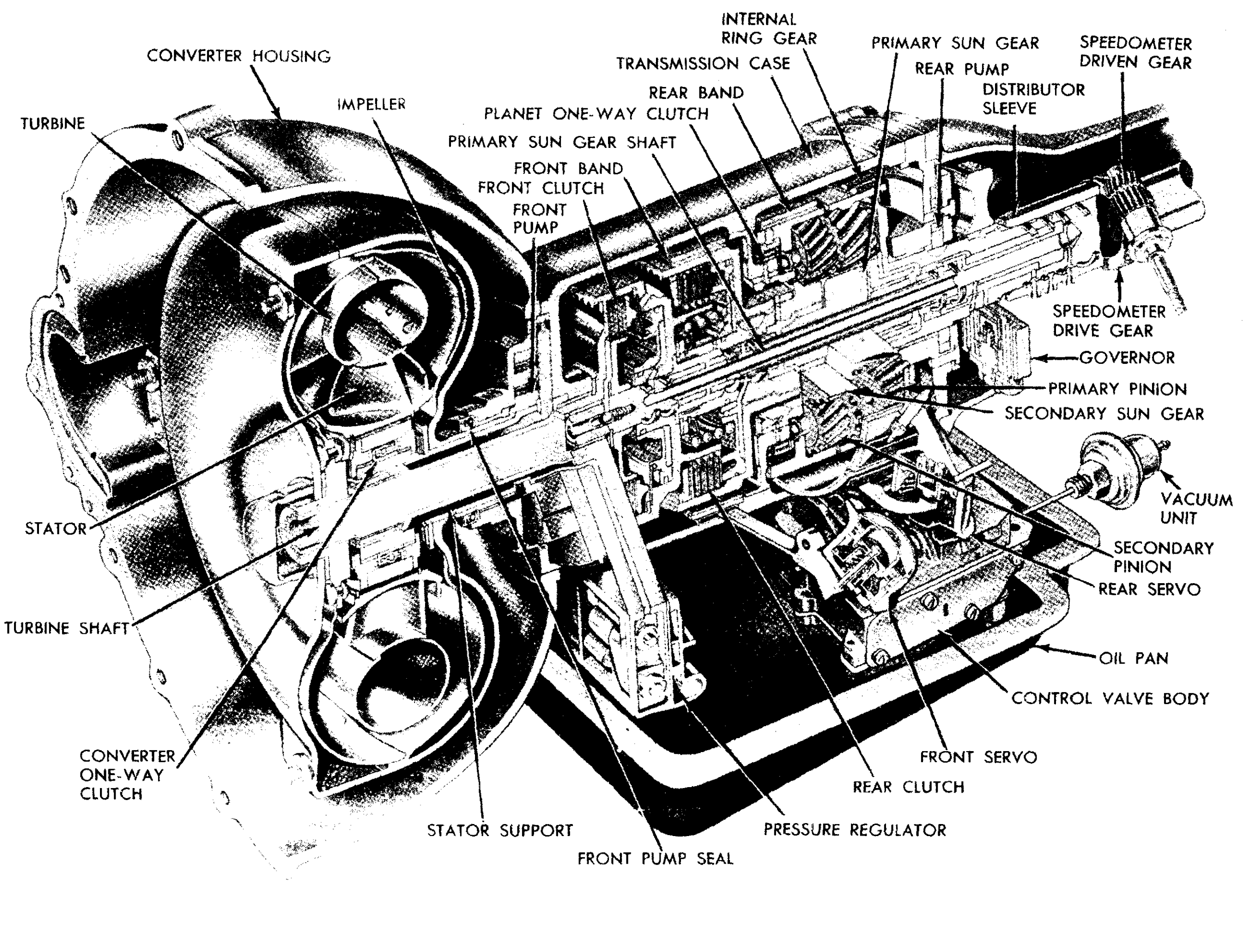

FIG. 1—Turbo-Drive Transmission

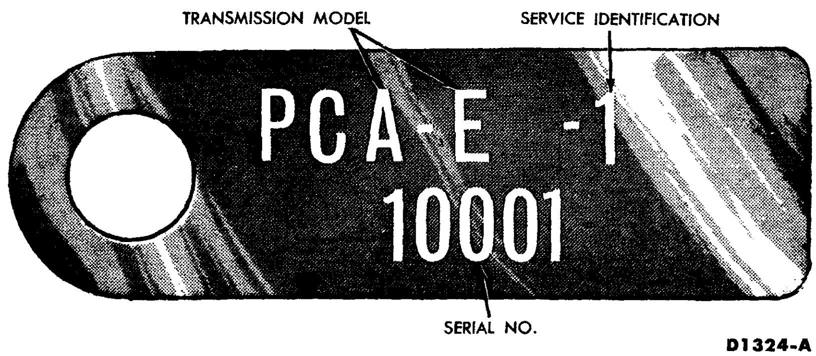

FIG. 2—Transmission Identification Tag

only selector lever settings at which the engine will start. To actuate the starter, insert the ignition key and turn it fully to the right.

TO ENGAGE THE TRANSMISSION

The transmission is engaged when one of the following positions in the quadrant is selected:

1. **Drive (D1 Large Dot).** D1 position should be used for most normal driving. This driving range features maximum performance, economy and flexibility by incorporating an automatic low gear start. The transmission automatically shifts from low to intermediate then to high gear. To obtain maximum acceleration from a standstill, press the accelerator to the floor and the car will move forward under wide open throttle.

With the accelerator all the way down to the floor, the transmission will shift from low to intermediate gear at approximately 45 mph and then into high gear at approximately 70 mph.

For fast acceleration while driving in high gear, press the accelerator to the floor. The transmission will automatically downshift from high to intermediate at any speed between approximately 30 to 70 mph and into low gear at speeds below approximately 30 mph. Release the accelerator and the transmission will automatically upshift to intermediate or high gear depending upon car speed and accelerator position.

2. **Drive (D2 Small Dot).** The D2 position provides intermediate gear starts with a single shift into high gear. This range is desirable for smooth gentle starts, as well as driving under slippery road conditions. The smooth transition of power to the rear wheels in D2 will minimize rear wheel spin and provide better control of the vehicle. The selector lever can be alternated between D1 and D2 positions at any road speed.

3. **Low (L).** The L position is provided for extra pulling power and engine braking. Extra pulling power is sometimes needed when driving through deep sand, mud, or snow and when climbing steep grades. When driving from a standing start, the transmission will not upshift into a higher gear while the selector lever is in the L position. Therefore, to avoid imposing unnecessary stress on the engine and prevent overheating the transmission, the car should not be driven in low gear for extended periods of time or at continuous speeds in excess of 25 mph.

To obtain maximum engine braking, shift to the L position when descending steep grades. The transmission will automatically shift to intermediate gear at speeds above approximately 25 mph. When the car speed drops below approximately 25 mph, the transmission will automatically shift to, and remain in, low gear. Move the selector lever back to D1 or D2 position and the transmission will resume normal automatic shift operation.

4. **Reverse (R).** Use the R position to back up the car. Bring the car to a complete stop before moving the selector to R.

5. **Park (P).** Bring the car to a complete standstill. Set the selector in P position and, as an added precaution, set the parking brake.

6. **"Rocking" the Car.** Move the selector lever back and forth between R and L with the accelerator pedal depressed slightly to increase engine speed and provide traction.

CAUTION: **Do not race the engine. If "rocking" at medium throttle will not provide traction, have the car pulled from its stuck position to prevent overheating the transmission.**

7. **Towing.** If the transmission is in working order, the car may be towed for short distances (less than 12 miles) at a speed no higher than 40 mph with the selector lever set at N. If the transmission is inoperative, the drive shaft should be disconnected before towing, or the rear of the car raised by the tow truck. If the rear of the car is raised, a locking device should be installed on the steering wheel to keep the front wheels in a straight-ahead position.

TORQUE CONVERTER OPERATION

The hydraulic torque converter (Fig. 3) consists of an impeller (pump), a turbine, and a stator. All these parts are enclosed and operate in a fluid-filled housing.

When the engine is running, the fluid in the torque converter flows from the impeller to the turbine and back to the impeller through the stator. This flow produces a maximum torque increase of about 2 to 1 when the turbine is stalled. When enough torque is developed by the impeller, the turbine begins to rotate, turning the turbine shaft.

The converter torque multiplication gradually tapers off as turbine speed approaches impeller speed, and

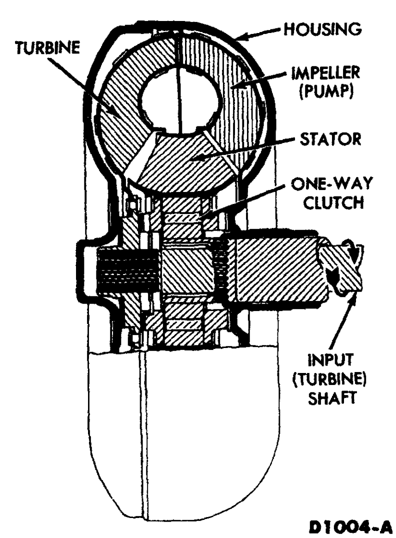

FIG. 3—Cross-Section of Typical Torque Converter

it becomes 1 to 1 when the turbine is being driven at 9/10 impeller speed. This is known as the "coupling point."

When the turbine is rotating at less than 9/10 impeller speed, the converter is multiplying torque. The fluid leaving the turbine blades strikes the front face of the stator blades. These blades are held stationary by the action of a one-way clutch (Fig. 3) as long as the fluid is directed against the front face of the blades.

When the turbine rotates faster than 9/10 impeller speed the converter no longer multiplies torque. The fluid is directed against the back face of the stator blades. As the one-way clutch permits the stator to rotate only in the direction of impeller rotation, the stator begins to turn with the impeller and turbine. The converter operates as an efficient fluid coupling as long as the turbine speed remains greater than 9/10 impeller speed.

A constant flow of fluid into and out of the converter is maintained. Some of the fluid coming out of the converter is forced through a transmission oil cooler unit located in the radiator tank.

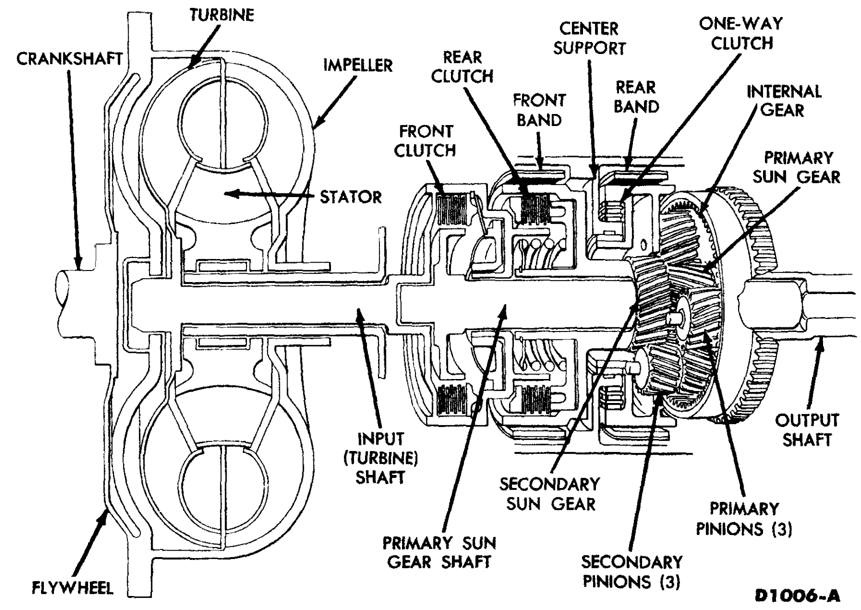

FIG. 4—Planetary Gear Train

OPERATION OF PLANETARY GEAR TRAIN, CLUTCHES, BANDS AND SERVOS

PLANETARY GEAR TRAIN

The planetary gear train consists of a primary sun gear, secondary sun gear, primary and secondary pinions which are held in a common carrier, and an internal gear to which the transmission output shaft is attached (Fig. 4).

FRONT CLUTCH

The front clutch drive plates (Fig. 5) are connected to the turbine shaft through the front clutch drum. The driven plates are connected to the primary sun gear shaft.

The front clutch is operated by fluid pressure against the clutch piston. The piston moves against a disc spring which acts as a lever to lock the drive and driven plates together. When the clutch is applied, the primary sun gear is locked to and driven by the turbine shaft. The piston is returned to the release position by the disc spring when the fluid pressure is removed (Fig. 5). A check ball is installed in the front clutch piston to permit fluid exhaust when the piston is in its released position.

In neutral, the front clutch drum and steel plates are being driven by the turbine shaft while the bronze plates are stationary. In reverse, the clutch is not applied.

REAR CLUTCH

The rear clutch (Fig. 5) is operated by fluid pressure against the clutch piston. Movement of the piston compresses the release spring and locks the multiple-disc clutch. The rear clutch drive plates are splined to the front clutch drum and the driven plates are connected to the rear clutch drum and secondary sun gear. When the rear clutch is applied (in the reverse and third gear ratios) the secondary sun gear is driven. The piston is returned to the released position by the release spring (Fig. 5).

In neutral, the rear clutch bronze plates are being driven while the steel plates are free. In second gear, the bronze plates are driven, but the steel plates are held stationary. In first gear, the bronze plates are driven clockwise at engine speed while the steel plates are driven counterclockwise.

FRONT BAND AND SERVO

One end of the front band, which encircles the rear clutch drum, is anchored to the transmission case, and the other end is connected to the front servo.

Fluid pressure moves the front servo piston against the inner end of the front servo actuating lever. Force is transmitted through a strut between the outer end of the lever and the end of the band to tighten the band around the rear clutch drum. Under certain conditions, the servo is released by directing fluid pressure to the opposite side of the piston, assisted by release spring force.

REAR BAND AND SERVO

The rear band fits around the planetary gear drum. One end of the band contacts the end of the band adjusting screw, and the other

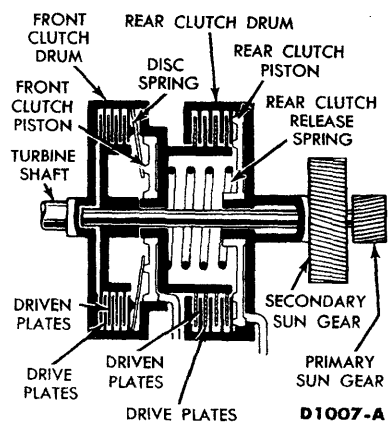

FIG. 5—Typical Front and Rear Clutches

end connects to the rear servo.

Two rear servo pistons apply the rear band. The small (fast-acting) piston, which is in direct contact with the servo lever, is located inside the large piston.

Fluid pressure against the large piston flows through a check valve to work against the small piston, which has low pressure resistance from the spring force of the rear band and whatever friction is in the servo lever and band struts. At a low apply pressure and small volume of fluid flow, the small piston moves and tightens the rear band on the pinion carrier.

When the apply pressure builds up to about 10 psi, the large piston moves against its return spring, allowing the check valve to close. When the check valve closes, the fluid in the small piston is trapped, and the apply force of the large piston is added to that of the small piston.

With full band application, the trapped fluid can bleed out through an orifice, allowing the small piston to bottom on the large piston.

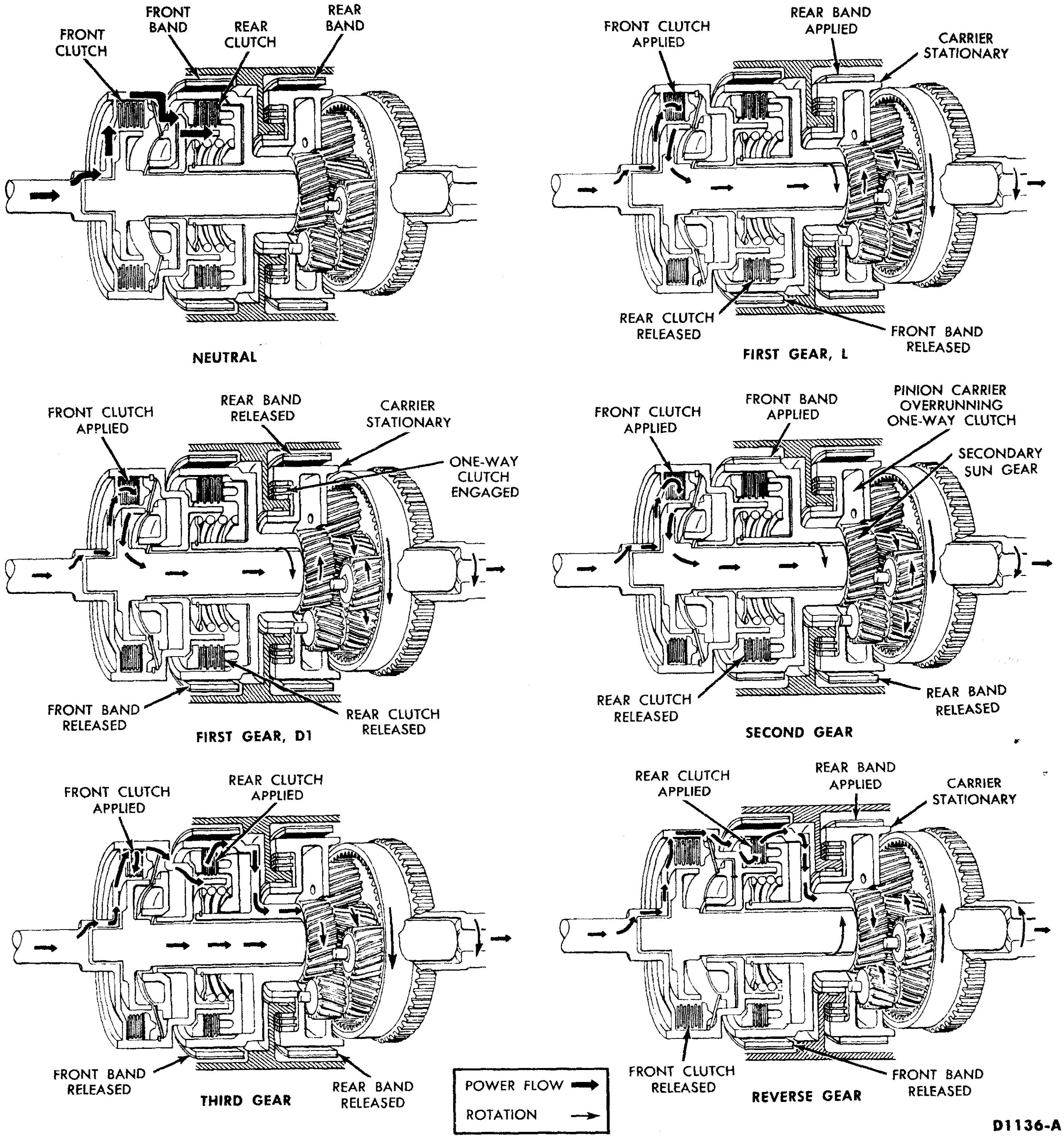

FIG. 6—Typical Power Flow—Each Gear Ratio

TABLE 1—Gear Ratios

Gear	Selector Lever Position	Clutch Applied	Band Applied	Gear Ratio
Neutral	N	None	None	—
First	D1 or L	Front	Rear*	2.37:1
Second	D1 or D2	Front	Front	1.48:1
Third	D1 or D2	Front and Rear	None	1:1
Reverse	R	Rear	Rear	1.84:1

*In first gear D1, the planet carrier is held against rotation by the one-way clutch.

POWER FLOWS—EACH GEAR RATIO

Table 1 lists the ratios obtained through the various power flows.

POWER FLOW – NEUTRAL

When the transmission is in neutral (Fig. 6), no gears are held or driven, and no power is transmitted to the output shaft.

POWER FLOW – FIRST GEAR, L

In first gear when the selector lever is at L, the primary sun gear is driven and the pinion carrier is held by the rear band (Fig. 6). Power is transmitted to the primary pinions, the secondary pinions, and the internal gear, driving the internal gear in the same direction as the primary sun gear. The secondary sun gear turns free in the reverse direction and has no effect on the gear train.

POWER FLOW–FIRST GEAR, D1

In first gear at the D1 selector lever position, the pinion carrier is held against rotation by the one-way clutch instead of by the rear band (Fig. 6). First gear in D1 is the only gear that uses the one-way clutch only to hold the pinion carrier.

POWER FLOW – SECOND GEAR

Second gear ratio is obtained by driving the primary sun gear and holding the secondary sun gear (Fig. 6). The primary pinions drive the secondary pinions, causing them to "walk" around the secondary sun gear, rotating the internal gear and output shaft.

POWER FLOW – THIRD GEAR

In third gear, the primary and secondary sun gears are locked together and driven as a unit (Fig. 6). Therefore, the pinions cannot rotate and the entire planetary train revolves as a unit, which causes the output shaft to rotate at the same speed as the turbine shaft.

POWER FLOW – REVERSE

Reverse gear is obtained by driving the secondary sun gear and holding the pinion carrier (Fig. 6). The secondary pinions drive the internal gear in the reverse direction. The primary sun gear and the primary pinions rotate freely and have no effect on the gear train.

POWER FLOW – PARK POSITION

When the selector lever is in the P position, the parking pawl engages the external teeth on the internal gear to lock the internal gear and output shaft to the case. This locks the rear wheels to prevent movement of the car.

OPERATION OF HYDRAULIC CONTROL SYSTEM

PRESSURE PUMPS

The front pump, driven by the converter impeller, can deliver fluid pressure to the hydraulic control system whenever the engine is running (Fig. 7). The rear pump, driven by the transmission output shaft, delivers fluid pressure to the control system when the car moves forward.

Both pumps deliver fluid pressure to the control pressure regulator and control valve body. A regulated control pressure is available at the control valve body whenever the engine is running.

CONTROL PRESSURE AND COMPENSATOR PRESSURE

Control pressure is regulated by the spring-loaded control pressure regulator valve (Fig. 7). It is adjusted to engine torque, road speed, and selector lever position.

To accomplish this, compensator pressure under various conditions is adjusted by throttle pressure (engine torque), governor pressure (road speed), or selector lever position. Compensator pressure, in turn, adjusts control pressure by positioning the control pressure regulator valve.

CONVERTER PRESSURE

Like control pressure, converter pressure is regulated by the converter pressure regulator valve spring and is adjusted to driving conditions by compensator pressure and selector lever positions.

THROTTLE PRESSURE

Throttle pressure adjusts the transmission operation to engine torque. Throttle pressure is produced from control pressure by the throttle valve. The throttle valve is controlled by a spring-loaded vacuum diaphragm unit mounted on the rear of the transmission case. Throttle pressure is regulated only when the front clutch is on. Because, from the front clutch circuit, control pressure is directed to the throttle valve to produce throttle pressure.

The vacuum diaphragm is actuated by the engine intake manifold vacuum, working against spring pressure. When the vacuum is higher than 16 in. Hg, the diaphragm moves against spring pressure and moves the push rod away from the throttle valve to cut off the throttle pressure regulation. As the engine rpm is advanced, manifold vacuum will fall below 16 in. Hg. As the vacuum drops, the spring-loaded diaphragm moves the push rod to open the throttle valve and regulates the throttle pressure in relationship to the changes in manifold vacuum.

THROTTLE PRESSURE BOOST VALVE

To compensate for the slight manifold vacuum changes with throttle movements beyond about 50° carburetor valve opening, a throttle pressure boost valve comes into operation. At about 51 psi throttle pressure the spring-loaded boost valve (Fig. 7) comes into a balance position. Throttle pressure below 51 psi cannot move the boost valve against spring force plus throttle pressure force acting at the boost valve. Be-

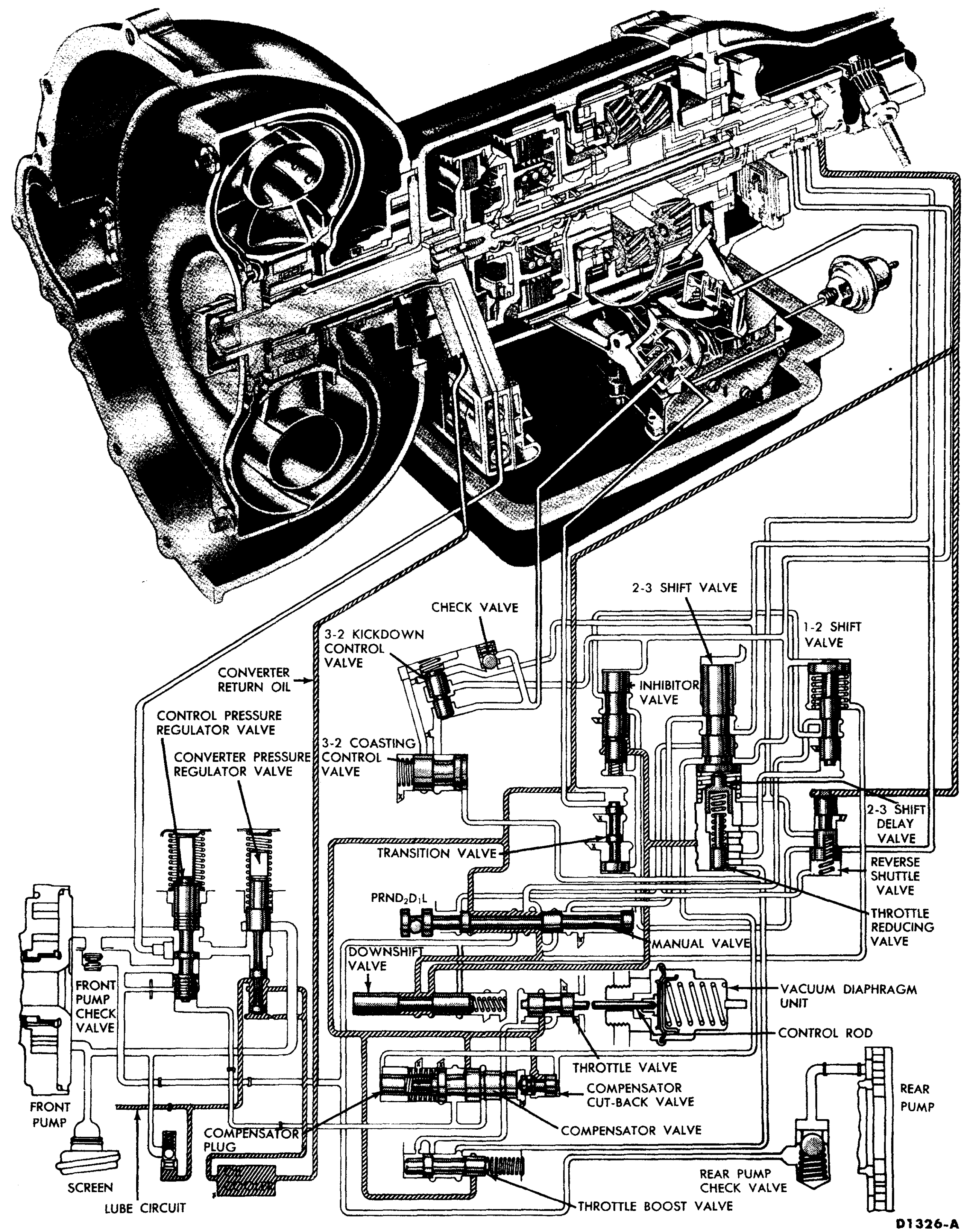

FIG. 7—Vacuum Controlled—Main Control, Hydraulic Circuit

low 51 psi, therefore, throttle pressure will flow through the boost valve without interference.

Throttle pressures above 51 psi will move the boost valve to the right (Fig. 7). This movement will first cut off throttle pressure flow to the shift valves and coasting control valve, and it will then open a passage to permit control pressure to enter the throttle pressure circuit. The new boosted throttle pressure is directed to the shift valves and the coasting control valve. Throttle pressure will continue to work against the end of the boost valve. For each pound of increase in throttle pressure (above 51 psi), the boosted throttle pressure will increase about three pounds.

GOVERNOR PRESSURE

Governor pressure is produced from control pressure from the front clutch circuit by the valve in the governor body which rotates at output shaft speed.

The governor valve is a balanced valve. It is balanced between centrifugal force acting on the governor valve plus governor spring force and governor pressure force (Fig. 7). Governor pressure is, therefore, proportional to road speed.

TRANSITION VALVE

The transition valve controls the front servo apply pressure flow.

In the D1 range, the transition valve blocks front servo apply pressure flow until the 1-2 valve is closed by governor pressure.

In the D2 range, the transition valve permits front servo apply pressure to flow through it at all times.

1-2 SHIFT VALVE

The 1-2 shift valve controls the 1-2 upshift in the D1 range. On the 2-1 downshift, either manual (shift to L) or kickdown, the 1-2 shift valve controls the shift only within the road speed range permitted by the inhibitor valve.

The 1-2 valve is held in its open position by a spring. It is closed by governor pressure. Under various driving conditions, governor pressure is opposed by spring force plus reduced throttle and reduced boosted throttle pressures, and control pressure.

THROTTLE REDUCING VALVE

Before throttle pressure or boosted throttle pressure is admitted to the face of the 2-3 shift valve and 1-2 shift valve, it must open a passage past the spring-loaded valve (Fig. 7).

Approximately 20 psi throttle pressure is required to move the valve against its spring far enough to open the passage. Once past the valve, throttle pressure will work on the spring end of the plug and exert a force to cut off throttle pressure flow past the valve. In this case, the valve becomes a balanced valve wherein the valve is balanced between throttle pressure force on the one end and spring force plus throttle pressure force on the other end. The pressure past the valve will, therefore, be reduced.

2-3 SHIFT VALVE

The 2-3 shift valve controls the 2-3 upshift and the 3-2 downshift. The valve is held in its closed position by springs. It is opened by governor pressure acting on the end of the valve. Under various driving conditions, governor pressure is opposed by spring force plus throttle or boosted throttle pressures, and control pressure.

INHIBITOR VALVE

The inhibitor valve prevents a 2-1 downshift, either manual or kickdown, at excessive road speeds.

The inhibitor valve is held in its open position by a spring. It is closed by governor pressure. Under various driving conditions, governor pressure is opposed by spring force plus control pressure.

3-2 COASTING CONTROL VALVE

The 3-2 coasting control valve operates in the front servo release passage.

During a 3-2 closed-throttle downshift in D2 range, the valve is positioned by its spring so that front servo release pressure must exhaust slowly through an orifice. This slow exhaust of release pressure provides a slow front band application.

During a partial-to-full-throttle 3-2 downshift, the 3-2 coasting control valve is positioned by throttle pressure or boosted throttle pressure so that front servo release pressure can exhaust rapidly to provide a rapid front band application.

DOWNSHIFT VALVE

The downshift valve is in the control valve upper body. The inner downshift lever contacts one end of the spring-loaded downshift valve.

Control pressure is directed to a land of the valve. Linkage is connected between the accelerator pedal and downshift lever. The downshift valve is moved to open a passage to direct control pressure to the shift valves and the inhibitor valve when the accelerator pedal is depressed through the detent (Fig. 7).

3-2 KICKDOWN CONTROL VALVE

The 3-2 kickdown control valve operates in the front servo release pressure passage between the 2-3 shift valve and the front servo. A check valve is installed parallel with the kickdown control valve in the same passage so that release pressure flow to the servo by-passes it.

The kickdown valve controls the rate of front servo release pressure exhaust (flow from the servo), and thereby the rate of front band application.

The 3-2 kickdown control valve eliminates the possibility of a runaway condition in the transmission during a 3-2 kickdown at low car speeds (about 25 mph). It also eliminates the possibility of a tie-up during the same shift at higher speeds (50 mph and more).

REVERSE SHUTTLE VALVE

When the transmission is shifted to reverse, rear servo apply pressure is directed to the reverse shuttle valve (Fig. 7). In addition, rear clutch apply pressure is also directed to the reverse shuttle valve where it acts on the area provided by the difference in the diameters of the lands of the valve. As the rear clutch is applied, pressure builds up in this circuit until the pressure force on the valve provided by rear clutch apply pressure overcomes the reverse shuttle valve spring force. At this point the valve moves against spring force, blocking the rear servo exhaust passage and allowing rear servo apply pressure to pass through the shuttle valve and apply the rear servo and band. In this manner, the rear band application is timed with the rear clutch application when reverse ratio is selected.

In Park position, rear servo apply

pressure is directed to the reverse shuttle valve. The shuttle valve spring holds the valve in the position which blocks the pressure from passing through the valve, and the rear servo is not applied. The position of the valve opens the rear servo apply passage to exhaust.

In D1 and D2 ranges, the pressure to the 2-3 shift valve is directed to the spring end of the reverse shuttle valve. Force on the valve provided by D1 or D2 pressure plus spring force, will hold the valve in the closed position, even when front clutch apply and rear clutch apply are fed to the valve. This prevents the rear servo from being applied in D1 or D2.

When the transmission is shifted to manual low, the D1 or D2 control pressure that was under the reverse shuttle valve is exhausted at the manual valve. The front clutch apply pressure forces the shuttle valve against the spring force, opening the valve. If car speed is below the low inhibitor point, or if the car is stopped, the rear servo apply oil is present at the shuttle valve and will apply the rear servo as soon as the shuttle valve moves. If the car speed is above the inhibitor point, rear servo apply pressure will be cut off at the inhibitor valve.

HYDRAULIC CONTROL SYSTEM – NEUTRAL

The manual valve at N selector lever position blocks the fluid flow to both clutches and both bands. With no fluid pressure in the clutches or servos, the clutches and bands are released by spring pressure, preventing power from being transmitted to the transmission output shaft. Without control pressure in the front clutch circuit, the throttle valve and compensator valves do not receive control pressure.

Neutral operation of the transmission regulates control pressure and maintains a full torque converter, lubricates the transmission, and maintains a flow of fluid through the cooling system.

HYDRAULIC CONTROL SYSTEM – D1, FIRST GEAR

When the selector lever is moved from N to D1, the manual valve opens three passages to control pressure. From left to right, the first passage directs control pressure to supply the 2-3 valve and reverse shuttle valve. The second passage admits control pressure to apply the front clutch and supply the governor and transition valve. The front clutch circuit also directs control pressure to the throttle and compensator valves. Control pressure is now regulated by road speed and the rate the car is accelerated. The third passage directs control pressure to flow through the 1-2 shift valve and inhibitor valve and close the transition valve.

With the front clutch applied, the primary sun gear tries to drive the pinion carrier in a counterclockwise direction. Counterclockwise rotation at the pinion carrier is prevented by the one-way clutch. With the front clutch applied and the pinion carrier held, the transmission is in first gear.

HYDRAULIC CONTROL SYSTEM – D1, SECOND GEAR

The 1-2 shift occurs when governor pressure force on the 1-2 shift valve overcomes throttle pressure and spring forces. The 1-2 shift valve moves inward, exhausting the fluid which holds the transition valve closed. The transition valve opens and admits control pressure to apply the front band.

The front clutch remains on, and the front band applies to put the transmission in second gear.

HYDRAULIC CONTROL SYSTEM – D1, THIRD GEAR

The 2-3 shift occurs when governor pressure force overcomes spring and throttle pressure force at the 2-3 shift valve. When the shift valve opens, control pressure flows through it to apply the rear clutch and release the front band. With both clutches applied, the transmission is in third gear. Control pressure is directed to the reverse shuttle valve to position the valve to prevent the reverse servo from being applied.

HYDRAULIC CONTROL SYSTEM – D2, SECOND GEAR

When the manual valve is at the D2 selector lever position, control pressure to the 1-2 shift valve is cut off. This condition permits control pressure to flow through the transition valve to apply the front band.

With the front clutch and the front band applied, the transmission operates in second gear. Control pressure is directed to the reverse shuttle valve to position the valve, preventing the reverse servo from being applied.

HYDRAULIC CONTROL SYSTEM – D2, THIRD GEAR

D2 range third gear operation is the same as D1 range, third gear except that the closed throttle downshift is from third to second in D2 instead of from third to first as in D1.

HYDRAULIC CONTROL SYSTEM – D1 AND D2 RANGES, 3-2 KICKDOWN

When the accelerator pedal is depressed through the detent, the downshift valve opens a passage that admits control pressure behind the throttle reducing valve to oppose governor pressure. If the transmission is in high and road speed is below the 3-2 inhibitor point, the 2-3 shift valve will be forced closed against governor pressure. When the 2-3 shift valve closes, control pressure which has been applying the rear clutch and releasing the front band is exhausted. The apply pressure that was in the front servo in third gear is now free to apply the front band. As soon as the front band applies, the transmission is in second gear.

HYDRAULIC CONTROL SYSTEM – L, FIRST GEAR

In L range, first gear, control pressure is directed by the manual valve to apply the front clutch and rear band. The front clutch is applied with the same circuits as in D1 and D2. To apply the rear band, the front clutch apply pressure positions the reverse shuttle valve to allow control pressure to pass through the valley of the reverse shuttle valve.

When the transmission is operating in high gear and the selector lever is moved to L, the control pressure used in D1 and D2 at the bottom of the reverse shuttle valve is exhausted at the manual valve. The front clutch apply circuit acting on the end of the reverse shuttle valve moves the valve against the spring opening the circuit to apply the rear band. The operation of the inhibitor valve controls the pressure in the circuit to apply the rear band.

When the manual valve is in the

L position, control pressure is directed to the 1-2 and 2-3 shift valves to hydraulically lock these valves in position. The governor pressure cannot move the shift valves against the control pressure, therefore automatic shifts from low gear are eliminated (Fig. 7).

HYDRAULIC CONTROL SYSTEM – R, REVERSE GEAR

When the manual valve is shifted into the reverse position, control pressure is directed from the manual valve to apply the rear clutch and rear band. The rear clutch circuit is directed through the upper valley of the 2-3 shift valve to apply the rear clutch. The same circuit is directed to the reverse shuttle valve. This positions the valve to open the circuit to apply the rear servo and rear band (Fig. 7).

PRESSURE REGULATOR

To insure adequate cooling, transmission fluid which is returned from the converter first passes through the oil cooler. From there, it is directed to the lower end and valley of the converter pressure regulator valve. When the converter fill and converter return pressure build-up is high enough, the converter pressure regulator valve will move to allow cooler fluid to pass through the lower valley of the valve into the lubrication circuit (Fig. 8).

A regulating check valve in the regulator body will limit lube pressure to 15 psi (nominal). If pressure exceeds 15 psi, the check valve ball will unseat and excess fluid will be returned to the front pump intake port. The check valve will insure an adequate flow of fluid through the converter and cooler once the demand for lube oil flow has been satisfied.

If, at high engine rpm, pump output exceeds the demand for converter fill, the converter pressure regulator valve will be moved further to by-pass excess front pump output back to the front pump inlet port.

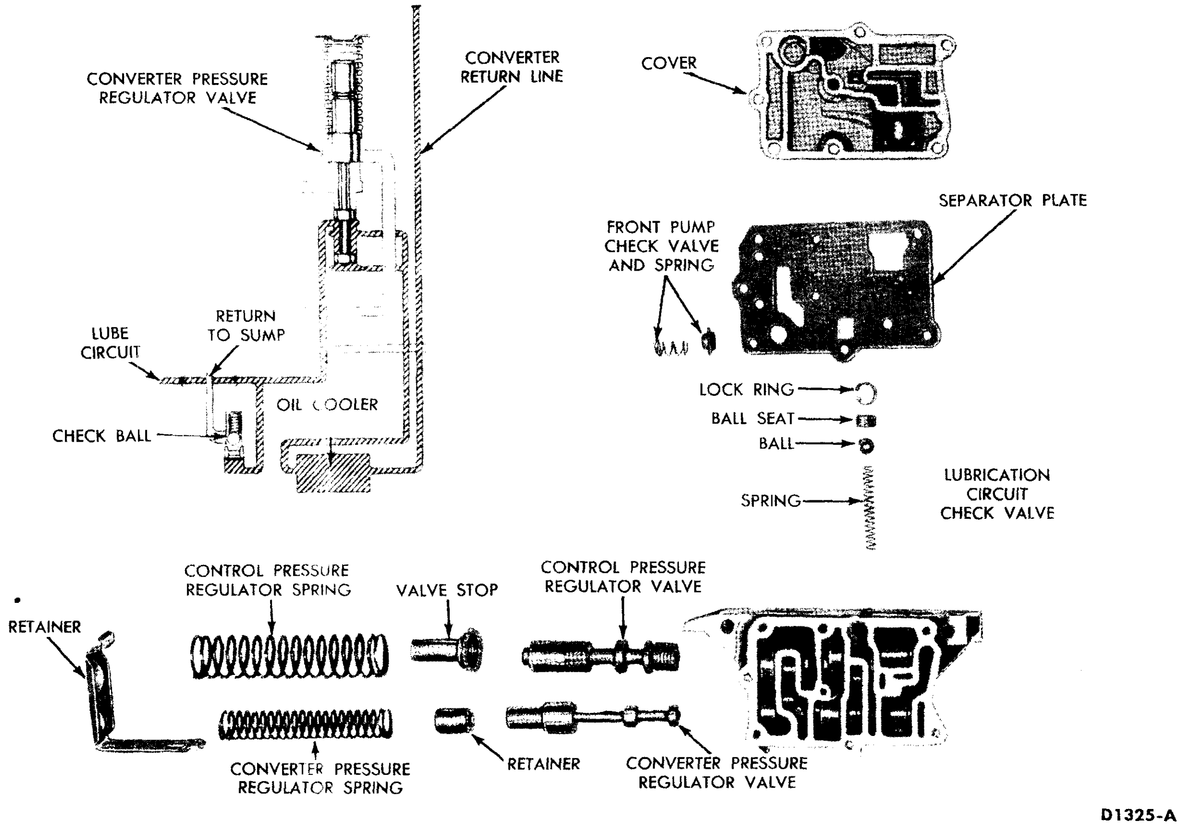

FIG. 8—Pressure Regulator

2 IN-CAR ADJUSTMENTS AND REPAIRS

LINKAGE ADJUSTMENTS

Linkage adjustments must be made in the following sequence:

1. Adjust the engine idle speed.
2. Adjust the accelerator pedal height.
3. Adjust the downshift rod.
4. Adjust the manual linkage.

ENGINE IDLE SPEED CHECK

If the car has air conditioning, turn the system off before adjusting the engine idle speed.

1. Apply the parking brake and place the selector lever in N.
2. Run the engine at idle speed until it reaches normal operating temperature.
3. Connect a tachometer and place the selector lever in D2 or D1.
4. With the carburetor fast idle cam tripped, the engine idle speed should be within specifications in drive range. (Refer to Carburetor Idle Speed and Anti-Stall Dashpot

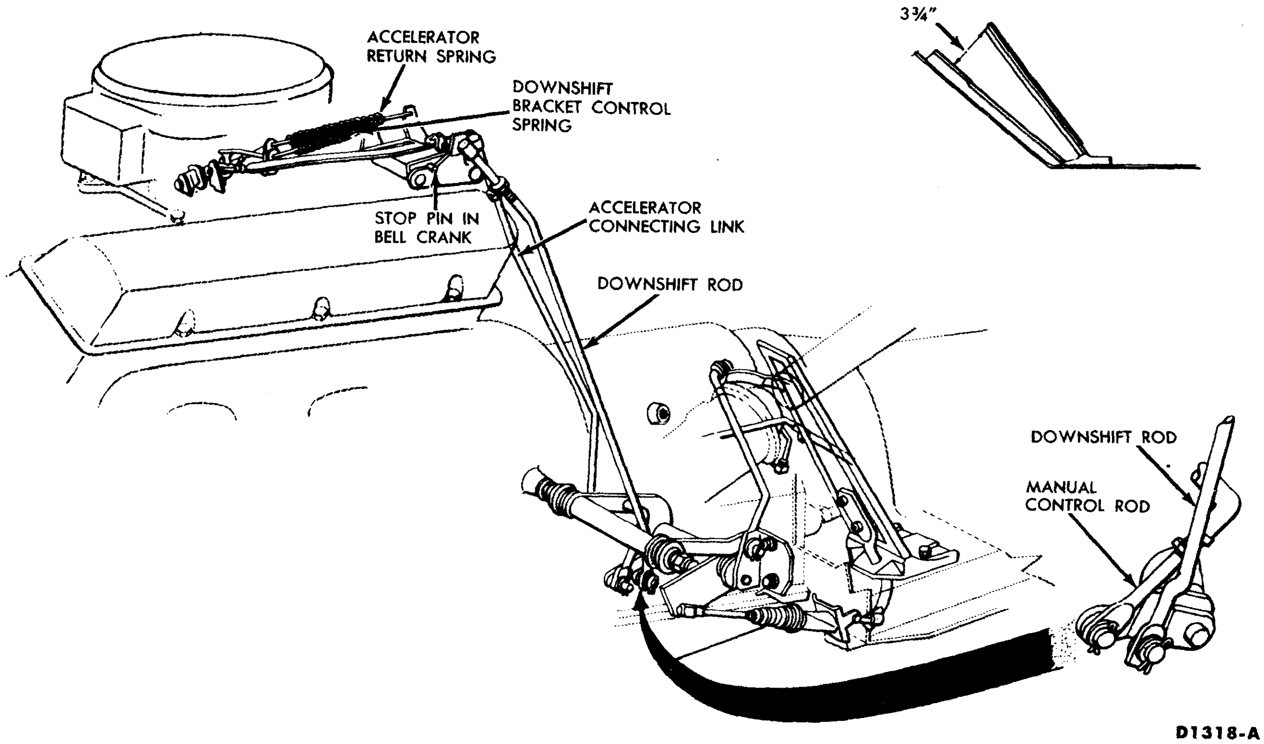

FIG. 9—Typical Linkage Adjustments

Adjustments in Group 10 for details regarding the location and adjustment procedure.)

ACCELERATOR PEDAL HEIGHT CHECK

1. The pedal height adjustment must be made only at the accelerator connecting link (Fig. 9).

2. With the engine turned off, measure the distance from the top of the accelerator pedal to the carpet. This measurement should be approximately 3¾ inches. **This is a nominal measurement only. Further adjustment may be required after road test if the kickdown operation is not functioning properly.**

3. Depress the accelerator pedal and check for detent feel and kickdown action of the bellcrank. Adjust the accelerator pedal height, as required, to achieve proper operation of the downshift rod. Check the kickdown operation when the car is road tested.

DOWNSHIFT ROD

1. Loosen the lock nut on the downshift rod. Disconnect the rod from the ballstud on the bellcrank assembly by sliding the spring clip off the end of the rod. Make sure the movable outer bracket on the bellcrank is up against the stop pin on the inner mounting bracket on the bellcrank assembly (Fig. 9).

2. Pull upward and hold the downshift rod against the transmision internal stop. Adjust the length of the rod until the hole in the rod is aligned with the ballstud on the bellcrank assembly.

3. Lengthen the downshift rod one turn and position it on the ballstud. Slide the spring clip over the end of the rod to lock the rod to the ballstud. Tighten the lock nut securely. **Be sure the bellcrank outer bracket remains against the stop pin. If it is not against the pin, lengthen the downshift rod one additional turn.**

If the downshift rod is adjusted too long, the transmission will not upshift because the downshift valve is opened to line pressure.

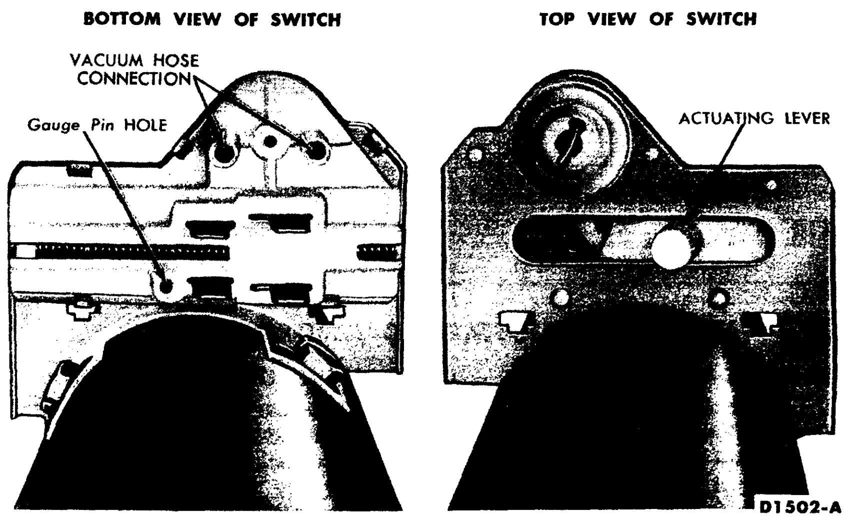

FIG. 10—Starter Neutral Switch Location

MANUAL LINKAGE

1. If the car has a movable steering column, position the column in the uppermost position. With the engine turned off, place the selector lever against the stop in the D1 position. Raise the car. Remove the linkage splash shield.

2. Disconnect the adjustable link from the transmission manual shift lever on the transmission (Fig. 9).

3. Be sure that the transmission shift lever is fully engaged in the second detent from the bottom D1. The bottom detent is low (L).

4. Loosen the lock nut on the adjustable link (Fig. 9). Pull downward on the link to hold the selector lever against the stop. Lengthen or shorten the link by rotating the lower end until the hole in the link aligns with the stud on the transmission manual lever. Lengthen the link one-half additional turn and connect it to the transmission shift lever.

5. Check the selector lever through all positions to assure correct linkage adjustment.

Do not make compensating adjustments in the manual control linkage to overcome misalignment of the selector lever indicator or the starter neutral switch. Adjustment or necessary corrections must be made to these components without disturbing the correct manual linkage adjustment.

STARTER NEUTRAL SWITCH ADJUSTMENT

1. With the manual linkage properly adjusted, check the starter engagement circuit in all transmission selector lever positions. The circuit must be open in all drive positions and closed only in park and neutral. (The starter should engage only in park and neutral).

2. To adjust the switch, loosen the retaining screws that locate the switch on the steering column (Fig. 10).

3. Place the transmission selector lever firmly against the stop of the neutral detent position.

4. Rotate the switch actuating lever until the gauge pin (no. 43 drill) can be inserted into the gauge pin holes (Fig. 10).

5. Tighten the 2 switch retaining screws and remove the gauge pin.

6. Check the operation of the switch in each selector lever position. **The starter should engage in only the neutral and park detent positions. Whenever the manual**

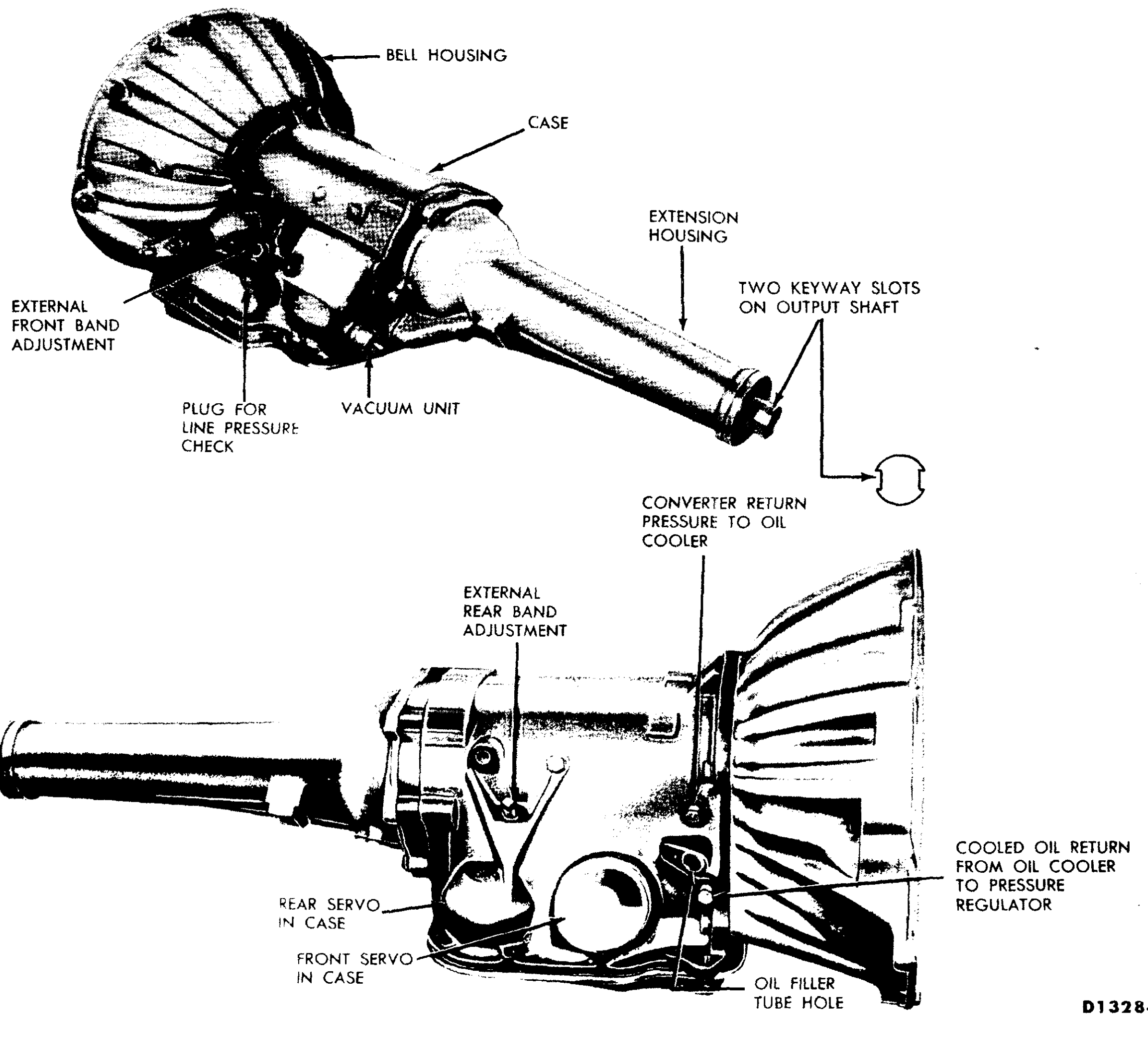

FIG. 11–External Transmission Components

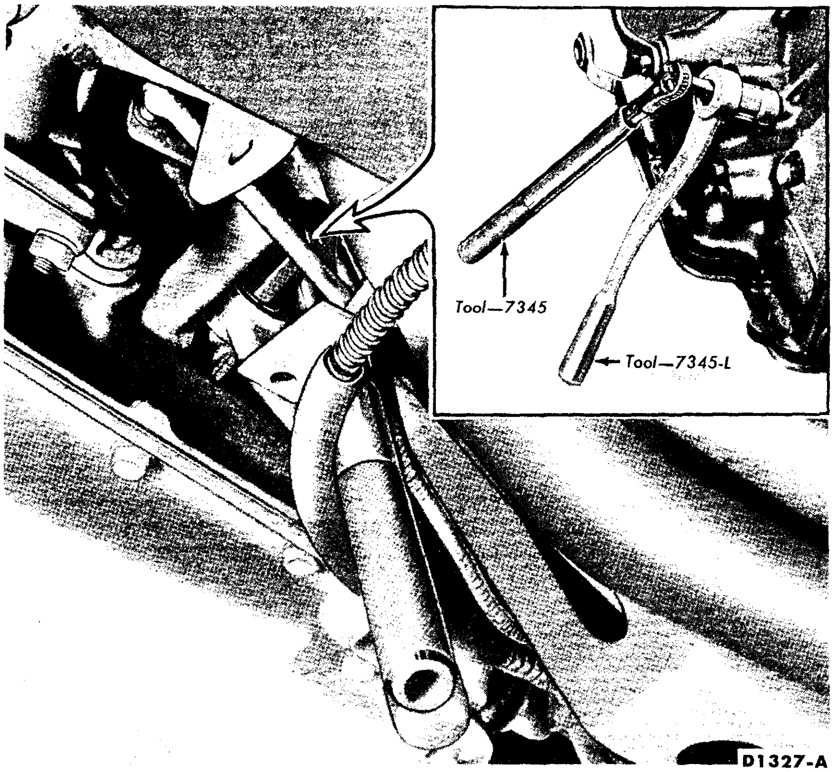

FIG. 12—Front Band Adjustment

linkage is adjusted, the starter neutral switch should be checked and, if necessary, adjusted.

FRONT BAND ADJUSTMENT

The front band is adjusted **externally**. The adjusting screw is threaded through the left front side of the transmission case (Fig. 11). Tools 7345 and 7345-L are required to adjust the front band (Fig. 12).

1. Raise the car. Remove the transmission linkage splash shield.
2. Remove all dirt from the adjusting screw threads, then oil the threads. Loosen the adjusting screw lock nut.
3. Tighten the adjusting screw with tool 7345 until the tool handle "breaks" over center. **If the adjusting screw is tighter than wrench capacity (10 ft-lbs torque), loosen the adjusting screw and re-tighten the screw.**
4. Back the adjusting screw off exactly **3 turns.**

Severe damage may result if the adjusting screw is not backed off exactly 3 complete turns.

5. Hold the adjusting screw stationary and tighten the lock nut to 35-40 ft-lbs.

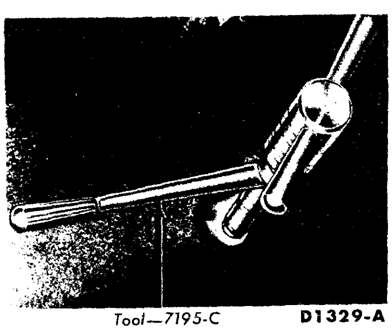

FIG. 13—Rear Band Adjustment

REAR BAND ADJUSTMENT

1. Fold back the floor mat to expose the right side of the floor pan.
2. Remove the access hole cover from the floor pan. Remove all dirt from the adjusting screw threads, then oil the threads (Fig. 13).
3. Loosen the rear band adjusting screw lock nut with tool 7195-C, as shown in Fig. 13. Using the T-handle on the tool, tighten the adjusting screw until the wrench over-runs. **If the screw is found to be tighter than wrench capacity (10 ft-lbs torque), loosen the screw and re-tighten until the wrench overruns.**
4. Back off the adjusting screw 1½ turns. **Severe damage may result if the adjusting screw is not backed off exactly 1½ turns.**
5. Hold the adjusting screw stationary, and tighten the adjusting screw lock nut to approximately 35-40 ft-lbs.

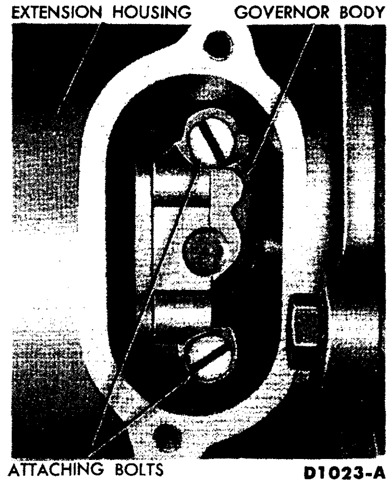

FIG. 14—Governor In Extension Housing

GOVERNOR REPLACEMENT

1. Raise the car so that the transmission extension housing is accessible.
2. Remove the inspection cover from the governor assembly hole in the extension housing.
3. Rotate the drive shaft until the governor is in line with the inspection hole in the extension housing.
4. Remove the two governor valve body retaining bolts and governor from the counterweight (Fig. 14).

Do not drop any parts into the extension housing.

5. If the removed governor can be cleaned, make sure all parts are thoroughly clean and lubricated and the governor valve moves freely within the valve body before the valve body is assembled to the counterweight.
6. Lubricate the new governor valve parts with clean transmission fluid. The valve must move freely in the valve body bore.
7. Install the governor valve assembly to the counterweight so that the valve body cover is faced toward the rear of the car. Torque the two attaching bolts to specifications.

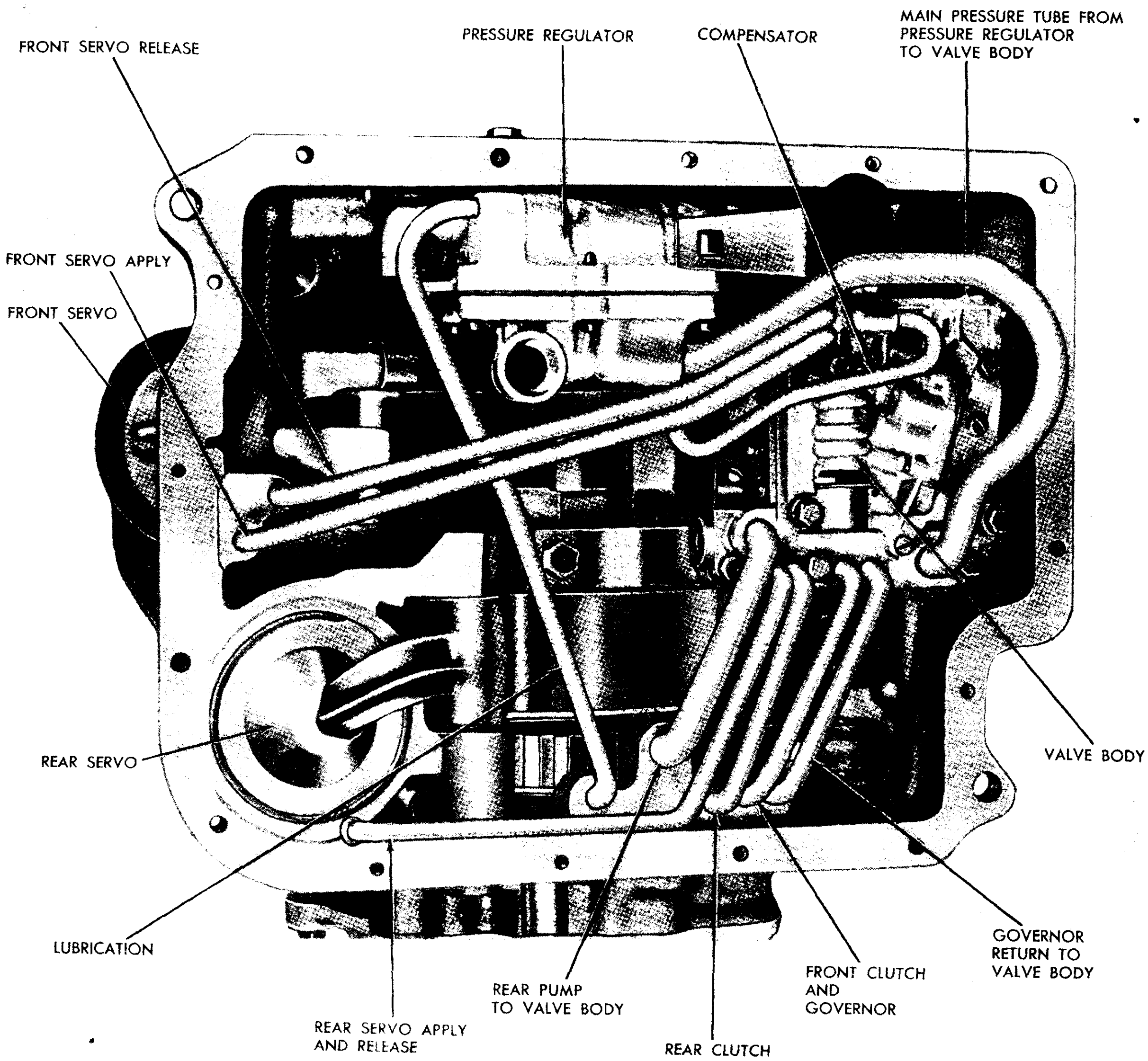

FIG. 15—Hydraulic Pressure Tubes

OIL PAN AND/OR CONTROL VALVE BODY REPLACEMENT

1. Raise the car so that the transmission oil pan is accessible. Remove the reinforcement plate under the transmission oil pan.

By loosening the oil pan bolts, drain the fluid from the transmission. **If the same fluid is to be used again in the transmission, filter the fluid through a 100-mesh screen as it drains from the transmission. Re-use the fluid only if it is in good condition.**

2. Remove the oil pan, gasket, and oil filter type screen. **During the following operations, care must be taken to avoid bending or damaging the oil tubes (Fig. 15).**

3. Remove the front servo apply and release tube.

4. Remove the main pressure tube from the pressure regulator to the main control valve.

5. Remove the compensator tube from the valve body to pressure regulator.

6. Remove the rear pump to valve body pressure tube.

7. Remove the rear servo apply and release tube.

8. Remove the three short tubes which direct front clutch, rear clutch, and governor pressure between the valve body and the transmission case.

9. Remove the throttle valve vac-

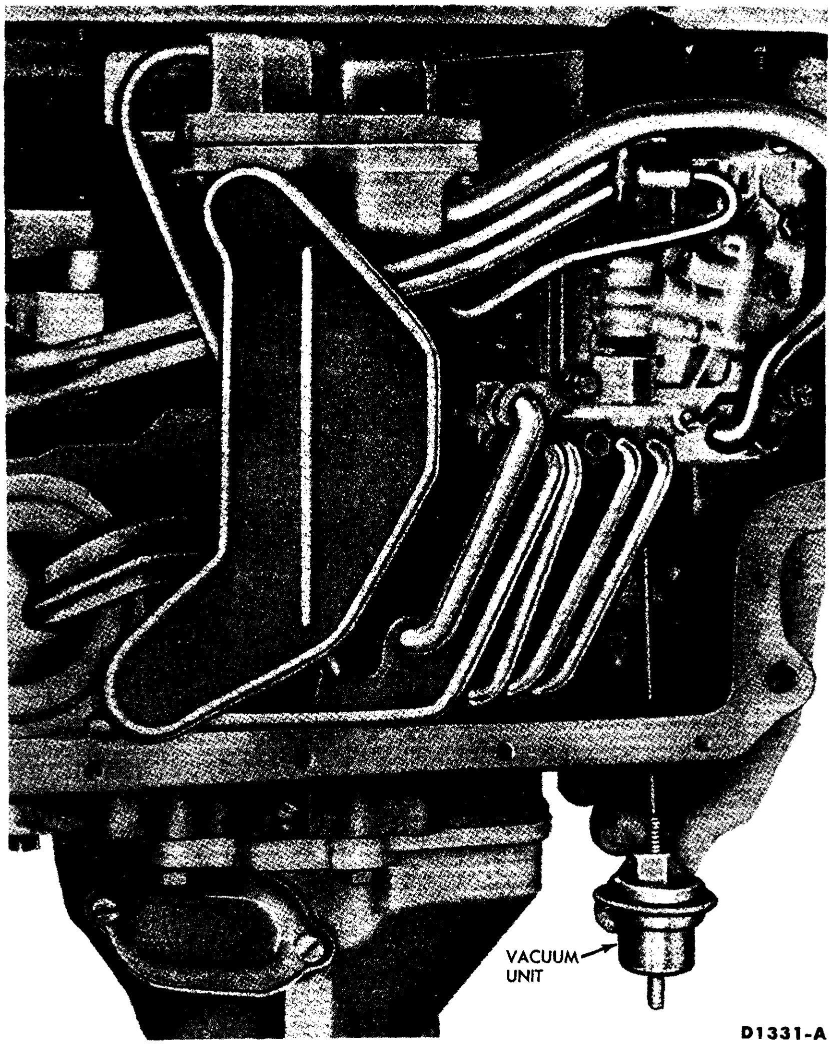

FIG. 16—Vacuum Unit Removal or Installation

uum diaphragm assembly and throttle control valve rod.

10. Remove the main control valve assembly attaching bolts; then, remove the assembly by lifting it from the mounting pad on the case. Hold the manual valve in place as the assembly is removed.

11. To install the control valve body, reverse the above removal procedure, torquing the retaining bolts to specifications. Make sure the vacuum unit and control rod are properly assembled before the oil pan is assembled (Fig. 16).

PRESSURE REGULATOR REPLACEMENT

With the lubricating tube and the same detail parts removed as outlined under Control Valve Body Removal, except for the control valve body and vacuum unit (Fig. 15), use the following procedure to remove and replace the pressure regulator.

1. Remove the pressure regulator spring retainer, springs and spacers.

2. Remove the pressure regulator assembly attaching bolts, and then, remove the assembly.

3. To assemble the pressure regulator assembly, reverse the above procedures and torque the retaining bolts to specifications.

PARKING PAWL REPLACEMENT

1. Loosen the lock nut on the rear band adjustment stud. Tighten the stud with tool 7195-C (Fig. 13) until the tool handle overruns. **Do not back off the adjusting screw.** This will hold the planet carrier, front and rear clutch assemblies in

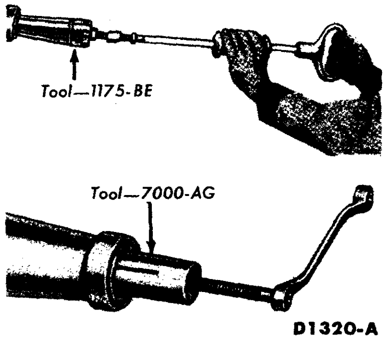

FIG. 17—Extension Housing Seal & Bushing Removal

place during the parking pawl replacement procedure.

2. Raise the car on the hoist and support the front of the transmission with an adjustable jack stand and drain the transmission fluid from the oil pan.

3. Mark the drive shaft with the location of the axle companion flange. Remove the two U-bolts holding the drive shaft to the companion flange; then, remove the drive shaft.

4. Remove the reinforcement plate under the transmission oil pan. Remove the oil pan and oil filter type screen. Remove the parking brake equalizer bar retracting spring and disconnect the parking brake cable and equalizer assembly.

5. Remove the three short tubes from the main control valve that direct rear clutch, front clutch, and governor return pressure to the case.

6. Remove the crossmember at the extension housing and remove the extension housing.

7. With a soft hammer tap the distributor and rear pump to move the distributor back until the rear clutch, front clutch, and governor return tubes are removed from the case.

8. Remove the output shaft and rear pump as an assembly.

9. Remove the end of the toggle return spring from the toggle lever

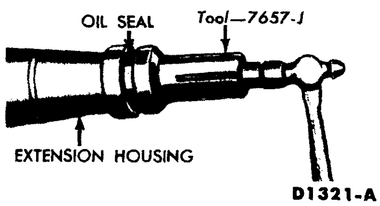

FIG. 18—Extension Housing Seal & Bushing Installation

pin, and remove the 0.328 diameter washer and pin.

10. Remove the parking pawl support pin with a magnet.

11. Remove the parking pawl parts.

12. To assemble the new parking pawl, reverse the above procedure using new gaskets. Reset the rear band and fill the transmission with fluid.

EXTENSION HOUSING OIL SEAL AND BUSHING REPLACEMENT

1. Raise the car and mark the drive shaft for proper replacement. Remove the drive shaft and position the parking brake equalizer and cables to obtain free access to the transmission extension housing.

2. Remove the extension housing oil seal using tool 1175-AE (Fig. 17). After removing the oil seal, the bushing can be removed with tool 7000-AG (Fig. 17).

3. Install a new bushing using tool 7657-J with the adapter ring detail of the tool. Install a new oil seal using tool 7657-J without the adapter ring (Fig. 18).

3 REMOVAL AND INSTALLATION

When removing the transmission, it is necessary to remove the complete transmission and converter housing assembly as one unit. The transmission gear box and converter housing cannot be separated while in the car. One additional converter housing to transmission case bolt is located behind the converter assembly where it is not accessible until after the converter has been removed (Fig. 19).

REMOVAL

1. Raise the hood. Remove the converter housing to engine upper bolts and remove the power box cover. Connect a starter remote control lead to the battery terminal. Attach the other remote control lead to the small terminal which has a red and blue wire at the power box. Place the transmission in neutral, N.

2. Raise the car and remove the reinforcement plate from under the transmission oil pan. Drain the fluid from the transmission by loosening the oil pan bolts. Remove the converter access cover from the front of the converter housing; then, remove the transmission linkage splash shield. Disconnect the oil filler tube.

3. Disconnect the drive shaft at the differential pinion shaft flange. Remove the drive shaft. **Mark the rear universal joint and the pinion flange before removing the drive shaft so that it can be installed in the same position.**

4. Remove the parking brake equalizer bar retracting spring. Disconnect the parking brake cables and equalizer assembly.

5. Disconnect the downshift rod and the necessary manual shift linkage parts at the transmission levers.

6. Disconnect the vacuum line hose at the vacuum diaphragm. Disconnect the speedometer cable at the transmission.

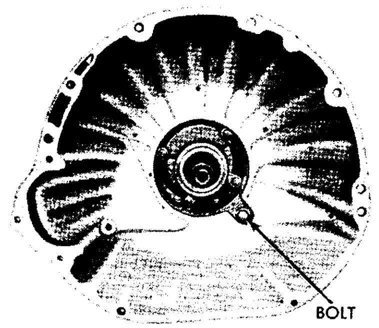

FIG. 19—Internal Bolt—Retaining Converter Housing to Case

7. Remove the engine stabilizer bar installation from the converter housing.

8. Remove the converter to flywheel retaining nuts. As the converter is rotated, remove the converter drain plugs and drain the fluid from the converter. **Use the starter remote control to turn the flywheel.**

9. Turn the front wheels fully to the right and remove the starter motor.

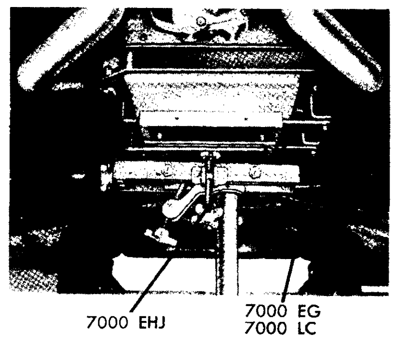

FIG. 21—Positioning Transmission on Jack

10. Disconnect the oil cooler lines at the transmission and radiator and remove the tubes (Fig. 20).

11. Position the transmission jack (7000EHJ with Adapter Kit 7000-EG and Bracket Kit 7000-LC) under the transmission and raise the transmission slightly (Fig. 21).

12. Remove the rear support (crossmember) to transmission extension housing nuts. Remove the crossmember bracket to underbody bolts and remove the crossmember and brackets.

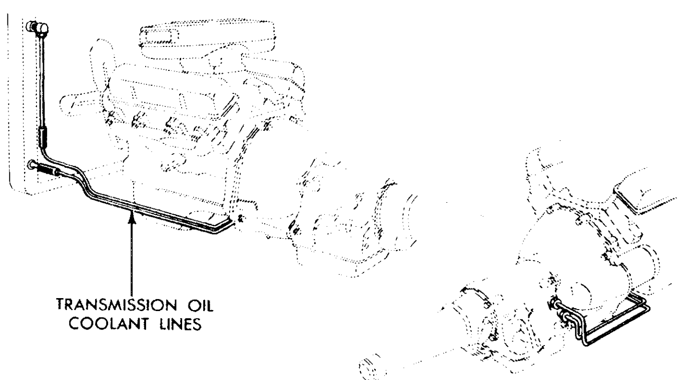

FIG. 20—Oil Coolant Line Routing

13. Detach the vacuum line at the converter housing.

14. Remove the manual linkage equalizer assembly mounted between the transmission and the underbody.

15. Remove the remaining converter housing to engine retaining bolts.

16. Move the transmission and converter assembly to the rear and remove it from under the car.

INSTALLATION

1. With the transmission on the jack (Fig. 21), raise the transmission and converter assembly into position. Align the converter with the flywheel and the converter housing with the engine dowel pins.

2. Install the converter housing to engine lower bolts and tighten the bolts snugly. Attach the vacuum line support to the converter housing.

3. Install the manual linkage equalizer assembly between the transmission and the underbody, and then, the engine stabilizer bar to the converter housing.

4. Connect the vacuum line to the vacuum diaphragm.

5. Install the speedometer cable and drive gear in the extension housing.

6. Install the crossmember and body brackets. Torque the crossmember to underbody bolts and the body bracket bolts.

7. Lower the transmission. Install the crossmember to rear support retaining nuts. Torque the nuts to specifications.

8. Install the drive shaft in the position previously marked. Torque the rear universal joint U-bolts to specifications.

9. Install the parking brake equalizer and cable assembly. Install the parking brake equalizer retracting spring.

10. Connect the downshift rod and the manual shift linkage at the transmission. Adjust the manual shift linkage.

11. Position the starter motor seal and install the starter motor. Connect the starter motor cable.

12. Install the converter housing to the engine. Torque all converter housing retaining bolts to specifications.

13. Connect the oil cooler lines and install the underbody reinforcement plate. Torque the plate bolts to specifications.

14. Install the converter to flywheel retaining nuts and washers. Torque the nuts to specifications.

15. Install the transmission linkage splash shield.

16. Lower the car. Install the converter housing to engine upper bolts and torque the bolts to specifications. Fill the transmission. Check the adjustment of the downshift linkage.

4 MAJOR REPAIR OPERATIONS

DISASSEMBLY

The following procedure covers the bench disassembly and assembly of the transmission, after the unit has been removed from the car.

CONVERTER AND CONVERTER HOUSING

1. Hold the converter assembly with both hands and pull the converter directly forward. To prevent damage to the front pump seal, do not rock the converter assembly from side to side.

2. Remove the one bolt which holds the converter housing to the transmission case from inside the converter housing (Fig. 19).

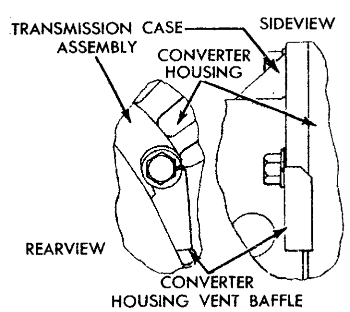

FIG. 22–Converter Housing Vent Baffle

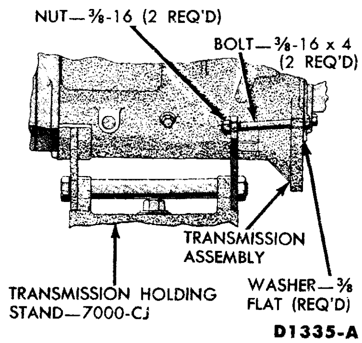

FIG. 23–Adapting Holding Fixture for Transmission

3. Remove the five bolts which hold the converter housing to the transmission case. Remove the converter housing vent baffle (Fig. 22). Remove the converter housing and gasket.

TRANSMISSION SUB-ASSEMBLIES

1. Place the transmission in Holding Fixture 7000-CJ, using two ⅜-16 x 4 inch bolts and ⅜-16 nuts to secure it to the holding fixture (Fig. 23).

2. Remove the oil pan, gasket, and oil filter type screen. **During the following operations, care must be taken to avoid bending or damaging the oil tubes (Fig. 15).**

3. Remove the front servo apply and release tube.

4. Remove the main pressure tube from the pressure regulator to the main control valve (Fig. 15).

5. Remove the compensator tube from the valve body to the pressure regulator.

6. Remove the rear pump to valve body pressure tube.

7. Remove the rear servo apply and release tube.

8. Remove the three short tubes which direct front clutch, rear clutch, and governor pressure between the valve body and transmission case.

9. Remove the lubricating tube.

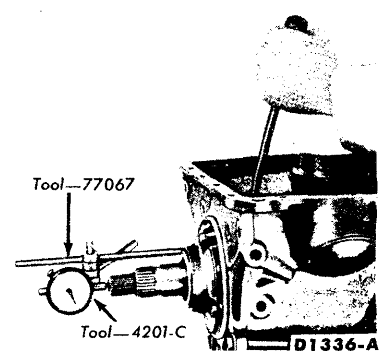

FIG. 24–Checking Transmission End Play

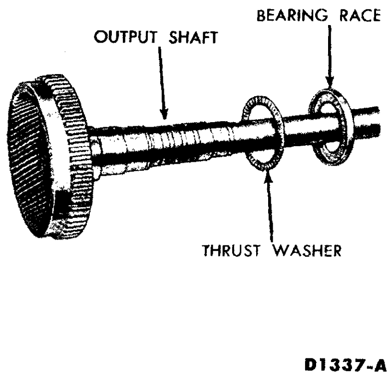

FIG. 25—Output Shaft Thrust Washer & Race

10. Remove the throttle valve vacuum diaphragm assembly and throttle control valve rod.

11. Remove the main control valve assembly attaching bolts; then, remove the assembly by lifting it from the mounting pad on the case. **Hold the manual valve in place as the assembly is removed.**

12. Remove the pressure regulator spring retainer and springs.

13. Remove the pressure regulator assembly attaching bolts, and then, remove the assembly.

14. Loosen the front and rear band adjusting studs several turns.

15. Check transmission end play. (The specified limits are 0.010 to 0.029 inch.) Use Dial Indicator 4201-C and Dial Indicator Support Fixture 77067 (Fig. 24).

16. Remove the front pump attaching bolts and remove the pump from the case. Remove the front pump to transmission case gasket.

17. To remove the extension housing seal and bushing, if necessary, refer to In-Car Adjustments and Repairs. Remove the extension housing bolts and pull the housing away from the transmission case and off the output shaft.

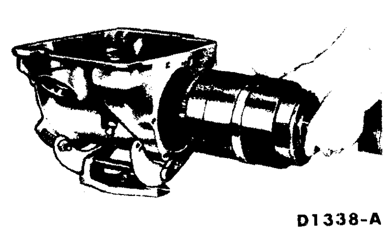

FIG. 26—Removing Transmission Gear Train

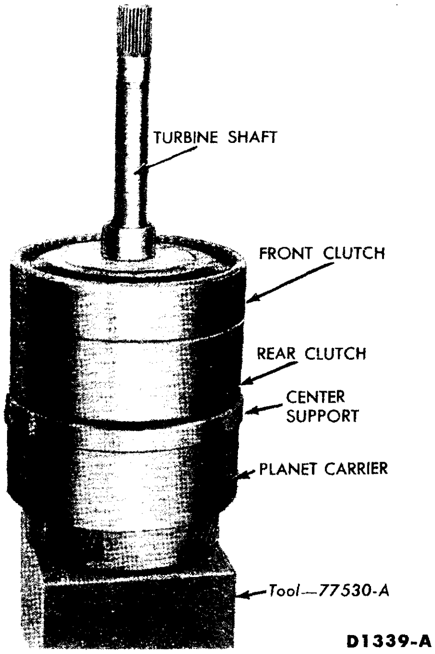

FIG. 27—Gear Train Positioned In Holding Fixture

18. Remove the distributor sleeve retaining snap ring.

19. Remove the distributor sleeve and tubes from the output shaft by tapping with a soft-faced hammer on the sleeve. **Do not bend or distort the tubes.** Remove the four oil seal rings and spacer washer from the output shaft.

20. Remove the governor snap ring and remove the governor from the output shaft. Remove the governor drive ball.

21. Remove the rear pump from the case, and remove the extension housing pump gaskets. Remove the rear pump discharge port "O" ring from the case.

22. Remove the output shaft needle bearing type rear thrust washer from the rear pump. Remove the bearing race (Fig. 25).

23. Hold the planet assembly forward and remove the output shaft.

24. Remove the output shaft front thrust washer.

25. Remove the two oil seal rings from the front clutch sun gear shaft.

26. Using a brass drift, tap the rear band actuating lever shaft out through the rear of the case.

27. Remove the rear band actuating lever, strut, and rear band anchor strut. Remove the center support bolts.

28. Expand the rear band with snap ring pliers and use the actuating lever strut as a spacer to hold the rear band in the spread position. Slide the clutch assemblies, center support and planet carrier out of the rear of the case (Fig. 26).

29. Place the clutch assemblies, center support, and planet carrier in the Holding Fixture tool No. 77530-A (Fig. 27).

30. Remove and separate the clutch assemblies. Separate the planet carrier from the center support (Fig. 28). Place the rear clutch and primary sun gear into Holding Fixture 77530-A.

31. Remove the bronze and steel thrust washers from the clutch assembly.

32. Remove the oil seal rings from the primary sun gear shaft, and remove the rear clutch from the sun gear shaft (Fig. 29). Remove the rear clutch seal rings from the sun gear shaft and the thrust washer between the rear clutch and primary sun gear.

33. With a screwdriver, remove the front clutch snap ring which holds the turbine shaft to the front clutch hub. Remove the turbine shaft. Remove the front clutch plates and internal hub. With an arbor press and tool 77565 remove the Belleville spring and snap ring (Fig. 30) and with an air hose and tool No. 7000DE, remove the piston.

34. Remove the rear clutch pressure plate snap ring and rear clutch plates. With an arbor press and tool 77515-A, compress the rear clutch spring, remove the snap ring spring retainer and release the spring (Fig. 31). With an air hose and tool No. 7000DE, remove the piston.

35. When assembling the clutch-

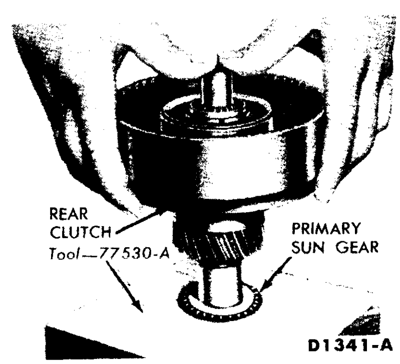

FIG. 29—Removing Rear Clutch From Primary Sun Gear Shaft

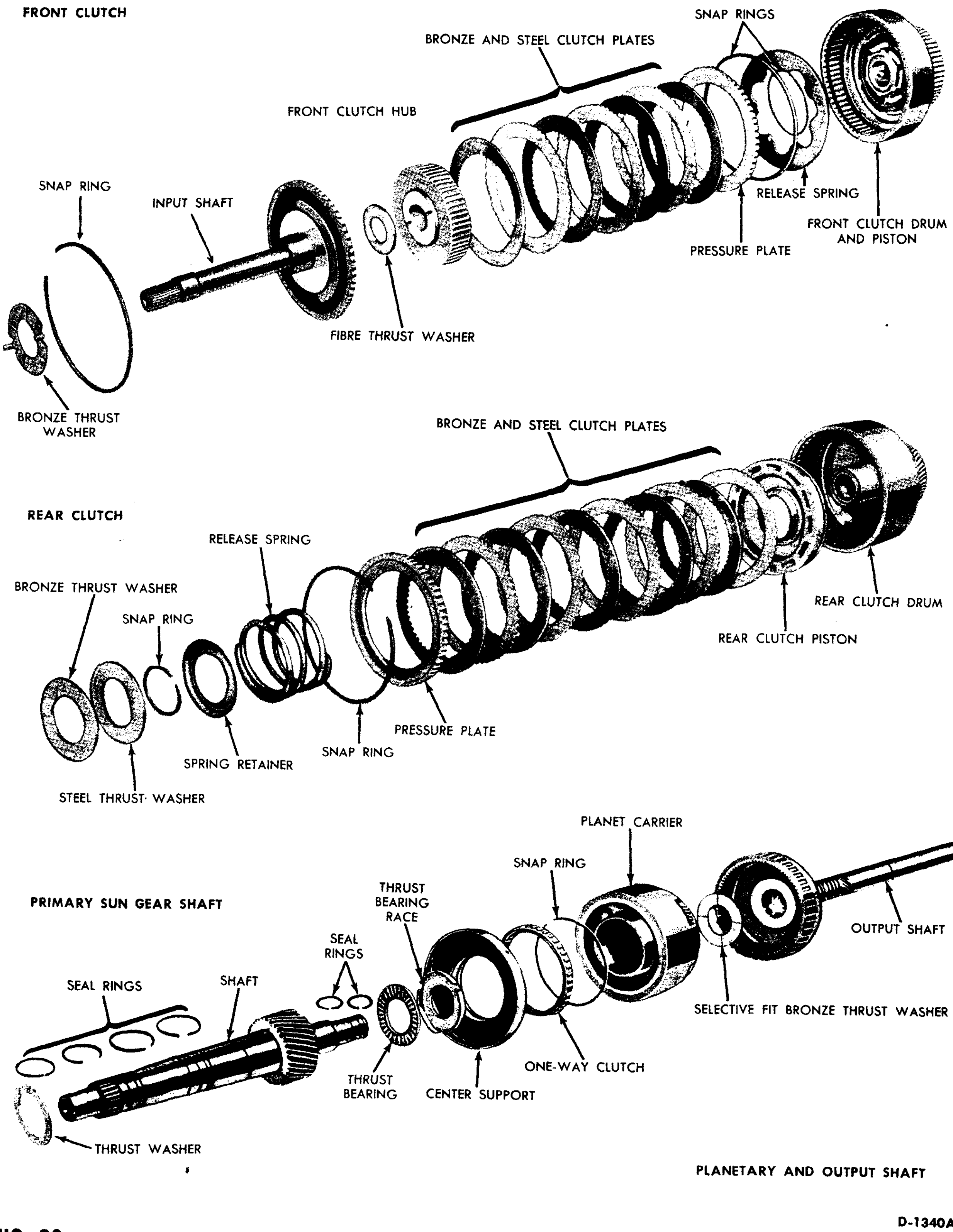

FIG. 28—Clutch and Gear Train—Explode

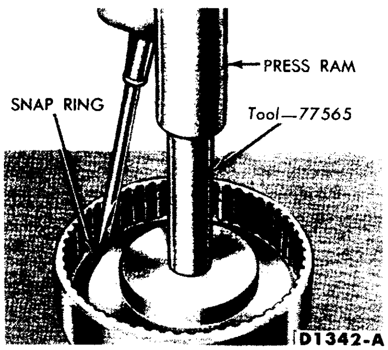

FIG. 30—Removing Belleville Spring Snap Ring

es and gear train, reverse the above procedure.

36. Remove the rear band through the bottom of the case.

37. Remove the front band, anchor strut and actuating lever strut from the case.

38. To remove the rear servo assembly, hold and compress the spring retainer with a large "C" clamp or a valve spring compressing tool (No. 7513-EE) as the snap ring is removed (Fig. 32). After the snap ring has been removed, release the pressure slowly on the spring retainer holding the tool so that the compressed return spring does not release too quickly.

39. Remove the rear servo spring retainer, spring, and piston from the case. Remove the accumulator piston, check valve, spring and O-ring (Fig. 33).

40. Remove the front servo cover with a screwdriver.

41. Apply thumb pressure on the front servo piston and remove the front servo piston retainer snap ring and piston assembly (Fig. 34).

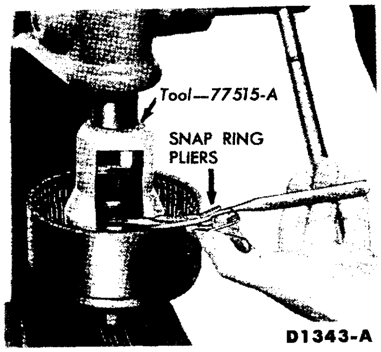

FIG. 31—Removing Spring Retainer Snap Ring From Rear Clutch

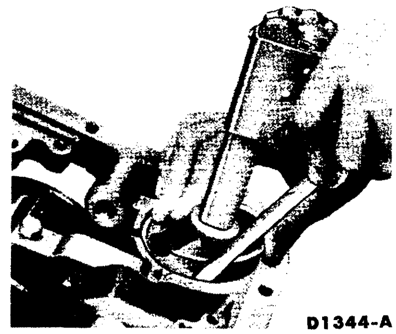

FIG. 32—Removing Rear Servo Snap Ring

42. Remove the front servo piston assembly and return spring. Disassemble the pistons and O-rings (Fig. 35).

43. Drive out the front band actuating lever shaft access hole plug on the front face of the case near the front pump.

44. Remove the front servo actuating lever retainer clip (Fig. 36). Remove the actuating lever shaft through the hole in the front face of the case. Remove the front servo actuating lever.

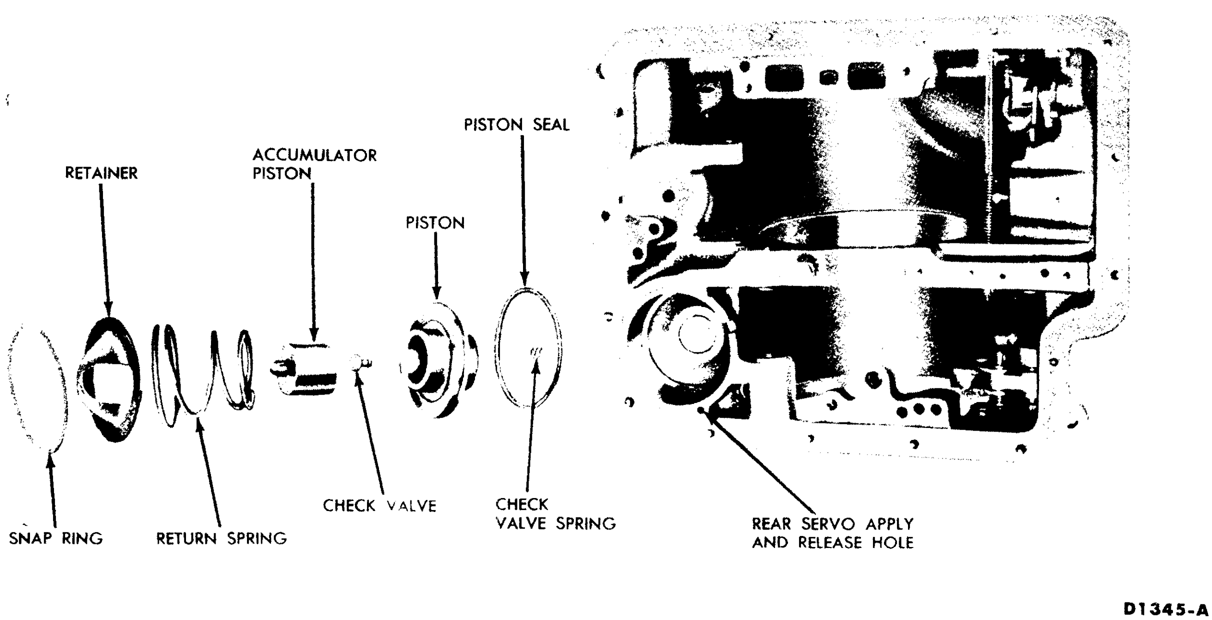

FIG. 33—Rear Servo Assembly

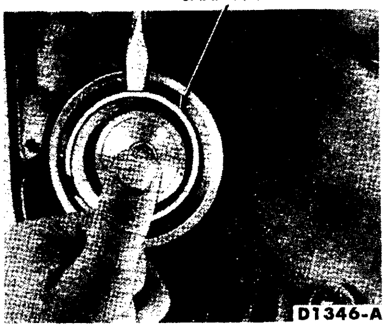

FIG. 34—Removing Front Servo Snap Ring

PARTS REPAIR AND REPLACEMENT

During the repair of the sub-assemblies, certain general instructions which apply to all units of the transmission must be followed. These instructions are given here to avoid unnecessary repetition.

Handle all transmission parts carefully to avoid nicking or burring the bearing or mating surfaces.

Lubricate all internal parts of the transmission with transmission fluid before assembly. Do not use any other lubricants.

Gaskets and thrust washers may be coated with petroleum jelly to facilitate assembly. **Always install new gaskets when assembling parts of the transmission.**

Tighten all bolts and screws to the recommended torque. Refer to Part 7-1 for cleaning and inspection procedures.

FRONT PUMP

1. Remove the stator support attaching screws and remove the stator support. Mark the top surface of the pump driven gear with Prussian blue to assure correct assembly. **Do not scratch the pump gears.**

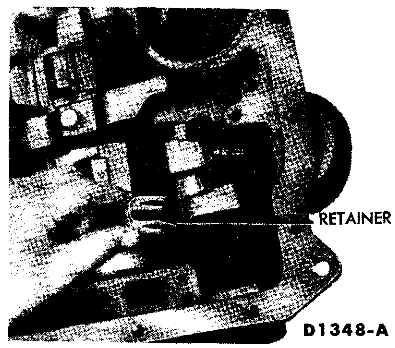

FIG. 36—Removing Front Servo Actuating Lever Retainer Clip

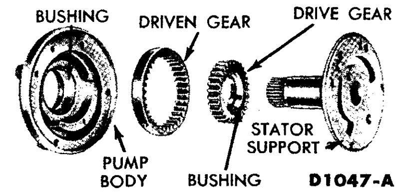

FIG. 37—Front Pump Disassembled

2. Remove the drive and driven gears from the pump body.

3. Refer to Fig. 37 for a disassembled view of the front pump. Inspect the pump body housing, drive gear bushing, gear pockets, and crescent for scores.

4. Inspect the mating surfaces of the pump body and cover for burrs.

5. Inspect the drive and driven gear bearing surface for scores, and check the gear teeth for burrs. Inspect the stator support splines for burrs and wear.

6. Check the fluid passages for obstructions.

7. If any parts other than the stator support are found defective, replace the pump as a unit. Minor burrs and scores may be removed with crocus cloth. The stator support is serviced separately.

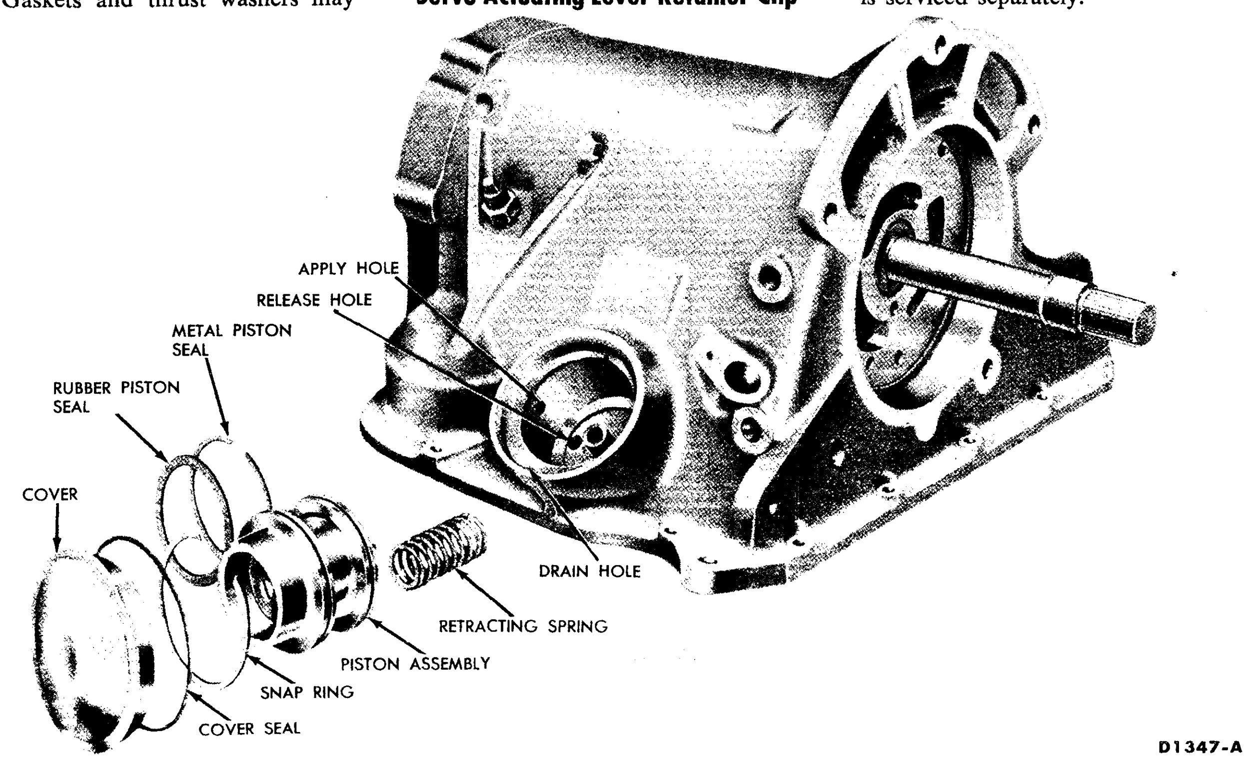

FIG. 35—Front Servo Assembly

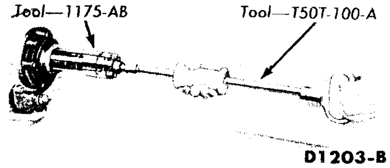

FIG. 38—Removing Front Pump Seal

8. Bolt the front pump to the transmission case with capscrews.

9. Install the oil seal remover with tool 1175AE shown in Fig. 38. Then pull the front seal from the pump body. **The front seal is ½-inch thick.**

10. Clean the pump body counterbore. Then inspect the bore for rough spots. Smooth up the counterbore with crocus cloth.

11. Remove the pump body from the transmission case.

12. Coat the outer diameter of a new seal with FoMoCo Sealing Compound, or its equivalent. Then position the seal in the pump body. Drive the seal into the pump body with the tool shown in Fig. 39 until the seal is firmly seated in the body.

13. Place the pump driven gear in the pump body with the mark on the gear facing upward. Install the drive gear in the pump body.

14. Install the stator support, attaching screws, and lock washers. Check the pump for free movement of the gears.

REAR PUMP

1. Remove the screws and lock washers which secure the pump cover

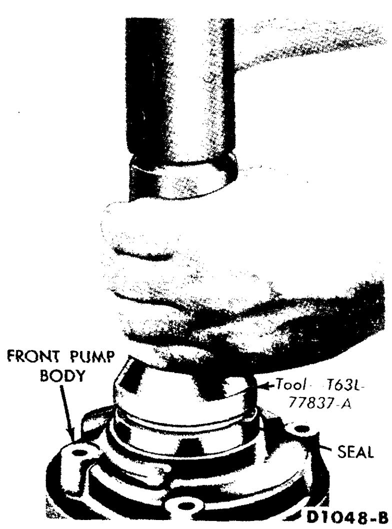

FIG. 39—Installing Front Pump Seal

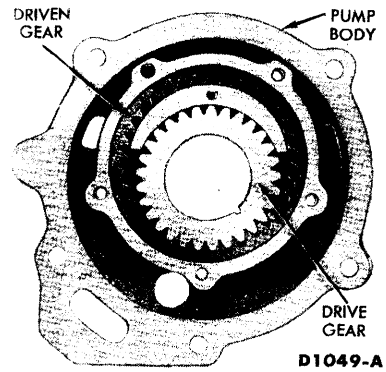

FIG. 40—Rear Pump

to the pump body, and remove the cover. Mark the top face of the pump drive and driven gear with Prussian blue to assure correct installation of the gears at assembly (Fig. 40). **Do not scratch or punch marks on the pump gears.**

2. Remove the drive and driven gears from the pump body.

3. Inspect the gear pockets and the crescent of the pump body for scores or pitting.

4. Inspect the inner bushing and the drive and driven gear bearing surfaces for scores.

5. Check all fluid passages for obstructions, and check the mating surfaces and gasket surfaces of the pump body and cover for burrs.

6. Inspect the pump cover bearing surface for scores. Minor burrs or scores may be removed with crocus cloth.

7. If any pump parts, other than the pump cover, are defective, replace the pump as a unit. The pump cover can be replaced separately.

8. Place the pump driven gear in the pump body with the mark (placed on the gear at disassembly) facing upward.

9. Install the drive gear in the pump body with the mark facing upward. Install the pump cover, attaching screws, and lock washers. Torque the screws to specification.

10. Check the pump for free movement of the gear.

PRESSURE REGULATOR

1. Remove the valves from the regulator body.

2. Remove the regulator body cover attaching screws, and remove the cover.

3. Remove the separator plate. Then remove the front pump check valve and spring from the regulator cover (Fig. 8).

4. Wash all parts thoroughly in clean solvent and blow dry with moisture-free compressed air.

5. Inspect the regulator body and cover mating surfaces for burrs.

6. Check all fluid passages for obstructions.

7. Inspect the control pressure and converter pressure valves and bores for burrs and scores. Remove all burrs carefully with crocus cloth.

8. Check the free movement of the valves in their bores. Each valve should fall freely into its bore when both the valve and bore are dry.

9. Inspect the valve springs for distortion. Remove the lubricating check ball lock ring, ball seat, ball and spring. After checking or repairing parts, assemble the parts in the reverse order of removal.

10. Position the check valve spring and valve in the regulator cover.

11. Position the separator plate on the regulator cover.

12. Position the regulator cover and separator plate on the regulator body, and install the attaching screws. Torque the screws to specification.

13. Insert the valves in the pressure regulator body.

CONTROL VALVE BODY

During the disassembly of the control valve assembly, avoid damage to valve parts and keep the valve parts clean. Place the valve assembly on a clean shop towel while performing the disassembly operation. **Do not separate the upper and lower valve bodies and cover until after the valves have been removed.**

Disassembly

1. Remove the manual valve (Fig. 41).

2. Remove the throttle valve body and the separator plate. Remove the throttle valve.

3. Remove one screw attaching the separator plate to the lower valve body. Remove the upper body front plate. **The plate is spring-loaded. Apply pressure to the plate while removing the attaching screws.**

4. Remove the compensator sleeve and plug, and remove the compensator valve springs. Remove the compensator valve.

5. Remove the throttle boost valve and spring.

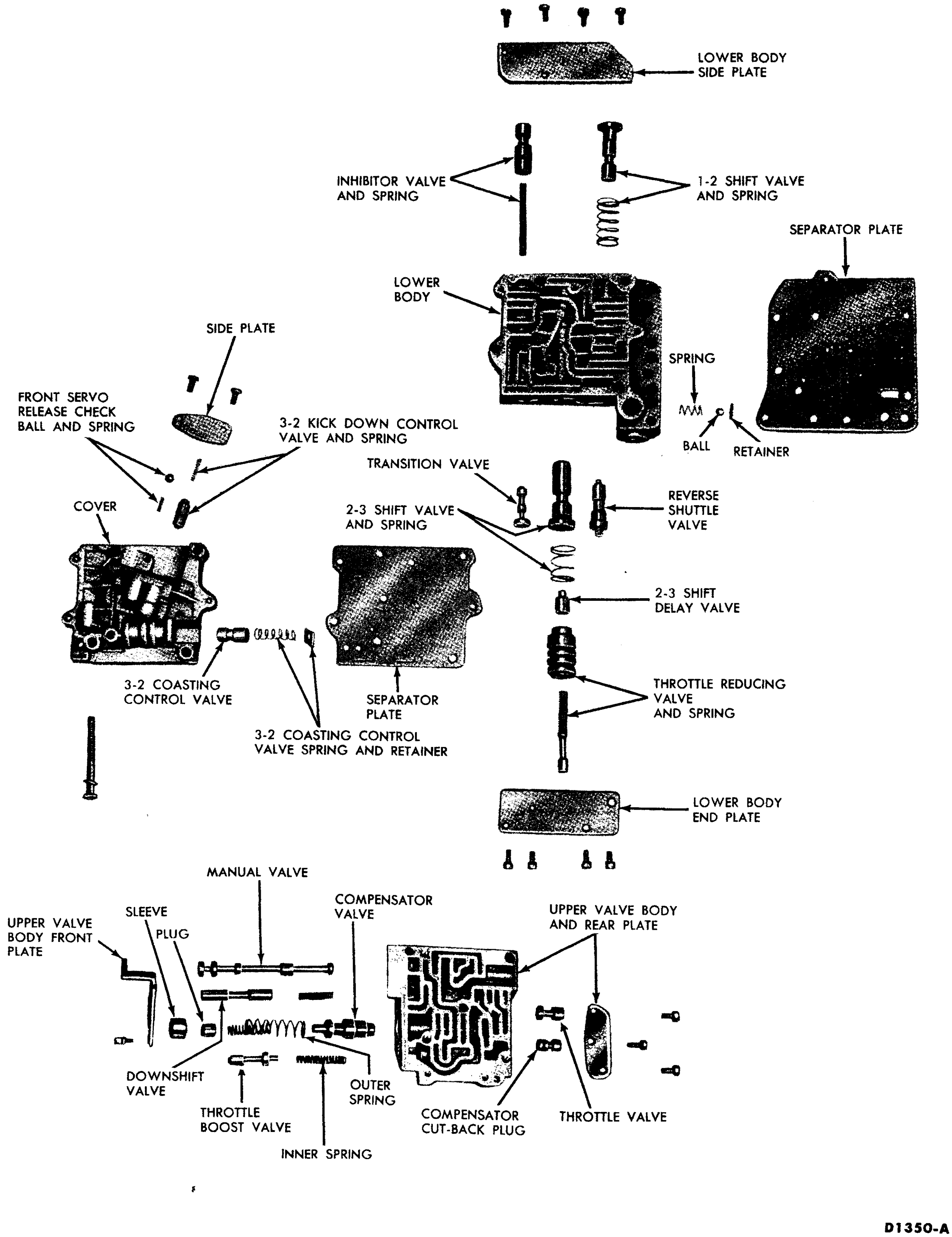

FIG. 41—Main Control Valve Body—Exploded View

6. Remove the downshift valve and spring.
7. Remove the upper valve body rear plate.
8. Remove the compensator cut-back valve.
9. Remove the lower body side plate. **The plate is spring-loaded. Apply pressure to the plate while removing the attaching screws.**
10. Remove the 1-2 shift valve and spring. Remove the inhibitor valve and spring.
11. Remove the two screws attaching the separator plate to the cover. Remove the lower body end plate. **The end plate is spring-loaded. Apply pressure to the plate while removing the attaching screws.**
12. Remove the reverse shuttle valve and spring.
13. Remove the 2-3 delay and throttle reducing valve sleeve, the throttle reducing valve, spring, and the 2-3 shift delay valve. Remove the 2-3 shift valve spring and valve.
14. Remove the transition valve.
15. Remove the plate (Fig. 41) from the valve body cover.
16. Remove the check ball spring and check ball. Remove the 3-2 kickdown control valve spring and valve.
17. Remove the 3-2 coasting control valve spring retainer from the cover. Remove the spring and valve.

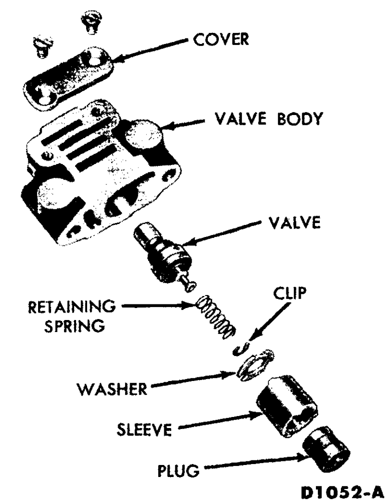

FIG. 42–Governor

18. Remove the through bolts and screws. Then separate the bodies.
19. Inspect the rear pump check valve for freedom of movement. This valve seat in the lower body is staked for a firm fit and should not be removed unless a new one is to be installed.

Assembly

1. Arrange all parts in their correct positions. Rotate the valves and plugs when inserting them in their bores to avoid shearing of soft body castings (Fig. 41).
2. Position the separator plate on the upper body.
3. Be sure that the rear pump check valve spring, valve, and seat in the lower body are correctly installed. Position the lower body on the upper body, and start **but do not tighten the attaching screw.**
4. Position the cover and separator plate on the lower body and start the four through bolts.
5. Align the separator with the upper and lower valve body attaching bolt holes. Install and torque the four valve body bolts to specification. **Excessive tightening of these bolts may distort the valve bodies, causing valves or plugs to stick.**
6. Install the 3-2 kickdown control valve and spring, and the check ball and spring in the cover. Install the plate.
7. Install the 3-2 coasting control valve, spring, and spring retainer in the cover.
8. Install the transition valve in the lower body.

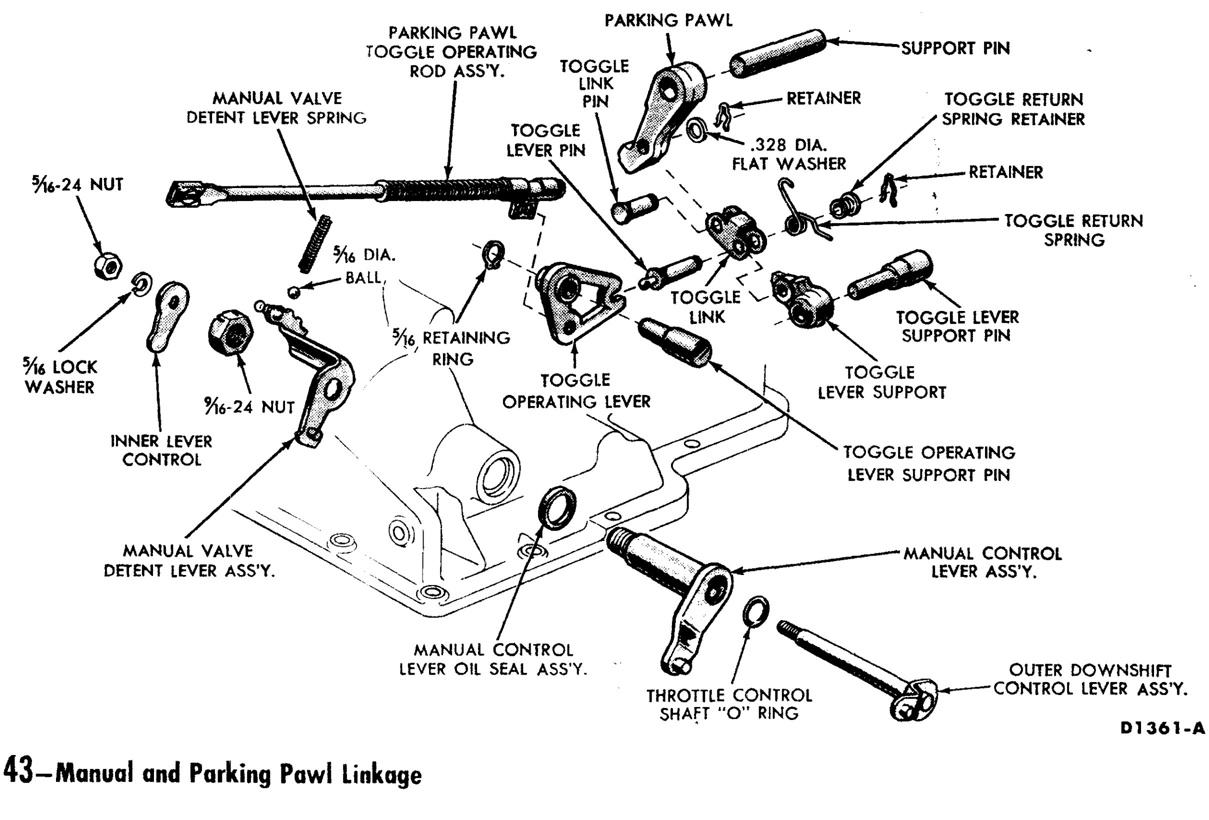

FIG. 43–Manual and Parking Pawl Linkage

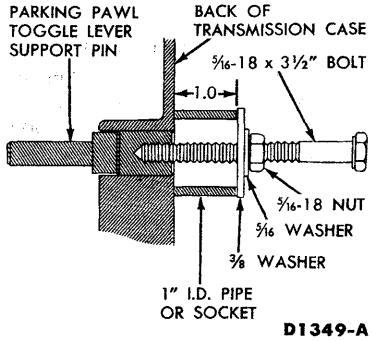

FIG. 44—Removing Parking Pawl Toggle Pin

9. Install the 2-3 shift valve and spring. Install the 2-3 shift delay valve and the spring and throttle reducing valve in the sleeve. Slide the sleeve and valve into position in the lower body.

10. Install the reverse shuttle valve and spring. Install the lower body end plate.

11. Install the inhibitor valve spring and valve in the lower body.

12. Install the 1-2 shift valve spring and valve. Install the lower body side plate.

13. Install the compensator cut-back valve in the upper body. Install the upper body rear plate.

14. Install the downshift valve spring and valve.

15. Install the throttle boost valve and spring.

16. Install the compensator valve, inner and outer compensator springs, and the compensator sleeve and plug.

17. Position the front plate. Apply pressure to the plate while installing the two attaching screws.

18. Install the throttle valve in the throttle valve body. Position the separator on the upper body and install the throttle valve body. Install the three attaching screws.

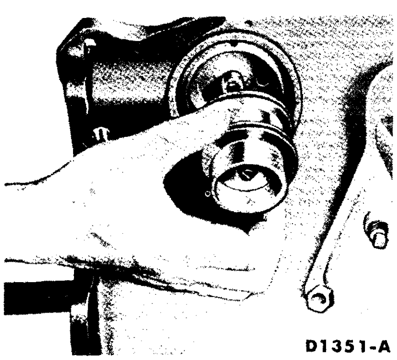

FIG. 45—Installing Front Servo Piston

19. Install four screws attaching the cover to the lower body, two screws attaching the separator plate to the upper body, and one screw attaching the separator plate to the lower body. Torque the cover and body screws to specification.

20. Install the manual valve.

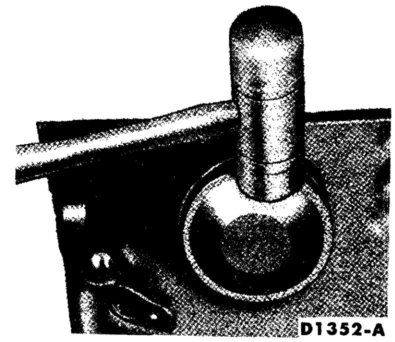

FIG. 46—Installing Front Servo Cover

GOVERNOR

1. Remove the governor valve body cover.

2. Remove the valve body from the counterweight.

3. Remove the plug, sleeve, washer, and valve from the body (Fig. 42).

4. Inspect the governor valve and bore for scores. Minor scores may be removed with crocus cloth. Replace the governor if the valve or body is deeply scored.

5. Check for free movement of the valve in the bore. Inspect fluid passages in the valve body and counterweight for obstructions. **All fluid passages must be clean.**

6. Inspect the mating surfaces of the valve body and counterweight for burrs and distortion. Mating surfaces must be smooth and flat.

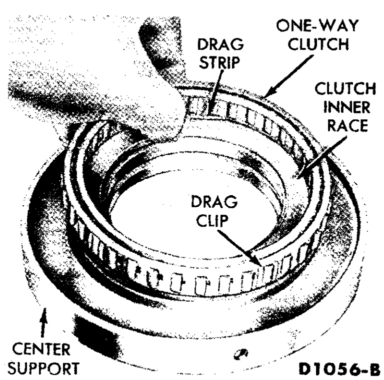

FIG. 47—One-Way Clutch Installation on Center Support

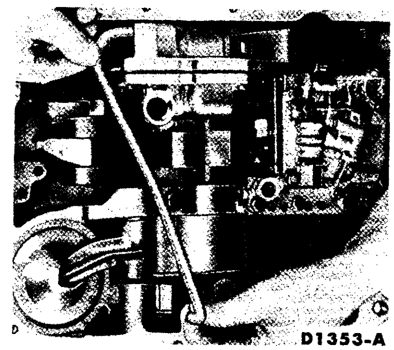

FIG. 48—Installing Lubrication Tube

7. Install the governor valve and spring assembly in the bore of the valve body. Install the washer, sleeve, and plug. Make sure the three points on the end of the sleeve seat in the slots in the washer.

8. Install the body on the counterweight. **Make sure the fluid passages in the body and the counterweight are aligned.**

9. Position the valve body cover on the body, and install the screws.

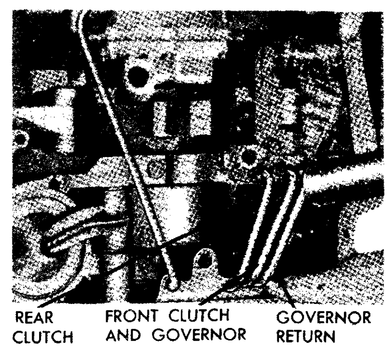

FIG. 49—Installing Rear Clutch, Front Clutch, and Governor Tubes

MANUAL AND PARKING PAWL LINKAGE

DISASSEMBLY

1. Detach the parking pawl toggle operating rod from the manual detent lever and parking pawl toggle operating lever assembly (Fig. 43).

2. Remove throttle control inner lever nut, inner lever, outer lever, manual valve detent lever nut, detent lever, ball, spring and outer lever from the case.

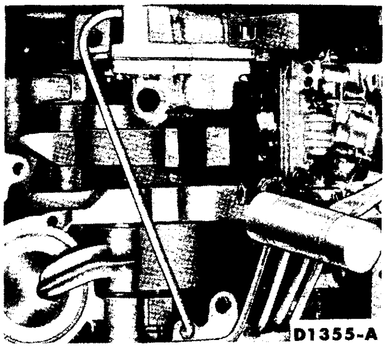

FIG. 50—Installing Rear Servo Apply and Release Tube

3. To remove the parking pawl toggle lever support pin from the back face of the case, a special tool must be adapted (Fig. 44). A piece of pipe approximately 1 inch long by 1 inch I.D., or a suitable socket can be used with a 5/16-18 x 3½ inch bolt, nut and washer as a pin pulling tool. **When the pin is replaced, make sure that it is flush with the back face of case. If the pin is pressed in too far, the parking pawl lever will bind and not release.**

4. Remove the parking pawl support pin and parking pawl assembly from the case.

5. Remove the parking pawl toggle operating lever retaining clip from the support pin; then, remove the lever. Tap out the toggle operating lever support pin using a brass drift to drive the pin into the case.

6. Remove the manual control lever oil seal from the case.

7. To assemble, reverse the above procedure.

ASSEMBLY

After all the parts have been carefully cleaned and inspected for defects, all mating surfaces should be lubricated with clean transmission fluid before they are assembled.

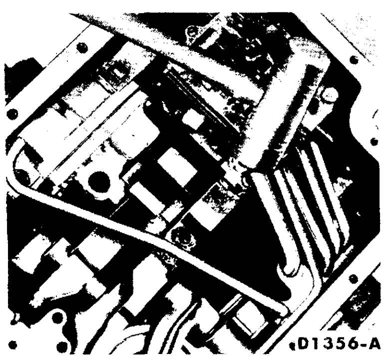

FIG 51—Installing Rear Pump Pressure Tube

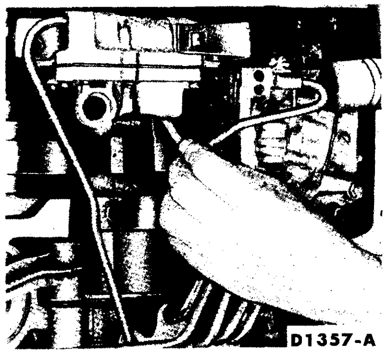

FIG. 52—Installing Compensator Tube

1. Assemble the front servo assembly into the case using new oil rings. Install the front servo release spring and piston assembly in the front servo bore in the case. Compress the front servo piston metal-type oil ring while installing the piston assembly (Fig. 45).

2. Apply pressure to the front servo retainer and install the retainer snap ring (Fig. 34).

3. Install the seal on the front servo cover and press the cover into place in its bore in the case. Do not damage the rubber seal on the cover (Fig. 46).

4. Using new oil rings, assemble the rear servo piston. Install the rear servo piston assembly in its bore in the transmission case. Position the spring on the piston and the retainer on the spring (Fig. 33).

5. Compress the rear servo piston spring retainer and install the snap ring (Fig. 32).

6. Install the front band in the case.

7. Install the rear band in the case. Expand the rear band, using the actuating lever strut as a spacer to hold the band in the expanded position.

8. Install the input shaft thrust washer in the case. Make sure that the tangs on the washer hold it in place as the gear train is assembled.

9. On the bench, assemble the planet one-way clutch, center support, and planet carrier. The one-way clutch is assembled with drag strips toward the front of the center support (Fig. 47). Check the action of the one-way clutch after the one-way clutch is installed on the center support. Position the planet carrier squarely on top of the one-way clutch. With the end of a screwdriver, position all the cams of the one-way clutch to enter the carrier, then rotate the planet carrier to install it.

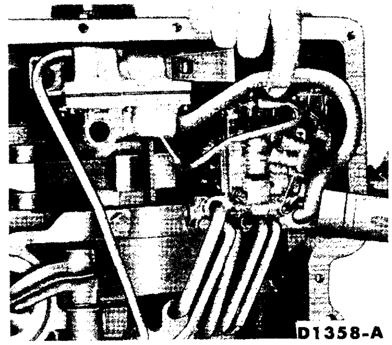

FIG. 53—Installing Main Pressure Tube

10. Assemble the planet and center support assembly to the front and rear clutch assembly. Make sure that the thrust washers between the clutch assemblies are properly positioned and the needle bearing thrust washer and race is positioned between the planet assembly and front clutch sun gear.

11. Install the two oil seal rings on the end of the sun gear shaft and the output shaft front thrust washer on the planet assembly. Now, assemble the output shaft to the gear train.

12. Install the complete gear train (clutches, center support, planet carrier and output shaft) in the case (Fig. 26). Make sure that the input shaft thrust washer tangs stay positioned in the slots in the front of the case. The center support can only be positioned one way to line up the bolt holes.

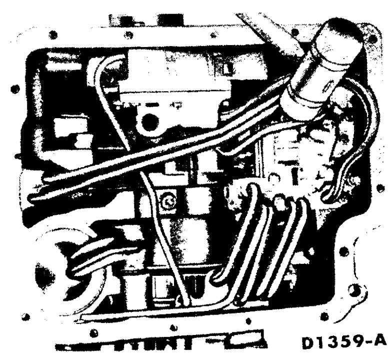

FIG. 54—Installing Front Servo Apply and Release Tubes

13. Install the center support bolts and washers. Torque the bolts to specifications.

14. Remove the spacer from the rear band. Install the rear band anchor strut and position the band on the strut. Make sure the slot in the strut and the pin in the band are in alignment.

15. Position the rear band actuating lever and strut in the case and install the rear band actuating lever shaft.

16. Install the front band actuating lever, pin and retaining clips. Insert the metal plug in the case at the lever pin hole. Install the front band actuating and anchor struts.

17. Check to see if the rear pump drive gear key is in the output shaft. Install the rear pump discharge port "O" ring in the case.

18. Position the output shaft needle bearing type thrust washer on the output shaft and the race into the front of the rear pump. Install the case to pump gasket on the pump.

19. Install the rear pump on the output shaft. The keyway of the drive gear and key on the output shaft will have to be in alignment.

20. Install the governor drive ball, governor and snap ring on the output shaft.

21. Install the spacer washer and four oil seal rings on the output shaft.

22. Install the rear pump to extension housing gasket on the rear pump.

23. Install the distributor sleeve with tubes assembled, on the output shaft, with the I.D. chamfer toward the front of the transmission.

24. Guide the distributor tubes into the transmission case as the distributor is moved forward over the oil rings and against the spacer washer.

25. Install the distributor sleeve retaining snap ring.

26. Install the extension housing and extension housing bolts and washers. Torque the bolts to specifications.

27. Install a new front pump gasket, front pump and bolts. Torque the bolts to specifications.

28. Check transmission end play (Fig. 24). (The specified end play limit is 0.010 to 0.029 inch.) If end play is not within specification, replace the selective fit output shaft thrust washer in front of the output shaft.

29. Adjust the front and rear bands. For the front band, back off the stud 3 turns after the tool overruns, using tool No. 7345 and 7345-L. Then tighten the lock nut to specifications. For the rear band, back off 1½ turns with tool No. 7195-C after the tool overruns; then, tighten the lock nut to specifications. (Refer to In-Car Adjustments and Repairs for Band Adjustment procedures.)

30. Install the pressure regulator assembly springs, spacers and retainer. Torque the bolts to specifiactions.

31. Install the main control valve assembly. Position the assembly so that maximum contact is obtained between the manual valve and detent lever when it is placed in each detent position. The manual valve should not bind in the casting as the detent lever is moved to each detent position.

32. Install the throttle control valve rod and throttle valve control diaphragm assembly.

33. Install the hydraulic pressure tubes in the following order, making sure that the tubes are set firmly in place to eliminate any hydraulic leakage. First install the lubricating tube (Fig. 48), then the rear clutch, front clutch and governor return tubes (Fig. 49). Next install the rear servo apply and release tube (Fig. 50). Then the rear pump pressure tube (Fig. 51) and compensator tube (Fig. 52). Install the main pressure tube (Fig. 53) and the front servo apply and release tubes (Fig. 54).

34. Install the seal on the front pump inlet tube on the screen and install the screen.

35. Install the oil pan gasket and oil pan. Torque the oil pan retaining bolts to specifications.

36. Remove the transmission from the holding fixture.

37. Install the converter housing gasket, housing and vent baffle. Install the one internal bolt retaining the converter to the case. Torque all bolts to specifications.

38. Install the converter in the front pump.

PART 7-3 SPECIFICATIONS

CONTROL PRESSURE RANGES

Manifold Vacuum HG (Inches)	Engine Speed RPM	Selector Position	Gauge Reading PSI
16 Minimum	Idle	D1-D2 P-R-N	57-77 57-213
16 to 13.7	As Required	D1-D2-L	Pressure Starts Rising
1.5 or Less	Stall 1550-1750	D1-D2-L R	151-176 201-213

TORQUE SPECIFICATIONS

APPLICATION	DESCRIPTION	FOOT POUNDS
Band Adjustment Stop to Case	Nut—½-20 Light Hex Jam	35-40
Case to Converter Housing	Bolt—7/16-14 x 1⅜ Hex Hd.	35-40
Converter Drain Plug	Plug—⅛-27 Dry Seal Taper Thd.	15-28
Converter Housing to Case	Bolt—7/16-14 x ⅞ Self Locking	35-45
Diaphragm Assy. to Case	Diaphragm Assy.—T.V. Control	20-30
Extension Assy. to Case	Bolt—⅜-16 x 3¼ Hex Hd.	28-38
Front Pump Assy. to Case	Bolt—5/16-18 x 2 Hex Hd.	17-22
Front Servo Rel. Piston to Pin	Screw & L/W. Assy—#10-32 x ⅜ Pan Hd.	*20-30
Governor Body to Counterweight	Screw—¼-20 1½ Fill Hd.	*50-60
Governor Cover to Body	Screw—#10-24 x ⅜ Flat Hd.	*20-30
Governor Insp. Cover to Ext.	Screw—¼-20 x ½ Fill Hd.	*50-60
Inner T.V. Lever to Shaft	Nut—5/16-24 Hex Lock	17-20
Main Control Valve Assy. Components	Screw—#10-24 x .44 Screw—#10-24 x ⅝ Screw—#10-24 x ¾ Screw—#10-24 x 7/16 Screw—#10-24 x 1.31	*20-30 *20-30 *20-30 *20-30 *20-30
Main Control Valve to Case	Bolt—¼-20 x 1⅝ Hex Hd.	8-10
Manual Control Lever to Shaft	Nut—9/16-24 Hex Lock	35-40
Oil Pan to Case	Bolt—5/16-18 x ⅝ Hex Hd.	10-13
Oil Pres. Reg. Cover to Body	Screw & L/W. Assy—#10-24 x ¾	*20-30
Planetary Support to Case	Screw—Planetary Support Locating	20-25
Pressure Gauge Tap	Plug—⅛-27 Dry Seal Taper Thd.	7-18
Pressure Regulator to Case	Screw—5/16-18 x ⅞ Hex Hd.	17-22
Rear Oil Pump Cover to Body	Screw—¼-20 x ⅝ Pan Hd. Screw—#10-24 x ⅝ Pan Hd.	*80-90 *25-35
Stator Support to Pump Body	Screw—#10-24 x ⅜ Flat Hd.	*25-35
Upper to Lower Valve Body	Bolt—¼-20 x 2½ Hex. Hd.	4-6

*Inch-Pounds.

CLUTCH PLATE APPLICATION

FRONT CLUTCH		REAR CLUTCH	
Steel Plates	Composition Plates	Steel Plates	Composition Plates
4	5	5	5

TRANSMISSION GEAR RATIOS

Gear	Selector Lever Position	Clutch Applied	Band Applied	Gear Ratio
Neutral	N	None	None	—
First	D1	Front	Rear#	2.37:1
Second	D1 or D2	Front	Front	1.48:1
Third	D1 or D2	Front and Rear	None	1.1:1
Reverse	R	Rear	Rear	1.84:1

#In first gear D1, the planet carrier is held against rotation by the one-way clutch.

STALL SPEEDS

Selector Lever Position	Clutch Applied	Band Applied	Engine RPM
D2	Front	Front	1550-1750
D1	Front	One-Way Clutch	
L	Front	Rear	
R	Rear	Rear	
Converter Stall Ratio..2.1:1			

LUBRICANT REFILL CAPACITY

Type of Lubricant	Approximate Capacity
Ford Automatic Transmission Fluid C1AZ-19582-A	12 Qts., 21 oz.

CHECKS AND ADJUSTMENTS

Operation	Specification
Transmission End Play Check	0.010-0.029 inch Selective Thrust Washers Available: 0.063-0.061 inch, 0.069-0.067 inch 0.076-0.074 inch, 0.083-0.081 inch
Turbine and Stator End Play Check	0.060 inch (maximum)
Front Band Adjustment (Use ¼-inch spacer between adjustment screw and servo piston stem)	Adjust screw to 10 ft-lbs torque, and back off three full turns
Rear Band Adjustment	Adjust screw to 10 ft-lbs torque, and back off 1½ turns; lock nut to 35-40 ft-lbs
Primary Sun Gear Shaft Ring End Gap Check	0.002-0.009 inch
Accelerator Pedal Height Adjustment	3¾ inches above floor mat
Rear Clutch Steel Plate Coning Clearance Check	0.010 inch (maximum)
Output Shaft to Fluid Distributor Seal Ring End Gap	0.001 to 0.006 inch

TRANSMISSION SHIFT POINTS (APPROXIMATE)

Automatic Shift Speeds (mph)								Manual Shift Speeds (mph)
D1		D1 or D2		D1	D1 or D2	D1	D2	L
1-2 Minimum Throttle	1-2 Maximum Throttle	2-3 Minimum Throttle	2-3 Maximum Throttle	3-1 Minimum Throttle	3-2 Maximum Throttle	2-1 Maximum Throttle	3-2 Minimum Throttle	2-1
8-11	41-50	12-25	68-81	7-9	63-75	21-33	7-12	19-28

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ENGINE

GROUP 8

PART 8-1 GENERAL ENGINE SERVICE

This part covers engine diagnosis, testing, adjustment and repair procedures. In addition, the cleaning and inspection procedures are covered.

For engine removal, disassembly, assembly, installation and major repair procedures, refer to the pertinent part of this group.

1 DIAGNOSIS AND TESTING

DIAGNOSIS

Engine performance complaints usually fall under one of the basic headings listed in the "Diagnosis Guide." When a particular trouble can not be traced to a definite cause by a simple check, the possible items that could be at fault are listed in order of their probable occurrence. Check the items in the order listed. For example, under "Poor Acceleration," the ignition system is listed as a probable cause of the trouble. All the conventional ignition system items that affect acceleration are listed. Check all these items before proceeding to the next probable cause.

For diagnosis of transistor ignition system malfunctions, refer to Group 9.

DIAGNOSIS GUIDE

ENGINE WILL NOT CRANK	The cause of this trouble is usually in the starting system (Group 14). If the starting system is not at fault, check for a hydrostatic lock or a seized engine as follows: Remove the spark plugs, then attempt to crank the engine with the starter. If the engine cranks, it indicates that water is leaking into the cylinders. Remove the cylinder head(s) and inspect the gasket(s) and/or head(s) for cracks. Examine the cylinder block for cracks. If the engine does not crank with the plugs removed, remove the oil pan and check for displaced bearing inserts or seized pistons.
ENGINE CRANKS NORMALLY, BUT WILL NOT START	Check the fuel supply. If there is sufficient fuel in the tank and the proper starting procedure is used, the cause of the trouble probably lies in either the ignition or the fuel system. To determine which system is at fault, perform the following test: Disconnect a spark plug wire. Check the spark intensity at the end of the wire by installing a terminal adapter in the terminal of the wire to

CONTINUED ON NEXT PAGE

DIAGNOSIS GUIDE (Continued)

ENGINE CRANKS NORMALLY, BUT WILL NOT START (Continued)	be checked. Then hold the adapter approximately 3/16 inch from the exhaust manifold and crank the engine. **IF THERE IS NO SPARK OR A WEAK SPARK AT THE SPARK PLUGS** The cause of the trouble is in the ignition system. To determine if the cause of the trouble is in the primary or the secondary circuit, remove the coil high tension lead from the top of the distributor, and **hold it approximately 3/16 inch from the cylinder head.** With the ignition on, crank the engine and check for a spark. If the spark at the coil high tension lead is good, the cause of the trouble is probably in the distributor cap, rotor or spark plug wires. If there is no spark or a weak spark at the coil high tension lead, the cause of the trouble is probably in the primary circuit, coil to distributor high tension lead, or the coil. **IF THERE IS A GOOD SPARK AT THE SPARK PLUGS** Check the spark plugs. If the spark plugs are not at fault, check the following items: **AUTOMATIC CHOKE** Check the position of the choke plate. If the engine is hot, the plate should be open. If the plate is not open, the engine will load up due to the excessively rich mixture and will not start. If the engine is cold, the plate should be closed. If the plate is not operating properly, check the following items: The choke plate and linkage for binding. The fast idle cam for binding. Thermostatic spring housing adjustment. **FUEL SUPPLY AT THE CARBURETOR** Work the throttle by hand several times. Each time the throttle is actuated, fuel should spurt from the accelerating pump discharge nozzle(s). If fuel is discharged by the accelerating pump, the engine is probably flooded, or there is water in the fuel system, or an engine mechanical item is at fault. If fuel is not discharged by the accelerating pump, disconnect the carburetor fuel inlet line at the carburetor. Use a suitable container to catch the fuel. Crank the engine to see if fuel is reaching the carburetor. If fuel is not reaching the carburetor, check: The fuel filter. The fuel pump. The carburetor fuel inlet line for obstructions. The fuel pump flexible inlet line for a collapsed condition. The fuel tank line for obstructions. The fuel tank vented cap. If fuel is reaching the carburetor, check: The fuel inlet system including the fuel inlet needle and seat assembly and the float assembly. Check for dirt in the carburetor which will not allow fuel to enter or be discharged from the idle system.
ENGINE STARTS, BUT FAILS TO KEEP RUNNING	**FUEL SYSTEM** Idle fuel mixture needles not properly adjusted. Engine idle speed set too low. The choke not operating properly. Float setting incorrect. Fuel inlet system not operating properly. Dirt or water in the fuel lines or in the fuel filter. Carburetor icing. Fuel pump defective. Check for dirt in the carburetor not allowing fuel to enter or be discharged from the idle system. Incorrect throttle linkage adjustment. Clogged air bleeds or idle passages. Restricted fuel tank vented cap or fuel lines. Incorrect fast (cold) idle screw adjustment. **IGNITION SYSTEM** Breaker points not properly adjusted. Defective spark plugs. Leakage in the high tension wiring. Defective ignition resistor. Open circuit in primary resistance wire.

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DIAGNOSIS GUIDE (Continued)

ENGINE RUNS, BUT MISSES

Determine if the miss is steady or erratic and at what speed the miss occurs by operating the engine at various speeds under load.

MISSES STEADILY AT ALL SPEEDS

Isolate the miss by operating the engine with one cylinder not firing. This is done by operating the engine with the ignition wire removed from one spark plug at a time, until all cylinders have been checked. **Ground the spark plug wire removed.**

If the engine speed changes when a particular cylinder is shorted out, that cylinder was delivering power before being shorted out. If no change in the engine operation is evident, the miss was caused by that cylinder not delivering power before being shorted out. In this case, check the:

IGNITION SYSTEM

If the miss is isolated in a particular cylinder, perform a spark test on the ignition lead of that cylinder.

If a good spark does not occur, the trouble is in the secondary circuit of the system. Check the spark plug wire and the distributor cap.

If a good spark occurs, check the spark plug. If the spark plug is not at fault, a mechanical component of the engine is probably at fault.

ENGINE

Perform a manifold vacuum test or a compression test to determine which mechanical component of the engine is at fault.

MISSES ERRATICALLY AT ALL SPEEDS

EXHAUST SYSTEM

Exhaust system restricted.

IGNITION SYSTEM

Breaker points not properly adjusted.

Defective breaker points, condenser, secondary wiring, coil, or spark plugs.

High tension leakage across the coil, rotor, or distributor cap.

FUEL SYSTEM

Float setting incorrect.

Fuel inlet system not operating properly.

Dirt or water in the fuel lines or carburetor.

Restricted fuel filter.

COOLING SYSTEM

Check the cooling system for internal leakage and/or for a condition that prevents the engine from reaching normal operating temperature.

ENGINE

Perform a manifold vacuum test or a compression test to determine which mechanical component of the engine is at fault.

MISSES AT IDLE ONLY

FUEL SYSTEM

Idle fuel mixture needles not properly adjusted.

IGNITION SYSTEM

Defective coil, condenser, breaker points, rotor, ignition, wiring or spark plugs.

Excessive play in the distributor shaft.

Worn distributor cam.

ENGINE

Perform a manifold vacuum test or a compression test to determine which mechanical component of the engine is at fault.

MISSES AT HIGH SPEED ONLY

FUEL SYSTEM

Low or erratic fuel pump pressure.

Fuel inlet system not operating properly.

Restricted fuel filter.

High-speed system restricted, clogged, or damaged.

Positive crankcase ventilation system restricted or valve not operating properly.

Metering rod piston stuck in down position.

COOLING SYSTEM

Engine overheating.

ENGINE

Perform a manifold vacuum test or a compression test to determine which mechanical component of the engine is at fault.

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DIAGNOSIS GUIDE (Continued)

ROUGH ENGINE IDLE	**FUEL SYSTEM** Engine idle speed set too low. Idle fuel mixture needles not properly adjusted. Float setting incorrect. Air leaks between the carburetor, spacer, and the manifold and/or fittings. Fuel leakage at the carburetor fuel bowls. Idle fuel system air bleeds or fuel passages restricted. Fuel bleeding from the accelerating pump discharge nozzles. Secondary throttle plates not closing. Improper secondary throttle plate stop adjustment. Idle compensator malfunctioning. Coolant thermostat defective. Leaking fuel pump, lines, or fittings. Carburetor hot and cold air valve malfunctioning.	**IGNITION SYSTEM** Improperly adjusted or defective breaker points. Fouled or improperly adjusted spark plugs. Incorrect ignition timing. Spark plug misfiring. **ENGINE** Loose engine mounting bolts to worn insulator. Cylinder head bolts not properly torqued. Positive crankcase ventilation regulator valve defective or a restricted tube. Worn camshaft lobes. Perform a manifold vacuum test and/or compression test to determine which mechanical component is at fault.
POOR ACCELERATION	**IGNITION SYSTEM** Incorrect ignition timing. Fouled or improperly adjusted spark plugs. Improperly adjusted or defective breaker points. Distributor not advancing properly. Broken distributor spring. **FUEL SYSTEM** Inoperative accelerating pump inlet ball check. Inoperative accelerating pump discharge ball check. Accelerating pump plunger defective. Float setting incorrect. Throttle linkage not properly adjusted. Accelerating pump stroke not properly adjusted. Defective fuel pump and/or push rod. Automatic choke malfunction. Restricted fuel tank vented cap.	Restriction in the fuel line or a leak. Incorrectly installed accelerator pump link. Leaky gaskets, or accelerating pump plunger. Dirt or corrosion in accelerating system. Distributor vacuum passages in the carburetor blocked. Restricted fuel filter. **BRAKES** Improper adjustment — too tight. **TRANSMISSION** Improper regulation of line pressure. Improper band adjustment. Converter one-way clutch. **ENGINE** Perform a manifold vacuum test and/or compression test to determine which mechanical component of the engine is at fault.
ENGINE DOES NOT DEVELOP FULL POWER, OR HAS POOR HIGH SPEED PERFORMANCE	**FUEL SYSTEM** Restricted air cleaner. Restricted fuel filter. Clogged or undersize main jets and/or low float setting. Clogged or undersize secondary jets.	Metering rod piston stuck in down position. Secondary throttle plates not opening. Fuel pump pressure and volume incorrect. Distributor vacuum passage in the carburetor blocked.

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DIAGNOSIS GUIDE (Continued)

ENGINE DOES NOT DEVELOP FULL POWER, OR HAS POOR HIGH SPEED PERFORMANCE (Continued)	**FUEL SYSTEM (Continued)** Automatic choke malfunction or improperly adjusted. **IGNITION SYSTEM** Ignition timing not properly adjusted. Defective coil, condenser, or rotor. Distributor not advancing properly. Excessive play in the distributor shaft. Distributor cam worn. Fouled or improperly adjusted spark plugs, or spark plugs of incorrect heat range. Improperly adjusted or defective breaker points. **EXHAUST SYSTEM** Restriction in exhaust system. **COOLING SYSTEM** Thermostats inoperative or incorrect heat range. Check the cooling system for internal leakage and/or for a condition that prevents the engine from reaching normal operating temperature. **ENGINE** Positive crankcase ventilation valve not operating properly. Perform a manifold vacuum test or a compression test to determine which mechanical component of the engine is at fault. One or more camshaft lobes worn beyond wear limit. **TRANSMISSION** Improper band adjustment or transmission malfunction. Perform an engine stall test.
EXCESSIVE FUEL CONSUMPTION	Determine the actual fuel consumption with test equipment installed in the car. If the test indicates that the fuel consumption is not excessive, demonstrate to the owner how improper driving habits will affect fuel consumption. If the test indicates that the fuel consumption is excessive, make a preliminary check of the following items before proceeding to the fuel and ignition systems. **PRELIMINARY CHECKS** **CHASSIS ITEMS** Check: Tires for proper pressure. Front wheel alignment. Brake adjustment. **EXHAUST SYSTEM** System restricted. **ODOMETER** Check calibration. **IGNITION SYSTEM** Check: Distributor breaker points. Ignition timing. **ENGINE** Positive crankcase ventilation regulator valve defective or restricted tubes. **FINAL CHECKS** **FUEL SYSTEM** Check: Fuel pump pressure and volume. Engine idle speed. Idle fuel mixture needles for proper adjustment. Automatic choke for proper operation. Fast idle speed screw for proper adjustment. Accelerating pump stroke adjustment. Anti-stall dashpot for proper adjustment. Air cleaner for restrictions. Float setting or fuel level. Jets for wear and/or damage. Metering rod piston operation. Air bleeds for obstructions. Accelerating pump discharge nozzles for siphoning. Accelerator linkage for binds. Choke adjustment. **IGNITION SYSTEM** Check: Spark plug condition and adjustment. Distributor spark advance operation. Ignition timing. **ENGINE** Perform a manifold vacuum test or an engine compression test to deter-

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DIAGNOSIS GUIDE (Continued)

EXCESSIVE FUEL CONSUMPTION (Continued)	**ENGINE (Continued)** mine which mechanical component of the engine is at fault. **COOLING SYSTEM** Check thermostat operation and heat range.	**TRANSMISSION** Check the band adjustment and perform a stall test.
ENGINE OVERHEATS	**TEMPERATURE SENDING UNIT AND GAUGE** Unit or gauge defective (not indicating correct temperature), or constant voltage regulator defective. **ENGINE** Cylinder head bolts not properly torqued causing coolant loss. Incorrect valve clearance. Low oil level or incorrect viscosity oil used. Perform an engine manifold vacuum test and/or compression test to determine which mechanical component of the engine is at fault. **COOLING SYSTEM** Insufficient coolant.	Cooling system leaks. Drive belt tension incorrect. Radiator fins obstructed. Thermostats defective or of incorrect heat range. Thermostats improperly installed. Cooling system passages blocked. Water pump inoperative. Faulty fan drive. **IGNITION SYSTEM** Incorrect ignition timing. **EXHAUST SYSTEM** Restrictions in system. **BRAKES** Brakes too tight.
LOSS OF COOLANT	**COOLING SYSTEM** Leaking radiator. Loose or damaged hose connections. Water pump leaking. Radiator pressure cap defective. Overheating.	**ENGINE** Cylinder head gasket defective. Intake manifold to cylinder head gasket defective. Cylinder head or intake manifold bolts not properly torqued. Cylinder block core plugs leaking. Temperature sending unit leaking. Cracked cylinder head or block, or warped cylinder head or block gasket surface.
ENGINE FAILS TO REACH NORMAL OPERATING TEMPERATURE	**TEMPERATURE SENDING UNIT AND GAUGE** Unit or gauge defective (not indicating correct temperature) or constant voltage regulator defective.	**COOLING SYSTEM** Thermostats inoperative or of incorrect heat range.
NOISY HYDRAULIC VALVE LIFTER	A noisy hydraulic valve lifter can be located by operating the engine at idle speed and placing a finger on the face of the valve spring retainer. If the lifter is not functioning properly, a shock will be felt when the valve seats. Another method of identifying a noisy lifter is by the use of a piece of hose. With the engine operating at idle speed, place one end of the hose near the end of the valve stem and the other end to the ear and listen for a metallic noise. Repeat this procedure on each intake and	exhaust valve until the noisy lifter(s) has been located. The most common causes of hydraulic valve lifter troubles are dirt, gum, varnish, carbon deposits and air bubbles. Dirt in the lifter assembly can prevent the disc valve from seating, or it may become lodged between the plunger and body surfaces. In either case, the lifter becomes inoperative due to failure to "pump-up," or because the internal parts are no longer free to function properly. When dirt is found to be respon-

CONTINUED ON NEXT PAGE

DIAGNOSIS GUIDE (Continued)

NOISY HYDRAULIC VALVE LIFTER (Continued)	sible for lifter malfunction, remove the lifter assembly and thoroughly clean it. Recommended engine oil and filter change intervals should be followed to minimize lifter problems caused by dirt (Group 19). Deposits of gum and varnish cause similar conditions to exist which may result in lifter malfunction. If these conditions are found to be present, the lifter should be disassembled and cleaned in solvent to remove all traces of deposits. Air bubbles in the lubricating oil, caused by an excessively high or low oil level, may likewise cause lifter malfunction. A damaged oil pick-up tube may allow air to be drawn into the lubricating system. Check for engine oil aeration as follows: Check the engine oil level to be sure it is within specification and correct as required. **Be sure the correct engine oil dipstick is being used.** Operate the engine at approximately 1200 rpm until normal operating temperature is reached. Stop the engine and remove the oil pressure sending unit. Install a fitting in this opening with a petcock-type valve that will permit attachment of a ¼- to ⅜-inch diameter hose of sufficient length to direct the oil discharge into the oil filler pipe. Close the valve. Start the engine and operate it at approximately 500 rpm for a minimum of five minutes; then, open the valve slightly to permit a steady discharge of oil. Check the oil flow. Increase the engine speed to approximately 1000 rpm and check for air bubbles in the oil. **To facilitate checking for air bubbles, direct the oil flow over white paper or through a piece of transparent tube. The engine should not be operated at excessive speeds or for extended periods with the oil bleed attached.** If oil aeration is evident, remove the oil pan for further test and/or inspection of the oil pump intake system. Perform corrective action as required to remove air from the lubricating oil.

TESTING

CAMSHAFT LOBE LIFT

This procedure is similar to that used for checking valve timing. Check the lift of each lobe in consecutive order and make a note of the readings.

1. Remove the valve rocker arm and shaft assemblies from the cylinder heads.

2. Install a dial indicator on the cylinder head (Fig. 1). **Make sure the push rod is in the valve lifter socket and the actuating point of the indicator is in the same plane as the push rod movement.**

3. Install an auxiliary starter switch. "Bump" the engine over until the valve lifter rests on the base circle of the cam. **At this point the push rod is in its lowest position.**

On an engine equipped with transistor ignition, refer to Group 9 for the procedure on installing an auxiliary starter switch.

4. Set the dial indicator on zero, then "bump" the crankshaft over until the push rod is in its fully raised position. **Note the total lift recorded on the indicator.** Continue to rotate the camshaft with the auxiliary starter switch until the indicator reads zero. **This is a check on the accuracy of the original indicator reading.**

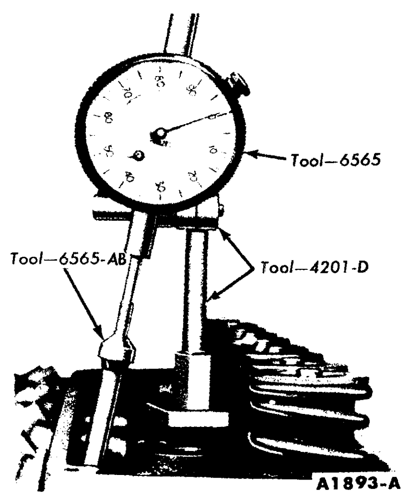

FIG. 1—Checking Camshaft Lobe Lift

5. If the camshaft reading on any lobe is below specified wear limits, the camshaft and the tappets operating on the worn lobes must be replaced.

6. If the camshaft readings for all lobes are within specifications, remove the dial indicator assembly and holding fixture.

7. Remove the auxiliary starter switch. Install the rocker arm and shaft assemblies and related parts.

MANIFOLD VACUUM TEST

A manifold vacuum test aids in determining the condition of an engine and also in helping to locate the cause of poor engine performance. To check manifold vacuum:

1. Operate the engine until normal operating temperature is reached.

2. Connect an accurate, sensitive vacuum gauge to the vacuum fitting located on the left side of the manifold below the carburetor spacer.

3. Operate the engine at the recommended idle rpm, with the transmission selector lever in neutral.

4. Check the vacuum reading on the gauge.

Test Conclusions. Manifold vacuum is affected by carburetor adjustment, valve timing, ignition timing, condition of the positive crankcase ventilation system, the condition of the valves, cylinder compression and leakage of the manifold, carburetor,

carburetor spacer, or cylinder head gaskets.

Because abnormal gauge readings may indicate that more than one of the above factors are at fault, exercise caution in analyzing an abnormal reading. For example, if the vacuum is low, the correction of one item may increase the vacuum enough to indicate that the trouble has been corrected. It is important, therefore, that each cause of an abnormal reading be investigated and further tests be conducted where necessary in order to arrive at the correct diagnosis of the trouble.

Table 1 lists various types of readings and their possible causes.

Allowance should be made for the effect of altitude on the gauge reading. The engine vacuum will decrease with an increase in altitude.

and choke plate in the wide open position.

4. Install a compression gauge in No. 1 cylinder.

5. Using an auxiliary starter switch, crank the engine a minimum of five pumping strokes and record the highest reading. **On engines equipped with transistor ignition, refer to Group 9 for the procedure on installing an auxiliary starter switch.** Note the number of compression strokes required to obtain the highest reading.

6. Repeat the test on each cylinder, cranking the engine the same number of times for each cylinder as was required to obtain the highest reading on the No. 1 cylinder.

Test Conclusions. A variation of ± 20 psi from specified pressure is satisfactory. However, the compression of all cylinders should be uniform within 10 psi.

A reading of more than the allowable tolerance above normal indicates excessive deposits in the cylinder.

A reading of more than the allowable tolerance below normal indicates leakage at the cylinder head gasket, piston rings or valves.

A low, even compression in two adjacent cylinders indicates a cylinder head gasket leak. This should be checked before condemning the rings or valves.

To determine whether the rings or the valves are at fault, squirt the equivalent of a tablespoon of heavy oil into the combustion chamber. Crank the engine to distribute the oil and repeat the compression test. The oil will temporarily seal leakage past the rings. If approximately the same reading is obtained, the rings are satisfactory, but the valves are leaking. If the compression has increased 10 pounds or more over the original reading, there is leakage past the rings.

During a compression test, if the pressure fails to climb steadily and remains the same during the first two successive strokes, but climbs higher on the succeeding strokes, or fails to climb during the entire test, it indicates a sticking valve.

TABLE 1—Manifold Vacuum Gauge Readings

Gauge Reading	Engine Condition
18 inches or over	Normal.
Low and steady.	Loss of power in all cylinders caused possibly by late ignition or valve timing, or loss of compression due to leakage around the piston rings.
Very low.	Manifold, carburetor, spacer or cylinder head gasket leak.
Needle fluctuates steadily as speed increases.	A partial or complete loss of power in one or more cylinders caused by a leaking valve, cylinder head or intake manifold gasket leak, a defect in the ignition system or a weak valve spring.
Gradual drop in reading at engine idle.	Excessive back pressure in the exhaust system.
Intermittent fluctuation.	An occasional loss of power possibly caused by a defect in the ignition system or a sticking valve.
Slow fluctuation or drifting of the needle.	Improper idle mixture adjustment or carburetor, spacer or intake manifold gasket leak.

COMPRESSION TEST

1. Be sure the crankcase oil is at the proper level.

2. Be sure the battery is properly charged. Operate the engine for a minimum of 30 minutes at 1200 rpm or until the engine is at normal operating temperature. Turn the ignition switch off, then remove all the spark plugs. Remove the coil high tension lead from the distributor cap and coil.

3. Set the primary throttle plates

HYDRAULIC VALVE LIFTER TESTS

Dirt, deposits of gum and varnish and air bubbles in the lubricating oil can cause hydraulic valve lifter failure or malfunction.

Dirt, gum and varnish can keep a check valve from seating and cause a loss of hydraulic pressure. An open valve disc will cause the plunger to force oil back into the valve lifter reservoir during the time the push rod is being lifted to force the valve from its seat.

Air bubbles in the lubricating system can be caused by too much oil in the system or too low an oil level. Air may also be drawn into the lubricating system through an opening in a damaged oil pick-up tube. **Air in the hydraulic system can cause a loss of hydraulic pressure.**

Assembled valve lifters can be tested with tool-6500-E to check the leak down rate. The leak down rate specification (for gauging purposes) is 10-100 seconds at 50 lbs. load. Plunger travel is 0.125 inch. Test the valve lifters as follows:

1. Place the valve lifter in the tester, with the plunger facing upward. Pour hydraulic tester fluid into the cup to a level that will cover the valve lifter assembly. **The fluid can be purchased from the manufacturer of the tester. Do not use kerosene, for it will not provide an accurate test.**

2. Place a 5⁄16-inch steel ball in the plunger cup (Fig. 2).

3. Adjust the length of the ram

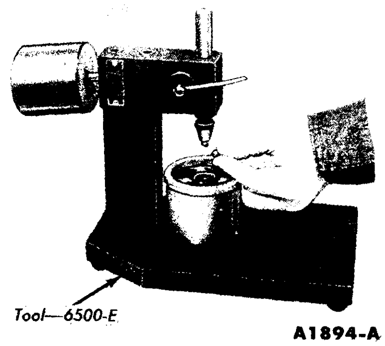

FIG. 2–Placing Steel Ball in Valve Lifter Plunger

so that the pointer is in line with the starting mark when the ram contacts the valve lifter plunger (Fig. 3).

4. Work the valve lifter plunger up and down until the lifter fills with fluid and all traces of air bubbles have disappeared (Fig. 4).

5. Allow the ram and weight to force the valve lifter plunger downward. Measure the exact time it takes

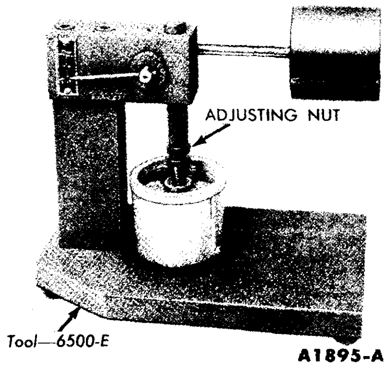

FIG. 3–Adjusting the Ram Length

for the pointer to travel from the "Start Timing" to the "Stop Timing" marks of the tester (Fig. 5).

6. A valve lifter that is satisfactory must take at least 10 seconds, but not more than 100 seconds, to leak down.

7. If the valve lifter is not within specifications, disassemble the lifter and clean and inspect it as outlined in Section 3. Assemble the lifter and test the lifter again. If it does not meet specifications, replace it with a new lifter. **Always test a new lifter before installing it in the engine.**

8. Remove the fluid from the cup and bleed the fluid from the lifter by depressing the plunger up and down (Fig. 4). **This step will aid in depressing the lifter plunger when checking the valve clearance.**

POSITIVE CRANKCASE VENTILATION SYSTEM TEST

A malfunctioning positive crankcase ventilation system may be indicated by loping or rough engine idle. Do not attempt to compensate for this idle condition by disconnecting the crankcase ventilation system and making carburetor adjustments. The removal of the crankcase ventilation system from the engine will adversely affect the fuel economy and engine ventilation with resultant shortening of engine life.

To determine whether the loping or rough idle condition is caused by a malfunctioning crankcase ventilation system, clean the ventilation system components, and install a known good regulator valve in the ventilation system.

Start the engine and compare the engine idle condition to the prior idle condition.

If the loping or rough idle condition remains when the good regulator valve is installed, the crankcase ventilation system is not at fault. Further engine component diagnosis will have to be conducted to find the malfunction.

If the idle condition is found to be satisfactory, refer to Section 3 of this Part for the cleaning procedure.

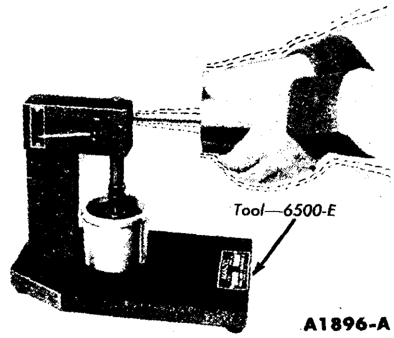

FIG. 4–Operate Plunger Until Air Bubbles Disappear

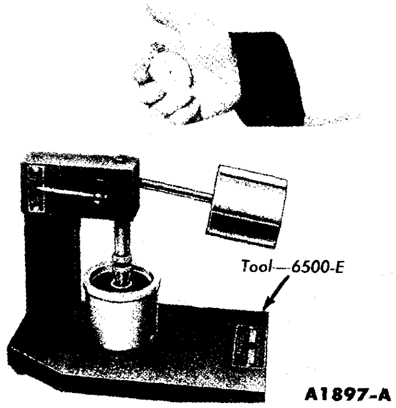

FIG. 5–Checking Leak-Down Rate

2 COMMON ADJUSTMENTS AND REPAIRS

VALVE CLEARANCE

A 0.060-inch shorter push rod (color coded white) or a 0.060-inch longer push rod (color coded yellow) are available for service to provide a means of compensating for dimensional changes in the valve mechanism. Valve stem to valve rocker arm clearance should be within specifications with the hydraulic lifter completely collapsed (refer to Part 8-3). Repeated valve reconditioning operations (valve and/or valve seat refacing) will decrease this clearance to the point that, if not compensated for, the hydraulic valve lifter will cease to function.

To determine whether a shorter or a longer push rod is necessary, make the following check:

1. Disconnect the coil high tension lead and starter relay leads, and install an auxiliary starter switch.

On engines equipped with transistor ignition, refer to Group 9 for the procedure on installing an auxiliary starter switch.

2. Position the crankshaft as outlined in steps 5 and 6.

3. Position the hydraulic lifter compressor tool on the rocker arm and slowly apply pressure to bleed down the hydraulic lifter until the plunger is completely bottomed (Fig. 6). Hold the lifter in the fully collapsed position, and check the clearance between the valve stem and the rocker arm of the valve being checked.

4. Check the clearance with 0.078 and 0.218-inch feeler gauges.

If the 0.078-inch feeler gauge enters, a standard length push rod may be used.

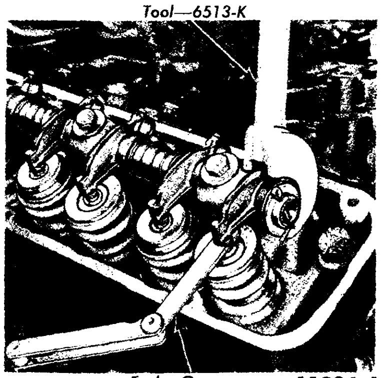

FIG. 6–Checking Valve Clearance

If the 0.078-inch gauge does not enter, replace the standard push rod with a 0.060-inch shorter service push rod.

If the 0.218-inch feeler gauge enters, the operating range of the lifter is excessive. This indicates that the incorrect push rod has been installed or severe wear has occurred at the push rod ends, rocker arm, or valve stem. In this case, it will be necessary to determine the area of discrepancy and the incorrect or defective part(s) should be replaced.

If all the valve train components except the push rod are within limits, install a 0.060-inch longer push rod.

5. Rotate the crankshaft until No. 1 piston is on TDC at the end of the compression stroke. With No. 1 piston on TDC, check the following valves:

No. 1 Intake	No. 1 Exhaust
No. 3 Intake	No. 4 Exhaust
No. 7 Intake	No. 5 Exhaust
No. 8 Intake	No. 8 Exhaust

6. Position No. 6 piston on TDC and check the following valves:

No. 2 Intake	No. 2 Exhaust
No. 4 Intake	No. 3 Exhaust
No. 5 Intake	No. 6 Exhaust
No. 6 Intake	No. 7 Exhaust

When compressing the valve spring to remove push rods, be sure the piston in the individual cylinder is below TDC to avoid contact between the valve and the piston.

To replace a push rod, it will be necessary to remove the valve rocker arm shaft assembly, following the procedures in Part 2, Section 2.

Upon replacement of a valve push rod and/or valve rocker arm shaft assembly, the engine should not be cranked or rotated until the hydraulic lifters have had an opportunity to leak down to their normal operating position. The leak down rate can be accelerated by using the tool shown in Fig. 6 on the valve rocker arm and applying pressure in a direction to collapse the lifter.

VALVE ROCKER ARM SHAFT ASSEMBLY

Dress up minor surface defects on the rocker arm shaft and in the rocker arm bore with a hone.

If the pad at the valve end of the rocker arm has a grooved radius, replace the rocker arm. **Do not attempt to true this surface by grinding.**

PUSH RODS

Following the procedures in Part 8-1, Section 3, under "Push Rod Inspection," check the push rods for straightness.

If the runout exceeds the maximum limit at any point, discard the rod. **Do not attempt to straighten push rods.**

CYLINDER HEADS

Replace the head if it is cracked. **Do not plane or grind more than 0.010 inch from the cylinder head gasket surface.** Remove all burrs or scratches with an oil stone.

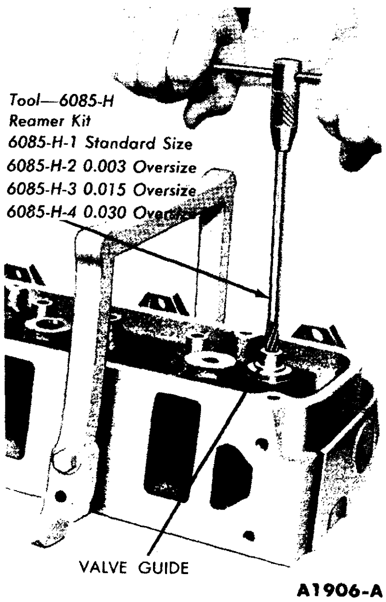

FIG. 7–Reaming Valve Guides

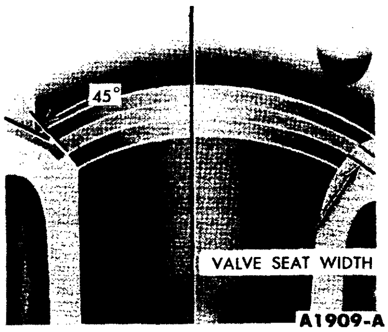

FIG. 8–Valve Seat Refacing

REAMING VALVE GUIDES

If it becomes necessary to ream a valve guide (Fig. 7) to install a valve with an oversize stem, a reaming kit is available which contains the following reamer and pilot combinations: a 0.003-inch O.S. reamer with a standard diameter pilot, a 0.015-inch O.S. reamer with a 0.003-inch O.S. pilot, and a 0.030-inch reamer with a 0.015-inch O.S. pilot.

When going from a standard size valve to an oversize valve, always use the reamers in sequence. **Always reface the valve seat after the valve guide has been reamed.**

REFACING VALVE SEATS

Refacing of the valve seats should be closely coordinated with the refacing of the valve face so that the finished seat will match the valve face and be centered. This is important so that the valve and seat will have a good compression-tight fit. Be sure that the refacer grinding wheels are properly dressed.

Grind the valve seats to a true 45° angle (Fig. 8). Remove only enough stock to clean up pits, grooves, or to correct the valve seat runout. After the seat has been refaced, measure the seat width (Fig. 8). Narrow the seat, if necessary, to bring it within limits.

If the valve seat width exceeds the maximum limit, remove enough stock from the top edge and/or bottom edge of the seat to reduce the width to specifications (Fig. 8).

On the valve seats, use a 60° angle grinding wheel to remove stock from the bottom of the seats (raise the seats) and use a 30° angle wheel to remove stock from the top of the seats (lower the seats).

The finished valve seat should contact the approximate center of the valve face. It is good practice to determine where the valve seat contacts the face. To do this, coat the seat with Prussian blue, then set the valve in place. Rotate the valve with light pressure. If the blue is transferred to the center of the valve face, the contact is satisfactory. If the blue is transferred to the top edge of the valve face, lower the valve seat. If the blue is transferred to the bottom edge of the valve face, raise the valve seat.

VALVES

Valve defects, such as minor pits, grooves, etc., may be removed by refacing the valves. Discard valves that are severely damaged, or if the face runout or stem clearance exceed specifications.

Discard any defective part of the valve assembly.

REFACING VALVES

The valve refacing operation should be closely coordinated with the valve seat refacing operation so that the finished angles of the valve face and of the valve seat will provide a compression-tight fit. Be sure that the refacer grinding wheels are properly dressed.

If the valve face runout is excessive and/or to remove pits and grooves, reface the valves to a true 44° angle. Remove only enough stock to correct the runout or to clean up the pits and grooves. If the edge of the valve head is less than 1/32 inch after grinding, replace the valve as the valve will run too hot in the engine. **The interference fit of the valve and seat should not be lapped out.**

Remove all grooves or score marks from the end of the valve stem, then chamfer as necessary. Do not remove more than 0.010 inch from the stem.

If the valve and/or valve seat has been refaced, it will be necessary to check the clearance between the rocker arm pad and the valve stem with the valve train assembly installed in the engine.

SELECT FITTING VALVES

If the valve stem to valve guide clearance exceeds the wear limit, ream the valve guide for the next oversize valve stem. Valves with oversize stem diameters of 0.003, 0.015, and 0.030 inch are available for service. **Always reface the valve seat after the valve guide has been reamed.** Refer to "Reaming Valves Guides."

CAMSHAFT

Remove light scuffs, scores, or nicks from the camshaft machined surfaces with a smooth oil stone.

CRANKSHAFT

Dress minor imperfections with an oil stone. Reface severely marred journals.

If the journals exceed the wear limit, they should be refinished to size for the next undersize bearing.

REFINISHING JOURNALS

Refinish the journal to give the proper clearance with the next undersize bearing. If the journal will not "clean up" to give the proper clearance with the maximum undersize bearing available, replace the crankshaft.

Always reproduce the same journal shoulder radius that existed originally. Too small a radius will result in fatigue failure of the crankshaft. Too large a radius will result in bearing failure due to radius ride of the bearing.

After refinishing the journals, chamfer the oil holes, then polish the journal with a No. 320 grit polishing cloth and engine oil. Crocus cloth may be used also as a polishing agent.

PISTONS, PINS AND RINGS

FITTING PISTONS

Pistons are available for service in standard sizes and 0.020 and 0.030 inch oversizes. The standard size pistons are color coded on the dome as follows: red, 4.2977-4.2983 inch; blue, 4.2989-4.2995 inch.

If the piston clearance is greater than the maximum limit, recheck calculations to be sure that the proper size piston has been selected, check for a damaged piston, then try a new piston.

If the clearance is less than the minimum limit, recheck calculations before trying another piston. If none can be fitted, refinish the cylinder for the size piston available.

When a piston has been fitted, mark it for assembly in the cylinder to which it was fitted.

If the taper and out-of-round conditions of the cylinder bore are within limits, new piston rings will give satisfactory service provided the piston clearance in the cylinder bore is within limits. If the new rings are to be installed in a used cylinder that has not been refinished, remove the cylinder wall "glaze."

To fit a piston:

1. Calculate the size piston to be used by taking a cylinder bore check (Fig. 23).
2. Select the proper size piston to provide the desired clearance (Fig. 9).
3. Make sure the piston and cylinder block are at room temprature (70°F). **After any refinishing operation, allow the cylinder bore to cool and make sure the piston and bore are clean and dry before the piston fit is checked.**
4. Attach a tension scale to the end of a feeler gauge ribbon that is free of dents or burrs. The feeler ribbon should be ½-inch wide and of one of the thicknesses listed in Fig. 9.
5. Position the ribbon in the cylinder bore so that it extends the entire length of the piston at 90° from the piston pin location.
6. Invert the piston and install it in the bore so that the end of the piston is about 1½ inches below the top of the cylinder block and the piston pin is parallel to the crankshaft axis.
7. Hold the piston and slowly pull the scale in a straight line with the ribbon, noting the pull required to remove the feeler ribbon (Fig. 10).

Compare the required pull with Fig. 9 to determine the piston clearance.

FITTING PISTON RINGS

1. Select the proper ring set for the size piston to be used.
2. Position the ring in the cylinder bore in which it is going to be used.
3. Push the ring down into the bore area where normal ring wear is not encountered.
4. Use the head of a piston to position the ring in the bore so that the ring is square with the cylinder wall. **Use caution to avoid damage to the ring or cylinder bore.**

PISTON CLEARANCE							
RIBBON 0.0015 THICK & 0.500 WIDE		RIBBON 0.002 THICK & 0.500 WIDE		RIBBON 0.0035 THICK & 0.500 WIDE		RIBBON 0.006 THICK & 0.500 WIDE	
Ribbon Pull Lbs.	Clear-ance Inches	Ribbon Pull Lbs.	Clear-ance Inches	Ribbon Pull Lbs.	Clear-ance Inches	Ribbon Pull Lbs.	Clear-ance Inches
13	—	13	—	13	0.0012	13	0.0038
12	—	12	—	12	0.0014	12	0.0040
11	—	11	—	11	0.0016	11	0.0041
10	—	10	—	10	0.0018	10	0.0043
9	—	9	0.0002	9	0.0021	9	0.0045
8	—	8	0.0005	8	0.0023	8	0.0047
7	0.0002	7	0.0007	7	0.0025	7	0.0049
6	0.0004	6	0.0010	6	0.0027	6	0.0050
5	0.0007	5	0.0012	5	0.0030	5	0.0057
4	0.0009	4	0.0015	4	0.0032	4	0.0059
3	0.0012	3	0.0017	3	0.0033	3	0.0060
2	0.0015	2	0.0020	2	0.0036	2	0.0062
1	0.0017	1	0.0022	1	0.0038	1	0.0063
0	0.0020	0	0.0025	0	0.0040	0	0.0065

A1930-A

FIG. 9—Piston Clearance Chart

5. Measure the gap between the ends of the ring with a feeler gauge (Fig. 11). If the ring gap is less than the recommended lower limit, try another ring or set.

6. Check the ring side clearance of the compression rings with a feeler gauge inserted between the ring and its lower land (Fig. 12). The gauge should slide freely around the entire ring circumference without binding. Any wear that occurs will form a step at the inner portion of the lower land. **If the lower lands have high steps, the piston should be replaced.**

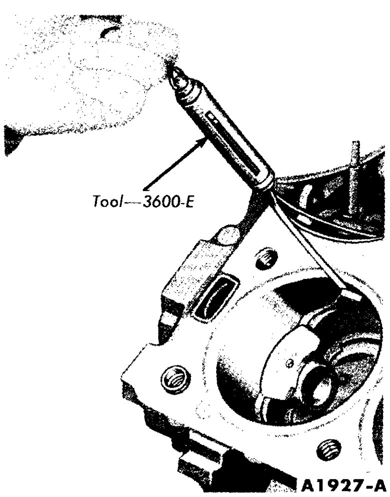

FIG. 10—Checking Piston Clearance

FITTING PISTON PINS

The piston pin to piston fit must be checked during assembly of the piston to the connecting rod.

CYLINDER BLOCK

REFINISHING CYLINDER WALLS

Honing is recommended for refinishing cylinder walls only when the walls have minor imperfections, such as light scuffs, scratches, etc. The grade of hone to be used is determined by the amount of metal to be removed. Follow the instructions of the hone manufacturer. If coarse stones are used to start the honing operation, leave enough material so that all hone marks can be removed with the finishing hone which is used to obtain the proper piston clearance.

Cylinder walls that are severely marred and/or worn beyond the specified limits should be refinished. Before any cylinder is refinished, all main bearing caps must be in place and tightened to the proper torque so that the crankshaft bearing bores will not become distorted from the refinishing operation.

Refinish only the cylinder or cylinders that require it. **All pistons are the same weight, both standard and oversize; therefore, various sizes of pistons can be used without upsetting engine balance.**

Refinish the cylinder with the most wear first to determine the maximum oversize. If the cylinder will not clean up when refinished for the maximum oversize piston recommended, replace the block.

Refinish the cylinder to within approximately 0.0015 inch of the required oversize diameter. This will allow enough stock for the final step of honing so that the correct surface finish and pattern are obtained. Use clean sharp hones of No. 220-280 grit for this operation.

For the proper use of the refinishing equipment, follow the instructions of the manufacturer. Only experienced personnel should be allowed to perform this work.

After the final operation in either of the two refinishing methods described and prior to checking the piston fit, thoroughly wash the cylinder walls with solvent to remove all abrasive particles, then thoroughly dry the walls. Check the piston fit. Mark the pistons to correspond to

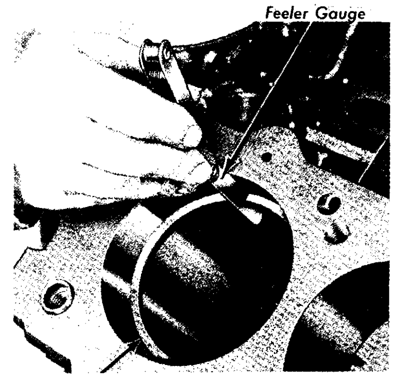

FIG. 11—Piston Ring Gap

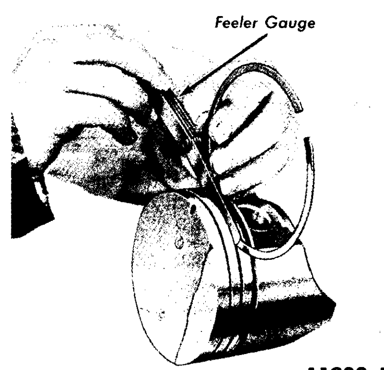

FIG. 12—Ring Side Clearance

the cylinders in which they are to be installed. When the refinishing of all cylinders that require it has been completed and all pistons fitted, thoroughly clean the entire block to remove all particles from the bearing bores, oil passages, cylinder head bolt holes, etc. Coat the cylinder walls with oil.

3 CLEANING AND INSPECTION

INTAKE MANIFOLD

CLEANING

Remove all gasket material from the machined surfaces of the manifold. Clean the manifold in a suitable solvent, and dry it with compressed air.

INSPECTION

Inspect the manifold for blocked or restricted passages, cracks, sand holes, improperly machined or damaged surfaces, or breakage. Replace the studs if they are stripped. Replace the manifold if it is damaged beyond repair.

Remove all filings and foreign matter that may have entered the manifold as a result of repairs.

EXHAUST MANIFOLDS

CLEANING

Remove all gasket material from the manifolds.

On the right exhaust manifold, clean the automatic choke heat chamber (stove). Make sure the air inlet passage is completely open and the cover does not leak. Blow out the automatic choke air heat tube and air inlet tube with compressed air.

INSPECTION

Inspect the manifold for sand holes, cracks, restricted passages and improperly machined surfaces. Replace stripped or broken bolts and studs.

VALVE ROCKER ARM SHAFT ASSEMBLY

CLEANING

Clean all the parts thoroughly. Make sure all oil passages are open. If necessary, remove the plugs from both ends of the rocker arm shaft to thoroughly clean the shaft passages.

INSPECTION

Check the clearance between each rocker arm and the shaft by checking the ID of the rocker arm bore and the OD of the shaft. If the clearance between any rocker arm and the shaft exceeds the wear limit, replace the shaft and/or the rocker arm. Inspect the shaft and the rocker arm bore for nicks, scratches, scores, or scuffs.

Inspect the pad at the valve end of the rocker arms for indications of scuffing or abnormal wear. If the pad is grooved, replace the rocker arm. **Do not attempt to true this surface by grinding.**

Check for broken locating springs.

PUSH RODS

INSPECTION

Check the ends of the push rods for nicks, grooves, roughness, or excessive wear.

The push rods can be visually checked for straightness while they are installed in the engine by rotating them with the valve closed. They also can be checked with a dial indicator (Fig. 13).

CYLINDER HEADS

CLEANING

With the valves installed to protect the valve seats, remove deposits from the combustion chambers and valve heads with a scraper and a wire brush. **Be careful not to damage the cylinder head gasket surface.** After the valves are removed, clean the valve guide bores with valve guide cleaning tool 6085-HI. Use cleaning solvent to remove dirt, grease, and other deposits.

Remove all deposits from the valves with a fine wire brush or buffing wheel.

INSPECTION

Check all water passages to make certain they are open. Examine the cylinder head for water leaks or cracks in the exhaust or inlet ports, or around the valve seats. Check the cylinder head gasket surfaces for burrs and nicks. Replace the head if it is cracked.

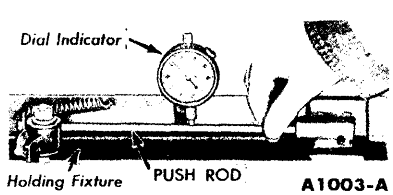

FIG. 13—Push Rod Runout

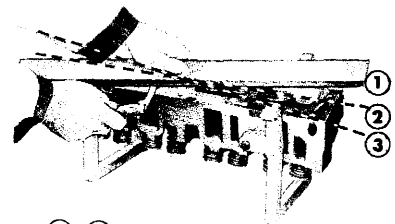

FIG. 14—Cylinder Head Flatness

Cylinder Head Flatness. Check the flatness of the cylinder head gasket surface (Fig. 14).

Valve Seat Runout. Check the valve seat runout with an accurate gauge (Fig. 15). Follow the instructions of the gauge manufacturer. If the runout exceeds the wear limit, reface the valve and valve seat.

Valve Seat Width. Measure the valve seat width with a valve seat scale. Reface the valve seats if the width is not within specifications.

Valve. The critical inspection points and tolerances of the valves are illustrated in Fig. 16.

Inspect the valve face and the edge of the valve head for pits, grooves, scores, or other defects. Inspect the stem for a bent condition and the end of the stem for grooves or scores. Check the valve head for signs of burning, erosion, warpage and cracking. Defects, such as minor pits, grooves, etc., may be removed. Discard valves that are severely damaged.

Inspect the valve springs, valve spring retainers, locks and sleeves for defects. Discard any visually defective parts.

Valve Face Runout. The valve face runout should not exceed the wear limit specified in Part 8-3. If the runout exceeds the wear limit, the valve should be replaced or refaced as outlined under "Refacing Valves" in this section.

Valve Stem Clearance. Check the valve stem to valve guide clearance of each valve in its respective valve guide with the tool shown in Fig. 17 or its equivalent.

Install tool 6505-F on the valve

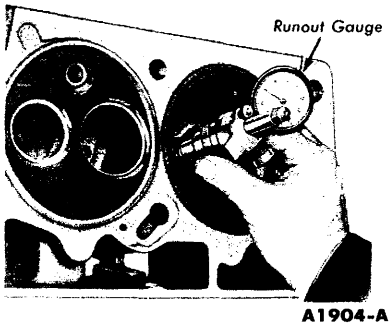

FIG. 15—Valve Seat Runout

stem until it is fully seated and tighten the knurled set screw firmly. Permit the valve to drop away from its seat until the tool contacts the upper surface of the valve guide.

Position the dial indicator with its flat tip against the center portion of the tool's spherical section at approximately 90° to the valve stem. In order to find actual valve stem clearance the tool should be moved back and forth at a right angle. Take a reading on the dial indicator without removing the tool from the valve guide upper surface. Divide the reading by two, the division factor for the tool.

Valve Spring Pressure. Check the pressure of each valve spring with tool 6513-DD (LM-106) as shown in Fig. 18. Set the knob on the calibrated screw to the compressed length of the valve spring. Pull the torque wrench until a click is heard. Multiply the reading on the torque wrench by two. The answer obtained is the pressure exerted by the springs. If the spring is not within specifica-

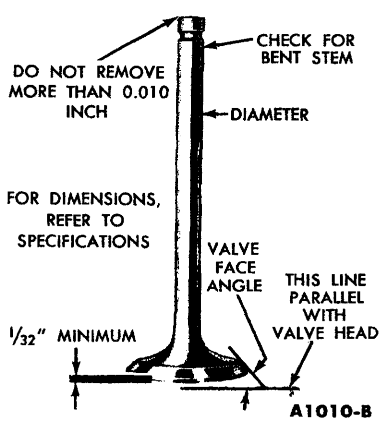

FIG. 16—Critical Valve Tolerances

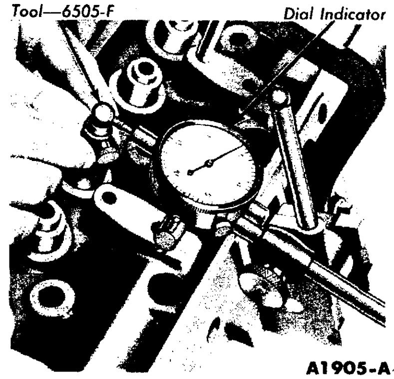

FIG. 17—Valve Stem Clearance

tions, it is recommended that the spring be replaced.

Valve Spring Squareness. Examine the valve springs. Discard any that show rust, pit marks, and a cracked or broken condition. Check each spring for squareness, using a steel square and a surface plate (Fig. 19). Stand the spring and square on end on the surface plate. Slide the spring up to the square. Revolve the spring slowly and observe the space between the top coil of the spring and the square. If the spring is out of square more than $3/64$ inch, replace it.

HYDRAULIC VALVE LIFTERS

The lifter assemblies should be kept in proper sequence so that they can be installed in their original position. Inspect and test each lifter separately so as not to intermix the internal parts. **If any part of the lifter assembly needs replacing, replace the entire assembly.**

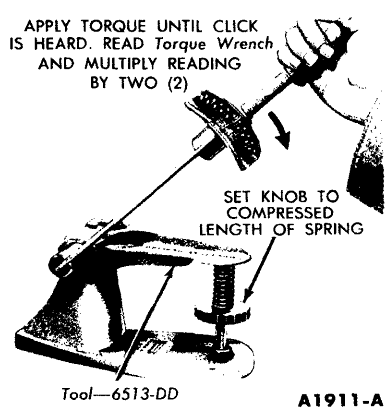

FIG. 18—Checking Valve Spring Tension

CLEANING

Thoroughly clean all the parts in clean solvent and wipe them with a clean, lint-free cloth.

INSPECTION

Inspect the parts and discard the entire lifter assembly if any part shows signs of pitting, scoring, galling, or evidence of non-rotation. Replace the entire assembly if the plunger is not free in the body. The plunger should drop to the bottom of the body by its own weight.

Assemble the lifter assembly and check for freeness of operation by pressing down on the push rod cup. The lifters can also be checked with a hydraulic tester to test the leak down rate. Follow the instructions of the test unit manufacturer or the procedures in Part 8-1, Section 1.

TIMING CHAIN AND SPROCKETS

CLEANING AND INSPECTION

Clean all parts in solvent and dry them with compressed air. Inspect the chain for broken links and the sprockets for cracks, and worn or damaged teeth. Replace all the components of the timing chain and sprocket assembly if any one item needs replacement.

CAMSHAFT

CLEANING AND INSPECTION

Clean the camshaft in solvent and wipe dry. Inspect the camshaft lobes for scoring and signs of abnormal wear. Lobe wear characteristics may result in pitting in the general area of the lobe toe. This pitting is not detrimental to the operation of the cam-

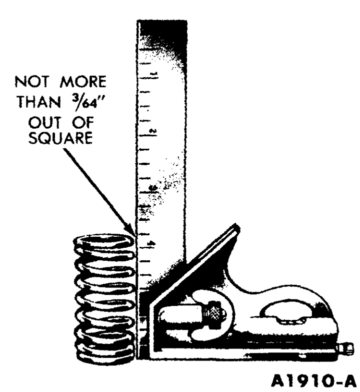

FIG. 19—Checking Valve Spring Squareness

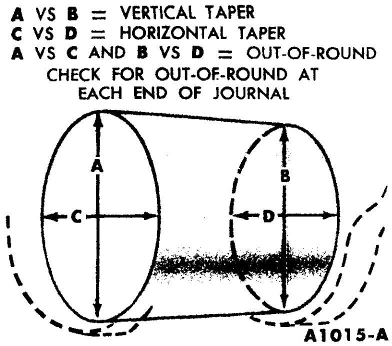

FIG. 20–Crankshaft Journal Measurements

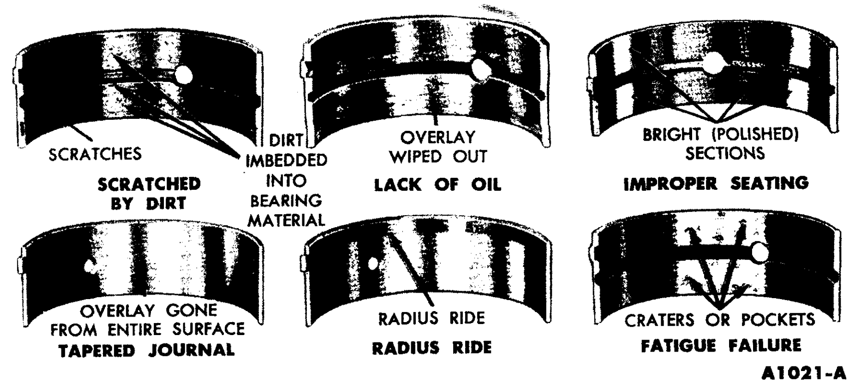

FIG. 22–Typical Bearing Failures

shaft, therefore, the camshaft should not be replaced until the lobe lift loss has exceeded 0.005 inch.

The lift of camshaft lobes can be checked with the camshaft installed in the engine or on centers. Refer to "Camshaft Lobe Lift."

Check the distributor drive gear for broken or chipped teeth.

CRANKSHAFT

CLEANING

Handle the crankshaft with care to avoid possible fractures or damage to the finished surfaces. Clean the crankshaft with solvent, then blow out all oil passages with compressed air.

INSPECTION

Inspect main and connecting rod journals for cracks, scratches, grooves, or scores.

Measure the diameter of each journal in at least four places to determine out-of-round, taper, or undersize condition (Fig. 20).

CONNECTING RODS

CLEANING

Remove the bearings from the rod and cap. Identify the bearings if they are to be used again. Clean the connecting rod in solvent, including the rod bore and the back of the inserts. **Do not use a caustic cleaning solution.** Blow out all passages with compressed air.

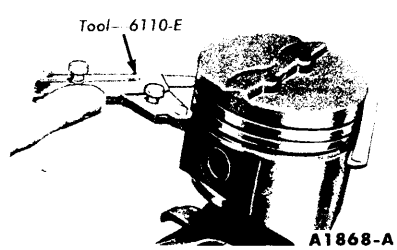

FIG. 21–Cleaning Ring Grooves

INSPECTION

The connecting rods and related parts should be carefully inspected and checked for conformance to specifications. Various forms of engine wear caused by these parts can be readily identified.

A shiny surface on the pin boss side of the piston usually indicates that a connecting rod is bent or the piston pin hole is not in proper relation to the piston skirt and ring grooves.

Abnormal connecting rod bearing wear can be caused by either a bent connecting rod, an improperly machined crankpin, or a tapered connecting rod bore.

Twisted connecting rods will not create an easily identifiable wear pattern, but badly twisted rods will disturb the action of the entire piston, rings, and connecing rod assembly and may be the cause of excessive oil consumption.

Inspect the connecting rods for signs of fractures and the bearing bores for out-of-round and taper. If the bore exceeds the recommended limits and/or if the connecting rod is fractured, it should be replaced.

Check the piston pin to connecting rod bushing clearance. Replace the connecting rod if the bushing is so worn that it can not be reamed or honed for an oversize pin.

Replace defective connecting rod nuts and bolts.

After the connecting rods are assembled to the piston, check the connecting rods for bend or twist on a suitable alignment fixture. Follow the instructions of the fixture manufacturer. If the bend and/or twist is excessive, the connecting rod should be straightened or replaced.

PISTONS, PINS AND RINGS

CLEANING

Remove deposits from the piston surfaces. Clean gum or varnish from the piston skirt, piston pins, and rings with solvent. **Do not use a caustic cleaning solution or a wire brush to clean pistons.** Clean the ring grooves with a ring groove cleaner (Fig. 21). Make sure the oil ring slots (or holes) are clean.

INSPECTION

Carefully inspect the pistons for fractures at the ring lands, skirts, and pin bosses, and for scuffed, rough, or scored skirts. If the lower inner portions of the ring grooves have high steps, replace the piston. The step will interfere with ring operation and cause excessive ring side clearance.

Spongy, eroded areas near the edge of the top of the piston are usually caused by detonation, or pre-ignition. A shiny surface on the thrust surface of the piston, offset from the centerline between the piston pin holes, can be caused by a bent connecting rod. Replace pistons that show signs of excessive wear, wavy ring lands, fractures, and/or damage from detonation or pre-ignition.

Check the piston to cylinder bore clearance with a tension scale and ribbon, following the procedure under "Fitting Pistons." Check the ring side clearance following the procedure under "Fitting Piston Rings" in Section 2.

If piston pins show signs of fracture or etching and/or wear, replace both the piston and pin assembly. Check the piston pin fit in the piston and rod during assembly of the rod, piston and pin.

Replace all rings that are scored, chipped, or cracked. Check the end gap and side clearance. It is good practice to always install new rings when overhauling the engine. **Rings should not be transferred from one piston to another regardless of mileage.**

MAIN AND CONNECTING ROD BEARINGS

CLEANING

Clean the bearing inserts and caps thoroughly in solvent, and dry with compressed air. **Do not scrape gum or varnish deposits from bearing shells.**

INSPECTION

Inspect each bearing carefully. Bearings that have a scored, chipped, or worn surface should be replaced. Typical examples of bearing failures and their causes are shown in Fig. 22. The copper lead bearing base may be visible through the bearing overlay. This does not mean that the bearing is worn. Do not replace the bearing if the bearing clearance is within recommended limits. Check the clearance of bearings that appear to be satisfactory with Plastigage. Fit new bearings following the recommended procedure (Part 8-2).

CYLINDER BLOCK

CLEANING

Thoroughly clean the block in solvent. Remove old gasket material

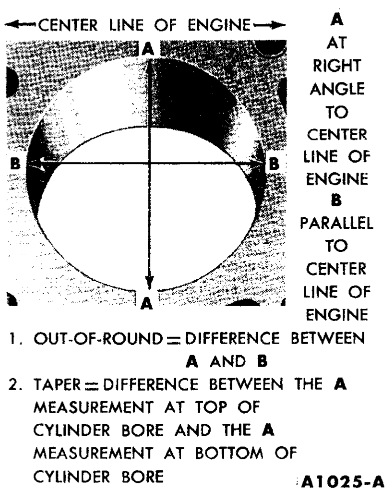

FIG. 23—Cylinder Bore Out-of-Round and Taper

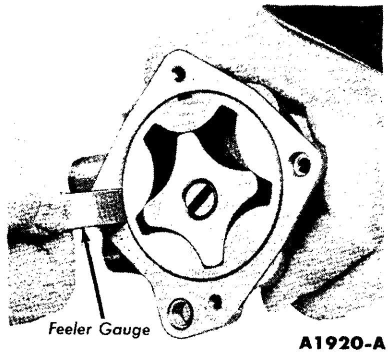

FIG. 24—Outer Race to Housing Clearance

from all machined surfaces. Remove all pipe plugs which seal oil passages, then clean out all the passages. Blow out all passages, bolt holes, etc. with compressed air. Make sure the threads in the cylinder head bolt holes are clean. Dirt in the threads may cause binding and result in a false torque reading. Use a tap to true-up threads and to remove any deposits.

INSPECTION

After the block has been thoroughly cleaned, make a check for cracks. Minute cracks not visible to the naked eye may be detected by coating the suspected area with a mixture of 25% kerosene and 75% light motor oil. Wipe the part dry and immediately apply a coating of zinc oxide dissolved in wood alcohol. If cracks are present, the coating will become discolored at the defective area. Replace the block if it is cracked.

Check all machined gasket surfaces for burrs, nicks, scratches, and scores. Remove minor imperfections with an oil stone. Check the flatness of the cylinder block gasket surface following the procedure and specifications recommended for the cylinder head.

Replace all expansion-type plugs that show evidence of leakage.

Inspect the cylinder walls for scoring, roughness, or other signs of wear. Check the cylinder bore for out-of-round and taper. Measure the bore with an accurate gauge following the instructions of the manufacturer. Measure the diameter of each cylinder bore at the top, middle, and bottom with the gauge placed at right angles and parallel to the centerline of the engine (Fig. 23).

Refinish cylinders that are deeply scored and/or when out-of-round and/or taper exceed the wear limits.

If the cylinder walls have minor surface imperfections, but the out-of-round and taper are within limits, it may be possible to remove the imperfections by honing the cylinder walls and installing new service piston rings providing the piston clearance is within limits. Use the finest grade of honing stone for this operation.

OIL PAN

CLEANING

Scrape any dirt or metal particles from the inside of the pan. Scrape all old gasket material from the gasket surface. Wash the pan in a solvent and dry it thoroughly. Be sure all foreign particles are removed from below the baffle plate.

INSPECTION

Check the pan for cracks, holes, damaged drain plug threads, a loose baffle, and a nicked or warped gasket surface.

Repair any damage, or replace the pan if repairs can not be made.

OIL PUMP

CLEANING

Wash all parts in a solvent and dry them thoroughly with compressed air. Use a brush to clean the inside of the pump housing and the pressure relief valve chamber. Be sure all dirt and metal particles are removed.

INSPECTION

Refer to the specifications for clearances and wear limits.

Check the inside of the pump housing and the outer race and rotor for damage or excessive wear.

Check the mating surface of the pump cover for wear. If the cover

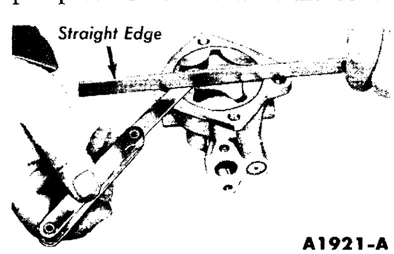

FIG. 25—Measuring Rotor End Play

mating surface is worn, scored, or grooved, replace the cover.

Measure the outer race to housing clearance (Fig. 24).

With the rotor assembly installed in the housing, place a straight edge over the rotor assembly and the housing. Measure the rotor end play clearance between the straight edge and the rotor and outer race (Fig. 25).

If the clearance between the housing and outer race and the rotor end play are not within specifications, replace the outer race and rotor, or the oil pump assembly. **The outer race, shaft and rotor are replaceable only as an assembly.**

Check the drive shaft to housing bearing clearance by measuring the OD of the shaft and the ID of the housing bearing.

Inspect the relief valve spring for a collapsed or worn condition.

Check the relief valve spring tension. If the spring tension is not within specifications and/or the spring is defective, replace the spring.

Check the relief valve piston for scores and free operation in the bore. Check the relief valve to body clearance. The relief valve should have a snug fit and should slide freely in the bore. Clean the valve and bore with fine crocus cloth if a slight restriction is felt.

CRANKCASE VENTILATION SYSTEM MAINTENANCE

Refer to Group 19 for the correct mileage interval for maintenance.

CLEANING

The breather cap located on the oil filter tube should be replaced at the proper mileage interval. Do not clean the breather cap.

At the recommended interval, remove the crankcase ventilation regulator valve, tube, hose connections, outlet adapter and oil separator element. Clean the valve, element, tube and outlet adapter in clean carburetor solvent and dry them with compressed air. Clean the rubber hose connections with a low-volatility, petroleum-base solvent and dry them with compressed air.

PART 8-2 430 V-8 ENGINE

1 DESCRIPTION AND OPERATION

The 430 V-8 engine (Figs. 1, 2 and 3) has a 4.300-inch bore and a 3.700-inch stroke. It has a total piston displacement of 430 cubic inches and a compression ratio of 10.1:1. The warranty plate identification symbol for the engine is "H".

MANIFOLDS

The four-venturi manifold is of the water-jacketed design. A wide layer of water constantly circulates within a chamber located below the intake air passages which allows close control of intake manifold temperatures.

The intake manifold port arrangement is shown in Fig. 4. The four fuel-air intake ports of the manifold are positioned in a manner that places the carburetor primary barrels in the center of the intake manifold. The secondary barrels are located off-center toward the rear. The centrally located primary barrels provide uniform fuel-air distribution to all cylinders.

The exhaust manifolds are secured to the cylinder heads. An air inlet duct and shroud assembly is positioned on the left exhaust manifold and directs warm air into the air cleaner and carburetor.

CYLINDER HEADS

The cylinder head assemblies have a flat machined surface and contain the valves, springs and related parts. The valve guides are an integral part of the cylinder head.

The front to rear valve arrangement for the cylinder heads (Fig. 4) is as follows; right bank I-E-I-E-I-E-I-E, and left bank E-I-E-I-E-I-E-I.

CYLINDER BLOCK

The cylinders are numbered from front to rear, on the right bank 1, 2, 3 and 4 and on the left bank 5, 6, 7 and 8. For easy reference, each cylinder number is embossed on the intake manifold and is located directly over the cylinder bores.

The cylinder firing order is 1-5-4-2-6-3-7-8. This information is embossed on the top surface of the intake manifold.

The cylinder block is cast in one piece with cored passages for cooling the entire length of the cylinder barrels.

Each cylinder has an angle wedge combustion chamber at the top of the cylinder bore. The combustion chambers-in-block are formed by machining the top of each cylinder bank on a 10° angle to the piston (Fig. 3).

The pistons are of a step design. Two raised projections on the dome of the piston prevent damage to the piston or valves if contact (valve float) should occur.

Slotted openings in the piston are parallel with the level of the oil control ring. These openings reduce heat build-up between the cylinder wall and piston body. The openings also allow trapped oil to return rapidly to the crankcase. The slot openings also work jointly with oil passages drilled through the pin bosses of the piston. Oil from the cylinder walls, received through the piston openings, lubricates the piston pins, then drains into the crankcase.

The oil control ring (lower ring) has two chrome-plated steel rails which contain the self-expanding spacer. The spacer has ample openings for positive oil control.

The second compression ring is phosphate-coated and has a scraper groove. The top compression ring has a chrome-plated *face to* resist abrasive wear, scoring and scuffing.

The piston pins have an interfer-

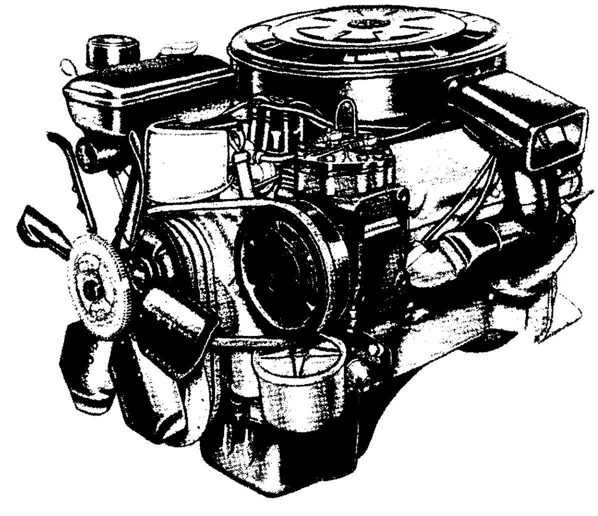

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FIG. 1—¾ Left Front View

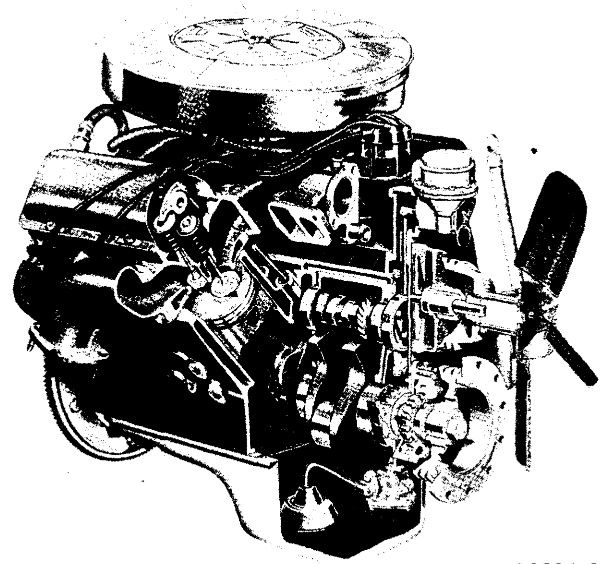

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FIG. 2—¾ Right Front Sectional View

ence fit within the connecting rod. The lower end of the connecting rods contain the locking-type, selective-fit connecting rod bearing inserts.

The crankshaft is supported within the cylinder block by five selective fit main bearing inserts. The center bearing (No. 3) absorbs crankshaft end thrust.

The distributor is mounted on the front of the cylinder block in a left of-center position. The distributor is driven by a helical gear located on the front of the camshaft.

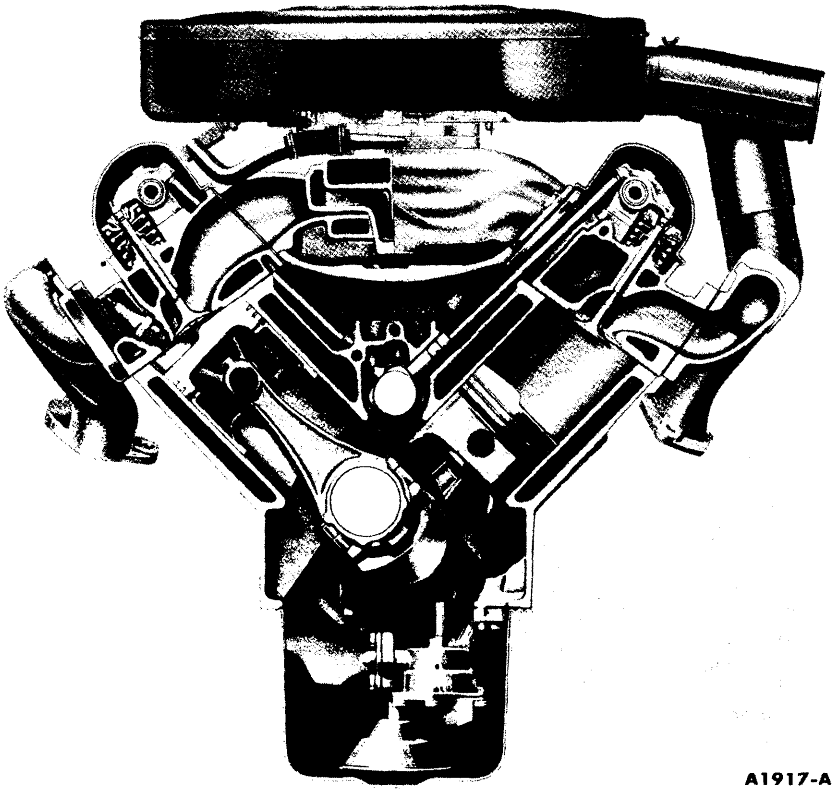

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FIG. 3—Front Sectional View

The fuel pump, which is mounted on the cylinder block front cover, is operated by a push rod and an eccentric cam which is secured to the camshaft.

A crankcase oil filler tube is pressed into the right front-side of the cylinder block. A disposable-type oil filler tube cap, containing an air filter element, is inserted onto the tube.

VALVE TRAIN

The intake valves are free rotating. Valve retainers (rotators) are used on all exhaust valve assemblies to ensure positive rotation at low rpm. Alternating pressure on the spring

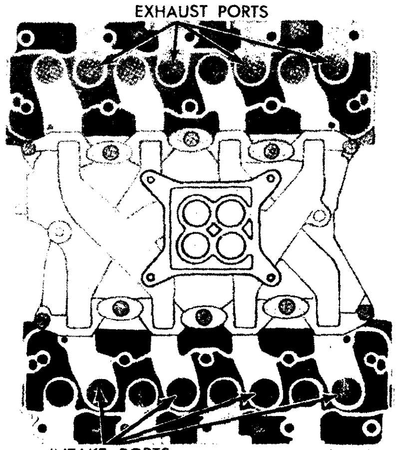

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FIG. 4—Intake Manifold and Cylinder Head Valve Ports

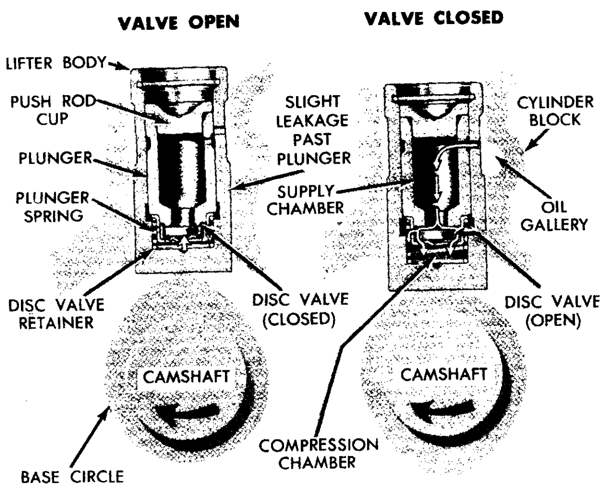


FIG. 5—Typical Hydraulic Valve Lifter Operation

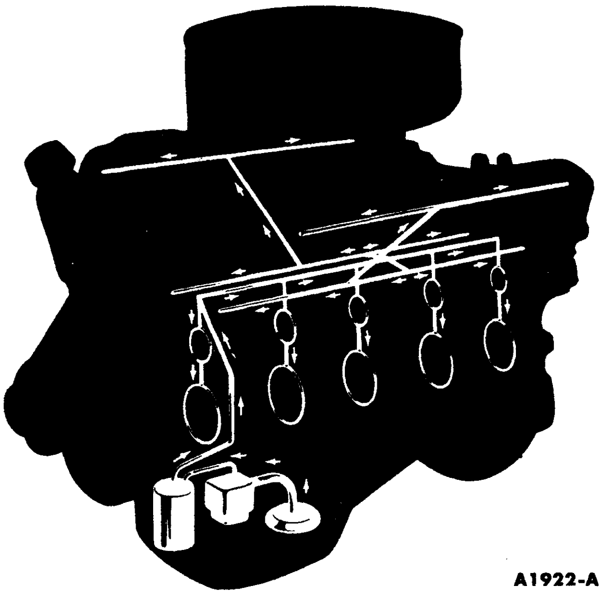


FIG. 6—Lubrication System

and washer, located within the rotator, causes a constant speed rotation. The valve rotator eliminates the need for a conventional valve spring retainer and sleeve for the exhaust valves.

The push rods have a radius at each end and are oil cushioned at the rocker arm and valve lifter.

The heavy gauge valve springs are color coded for identification purposes.

The rocker arms are a non-adjusting type. Each rocker arm and shaft assembly is held in position on the cylinder head by four rocker arm supports and retaining bolts. The valve rocker arm covers and gaskets are held in position by bolts, and reinforcements (washers), located around the cover rim. A comb-type bracket is located on the top of each cover for positive alignment of the spark plug high tension wiring.

The camshaft is supported by five replaceable bearing inserts. The inside diameters of the bearings are of a step design. The largest inside diameter is found in the front bearing. The inside diameters of the bearings decrease 0.015 inch in size per bearing, from the front bearing toward the rear.

The camshaft is also of step design, the largest journal outside diameter is found at the front journal. The journals, from the front to rear, decrease 0.015 inch in size per journal.

The camshaft is driven by the crankshaft sprocket, timing chain, and timing gear that has nylon teeth. The timing gear and camshaft eccentric is bolted to the camshaft.

Hydraulic valve lifters are used in the engine. The valve lifters are housed in bores located in the cylinder block valve lifter chamber. The valve lifters operate directly on the camshaft lobes, thereby transmitting the thrust of the camshaft lobes, by the means of hydraulic pressure, to the push rods which actuate the valve train. Figure 5 shows the various components and operation of a hydraulic valve lifter.

When either an exhaust valve or an intake valve is closed, the actuating valve lifter is on the base circle (lowest position) of the camshaft lobe.

When the valve lifter is in this position, the lifter plunger spring expands. This action forces the lifter plunger and valve push rod upward, forcing the valve end of the rocker arm to maintain solid contact with the valve (zero valve lash). In this position, the oil hole in the lifter body and plunger is indexed with the oil gallery in the cylinder block.

As the lifter plunger moves upward, the volume of the compression chamber is increased, resulting in reduced oil pressure in the compression chamber. Therefore, to equalize the resulting pressure differential between the supply chamber and the compression chamber, the disc valve moves off its seat and permits oil to flow from the supply chamber to the compression chamber. When the compression chamber becomes filled with oil, the pressures in the two chambers are equalized. The oil flow ceases and the disc valve spring seats the disc valve and closes the disc valve port.

As the camshaft rotates, the lifter assembly is raised by the camshaft lobe. This increases the push rod force against the lifter plunger and hydraulic pressure immediately builds up in the compression chamber until it acts as a solid member of the valve operating mechanism. The lifter then becomes a hydraulic ram which forces the valve in the cylinder head to open. During this period, a slight leakage of oil past the plunger occurs (calibrated leak down rate).

As the high point of the camshaft lobe rotates and passes by the foot of the valve lifter, the valve in the cylinder head seats and the valve lifter assembly is forced downward. Reduced force on the lifter plunger at this time relieves the pressure on the lifter plunger and it is free to be moved upward by the plunger spring. This action allows oil to flow once again through the indexed oil holes in the lifter body and plunger.

The operating cycle is completed for each revolution of the camshaft. Zero clearance (lash) in the valve train mechanism is maintained at all times by the hydraulic force and expansion of the plunger spring between the lifter body and plunger.

LUBRICATION SYSTEM

A pressure lubricating system employing a full-flow oil filter is used in the engine (Fig. 6).

The rotor-type oil pump, mounted inside the oil pan on the lower-left corner of the cylinder block is driven by the distributor through an intermediate shaft. Thus, the oil pump and distributor are driven at camshaft speed.

The oil is received from the oil pan sump by means of an oil pick-up screen and tube assembly which directs the oil to the oil pump. A spring-loaded relief valve in the oil pump controls the oil pressure of the system. When the pressure exceeds specifications, oil is released by the relief valve and is directed back to the intake side of the pump.

The oil leaves the pump directly through a passage in the block which directs the oil to the oil filter adapter mounted at the front lower-left hand corner of the block. The oil then travels through a passage in the oil filter adapter to the oil filter assembly.

The oil filter is the full-flow type. This means that the oil delivered by the oil pump is directed immediately into the filter where it is filtered before entering the main oil gallery for circulation throughout the engine. The oil filter assembly also has an anti-drainback valve to assure lubricant to all bearings upon engine start.

The filter bypass valve, located inside the oil filter, operates only when the filter flow is restricted because of dirt or other foreign materials. When the bypass valve is open, that portion of the oil flowing through the bypass valve does not travel through the filtering material but is supplied directly to the main oil passage.

The oil from the oil filter is then directed through an oil passage in the block to the main oil gallery that is located in the center of the chamber floor. From the main oil gallery the oil is fed to each cam bearing through drilled passages in the block. In this manner, the bearings provide continuous oiling of the camshaft journals. Oil flow to the crankshaft is directed by means of a groove in the camshaft bearing bores in the block to a connecting passage leading to the crankshaft main bearings.

The connecting rod bearings receive their lubrication through passages drilled from the crankshaft main bearing journals to the crankpins of the crankshaft. The cylinder walls are lubricated by oil sprayed from a slot or groove between the connecting rod and cap. When the hole in the connecting rod lines up with the hole in the crankpin, oil is sprayed onto the cylinder wall that is opposite the one in which the rod is operating.

A reservoir traps oil at the valve lifter bore bosses. Thus, oil is available for lifter lubrication as soon as the engine starts. This oil then drains through three narrow drain holes in the valve chamber floor.

The rocker arm assemblies receive their oil from the main oil gallery through a passage in the block that lines up with a hole in the cylinder head. The hole directs the oil through the No. 1 rocker shaft support on the right bank and No. 2 support on the left bank, into the rocker shafts. The oil in the rocker shafts is directed through small holes to each rocker arm. Thus lubricating the valve and the ball joint end of the push rods.

The oil returns from the valve chamber of the cylinder head to the push rod chamber through holes provided at the lower front and rear corners of the cylinder heads.

Oil drains from the front cam bearing to the thrust face of the camshaft sprocket that rides against the front cylinder block surface. The rotation of the camshaft sprocket and an oil slinger sprays the oil on the timing chain and crankshaft sprocket.

POSITIVE CRANKCASE VENTILATION SYSTEM

Ventilating air enters the engine through the oil filler cap located at the right front-side of the cylinder block. The filler cap contains a filtering element which filters the incoming air.

From the filler cap, the filtered air flows into the front section of the valve push rod chamber. The ventilating air is then directed by a baffle upward through the push rod holes in the cylinder heads into both rocker arm chambers, returning in the same manner at the rear of the push rod chamber. The baffle also directs air through a hole in the front wall of the cylinder block into the timing chamber and downward into the crankcase.

Air flows from the push rod chamber, through holes in the chamber valley, into the crankcase. It then rises upward, through holes in the rear of the engine, into the rear of the push rod chamber valley where a filtering element separates oil from the gaseous air vapors. The air and vapor by-products are then directed into the intake manifold through the carburetor spacer.

The air is directed into the intake manifold through a spring-loaded regulator valve, an exhaust tube and the carburetor spacer (Fig. 7). The amount of regulator valve opening or restriction is governed by intake manifold vacuum pressure (Fig. 7).

At low intake manifold vacuum pressure (high engine speed), the regulator valve opens to the position which allows the greatest air-vapor flow into the intake manifold (Fig. 7, View "A"). This action allows the greatest combustion of undesirable engine vapors.

At high intake manifold vacuum (idle speed), the valve closes and restricts the flow of ventilating air and vapors into the richer air-fuel mixture present in the induction system at this time (Fig. 7, View "B"). Figure 7, View "C" shows a view of the valve when vacuum pull is in the intermediate stage.

The inter-relationship between vacuum pull and valve spring force positions the valve in a manner that provides the best air-fuel mixture and engine ventilation under all operating conditions. **Restricted ventilating air and vapors are constantly recirculated within the engine until demanded by the regulator valve.**

COOLING SYSTEM

The coolant is drawn from the bottom of the radiator by the water pump which delivers the coolant to the cylinder block, cylinder heads and intake manifold (Fig. 8). The three progressive stages of engine warm-up and cooling are shown in Fig. 9.

STAGE 1

At low ambient temperatures or initial starting of the engine, the water pump discharges the engine coolant through each of its "legs" to both sides of the cylinder block (at

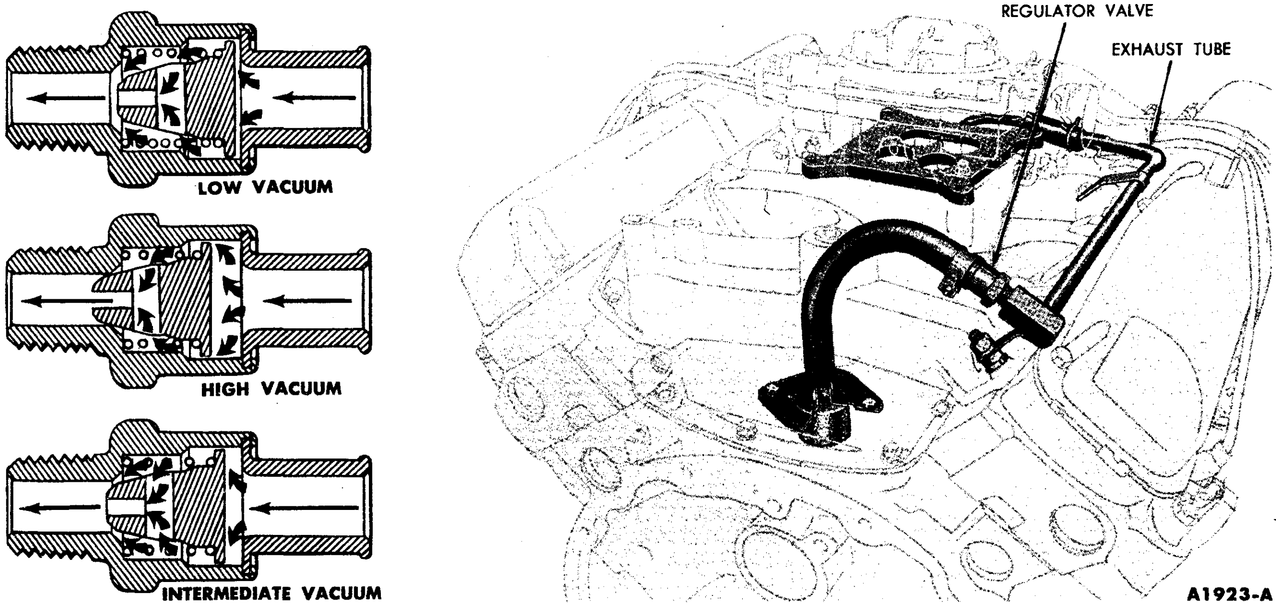


FIG. 7—Positive Crankcase Ventilation System

the front face) and into diverters (passageways) which direct the coolant upwards into each cylinder head. The coolant then flows to the rear of each cylinder head and into the intake manifold. From there, the coolant flows to the front of the intake manifold, out through the bypass connection and back into the water pump. The bypass system is used to assure limited circulation and to minimize pressure build-up.

Thermostats (A), (B) and (C) shown in Fig. 9 are closed. This circulation of the engine coolant during "Stage 1" continues to take place until the coolant reaches 137°-142° F. temperature. Thus, cooling is first provided to those engine components which rise fastest in temperature. Simultaneously, the intake manifold temperature will rise quicker and contribute to better vaporization of the engine fuel.

STAGE 2

The flow of the engine coolant described in "Stage 1" remains in effect during the additional flow of engine coolant provided in "Stage 2".

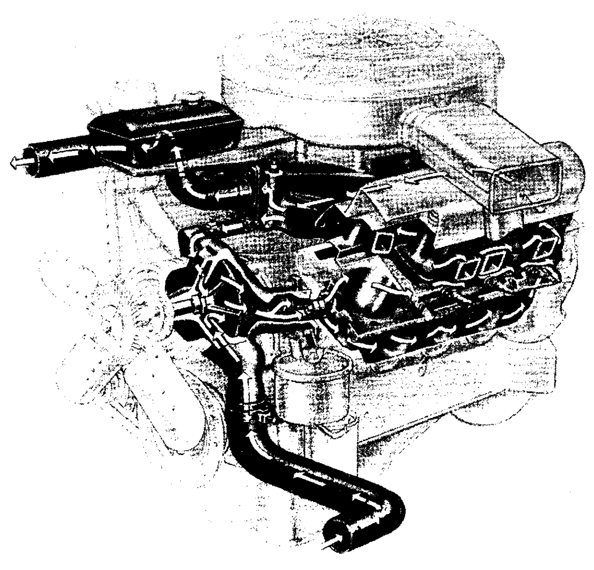


FIG. 8—Cooling System

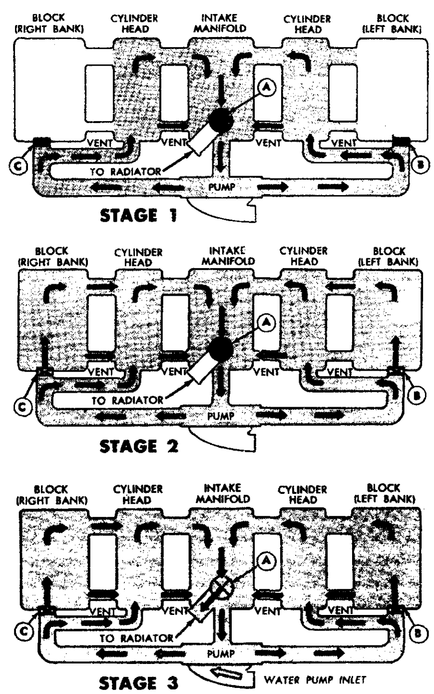


FIG. 9—Cooling System Stages

In addition to the water pump "legs" aligning with the openings in the face ends of the cylinder block for directing engine coolant into the cylinder heads, each "leg" also covers an opening into the cylinder block which includes small thermostats (B) and (C) as shown in Fig. 9. When the engine coolant in circulation during "Stage 1" reaches 137°-142°F. temperature, the thermostats (B) and (C) start to open and direct the flow of engine coolant through each side of the cylinder block to provide the required cooling throughout the cylinder block. The thermostats are fully open at 162°F. temperature.

The engine coolant then rises upward from the cylinder block, through mating passageways and into the cylinder heads where it is routed through "Stage 1".

STAGE 3

The flow of the engine coolant described in "Stage 1" and "Stage 2" remains in effect during the additional flow of engine coolant provided in "Stage 3".

When the engine coolant in circulation reaches 155°-162°F. (low temperature thermostat) or 185°-192°F. (high temperature thermostat) temperature, thermostat (A) located at the front end of the intake manifold starts to open and directs the flow of engine coolant out of the intake manifold water outlet port and into the coolant supply tank. The engine coolant is then directed into the radiator by a hose. The coolant then flows out of the outlet connection at the bottom of the radiator, through a hose, and into the inlet of the water pump. **At a temperature of 182°F. or above (low temperature thermostat) and 212°F. or above (high temperature thermostat), the thermostat is fully open and the engine coolant is completely recirculated by the water pump through all three stages of circulation to provide complete engine cooling.**

2 IN-CAR ADJUSTMENTS AND REPAIRS

ENGINE SUPPORTS

The front supports are located on each side of the crankcase and the rear support is located at the transmission extension housing (Fig. 10). An engine rear support reinforcement is located forward of the rear support, and an engine lateral restrictor is located on the right side of the transmission converter housing (Fig. 10).

ENGINE FRONT SUPPORT

The procedures given apply to either a right or left installation.

Removal

1. Block the rear wheels and set the parking brake. Raise the front of the car with a floor jack and install safety stands.

2. Disconnect the starter cable and remove the starter.

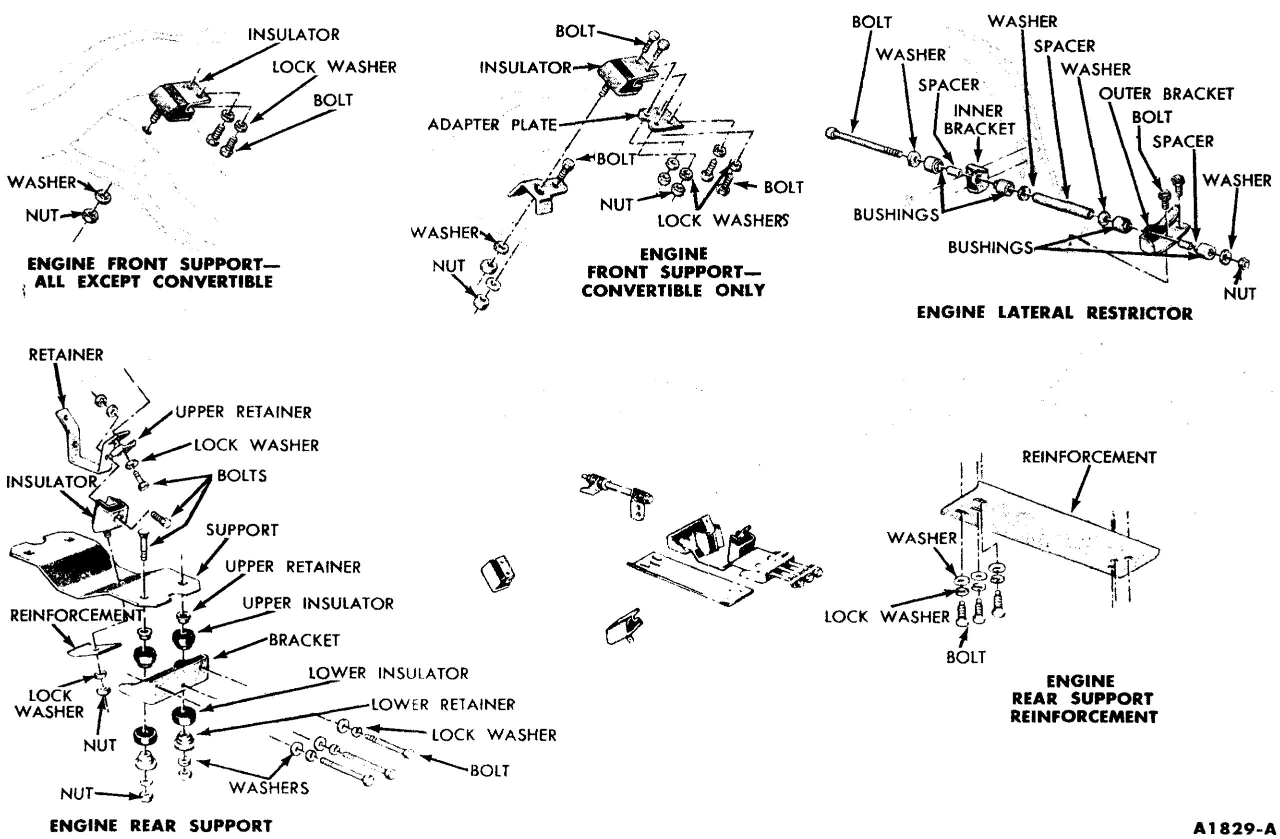


FIG. 10—Engine Front and Rear Supports

3. Remove the nuts and washers which secure the engine front support insulators to the underbody side member.

4. Place a jack under the front edge of the oil pan. Position a block of wood between the jack and the front edge of the oil pan. Raise the front of the engine about 2 inches to allow clearance for removal of the insulators.

5. Remove the bolts securing each support insulator (and adapter plate on convertibles) to the cylinder block. **Replace the insulator on one side before proceeding to the other support insulator.**

Installation

1. Position the support insulator (and adapter plate on convertibles) to the cylinder block. Install and torque the retaining bolts to specifications.

2. Lower the front of the engine and guide it as necessary to make certain that the engine front support bracket studs enter the holes in the underbody side member. Remove the floor jack and wood block.

3. Install the insulator stud mounting nuts and washers. Torque the nuts to specifications.

4. Install the starter and connect the starter cable.

5. Raise the front of the car and remove the safety stands. Lower the car.

6. Remove the rear wheel blocks and release the parking brake.

ENGINE REAR SUPPORT

Removal

1. Set the parking brakes and raise the car. Position a transmission support jack under the transmission.

2. Remove the nuts, bolts, washers, retainers and insulators that secure the support to the underbody side member brackets.

3. Remove the nuts and washers that secure the reinforcements and insulators to the support. Raise the transmission slightly and remove the support and reinforcements.

4. Remove the bolts, nuts and washers securing the engine support insulators to the transmission retainer. Remove the engine support insulators.

5. Remove the mounting bolts, washers and retainers from the transmission extension housing.

6. If necessary, remove the bolts and washers retaining the support brackets to the underbody side member. Remove the brackets.

Installation

1. If the support brackets were removed, position the support brackets to the underbody side member and install the bolts and washers. Torque the bolts to specifications.

2. Position the retainers to the transmission extension housing and install the bolts and lock washers. Torque the bolts to specifications. **Excessive torque can cause a noise or vibration condition.**

3. Position the engine rear support insulators to the transmission retainers and install the bolts, washers and nuts. Torque the bolts to specifications.

4. Position the support to the underbody side member brackets and the reinforcements to the support. Lower the transmission. Install the lock washers and nuts securing the reinforcements and insulators to the supports. Torque the nuts to specifications.

5. Install the bolts, retainers, insulators, washers and nuts that secure the support to the underbody side member brackets. Torque the nuts to specifications.

6. Remove the transmission support jack. Lower the car and release the parking brakes.

ENGINE LATERAL RESTRICTOR

REMOVAL

1. Remove the bolts securing the restrictor outer bracket to the underbody side rail.

2. Remove the bolt securing the restrictor inner bracket to the converter housing. Remove the lateral restrictor unit from the car.

INSTALLATION

1. Position the lateral restrictor unit in the car, with the outer bracket resting on the underbody side rail (Fig. 10).

2. Insert the inner bracket dowel pin into the converter housing. Install the inner bracket mounting bolt and torque it to specifications.

3. Install the outer bracket retaining bolts and torque them to specifications.

DISASSEMBLY

1. Remove the restrictor rod retaining nut and disassemble the restrictor unit (Fig. 10).

2. Clean the parts in solvent. Replace all parts that are worn or damaged beyond repair.

ASSEMBLY

1. Install the head of the large restrictor rod in a vise.

2. Assemble the restrictor parts over the rod as shown in Fig. 10. **Make certain that the lips of the rubber bushings are properly seated in the bores of the inner and outer restrictor brackets.**

3. Torque the retaining nut to specifications. Remove the assembly from the vise.

INTAKE MANIFOLD

REMOVAL

1. Open the hood and install fender covers. Drain the cooling system at the radiator and cylinder block.

2. Remove the carburetor air cleaner and air inlet duct assembly. As a safety measure, remove the ground cable from the battery.

3. Disconnect the heater inlet hoses at the connector fittings located at the rear of the intake manifold. Disconnect the automatic choke coolant return hose from the coolant return line of the heater.

4. Remove the retaining nut and washer securing the positive crankcase ventilation tube bracket to the intake manifold. Disconnect the ventilation tube and the adapter connecting hose from the engine.

5. Remove the right-bank spark plug wires from the spark plugs and the rocker arm cover.

6. Remove the radiator upper hose from the radiator and supply tank.

7. Disconnect the heat temperature sending unit wire, and the coil primary and secondary wires from their respective units.

8. Disconnect the accelerator linkage at the accelerator shaft assembly (bell crank).

9. On a car with an air conditioner, disconnect the wire from the fast idle solenoid.

10. Disconnect the heater outlet hoses from the "Y" tube connection.

11. Remove the two retaining bolts securing the radiator supply tank to the intake manifold. Remove the retaining bolt securing the engine ground strap, battery ground cable, and the supply tank brace to the water pump.

12. Remove the wires from the spark plugs and rocker arm cover on the left cylinder *bank. Remove* the distributor cap and wires as a unit.

13. Disconnect the vacuum hoses

from the tube leading into the intake manifold fitting.

14. Disconnect the fuel inlet line at the carburetor and fuel filter. Disconnect the vacuum line from the distributor diaphragm and carburetor.

15. Loosen the clamp and disconnect the coolant bypass hose at the water pump.

16. On a car with an air conditioner, remove the compressor support bracket.

17. Remove the intake manifold mounting bolts, clamps and washers. With assistance, remove the intake manifold assembly.

18. If the manifold is to be disassembled, remove the bypass hose and clamps, bypass tube, carburetor gaskets and spacer, fuel lines, vacuum lines, transmission carburetor linkage, temperature sending unit, vacuum inlet line fitting and heater outlet elbow fitting. Discard all gaskets.

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

INSTALLATION

1. If the intake manifold was disassembled, install the bypass hose and clamp, bypass tube, temperature sending unit and the heater outlet elbow fitting, using water-resistant sealer. Install the vacuum inlet line fitting, transmission carburetor linkage, vacuum lines and fuel lines. Install the carburetor spacer and new gaskets.

2. Clean the mating surfaces of the intake manifold and cylinder heads.

3. Install the intake manifold gaskets on the respective cylinder heads, with the word FRONT (imprinted on the gaskets) facing toward the front of the engine. To keep the gaskets temporarily in position, install manifold clamp bolts in the cylinder heads. **The intake manifold gaskets are interchangeable from one cylinder bank to the other.**

4. With assistance, lift the intake manifold and insert the bypass hose over the water pump inlet tube; then, position the manifold on the cylinder heads. **Make certain the gasket holes are properly aligned.**

5. Remove the gasket locating bolts. Install the intake manifold mounting bolts, clamps, studs, nuts and washers. Torque the mounting bolts in sequence to specifications as shown in Fig. 11.

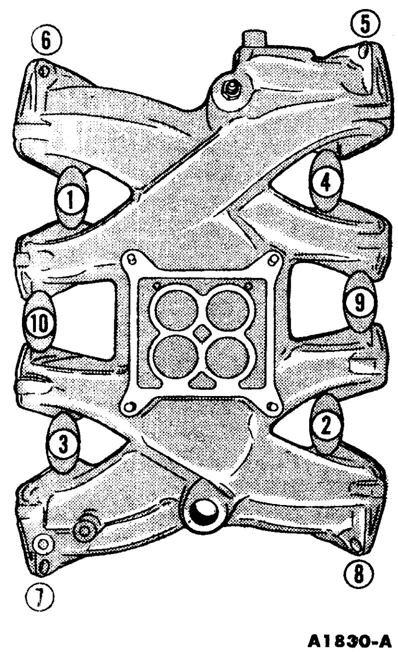


FIG. 11–Intake Manifold Bolt Torque Sequence

6. On a car with an air conditioner, install the compressor support bracket and tighten the mounting bolts and nuts.

7. Coat one side of a new coolant supply tank mounting gasket with water-resistant sealer and install it on the supply tank. Insert the thermostat into the manifold.

8. Install the coolant supply tank and coil as a unit on the intake manifold and loosely install the mounting bolts.

9. Secure the supply tank bracket, engine ground strap, and battery ground cable to the water pump and torque the mounting bolt to specifications. Torque the coolant supply tank mounting bolts to specifications. Connect the overflow hose to the supply tank.

10. Connect the fuel line to the carburetor and filter. Connect the vacuum line to the carburetor and distributor.

11. Connect the heater outlet hoses to the return line and tighten the clamps. Connect the accelerator linkage to the accelerator shaft assembly (bell crank).

12. Connect the transmission vacuum hose to the vacuum line. Connect the vacuum hoses to the intake manifold fitting located below the carburetor.

13. Install the positive crankcase ventilation tube and hose. Install the tube on the mounting bracket, located on the intake manifold, and tighten the retaining clamp.

14. Connect the heater outlet hoses and automatic choke coolant supply hose to the fitting located on the intake manifold and tighten the retaining clamps.

15. Connect the automatic choke coolant return hose to the heater return line and tighten the clamp.

16. Connect the radiator inlet hose to the radiator and supply tank. Tighten the retaining clamps.

17. Install the wiring loom in the clips located on the right bank rocker arm cover. Install the ignition coil primary and secondary wires, temperature sending unit wire, and the oil pressure sending unit wire.

18. On a car with an air conditioner, connect the lead wire to the fast idle solenoid.

19. Install the distributor cap and spark plug wires as a unit. Install the wires on the rocker arm cover and the spark plugs.

20. Install the battery ground cable on the battery. Close the radiator drain cock and the cylinder block drain plugs. Fill the cooling system. Start the engine; bleed the cooling system and fill it to its required level.

21. Check and adjust the initial timing, if necessary. Adjust the carburetor fuel and idle mixture adjustments. Adjust the transmission linkage.

22. Check the engine for vacuum, fuel, coolant and oil leakage.

23. Install the fresh air inlet duct assembly on the exhaust manifold. Install the air cleaner.

24. Remove the fender covers. Close the hood.

EXHAUST MANIFOLD

REMOVAL

1. Remove the air cleaner and air inlet duct assembly. Block the rear wheels and set the parking brake. Raise the front of the car with a floor jack and install safety stands.

2. Disconnect the exhaust manifold(s) at the resonator inlet pipe(s).

3. Remove the nuts and washers which secure the engine front support insulators to the underbody side members.

4. Place a jack under the front edge of the oil pan. Position a block of wood between the jack and the front edge of the oil pan. Raise the front of the engine about 2 inches to allow clearance for removal of the exhaust manifold. Position 2-inch wood blocks between the front support insulators and underbody side members. Remove the jack and wood block.

5. Bend the lock tabs and remove the exhaust manifold lower retaining bolts. Remove the safety stands and lower the car.

6. Bend the lock tabs and remove the exhaust manifold upper retaining nuts, manifold(s) and gasket(s).

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

INSTALLATION

1. Clean the surfaces of the exhaust manifold(s) and cylinder head(s). Apply a light film of graphite grease to the exhaust manifold and cylinder head port areas.

2. Position the exhaust manifold(s) and gasket(s) to the cylinder head(s). Install the lock tabs and upper retaining nuts. Torque the retaining nuts to specifications and bend the lock tabs.

3. Raise the car and install safety stands. Install the lower retaining bolts and lock tabs. Torque the retaining bolts to specifications and bend the lock tabs.

4. Raise the front of the engine and remove the wood blocks from between the front support insulators and underbody side members. Lower the engine and install the front support insulator nuts and washers. Torque the nuts to specifications.

5. Position the resonator inlet pipe(s) to the exhaust manifold(s) and install the retaining nuts. Torque the nuts to specifications.

6. Remove the safety stands and lower the car. Remove the rear wheel blocks and release the parking brake.

7. Start the engine and check for exhaust leaks. Install the air cleaner and air inlet duct assembly.

VALVE PUSH ROD CHAMBER COVER

REMOVAL

1. Remove the high tension lead wires from the coil terminal. Connect an auxiliary starter switch to the starter relay.

2. Position the No. 1 piston on TDC of the compression stroke. **Observe the position of the distributor rotor.**

3. Remove the intake manifold, following the procedure under "Intake Manifold Removal."

4. Remove the clamp securing the distributor to the cylinder block. Scribe a line on the distributor housing directly opposite the tip of the rotor, for installation purpose.

5. Remove the distributor from the cylinder block and valve push rod chamber cover. **Observe the distance the rotor turns as the distributor is removed. This will be very helpful when the distributor is installed, for the mating teeth of the helical gears will turn the distributor shaft.**

6. Clean the top of the valve push rod chamber cover to prevent dirt from falling into the chamber. Remove the cover.

INSTALLATION

1. Install a new gasket on the valve push rod chamber cover. Use an oil-resistant sealer on the gasket.

2. With the gasket in position, lower the front of the cover into position. Make certain that the rubber grommet in the cover is not dislodged by the distributor clamp stud. Torque the mounting bolts to specifications. **Torque the center end bolts first.**

3. With the No. 1 piston on TDC of the compression stroke, set the distributor rotor in position to fire No. 1 cylinder. (The rotor tip will be aligned with the previously scribed mark on the distributor housing.)

4. Turn the rotor counterclockwise a distance equal to the amount observed during the distributor removal procedure (approximately 1/8 turn).

5. Install the distributor. The shaft and rotor will turn clockwise as the distributor gear meshes with the camshaft gear. Check the position of the rotor with the scribed mark on the distributor housing.

6. If the installation is correct and the distributor is properly seated, install the distributor clamp, nut and lock washer. **Final timing of the distributor must be made after the engine is operating in the car.**

7. Install the intake manifold, following the procedure under "Intake Manifold Installation."

8. Remove the auxiliary starter switch and connect the high tension lead wires at the coil terminal.

VALVE ROCKER ARM COVER

REMOVAL

1. Remove the air cleaner.

2. Disconnect the spark plug wires at the spark plugs. Remove the wires from the bracket on the valve rocker arm cover(s) and position the wires out of the way.

To remove the left rocker arm cover, remove the air inlet duct assembly from the exhaust manifold. Move the heater hoses inward to allow room for removal of the rocker arm cover.

3. Remove the valve rocker arm cover(s) and gasket(s).

INSTALLATION

1. Clean the valve rocker arm cover(s). Apply oil-resistant sealer to one side of new cover gasket(s). Lay the cemented side of the gasket(s) in place in the cover(s).

2. Position the cover(s) on the cylinder head(s). Make sure the gasket seats evenly all around the head. Install the bolts (and the wire loom clamps on the left cover). The cover is tightened in two steps. First, torque the bolts to specifications. Two minutes later, torque the bolts to the same specifications.

If the left cover was removed, install the air inlet duct assembly.

3. Connect the spark plug wires. Install the air cleaner.

VALVE ROCKER ARMS, SHAFTS AND PUSH RODS

REMOVAL

1. Remove the valve rocker arm cover(s), following the procedures under "Valve Rocker Arm Cover Removal."

2. Loosen the four rocker arm support mounting bolts evenly and alternately, two turns at a time, until spring tension is removed. Remove the mounting bolts and washers. Lift the rocker arm assembly from the cylinder head.

3. Remove the push rods from the cylinder head. **Index the push rods to the bore from which they were removed, for inspection and replacement purposes.**

INSTALLATION

1. Lubricate each valve stem foot and the rocker arm pad with Lubriplate.

2. Position the rocker arm and

shaft assembly on the cylinder head. Install the mounting bolts, lock washers and flat washers. Tighten the screws until they are slightly engaged in the cylinder head.

3. Install the push rods on their hydraulic lifter seats. **Make certain that they are installed in the lifters from which they were removed.**

4. Seat the ends of the push rods in the rocker arm ball sockets.

5. Tighten the rocker arm mounting bolts evenly and alternately, two turns at a time, until they are snug. Torque the mounting bolts to specifications.

6. Check the valve clearances and correct, if necessary (Part 8-1, Section 2).

7. Install the valve rocker arm cover(s), following the procedure under "Valve Rocker Arm Cover Installation."

DISASSEMBLY

The valve mechanism and related parts are shown in Fig. 12.

1. Remove the cotter pins, flat washers and spring washer from the ends of the shaft.

2. Remove the rocker arms, springs and supports from the shaft. **Keep the parts in order so that they may be replaced in their original position if they are in satisfactory condition.**

3. If it is necessary to remove the plugs from each end of the shaft, drill or pierce one plug. Insert a steel rod through the plug and knock out the plug on the opposite end. Working from the open end, knock out the remaining plug.

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3, for the cleaning and inspection procedures.

REPAIRS

Refer to Part 8-1, Section 2, for the repair procedures.

ASSEMBLY

To ensure proper valve train lubrication, it is necessary that the valve rocker arm shafts and valve rocker arms be assembled correctly for the cylinder bank on which they are to be installed. When the right bank rocker arm and shaft is completely assembled, the identification notch on the shaft must be facing downward and toward the front of the engine. The left bank rocker arm and shaft must be assembled so that the identification notch on the shaft faces downward and toward the rear of the engine (Fig. 13).

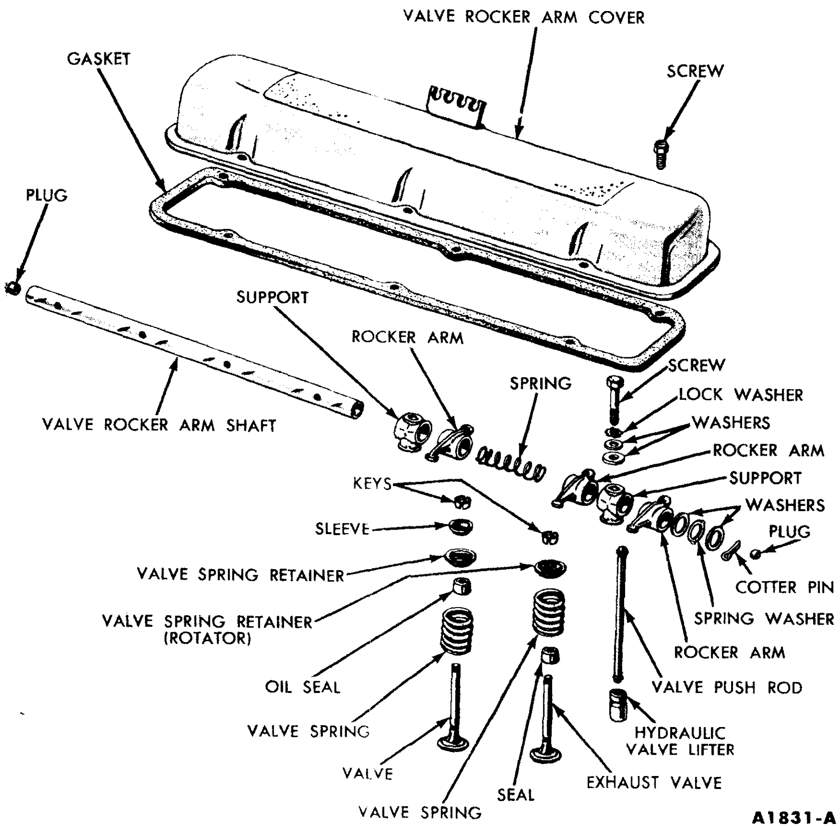


FIG. 12–Valve Mechanism and Related Parts

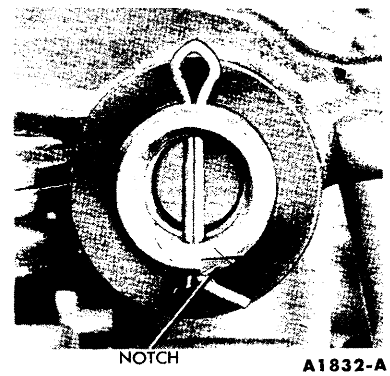


FIG. 13–Rocker Arms and Shaft Installed–Left Bank

1. Oil all moving parts with engine oil. Apply Lubriplate to the rocker arm pads and the tips of the valve stems.

2. If the plugs were removed from the ends of the shaft, use a blunt tool or large diameter pin punch and install a plug, cup-side out, in each end of the rocker arm shaft.

3. Install a cotter pin, flat washer and spring washer on one end of the shaft. Install the rocker arms, supports, support bolts and lock washers, and the springs (Fig. 12).

4. Complete the assembly operation by installing the remaining spring washer, flat washer and cotter pin. **Make certain the rocker arms are installed correctly for the respective cylinder bank upon which they are to be installed** (Fig. 13).

HYDRAULIC VALVE LIFTERS

REMOVAL

1. Remove the valve push rod chamber cover and related parts, following the procedure under "Valve Push Rod Chamber Cover Removal."

2. Remove the valve rocker arm covers, following the procedure under "Valve Rocker Arm Cover Removal."

3. Loosen the rocker arm and shaft assembly mounting bolts evenly and alternately, two turns at a time, until all spring tension is removed. Remove the mounting bolts and rocker arm assemblies from the cylinder head as a unit.

4. Remove the valve push rods from the cylinder heads. Remove the hydraulic lifters from the cylinder block. **Index the push rods and lifters to the bores from which they are removed, for inspection and replacement purposes (Fig. 14).**

INSTALLATION

1. Insert the lifters into the bores from which they were removed. Coat the outside of the lifters with engine oil before installation.

2. Install the push rods and the rocker arm and shaft assemblies, following steps 1 through 5 under "Valve Rocker Arms, Shafts and Push Rods Installation."

3. Check valve clearances and correct, if necessary (Part 8-1, Section 2).

4. Coat new valve rocker arm cover gaskets with an oil-resistant sealer. Install the rocker arm cover, reinforcements and bolts. Torque the mounting bolts to specifications.

5. Install the valve push rod chamber cover and related parts, following the procedure under "Valve Push Rod Chamber Cover Installation."

DISASSEMBLY

A disassembled view of an hydraulic valve lifter is shown in Fig. 15 for reference purposes during disassembly and assembly operations. **Each hydraulic valve lifter must be disassembled, cleaned, inspected, tested and assembled separately to prevent the mixing of internal parts. Each assembly is a matched set. Mixing of the parts can cause improper valve lifter operation. Soak all the lifters in solvent prior to disassembling them.**

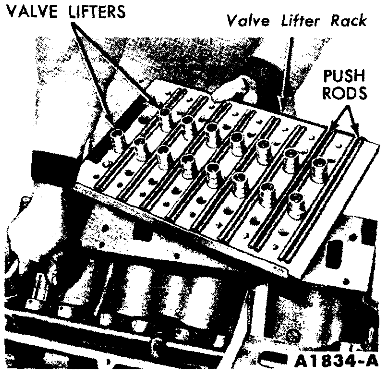
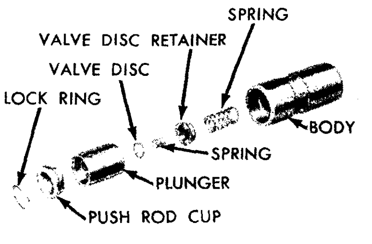


FIG. 14–Hydraulic Valve Lifter Removal or Installation



NOTE: PLUNGER AND BODY ARE MATCHED SELECTIVE FIT SETS. DO NOT MISMATE PAIRS.

A1835-A

FIG. 15–Hydraulic Valve Lifter Assembly

1. Remove the lock ring from the lifter body with needle nose pliers. Remove the push rod cup.

2. Remove the plunger with a lifter plunger remover (Fig. 16).

3. Remove the valve disc, small spring, disc retainer and plunger spring.

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

ASSEMBLY

1. Place the push rod cup, upside down, on the bench. Place the plunger on the push rod cup.

2. Place the valve disc, small spring, and the retainer on the plunger. Place the large spring on the valve disc retainer.

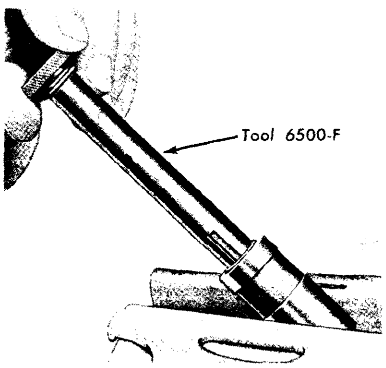


FIG. 16–Lifter Plunger Removal

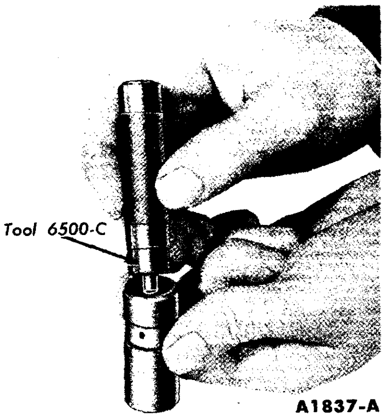


FIG. 17–Lock Ring Installation

3. Place the lifter body over the assemblies and push it down over the plunger. Pick the assembly up (still upside down) and push the plunger and push rod cup into the body. Turn the assembly right side up. Install the lock ring as shown in Fig. 17.

4. Test the hydraulic lifter (Part 8-1, Section 1).

POSITIVE CRANKCASE VENTILATION SYSTEM

The positive crankcase ventilation system components are shown in Fig. 18.

REMOVAL

1. Remove the air cleaner.

2. Loosen the clamp securing the hose to the regulator valve. Remove the hose and clamp. Remove the regulator valve from the ventilation tube fitting.

3. Loosen the clamps securing the hose to the ventilation tube and car-

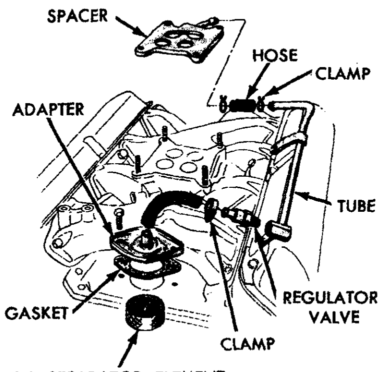


FIG. 18–Positive Crankcase Ventilation System

buretor spacer. Remove the hose and clamps.

4. Loosen the ventilation tube bracket retaining nuts and washers, then slide the ventilation tube out.

5. Remove the retaining bolts securing the outlet adapter to the valve push rod chamber cover. Remove the outlet adapter, gasket and oil separator element.

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

INSTALLATION

1. Install the oil separator element in the valve push rod chamber cover. Make certain the screen is positioned snugly around the edges of the opening.

2. Coat a new outlet adapter gasket with oil-resistant sealer and position it on the push rod chamber cover. Position the outlet adapter on the cover and install the retaining bolts.

3. Slide the ventilation tube brackets under the retaining washers and nuts. Tighten the nuts. Install the regulator valve in the ventilation tube fitting.

4. Install the hose and clamp on the outlet adapter and regulator valve. Position and tighten the clamp.

5. Install the hose and clamps on the carburetor and ventilation tube.

6. Install the air cleaner.

CYLINDER HEADS

Due to engine compartment clearance factors, it is necessary to remove the exhaust manifold and cylinder head as a unit from each cylinder bank.

REMOVAL

1. Raise the hood. Remove the ground cable from the battery.

2. Raise the front of the car with a jack. Install safety support stands. Disconnect the resonator inlet pipe(s) from the exhaust manifold(s).

3. Remove the valve push rod chamber cover from the engine, following the procedure under "Valve Push Rod Chamber Cover Removal."

4. Remove the valve rocker arm cover(s) and gasket(s) from the cylinder head(s).

5. On a car with an air conditioner, disconnect the compressor mounting bracket at the cylinder head.

6. To remove the right bank cylinder head, disconnect the transmission oil filler pipe bracket at the exhaust manifold. Remove the horns and bracket assembly from the fender apron.

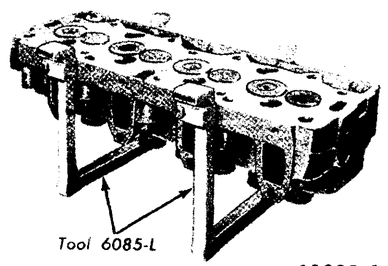


FIG. 19—Cylinder Head Holding Fixtures

7. Remove the cylinder head mounting bolts. Lift the cylinder head assembly (with the exhaust manifold attached) off the two locating dowels on each bank of the cylinder block. Remove the cylinder head gaskets. **Never pry between the cylinder heads and cylinder block when removing the heads. This can cause damage to the machined surfaces.**

8. If disassembly or machining of the cylinder head is required, remove the exhaust manifold, steel gasket and valve rocker arm assembly. Install cylinder head holding fixtures on the cylinder heads (Fig. 19). Use four intake manifold mounting bolts to attach the tools to the cylinder heads. **These tools have been designed to allow easy handling of the cylinder heads during all work operations.**

INSTALLATION

1. Clean the cylinder head and cylinder block gasket surfaces.

2. If the cylinder head was removed for a cylinder head gasket replacement, check the flatness of the cylinder head and block gasket surfaces (Part 8-1).

3. Remove the cylinder head holding fixtures from the cylinder heads.

4. Coat the exhaust manifold and cylinder head port areas with a light film of graphite grease. Install the exhaust manifold and steel gasket on the cylinder head. Install lock washers on the two lower, center mounting bolts. Install locking tab-type washers on the remaining bolts and studs. Torque the mounting bolts and nuts to specifications. Bend the washer locking tabs.

5. Apply cylinder head gasket sealer to both sides of a new gasket. Install the cylinder head gasket(s) over the cylinder block dowels. **Cylinder head gaskets can be used on either cylinder bank. Make certain the word "TOP" (stamped on the gasket) is facing upward. Also, make certain the gasket oil hole aligns with the oil passage in the cylinder block.**

6. Install the cylinder head(s) over the dowels, while guiding the exhaust manifold studs into the resonator inlet pipe connection.

7. On a car with an air conditioner install the compressor mounting bracket on the compressor.

8. Install the cylinder head mounting bolts and washers. Tighten the cylinder head bolts in sequence (Fig. 20), using 3 cold torque applications. First, torque the bolts to 95 ft-lbs, then torque them to 115 ft-lbs and finally to 135 ft-lbs.

9. On the right bank cylinder head, install the oil filler pipe bracket on the exhaust manifold. Torque the retaining nut to specifications. Bend the washer tab. Install the horns and bracket assembly on the fender ap-

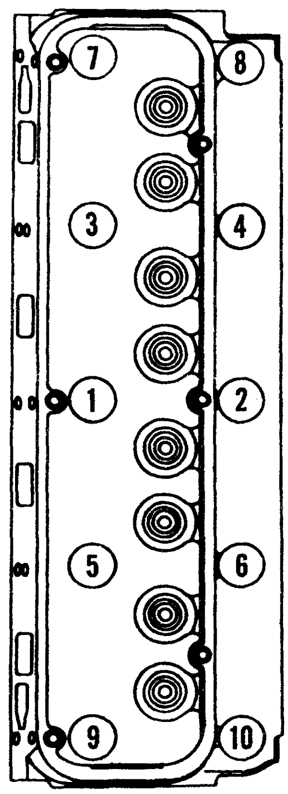


FIG. 20—Cylinder Head Bolt Torque Sequence

ron. Connect the lead wires to the horns.

10. Secure the resonator inlet pipe(s) to the exhaust manifold(s). Torque the mounting nuts to specifications.

11. Close the radiator drain cock. Install the cylinder block drain plugs. Lower the car.

12. Lubricate each valve stem foot and rocker arm pad with Lubriplate, then position the rocker arm and shaft assembly on the cylinder head. Install the mounting bolts, lock washers and flat washers. Tighten the bolts until they are slightly engaged in the cylinder head.

13. Install the push rods in the cylinder block, making sure they are properly seated in the hydraulic valve lifters from which they were removed. Seat the ends of the push rods in the rocker arm ball sockets.

14. Tighten the rocker arm shaft support mounting bolts, evenly and alternately, two turns at a time until they are snug. Torque the bolts to specifications.

15. Install the spark plugs in the cylinder head(s), using a $^{13}/_{16}$ inch spark plug deep socket tool. Torque the spark plugs to specifications. **Due to the angle at which the spark plugs are installed, care must be exercised to prevent breaking during installation.**

16. Check the valve clearances and correct, if necessary (Part 8-1, Section 2).

17. Install the valve rocker arm chamber cover and gasket on the cylinder head(s). Install the bolts and reinforcements. Torque the bolts to specifications.

18. Install the valve push rod chamber cover, intake manifold, and related parts, following the procedure under "Valve Push Rod Chamber Cover Installation."

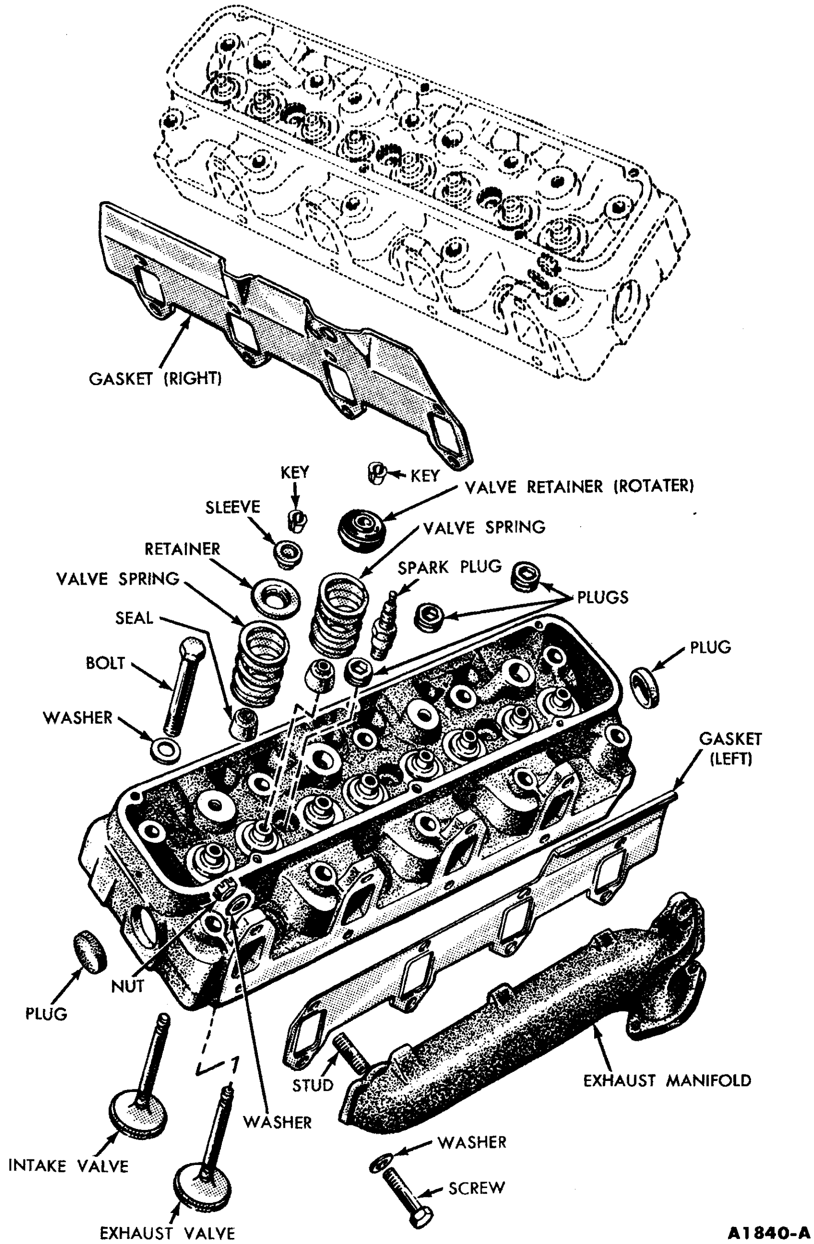


FIG. 21—Cylinder Head and Related Parts

DISASSEMBLY

The cylinder head and related parts are shown in Fig. 21.

1. Clean carbon deposits from the cylinder head and valve heads before removing the valves.

2. Compress the valve springs (Fig. 22). Tap the retainer gently with a soft hammer and remove the valve retainer locks.

3. Remove the intake valve spring retainer, inner sleeve, valve spring, valve seal and intake valve.

4. Remove the exhaust valve retainer (rotator), valve spring, valve seal and exhaust valve.

5. Repeat steps 1 through 4 for the remaining valves. **Keep the valves and their related parts together so that they may be installed in their respective positions in the cylinder head if inspection proves satisfactory.**

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

REPAIRS

Cylinder head repair procedures and checks such as valve and valve seat refacing, cylinder head flatness checks, etc., are covered in Part 8-1, Section 2.

ASSEMBLY

1. Lubricate the valve stems and valve guides with engine oil.

2. Install the intake and exhaust valves in their respective guides. Install new valve stem seals, valve spring assemblies, valve spring retainers and sleeves over the intake valves. Install new valve stem seals over the exhaust valves, then install

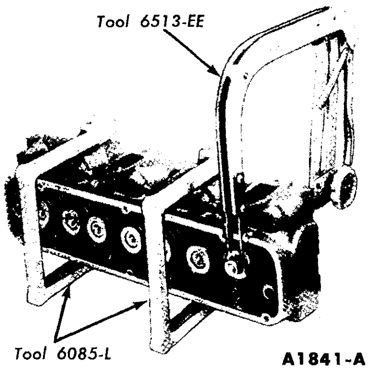


FIG. 22—Compressing Valve Spring—On Bench

the spring and valve retainer (rotator).

3. Compress the valve spring and install the valve retainer locks (Fig. 22). Release the valve spring compressor slowly and check the position of the valve retainer locks. Strike the end of the valve stem with a fiber mallet to make certain the retainer locks are properly installed. Repeat the operation for the remaining valves.

4. Use dividers to measure the assembled height from the surface of the cylinder head spring pad to the underside of the intake valve spring retainer or the exhaust valve rotator (Figs. 23 or 24).

5. If the measured dimension is greater than specified, install the necessary spacer or spacers (maximum of two) between the cylinder head spring pad and the valve spring to bring the assembled height to the specified dimension (Fig. 25). **Do not use spacers unless necessary. The use of spacers in excess of recommendations will result in overstressing of the valve springs.**

6. If the dimension when measured is less than specified, additional dimensional checks should be made of all components affecting the spring height.

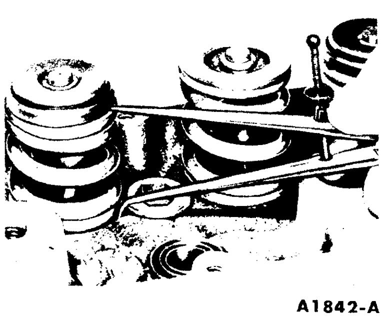


FIG. 23—Measuring Exhaust Valve Spring Assembled Height

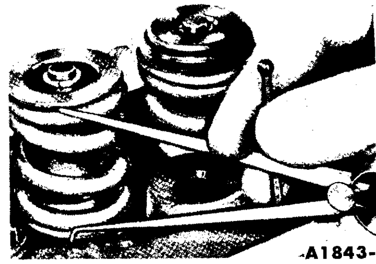


FIG. 24—Measuring Intake Valve Spring Assembled Height

VALVE SPRING, RETAINER AND STEM SEAL REPLACEMENT

The operation of the exhaust valve rotators can only be checked with the engine running.

With the valve rocker arm cover removed, place an index mark on each rotator. Start the engine. If the rotators are operating correctly, the index mark will revolve at an even rate. If no movement or erratic movement is noted, the rotator must be replaced. **Excessive wear at one spot on the tip of the exhaust valve stem is also an indication of rotator failure.**

Broken valve springs, or defective valve stem seals and rotators may be replaced without the need of removing the cylinder head, providing damage to the valve or valve seat has not occurred.

1. Remove the valve rocker arm cover(s), following the procedure under "Valve Rocker Arm Cover Removal."

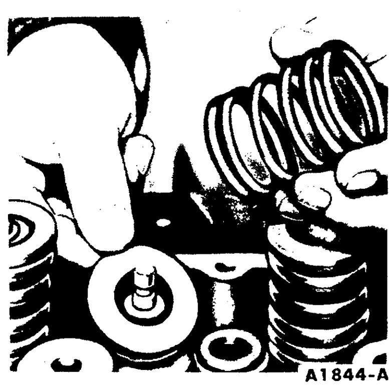


FIG. 25—Valve Spring Spacer Installation

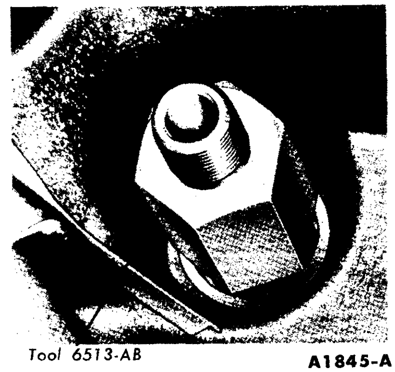


FIG. 26—Installation of Air Adapter Tool in Spark Plug Hole

2. Remove the applicable spark plug. Remove the high tension lead wire from the coil terminal. Connect an auxiliary starter switch to the starter relay. Crank the engine until the piston of the affected cylinder is on the power stroke.

3. Loosen the rocker arm support mounting bolts evenly and alternately, two turns at a time, until the valve spring tension has been released. Remove the push rod(s) of the valve(s) to be serviced.

4. Tighten the rocker arm support mounting bolts evenly and alternately, two turns at a time, until they are snug.

5. Install an air adapter in the spark plug hole and connect the air supply hose to the adapter (Fig. 26). **Air pressure may turn the crankshaft until the piston reaches the bottom of its stroke.**

6. Compress the valve spring and remove the valve retaining locks

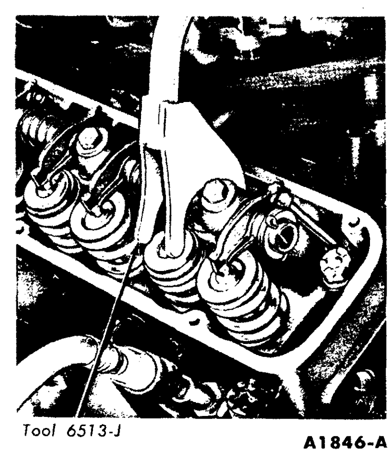


FIG. 27—Compressing Valve Spring—In-Chassis

from the valve (Fig. 27). **If air pressure fails to hold the valve in the closed position during this operation, it can be presumed that the valve is not seating or is damaged. If this condition occurs, remove the cylinder head for further inspection.**

7. Remove the valve spring and related parts. Remove the valve stem seal. **If air pressure has forced the piston to the bottom of the cylinder, any removal of air pressure will allow the valve(s) to fall into the cylinder. A rubber band, tape or string wrapped around the end of the valve stem will prevent this and will still allow enough travel to check the valve for binds.**

8. Inspect the valve stem for damage. Rotate the valve and check the valve stem tip for eccentric movement during rotation. Move the valve up and down through normal travel in the valve guide and check the stem for binds. **If the valve has been damaged, it will be necessary to remove the cylinder head for repairs as outlined in Part 8-1, Section 2.**

9. If the condition of the valve proved satisfactory, hold the valve in the closed position and apply the air pressure within the cylinder.

10. Inspect the valve stem seal for a cracked, torn, or brittle condition, and replace it if necessary. Install the seal on the valve stem.

11. Install the intake valve spring retainer and sleeve over the intake valve stem.

12. Install the exhaust valve spring, and retainer (rotator) over the exhaust valve stem.

13. Compress the spring (Fig. 27) and install the valve retainer locks. Tap the valve stem tip with a soft mallet to make certain that the retainer locks are properly seated.

14. Check the valve spring assembled height to make certain that it is within specifications (Figs. 23 and 24). If the assembled height exceeds specifications, install the necessary spacer or spacers to bring the height within specifications (Fig. 26). **Do not install spacers, unless necessary. Use of spacers in excess of recommendations will result in overstressing the valve springs and overloading the camshaft lobes which could lead to spring breakage or worn camshaft lobes.**

15. Remove the air line and adapter and install the spark plug.

16. Loosen the rocker arm support mounting bolts evenly and alternately, two turns at a time, until spring tension is removed. Apply Lubriplate to both ends of the push rod. Position the valve push rod within the rocker arm socket and the valve lifter tappet seat.

17. Tighten the rocker arm shaft support mounting bolts evenly and alternately, two turns at a time, until they are snug. Torque the bolts to specifications.

18. Remove the auxiliary starter switch. Install the high tension lead wire in the ignition coil terminal.

19. Install the spark plug wires. Check the valve clearances and correct, if necessary (Part 8-1, Section 2).

20. Start the engine and check to make certain that the exhaust valve retainers (rotators) are operating in the proper manner.

21. Install the valve rocker arm cover(s), following the procedure under "Valve Rocker Arm Cover Installation."

CRANKSHAFT DAMPER

REMOVAL

1. Open the hood and install fender covers. Remove the ground cable from the battery.

2. Loosen the alternator adjusting bracket and mounting bracket bolts. Pull the alternator inward toward the engine and remove the water pump-alternator drive belts.

3. On a car with an air conditioner, loosen the bolts securing the fan drive clutch and compressor drive pulley to the water pump pulley. Remove the fan drive clutch and fin assembly, and the compressor drive pulley from the vehicle as a unit.

Loosen the compressor adjusting bracket and support bracket bolts. Push the compressor inward toward the engine and remove the compressor drive belt.

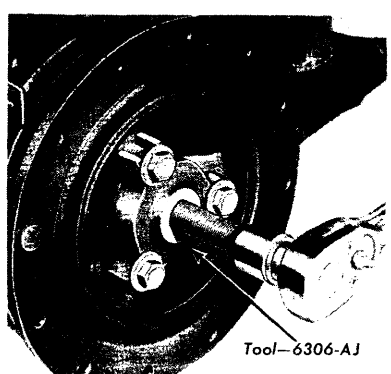


FIG. 28—Crankshaft Damper Removal

4. Remove the fan assembly, spacer and the mounting bolts as a unit from the water pump pulley.

5. Raise the vehicle. Remove the crankshaft damper retaining bolt and washer. Install the puller on the damper and remove the crankshaft damper (Fig. 28). Remove the Woodruff key, if necessary.

INSTALLATION

1. Install the Woodruff key in the crankshaft if it was removed. Install the crankshaft damper with the slot aligned with the Woodruff key in the crankshaft.

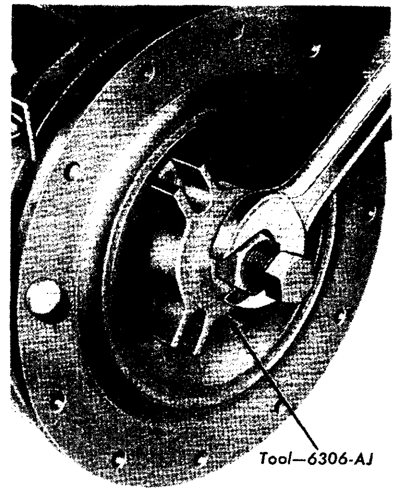


FIG. 29—Crankshaft Damper Installation

2. Drive the damper onto the crankshaft until it seats against the power steering pump (Fig. 29). Install the washer and retaining bolt. Torque the bolt to specifications.

3. Install the fan-alternator drive belts on their respective pulley sheaves. Adjust the alternator to obtain the specified belt tension and tighten the generator adjusting bracket and mounting bracket bolts.

4. On a car with an air conditioner, install the compressor drive pulley and the fan drive clutch and fan assembly on the water pump pulley as a unit.

Install the compressor drive belt. Adjust the compressor to obtain the specified belt tension and tighten the mounting bolts. Tighten the compressor adjusting bracket bolts.

5. Lower the vehicle. Install the

battery ground cable on the battery. Remove the fender covers and close the hood.

CYLINDER FRONT COVER

REMOVAL

1. Open the hood and install fender covers.

2. Drain the cooling system (open the radiator drain cock and remove the cylinder block drain plugs).

3. Disconnect the overflow hose from the coolant supply tank. Disconnect the primary and secondary wires from the ignition coil.

4. Remove the bolt securing the supply tank brace, engine ground strap, and battery ground cable to the water pump. Disconnect the radiator inlet hose from the coolant tank and the radiator.

5. Remove the supply tank, thermostat and gasket.

6. Loosen the coolant bypass hose clamp at the water pump.

7. On a car with an air conditioner, loosen the compressor support bracket and adjusting bracket bolts. Push the compressor inward toward the engine and remove the drive belt. Remove the fan drive clutch and fan assmbly, and the compressor drive pulley as a unit.

8. Loosen the alternator adjusting bracket and mounting bracket bolts. Push the alternator inward toward the engine and remove the fan-alternator drive belts. Remove the fan blade assembly, spacer, and mounting bolts from the water pump pulley as a unit.

9. Disconnect the radiator outlet hose at the water pump. Remove the bolt securing the oil dipstick tube bracket to the water pump. Remove the power steering reservoir bracket mounting bolt from the water pump and loosen the remaining reservoir bracket mounting bolts to allow clearance for removal of the water pump.

10. Remove the water pump from the cylinder block.

11. Remove the crankshaft damper mounting bolt and washer. Remove the crankshaft damper (Fig. 28).

12. Disconnect the power steering high and low pressure lines at the power steering pump and immediately plug the lines to prevent fluid drainage. Remove the retaining bolts securing the power steering pump reservoir mounting bracket to the cylinder front cover. Loosen the clamp securing the high pressure line to the bracket.

13. Remove the crankshaft damper Woodruff key from the crankshaft. Remove the power steering pump.

14. Remove the heat shield from the fuel pump. Disconnect the fuel lines at the fuel pump and fuel filter. Remove the fuel pump; then, remove the cup-type plug from the top of the cylinder front cover with the use of a long punch. Remove the fuel pump push rod.

15. Raise the front of the car and install safety support stands. Remove the bolts securing the cylinder front cover to the oil pan and the cylinder block.

16. Carefully remove the cylinder front cover. **If the oil pan gasket is damaged during the removal of the cylinder front cover, it will be necessary to replace it before installing the cylinder front cover.**

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

INSTALLATION

1. Coat the oil pan gasket (if it was not replaced) and the cylinder front cover gasket with an oil-resistant sealer. Place an extra daub of sealer at the point where the two gaskets meet. Install the gasket on the cylinder front cover; then, install the cover, coolant overflow hose clip, timing pointer, power steering hose bracket, and the mounting bolts on the cylinder block. Tighten the bolts finger-tight.

2. Install the oil pan to cylinder front cover reinforcements and mounting bolts. Torque the bolts to specifications. Torque the cylinder front cover mounting bolts to specifications.

3. **Make certain the power steering pump rubber insulators are installed properly.** Carefully install the power steering pump on the crankshaft, making certain the lips of the cylinder front cover seal maintain proper contact with the power steering pump. Install the retaining bolts and washers and torque the bolts to specifications. Connect the inlet and outlet lines to the power steering pump. Tighten the power steering hose clamp.

4. Install the Woodruff key in the crankshaft. Install and press the crankshaft damper on the crankshaft until it is seated against the power steering pump coupler shaft (Fig. 29). Install the retaining bolt and washer and torque the bolt to specifications.

5. Coat new water pump gaskets with water-resistant sealer. Install the gaskets, water pump, oil level dipstick tube bracket, and power steering reservoir mounting bracket. Torque the water pump mounting bolts to specifications. Torque the power steering pump reservoir bracket mounting bolts to specifications. Tighten the bypass hose clamp.

6. Install the fuel pump push rod in the cylinder front cover. Install a new cup-type plug in the top of the cover.

7. Coat a new fuel pump gasket with an oil-resistant sealer. Install the gasket and fuel pump on the cylinder front cover and torque the mounting bolts to specifications. Connect the fuel vapor line to the fuel pump. Install the fuel pump shield.

8. Install the thermostat in the intake manifold. Coat a new supply tank mounting gasket with water-resistant sealer. Install the supply tank on the intake manifold. Install the engine ground strap and battery ground cable on the supply tank brace; then, torque the water pump mounting bolt to specifications. Torque the supply tank to intake manifold mounting bolts to specifications.

9. Connect the ignition coil primary and secondary wires to the coil terminals. Connect the overflow hose to the supply tank.

10. Install the fan-alternator drive belts. Adjust the alternator to obtain the specified drive belt tension and tighten the generator adjusting bracket bolt. Tighten the alternator mounting bolts. Connect the radiator outlet hose to the water pump and radiator. Close the radiator drain cock.

11. On a car with an air conditioner, install the compressor drive pulley, fan clutch drive, and fan assembly in the engine compartment as a unit. Install the compressor drive pulley, fan clutch drive and fan assembly on the water pump pulley as a unit and tighten the mounting bolts.

Install the compressor drive belt on the compressor clutch and drive pulley. Adjust the compressor to obtain the specified drive belt tension.

12. Install the fan and spacer on the water pump pulley and torque the mounting bolts to specifications.

13. Connect the radiator inlet hose to the radiator and supply tank. Install the cylinder block drain plugs.

14. Fill the cooling system to the required level.

15. Fill the power steering pump reservoir to the required oil level.

16. Fill the crankcase with the proper type and grade of oil to bring it up to the required level.

17. Start the engine and check the oil pump pressure at the instrument panel indicator. Run the engine until normal operating temperature is reached.

18. While the engine is operating, check for oil, fuel and water leakage. Remove the fender covers and close the hood.

TIMING CHAIN, CAMSHAFT AND CRANKSHAFT SPROCKETS

REMOVAL

1. Remove the cylinder front cover, following the procedures under "Cylinder Front Cover Removal." Remove the oil slinger from the crankshaft.

2. Rotate the crankshaft in a clockwise direction (as viewed from the front) to take up the slack on the left side of the chain.

3. Establish a reference point on the block and measure from this point to the chain (Fig. 30).

4. Rotate the crankshaft in the opposite direction to take up the slack on the right side of the chain. Force the left side of the chain out with the fingers and measure the distance between the reference point and the chain. The deflection is the difference between the two measurements.

TAKE UP SLACK ON LEFT SIDE. ESTABLISH A REFERENCE POINT AND MEASURE DISTANCE **A**. TAKE UP SLACK ON RIGHT SIDE AND FORCE LEFT SIDE OUT WITH THE FINGERS AND MEASURE DISTANCE **B**. DEFLECTION IS **A** MINUS **B**.

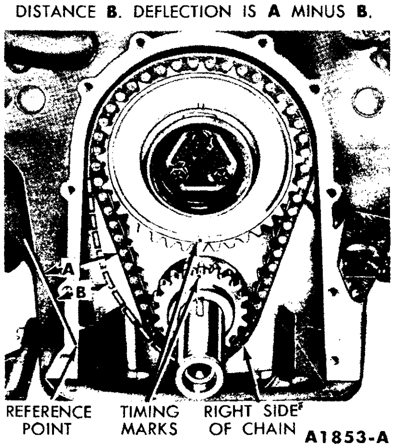


FIG. 30—Timing Chain Deflection

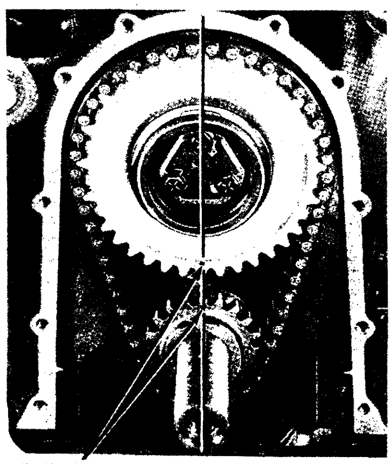


FIG. 31—Alignment of Timing Marks

If the deflection exceeds ½ inch, replace the timing chain and/or sprockets.

5. Rotate the crankshaft and align the timing marks of the crankshaft and camshaft sprockets (Fig. 31).

6. Remove the lock plate, fuel pump eccentric, drive bushing and wear plate from the camshaft.

7. Remove the camshaft sprocket and timing chain as a unit (Fig. 32).

8. Remove the crankshaft sprocket (Fig. 33). Remove the Woodruff key.

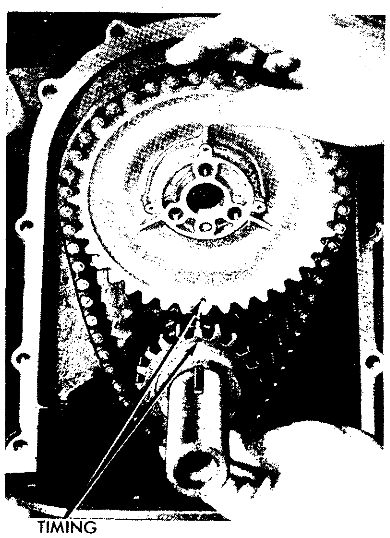


FIG. 32—Camshaft Sprocket and Timing Chain Removal or Installation

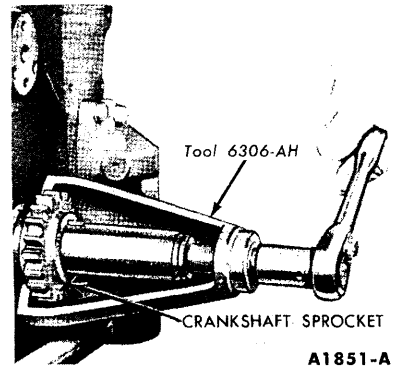


FIG. 33—Crankshaft Sprocket Removal

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

INSTALLATION

1. Install the Woodruff key in the crankshaft. Install the crankshaft sprocket (Fig. 34) with the timing mark facing the front of the car.

2. Position the timing chain around the camshaft sprocket. Align the timing mark on the camshaft sprocket with the mark on the crankshaft sprocket (Fig. 32).

3. Position the camshaft sprocket on the camshaft (Fig. 32). Install the wear plate, fuel pump eccentric sleeve, drive bushing, lock plate and mounting bolts. **The timing marks must be adjacent and on the same vertical centerline (Fig. 31). If the timing marks are not positioned as shown in the illustration, remove the camshaft sprocket and timing chain; then, install the units correctly.**

4. Make sure the drive bushing is

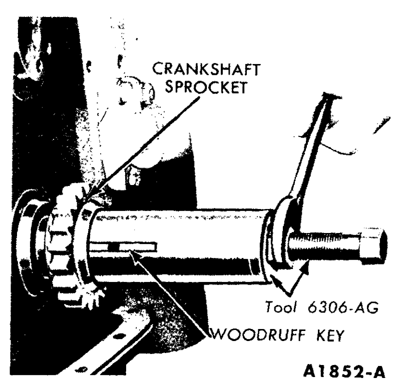


FIG. 34—Crankshaft Sprocket Installation

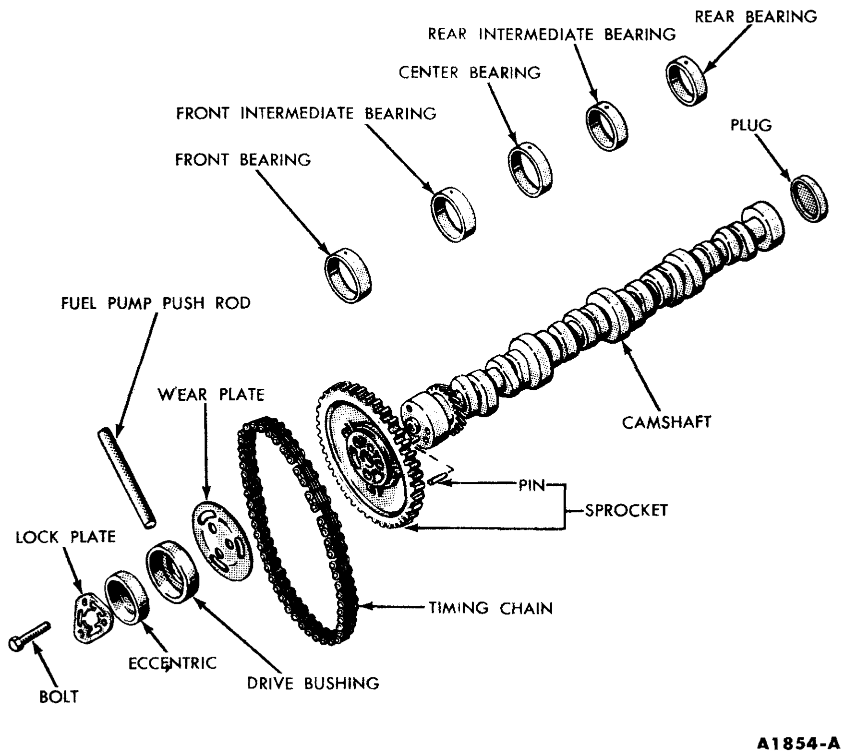


FIG. 35—Camshaft and Related Parts

properly seated over the fuel pump eccentric; then, torque the camshaft sprocket retaining bolts to specifications.

5. Install the oil slinger on the crankshaft, with the concave side of the slinger facing the rear of the engine.

6. Install the cylinder front cover, following the procedure under "Cylinder Front Cover Installation."

CAMSHAFT

The camshaft and related parts are shown in Fig. 35.

REMOVAL

1. Raise the hood and mask the hood edges to protect the finish. Install fender covers.

2. Remove the hood assembly. **If the hood is properly aligned, index the hood hinge to the hood for installation purposes before removing it from the car.**

3. Remove the hydraulic valve lifters from the engine, following the procedures under "Hydraulic Valve Lifter Removal."

4. Remove the timing chain and camshaft sprocket, following steps 1 thru 4 under "Timing Chain, Camshaft and Crankshaft Sprockets Removal."

5. Remove the radiator, following the applicable steps under "Radiator Removal" in Part 11-3, Section 2.

6. On a car with an air conditioner, carefully lift the condenser out of the engine compartment (with the lines still attached) and rest it on the left front fender.

7. Remove the camshaft from the cylinder block. **Use care to prevent damage to the camshaft bearing surfaces.**

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

REPAIRS

Refer to Part 8-1, Section 2 for the repair procedures.

INSTALLATION

1. Lubricate the camshaft journals and lobes with engine oil. Install the camshaft. **Use care to prevent the lobes and journals from damaging the camshaft bearings. Care must also be used to prevent the camshaft from dislodging the rear camshaft bearing plug.**

2. Install the timing chain camshaft sprocket, wear plate, fuel pump eccentric, drive bushing and lock plate by following steps 2 thru 6 under "Timing Chain, Camshaft and Crankshaft Sprockets Installation."

3. Coat the hydraulic lifters and lifter bores with engine oil. Insert the lifters into the bores from which they were removed.

4. Install the cylinder front cover, following steps 1 thru 7 under "Cylinder Front Cover Installation."

5. Install the fan-alternator drive belts. Adjust the alternator to obtain the specified drive belt tension. Tighten the alternator adjusting bracket bolt. Tighten the alternator mounting bolts.

6. Install the fan blade and spacer on the water pump pulley and torque the mounting bolts to specifications.

7. On a car with an air conditioner, install the compressor drive pulley and the fan drive clutch and fan assembly on the water pump pulley as a unit. Install the compressor drive belt on the compressor clutch and drive pulley. Adjust the compressor to obtain the specified drive belt tension. Tighten the compressor adjusting bracket bolts.

Position the condenser in the engine compartment.

8. Close the radiator drain cock. Position the radiator in the engine compartment.

9. On a car with an air conditioner, secure the condenser to the lower support of the radiator.

10. Secure the air deflector to the upper radiator support.

11. Place the radiator insulators between the radiator support bracket and the underbody. Make certain they are aligned with the mounting bolt holes. Install the radiator upper and lower mounting bolts.

12. Connect the lower hose to the radiator and water pump. Secure the fuel and vapor line bracket to the radiator.

13. Install the valve push rod chamber cover and the distributor, following steps 1 thru 6 under "Valve Push Rod Chamber Cover Installation."

14. Install the push rods and the valve rocker arm assemblies, following steps thru 5 under "Valve Rocker Arms, Shafts and Push Rod Installation."

15. Install the intake manifold and related engine parts, following steps 2 thru 17 and 19 and 21 under "Intake Manifold Installation."

16. Check the valve clearances and correct, if necessary (Part 8-1, Section 2).

17. Install the wiring loom in the clips located on the right bank rocker arm cover. Install the ignition coil primary and secondary wires, temperature sending unit wire, and the oil pressure sending unit wire.

18. Install the distributor cap and spark plug wires as a unit. Install the spark plug wires on the rocker arm covers and spark plugs.

19. Fill the crankcase to the required level with the proper type and grade of lubricant.

20. Add fluid to the power steering reservoir to bring the fluid up to the required level.

21. Start the engine. Check the oil pressure at the instrument panel indicator. Check for oil and coolant leaks.

22. Run the engine until normal operating temperature is indicated and perform or check the following items:

Check for fuel, oil, coolant and vacuum leakage.

Check and adjust the initial timing.

Perform carburetor idle and mixture adjustments.

Perform transmission linkage adjustments, if necessary.

23. On a car with an air conditioner, adjust the fast idle control linkage.

24. Install the hood assembly and adjust it, if necessary. Remove the masking tape from the hood.

25. Install the carburetor fresh air inlet duct assembly on the exhaust manifold. Install the carburetor air cleaner.

26. Remove the fender covers. Close the hood and road test the car.

CAMSHAFT REAR BEARING BORE PLUG REPLACEMENT

1. Remove the flywheel, following the procedure under "Flywheel Removal."

2. Drill a ½ inch hole in the center of the camshaft rear bearing bore plug.

3. Remove the plug with the clutch pilot bearing remover (tool 7600-E).

4. Clean the plug bore recess thoroughly.

5. Coat the bore with an oil-resistant sealer. Position the plug in the bore with the flange facing the front of the engine. Drive the plug inward until it is seated.

6. Install the flywheel, following the procedure under "Flywheel Installation."

MAIN AND CONNECTING ROD BEARING REPLACEMENT

It is necessary to check the condition of all crankshaft main and connecting rod journals before replacement procedures are performed.

If a crankshaft has journals that are damaged or worn below specifications, the crankshaft must be removed from the engine for grinding or replacement purposes. It will be necessary to remove the engine from the car and disassemble it to replace the crankshaft.

The standard main and connecting rod bearing inserts are a selective fit and do not require line reaming to size upon installation. **Do not file or lap bearing caps and webs or use shims to obtain the proper bearing clearance.**

Selective fit bearings are available for service in two standard sizes only. Each size carries a different suffix to the part number. They can be identified by a daub of red or blue color dye. Red marked bearing inserts decrease the clearance.

Undersize bearings which are not selective fit are available for use on journals that are undersize or have been reground.

MAIN BEARING REPLACEMENT

Check and replace one bearing at a time, leaving the other bearing caps securely attached to the cylinder block.

1. Remove the spark plugs. Remove the high tension lead wire from the coil terminal. Connect the auxiliary starter switch to the starter relay.

2. Drain the crankcase and remove the oil pan and oil pump.

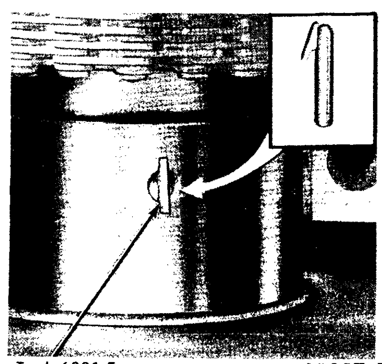


FIG. 36—Upper Main Bearing Insert Removal or Installation

3. Remove the main bearing cap to which new bearings are to be installed. Remove the upper bearing insert with tool 6331-E. Insert the tool into the crankshaft oil hole (Fig. 36) and rotate the crankshaft in the direction of normal rotation (clockwise). **Use tool 6331-E with care to avoid damage to the bearing insert.**

4. Clean and inspect each bearing insert carefully. Bearings that have a scored, chipped or worn surface will have to be replaced (Part 8-1, Section 3). **Dirt or other foreign material under a bearing insert may have distorted the bearing. Sound judgment and proper inspections are necessary when diagnosing bearing failures.**

5. Clean and inspect the main bearing journals for cracks, scratches, grooves, or score marks. Dress minor imperfections carefully with a fine oil stone. **If the journal is damaged it will have to be ground to size for the next undersize service bearing.**

6. Check the main bearing journal for an out-of-round condition with a dial indicator (tool 6565) and holding fixture (tool 4201-D). Secure tool 4201-D to the oil pan rail with an oil pan mounting bolt. (Fig. 37). Position the dial indicator on "O". Revolve the crankshaft and check the indicator reading. If out-of-round exceeds specifications, the crankshaft must be replaced.

7. Wipe oil and dirt from all contacting surfaces of the crankshaft, bearing inserts and bearing caps.

8. When replacing standard bearings with new bearings, it is

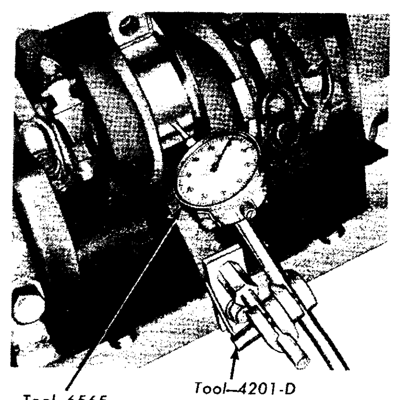


FIG. 37—Checking Crankshaft Journal for Out-of-Round Condition

recommended that two blue bearing inserts be used first to obtain the proper clearance. Make certain the oil holes are clear. Install the upper half of the bearing insert over the crankshaft on the locking tang side of the crankshaft main bearing web and rotate the insert into position as far as possible, then use tool 6331-E to fully seat the insert (Fig. 36).

9. Support the weight of the crankshaft with a small jack positioned to bear against the crankshaft counterweight adjoining the bearing which is being checked for clearance. **Crankshaft support is necessary when checking main bearing clearances in order to prevent the crankshaft weight from compressing the Plastigage, which would provide an incorrect reading.**

10. Place a piece of Plastigage, the full width of the bearing surface on the crankshaft journal, about ¼ inch off-center (Fig. 38). Place the lower bearing insert in the cap. Install the bearing insert and cap. Torque the bolts to specifications. **Do not rotate the crankshaft while making checks with Plastigage.**

11. Remove the bearing cap and the lower insert, but do not disturb the Plastigage. Compare the width of the flattened Plastigage at its widest point with the scale printed on the Plastigage envelope to obtain the minimum bearing clearance (Fig. 38). Check the Plastigage at its narrowest point to obtain the maximum bearing clearance. The difference between the minimum and maximum bearing clearance is the taper of the journal.

If the taper or out-of-round specification exceeds the allowable limits, the crankshaft must be removed and the journal ground to size for the next undersize bearing.

If the bearing clearance is greater than the specified limit, it will be necessary to remove the crankshaft and grind the journal to size for the next undersize bearing.

If the clearance is less than the specified limit, try two red bearing inserts or a combination of red and blue, depending on the condition. **Any combination of the standard red and/or blue bearing inserts may be used to obtain the desired results.**

12. After each bearing has been checked and found to be satisfactory, apply a light coating of engine oil to the bearing and journal, then install the lower bearing insert and cap. Tighten the retaining bolts to 95-105 ft-lbs torque.

13. Repeat the procedure for the remaining main bearings which require replacement.

14. If the rear main bearing is to be replaced, remove the rear main bearing cap. Remove and discard the rear seal and side seals.

15. Clean the rear journal oil seal groove.

16. Install a new rear journal oil seal in the rear main bearing cap (Fig. 39). After installation, cut the ends of the seals flush (Fig. 40).

17. Apply a thin coating of oil-resistant sealer to the rear main bearing cap at the rear of the top mating surface. **Do not apply sealer to the area forward of the side seal groove.** Install the rear main bearing cap. Torque the cap bolts to specifications.

18. Dip the side seals in light engine oil, then immediately install them in the grooves. **Do not use sealer on the side seals. The seals are designed to expand when dipped in oil. Using sealer may retard this expansion.** It may be necessary to tap the seals into place for the last ½ inch of travel. Do not cut the seal projecting ends.

19. Check the retainer side seals for leaks by squirting a few drops of oil into the parting lines between the rear main bearing cap and the cylinder block from the outside. Blow compressed air against the seals from the inside of the block. If air bubbles appear in the oil, it indicates possible oil leakage. **This test should not be performed on newly installed seals until sufficient time has been allowed for the seals to expand into the seal grooves.**

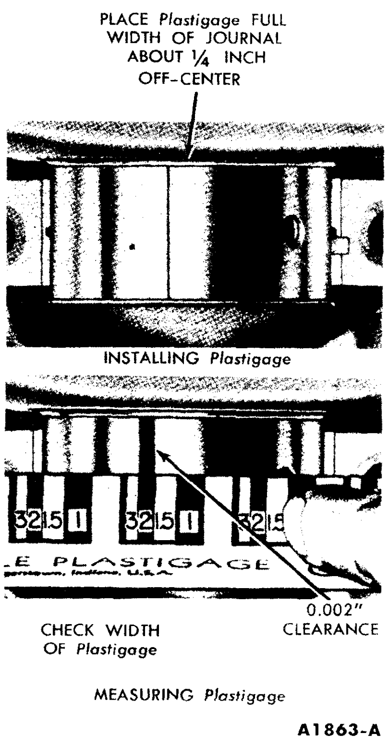


FIG. 38—Checking Bearing Clearance

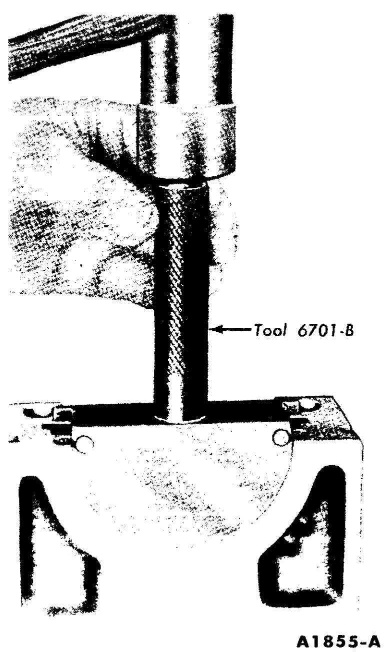


FIG. 39—Seal to Rear Bearing Cap Installation

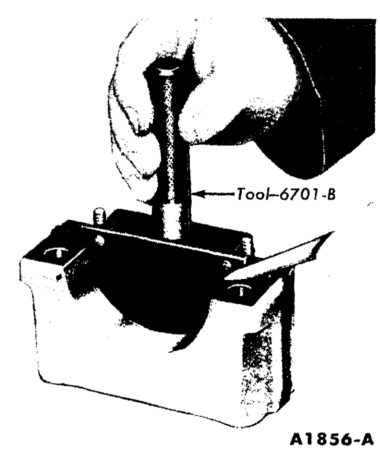


FIG. 40—Cutting Rear Bearing Cap Seal

20. Install the oil pump and intermediate shaft, by following steps 1 and 2 under "Oil Pump Installation."

21. Install the oil pan, by following steps 1 thru 9 under "Oil Pan Installation."

22. Remove the auxiliary starter switch. Insert the high tension lead wire in the coil. Install the spark plugs and torque them to specifications. Install the spark plug wires.

23. Start the engine and check the oil pressure at the instrument panel indicator. While the engine is running, check for oil leakage.

CONNECTING ROD BEARING REPLACEMENT

Check and replace one bearing at a time, leaving the other connecting rods securely attached to the journals.

1. Follow steps 1 and 2 under "Main Bearing Replacement."

2. Rotate the crankshaft to position the connecting rod journal at BDC for removal of the connecting rod bearing caps and inserts.

3. Remove the mounting nuts, bearing cap and lower bearing insert. Push the connecting rod and piston up into the cylinder bore with a wooden hammer handle. Remove the upper bearing insert.

4. Examine the bearing inserts. Bearings that have a scored, chipped, grooved, or worn surface must be replaced (Part 8-1, Section 2). **Dirt or other foreign material under a bearing insert may have distorted the bearing. Sound judgment and proper inspections are necessary when diagnosing bearing failures.**

5. If the wear pattern on the connecting rod bearing indicates a radius ride, inspect the crankshaft journal for the cause of the trouble.

If the crankshaft is the cause of failure, it must be removed from the engine to be ground to fit the next undersize bearing.

If bearing failure is due to a bent connecting rod, remove the connecting rod and piston assembly and check the connecting rod aligments.

6. Inspect the connecting rod journal for cracks, scratches, burrs, grooves or score marks. Carefully dress minor imperfections with a fine oil stone. Remove the crankshaft if it is damaged beyond repair and grind the journal to fit the next undersize bearing (Part 8-1, Section 2).

7. Clean oil, dirt and foreign material from the connecting rod journal, connecting rod, bearing cap and bearings.

8. Install the upper bearing on the rod. Make certain the locking tang of the bearing is properly located. Pull the rod assembly into firm contact with the crankshaft journal.

9. Install the lower bearing insert in the connecting rod cap. Place a piece of Plastigage on the bearing surface, the full width of the bearing, about ¼ inch off-center (Fig. 38). Install the cap and torque the mounting nuts to specifications. **Do not rotate the crankshaft while the Plastigage is in place.**

10. Remove the bearing cap. Compare the width of the flattened Plastigage at its widest point with the scale printed on the Plastigage envelope. This is the minimum bearing clearance (Fig. 38). Check the Plastigage at its narrowest point to obtain the maximum bearing clearance. The difference between the minimum and maximum bearing clearance is the taper of the journal.

If the taper exceeds the specified limit, the crankshaft must be removed and the journal ground to size for the next undersize bearing.

If the clearance is greater than the specified limit, it will be necessary to remove the crankshaft and grind the journal to size for the next undersize bearing.

If the clearance is less than the specified limit, try two red bearing inserts or a combination of red and blue, depending on the condition. **Any combination of the standard red and/or blue bearing inserts may be used.**

11. Lubricate the connecting rod bearings with engine oil and torque the connecting rod cap retaining nuts to specifications. Check the connecting rod side clearance with a feeler gauge (Fig. 41).

FIG. 41—Connecting Rod Side Clearance

12. Follow steps 20 thru 23 under "Main Bearing Replacement."

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

PISTON AND CONNECTING ROD ASSEMBLY

REMOVAL

1. Remove the intake manifold, valve push rod chamber cover, cylinder head(s) and related parts, following the procedure under "Cylinder Head Removal."

2. Remove the oil pan, following the procedure under "Oil Pan Removal."

3. Remove the oil pump, inlet tube and intermediate shaft, following the procedure under "Oil Pump Removal."

4. Prior to removing pistons, remove the ridge from each cylinder bore as follows:

Revolve the crankshaft until the piston to be removed is at BDC. Insert a clean cloth into the bore to prevent chips and carbon from falling onto the pistons and rings. Remove the cylinder bore ridge with cylinder ridge reamer tool 6011-E as shown in Fig. 42 (adapter tool 6011-F can be used to up-date cylinder ridge reamer tool 6011-A). Remove the cloth. Wipe the cylinder bore clean.

5. Rotate the crankshaft until the piston to be removed is at BDC. Remove the connecting rod bearing cap and bearing inserts. Push the connecting rod and piston out of the cylinder bore with a wooden hammer handle. **Use care to prevent striking of the cylinder bore with the connecting rod. If the cylinder bore is scored or nicked while removing the assembly, it will have to be honed or bored to repair the damage.**

Install the bearing inserts and connecting rod cap on the connecting rod from which they were removed. **The numbered side of the rod and cap should match. Each assembly is numbered so that it can be installed in the cylinder bore from which it was removed, if inspection proves their condition to be satisfactory.**

INSTALLATION

1. Remove the bearing cap and

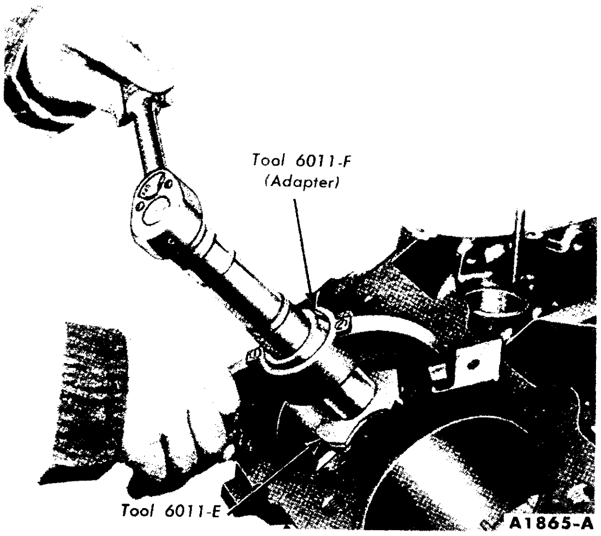


FIG. 42—Removing Cylinder Ridge

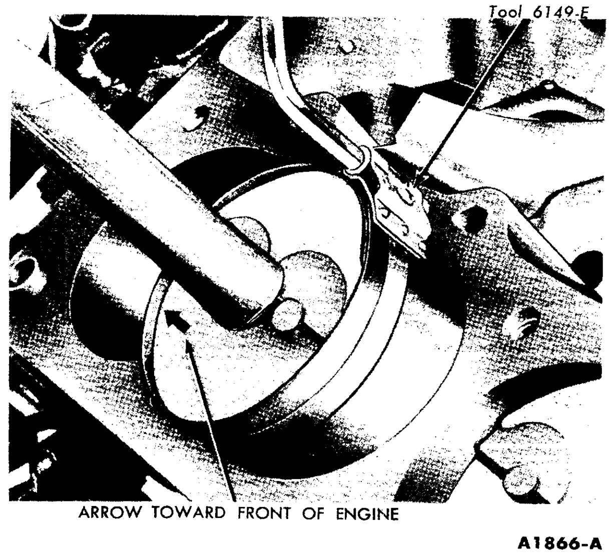


FIG. 43—Piston Installation

bearing insert from the connecting rod of the piston to be installed.

2. Coat the cylinder bores, pistons, rings and piston pins with engine oil. Check the piston ring gaps to make certain they are properly spaced (Fig. 52).

3. Install the piston and connecting rod assembly in the cylinder bore from which it was removed, or to which it was fitted. Revolve the crankshaft to position the connecting rod journal at BDC. Install piston ring compressor tool 6149-E over the piston assembly. **Make certain the notches on the edge of the tool face toward the top of the piston. The wrench and turning screw must be positioned toward**

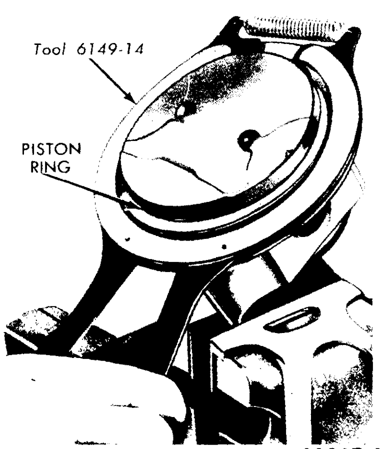


FIG. 44—Piston Ring Removal or Installation

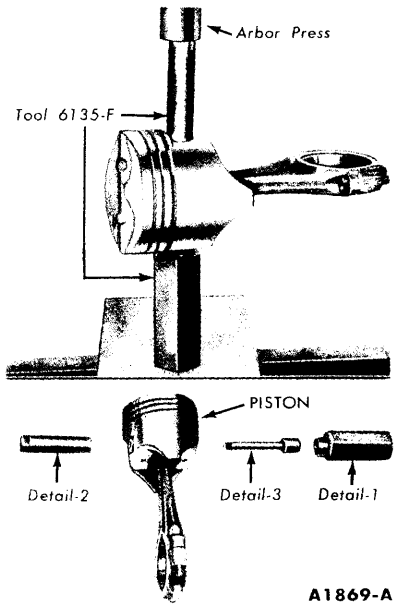


FIG. 45—Piston Pin Removal—Arbor Press

the inside of the "V" in the cylinder block. The arrow on the head of the piston must face toward the front of the engine, with the numbered side of the rod facing toward the outside of the cylinder block (Fig. 43).

4. Insert the piston assembly and the compressor tool in the cylinder bore (Fig. 43). **Use care to prevent the connecting rod or bolts from striking the cylinder bores or the connecting rod journals when installing the pistons. Damage to the bore may require honing of the cylinder and refitting of the piston to correct the condition.**

5. Push the piston assembly into the cylinder bore by applying pressure on the piston with a wooden hammer handle (Fig. 43). **Do not hammer on the piston dome. Hand pressure will immediately indicate any condition that hinders piston installation. Steps can then be taken to remedy the condition before damage occurs.**

6. Apply a light coat of engine oil to the journals and bearing inserts. Install the upper bearing insert in the connecting rod. Pull the rod downward until the upper bearing seats on the connecting rod journal. Install the lower insert in the con-

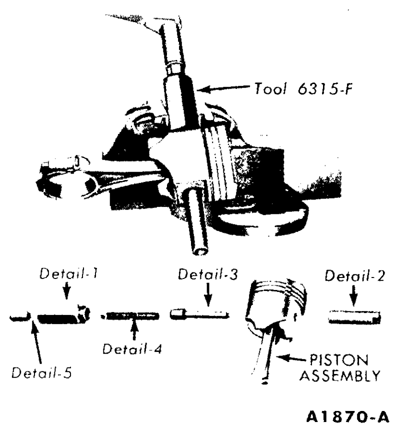


FIG. 46—Piston Pin Removal—Manual

necting rod cap. Install the cap and insert on the connecting rod so that the numbered side of the rod and cap match. Install the attaching nuts and tighten them until they are snug.

7. Check the fit of the connecting rod bearings, following the procedure under "Connecting Rod Bearings Replacement."

8. Install the oil pump and intermediate shaft, following the procedure under "Oil Pump Installation."

9. Install the oil pan, following steps 1 thru 8 under "Oil Pan Installation."

10. Close the radiator drain cock. Install the cylinder block drain plugs. Lower the car.

11. Install the exhaust manifold and cylinder head assembly, following steps 3 thru 16 under "Exhaust Manifold and Cylinder Head Installation."

12. Install the valve push rod chamber cover, following steps 1 thru 6 under "Valve Push Rod Chamber Cover Installation."

13. Install the intake manifold and related parts, following steps 2 thru 22 under "Intake Manifold Installation."

14. Install the ground cable on the battery. Fill the cooling system with coolant to the required level. Fill the crankcase to its required level with the proper type and grade of lubricant.

15. Start the engine. Check the oil pressure at the instrument panel indicator. Check for oil, coolant, fuel and vacuum leaks.

16. Check and adjust the initial timing. Adjust the carburetor fuel and idle mixture adjustments. Adjust the transmission linkage.

On a car with an air conditioner, adjust the fast idle control linkage.

17. Add the additional coolant needed to fill the cooling system to its required level while bleeding air from the cooling system.

18. Install the air cleaner and the air inlet duct assembly. Remove the fender covers. Close the hood and road test the car.

DISASSEMBLY

1. Remove the bearing inserts from each connecting rod. **Index the bearings so that they may be installed in the connecting rod and cap from which they were removed, if inspection proves their condition to be satisfactory.**

2. Remove the piston rings from the piston (Fig. 44).

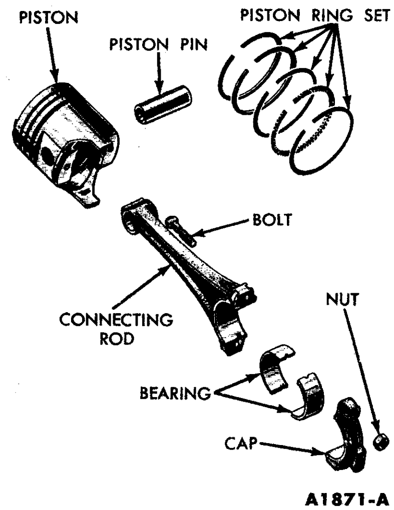


FIG. 47—Piston, Connecting Rod and Related Parts

3. Clean the piston ring grooves.

4. Disassemble the piston, piston pin and connecting rod (Fig. 45 or 46). **Each piston and connecting rod should be numbered so that they can be installed in the cylinder bore from which they were removed, if inspection proves their condition to be satisfactory.**

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

REPAIRS

Refer to Part 8-1, Section 2 for the repair procedures.

ASSEMBLY

The piston, connecting rod and related parts are shown in Fig. 47.

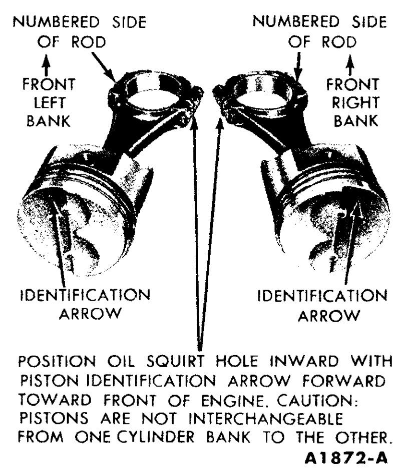


FIG. 48—Connecting Rod and Piston Assembly

1. Position the connecting rod to the piston as shown in Fig. 48. **Make certain the piston identification arrow and connecting rod numbered side is positioned correctly for installation of the piston in the proper cylinder and cylinder bank.**

2. Press the piston pin through the piston and connecting rod until it extends 1/4 inch beyond the piston boss (Fig. 49 or 50).

3. Use details 1, 2, 3, 4 and 5 of tool 6135-F and install the piston, piston pin and connecting rod assembly in a vise as shown in Fig. 51. Install a torque wrench on the nut. Observe the torque wrench reading while tightening the nut until detail 2 has seated against detail 1. A minimum torque limit specification of 20 ft.-lbs is required to fully seat the pin. Remove the tools.

4. If the minimum torque reading is less than 20 ft-lbs, remove the piston pin as shown in Fig. 45 or 46, and replace the connecting rod. **The piston pin bore of the new connecting rod must be checked to make certain it is within specifications. Check the diameter of the piston pin to make certain it is within specifications. If the piston pin is not within specifications, replace the piston and pin assembly. Check the fit of the new piston in the cylinder bore before assembling the piston and piston pin to the connecting rod.**

5. After the rods are assembled to the pistons, the complete assembly should be checked with a connecting

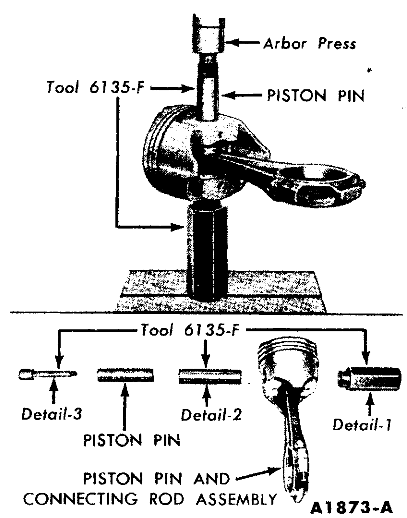


FIG. 49—Piston Pin Installation—Arbor Press

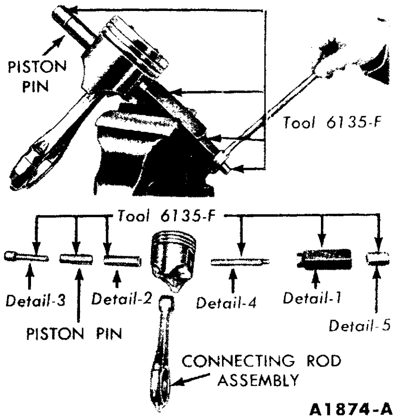


FIG. 50–Piston Pin Installation–Manual

rod alignment fixture tool or other suitable aligning equipment. Since many makes are in use, it is recommended that the tool manufacturer's instructions be followed to assure that the rod is not bent or twisted beyond the specified limits.

6. Check the piston ring gap and side clearance (Part 8-1, Section 2).

7. Install the rings on the pistons from which they were removed or to which they were fitted (Fig. 44). The lower compression ring must be assembled with the outside counterbore down with respect to the dome of the piston.

8. When spacing the ring gaps on the piston, the oil ring spacer expander gap "A" must be opposite from the raised projections on the dome of the piston with the oil ring segment gaps "B" staggered one inch to each side (Fig. 52). Compression ring gaps "C" are to be 150° on each side of the oil ring expander gap (Fig. 52).

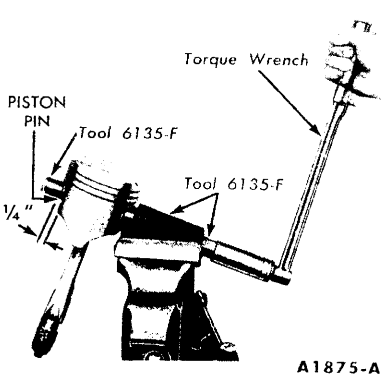


FIG. 51–Checking Interference Torque Required to Seat Piston Pin

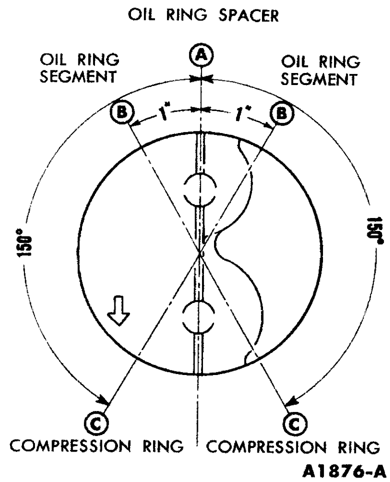


FIG. 52–Piston Ring Gap Spacing

9. Be sure the bearing inserts and the bearing bore in the connecting rod and cap are clean. Foreign material under the inserts may distort the bearing and cause a failure.

10. Lubricate all parts with light engine oil. Install the bearing inserts in the connecting rod and cap with the tangs fitting in the slots provided.

FLYWHEEL

REMOVAL

1. Remove the automatic transmission from the car (Part 7-2).

2. Index the flywheel reinforcing plate to the flywheel for installation purposes. Remove the mounting bolts, reinforcing plate and flywheel from the crankshaft.

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

INSTALLATION

1. Install the reinforcing plate on the flywheel and align the index marks. Install the reinforcing plate and flywheel on the crankshaft as a unit. Install the mounting bolts and torque them to specifications.

2. Install the starter motor and transmission assembly in the car (Part 7-2).

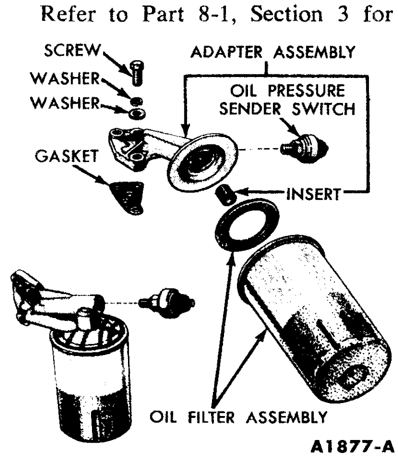


FIG. 53–Rotunda Oil Filter and Adapter

OIL FILTER AND ADAPTER

The Rotunda oil filter and adapter assembly is shown in Fig. 53.

REMOVAL

1. Raise the car. Place a drip pan under the filter assembly.

2. Turn the filter counterclockwise and remove it from the adapter. Disconnect the oil pressure sending unit lead wire. Remove the sending unit.

3. Remove the bolts securing the adapter to the cylinder block. Remove the adapter and gasket.

INSTALLATION

1. Clean the gasket surfaces at the cylinder block and adapter. Coat a new adapter gasket with an oil-resistant sealer and position it on the cylinder block.

2. Install the adapter on the cylinder block and torque the mounting bolts to specifications.

3. Install the oil pressure sending unit in the adapter. Connect the lead wire to the sending unit.

4. Coat the gasket on the filter with a light film of oil. Screw the filter onto the adapter until it is snug; then, advance it ¼ turn. **Do not overtighten the filter.**

5. Remove the drip pan and lower the car.

6. Start the engine. Operate the engine at fast idle and check for oil leakage.

7. Fill the crankcase to its required level with the proper type and grade of lubricant.

OIL PAN

REMOVAL

1. Raise the hood and install fender covers. Remove the oil level dipstick.

2. Revolve the crankshaft to position the No. 1 piston 15° BTDC for oil pan clearance purposes. (Refer to the position of the rotor and/or crankshaft damper timing marks.)

3. Set the parking brake. Raise the car.

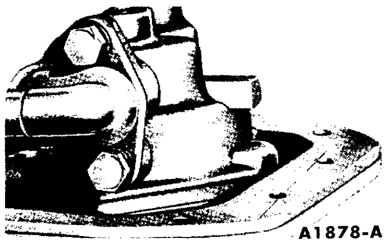


FIG. 54—Oil Inlet Tube and Screen Mounting Bolts

4. Drain the lubricant from the crankcase.

5. To allow clearance for removal of the oil pan, remove the engine front support insulator to underbody side member retaining nuts. Install a block of wood on a floor jack and position the jack under the front leading edge of the oil pan. Raise the engine approximately 1¼ inches and insert a 1½ inch block of wood between the insulators and the underbody side members. Remove the floor jack.

6. Remove the oil pan mounting bolts and reinforcements (washers). Free the oil pan from the cylinder block. Remove the two mounting bolts securing the oil pump pick-up tube and screen assembly to the oil pump, and allow the tube and screen to drop into the oil pan (Fig. 54). Remove the oil pan.

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

INSTALLATION

1. Coat a new oil pan gasket with oil-resistant sealer and install it on the cylinder block.

2. Coat a new oil pick-up tube mounting gasket with oil-resistant sealer and install the gasket on the oil pick-up tube and screen assembly.

3. Install the oil inlet tube and screen assembly loosely on the oil pump with the upper mounting bolt and washer.

4. Position the oil pan on the crossmember. Swing the oil inlet tube forward and install the inlet tube lower mounting bolt and lock washer. **Make certain the inlet tube gasket is seated properly. A leak can cause loss of the oil pressure and cause extensive engine damage.** Torque the upper and lower mounting bolts to specifications.

5. Position the oil pan on the cylinder block. Make certain the gasket is properly aligned; then, install the mounting bolts and reinforcements. Torque the bolts to specifications. Install the oil pan drain plug and torque it to specifications.

6. Position the floor jack and a block of wood under the leading edge of the oil pan; raise the engine and remove the blocks from beneath the insulators. Lower the engine and remove the jack. Torque the insulator to underbody side member nuts to specifications.

7. Lower the car. Install the oil level dipstick and oil filter. Fill the crankcase to the required level with the proper grade and type of lubricant.

8. Start the engine and check the oil pump pressure by observing the oil pressure indicator on the instrument panel.

9. With the engine running, check for oil leaks.

10. Remove the fender covers and close the hood.

OIL PUMP

REMOVAL

1. Remove the oil pan, following the procedure under "Oil Pan Installation."

2. Remove the oil pump assembly, gasket and distributor intermediate shaft from the cylinder block.

INSTALLATION

1. Install the distributor intermediate shaft in the oil pump rotor shaft. Apply oil-resistant sealer to a new oil pump mounting gasket and install the gasket on the oil pump.

2. Insert the intermediate shaft into position in the distributor shaft hex bore. **Make certain it is properly seated.** Secure the oil pump to the cylinder block and torque the screws to specifications. **Make certain the gasket is properly installed. Oil leakage can cause loss of oil pressure and extensive engine damage.**

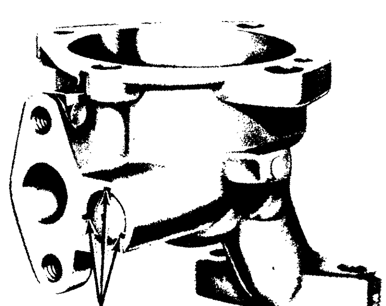


FIG. 55—Relief Valve Stake Marks

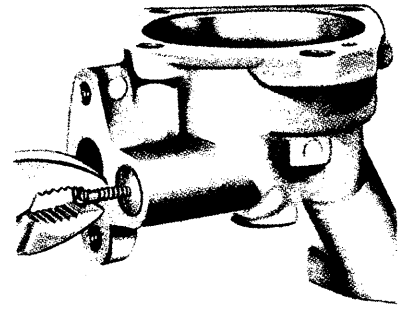


FIG. 56—Relief Valve Plug Removal

3. Install the oil pan and related parts following the procedure under "Oil Pan Installation."

DISASSEMBLY

1. Remove the four screws and washers securing the oil pump cover to the oil pump.

2. Remove the oil pump outer rotor and rotor shaft assembly from the oil pump housing.

3. Scrape the stake marks which secure the relief valve plug in the oil pump housing (Fig. 55). To remove the plug, insert a self-tapping screw in the old relief hole and pry it from the oil pump housing (Fig. 56). **Use care to prevent loss of the relief valve spring while performing this operation.**

4. Remove the spring and relief valve from the oil pump housing.

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for

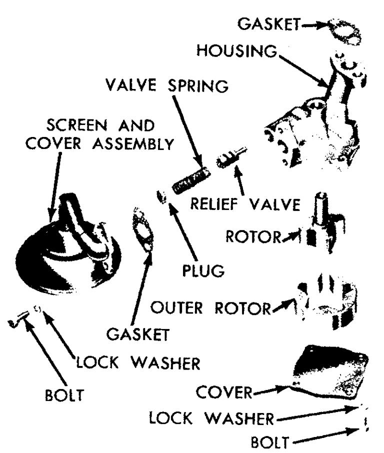


FIG. 57—Oil Pump Assembly

the cleaning and inspection procedures.

ASSEMBLY

The oil pump assembly is shown in Fig. 57.

1. Install the relief valve, spring and relief valve plug in the oil pump housing. Press the plug inward until it seats; then, stake it in place. **The relief hole in the plug must not be covered or obstructed.**

2. Install the outer rotor and rotor shaft in the housing assembly. Fill the housing with engine oil for priming purposes.

3. Install the plate, using four lock washers and screws. Torque the screws to specifications.

OIL FILLER PIPE AND CAP

REMOVAL

1. Remove the bolt securing the oil filler pipe bracket to the intake manifold.

2. Carefully pry the filler pipe out of the cylinder block. Clean the filler pipe with solvent.

INSTALLATION

1. To replace the filler pipe, tap it into the cylinder block with a soft mallet until it seats.

2. Secure the oil filler pipe bracket to the intake manifold and torque the mounting bolt to specifications.

3 ENGINE REMOVAL AND INSTALLATION

The engine removal and installation procedures are for the engine only, without the transmission attached. A typical engine installation is shown in Fig. 58.

REMOVAL

1. Raise the hood and mask the edges of the hood, fenders and cowl to protect the paint. Place fender covers on the fenders.

2. Set the parking brake and raise the car. Install support stands beneath the underbody front cross member.

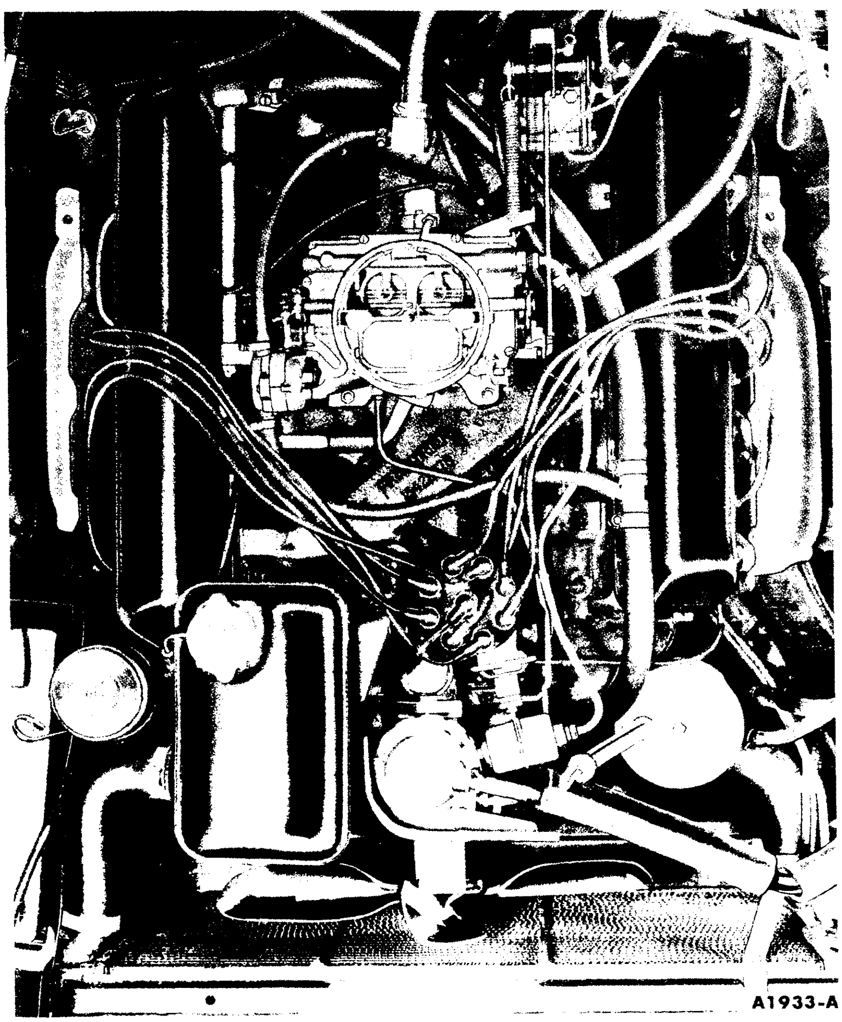


FIG. 58—Typical Engine Installation

3. Drain the cooling system at the radiator and cylinder block. Drain the crankcase.

4. Remove the hood asembly. **If the hood is properly aligned, index the hood to the hinge for installation purposes.**

5. Remove the carburetor air cleaner and air inlet duct assembly. Disconnect the battery ground cable from the battery.

6. Remove the radiator inlet hose from the radiator and supply tank.

7. Disconnect the heater inlet hoses at the intake manifold and set the hoses to one side at the rear of the engine. Disconnect the heater to water pump hose at the "Y" outlet tube connection. Disconnect the power brake vacuum booster line from the intake manifold connection and position it to one side at the rear of the engine.

8. Disconnect the heater vacuum hose from the intake manifold fitting.

9. Disconnect the automatic transmission vacuum line at the intake manifold.

10. Remove the transmission filler tube slotted bracket from the right rear exhaust manifold mounting stud.

11. Disconnect the battery ground strap at the cylinder block.

12. Disconnect the primary wires at the coil. Disconnect the wires from the temperature sending unit and the fast idle solenoid (cars equipped with air conditioning).

13. Disconnect the lead wire from the oil pressure sending unit. Remove the wiring loom from the retaining clips located on the valve rocker arm cover and position it at the rear of the engine.

14. Disconnect the transmission fluid inlet hose connection at the radiator. Disconnect the transmission fluid outlet hose connection at the outlet line. Remove the transmission

fluid filter from the underbody side member (if the car is so equipped). Cover the openings of all the connections to prevent the entrance of foreign material.

15. Remove the fuel inlet hose mounting bracket from the radiator. Remove the heat shield from the fuel pump. Disconnect the fuel inlet hose and vapor outlet hose from the fuel pump.

16. On a car with an air conditioner, remove the fan drive clutch to water pump pulley retaining bolts. Remove the fan drive clutch, fan and compressor pulley from the car as a unit.

17. Remove the fan blade assembly and spacer from the water pump pulley.

18. Disconnect the radiator outlet hose at the water pump.

19. On a car with an air conditioner, remove the radiator lower mounting bolts. Remove the bolts securing the radiator to the condenser. Remove the bolts securing the radiator to the radiator support. Remove the radiator.

Disconnect the compressor clutch wire at the bullet connector. Remove the compressor support bracket.

Remove the compressor high and low pressure service valve caps and "front seat" the high and low pressure service valves.

Loosen the manifold gauge port caps slightly and slowly bleed the refrigerant from the compressor. Tighten the port caps when all the refrigerant has been bled.

Remove the high and low pressure service valves and muffler assembly from the compressor. Cover all openings of the compressor and service valves tightly with tape to prevent condensation. Position the service valves and lines against the fender apron for engine clearance purposes.

Disconnect the fast idle control rod at the accelerator shaft (bell crank) assembly.

20. Remove the radiator lower mounting bolts. Remove the bolts securing the radiator to the radiator support. Remove the radiator.

21. Disconnect the transmission and accelerator linkage at the accelerator shaft assembly (bell crank). Secure the linkage to the dash panel for engine clearance purposes.

22. Remove the access cover from the converter housing. Remove the underbody splash shield located at the lower front of the transmission.

23. Remove the resonator inlet pipes from the exhaust manifolds.

24. Remove the clamp securing the power steering pump outlet line to the mounting bracket. Disconnect the power steering outlet line from the power steering pump. Drain the fluid into a clean container.

25. Remove the nuts and washers which secure the engine front support insulators to the underbody side members.

26. Remove the bolts securing the starter to the converter housing. Remove the starter and dust seal.

27. Disconnect the lead wires from the alternator. Remove the transmission oil cooler inlet and outlet transfer line retaining clip from the cylinder block.

28. Revolve the flywheel and remove the flywheel to converter retaining nuts.

29. Remove the engine lateral restrictor from the converter housing. Remove the lower converter housing to cylinder block retaining bolts.

30. Install a transmission support jack under the transmission.

31. Remove the upper converter to cylinder block retaining bolts.

32. On a car with an air conditioner, remove the compressor support bracket from the cylinder head and the intake manifold.

33. Screw engine lifting eyes (tool 6000-K) into the exhaust manifolds (Fig. 59).

34. Remove the lower front mounting bolt from each cylinder head. Install fabricated lifting eyes and secure them to the cylinder heads finger-tight. Install two fabricated lifting chains and hooks on the upper chain links that are secured to the lifting bar of tool 6000-B. Install the engine hoisting sling (tool 6000-BA) on a hoist and insert the lifting hooks through the lifting eyes (Fig. 59). Fabricate the lifting chain, hook and bracket assemblies as shown in Fig. 60.

35. With assistance, remove the engine from the car. Guide the engine carefully to prevent damage.

36. Remove the fan - alternator drive belts. Remove the alternator and mounting bracket as a unit from the engine prior to installing the engine on the work stand.

INSTALLATION

1. Screw engine lifting eyes (tool 6000-K) into the exhaust manifolds. Remove the lower front mounting bolt from each cylinder head. Install the fabricated lifting eyes in the cylinder head and tighten them finger-tight. Install the engine hoisting sling (tool 6000-BA) on a hoist and insert the hooks through the lifting eyes (Fig. 59).

2. Install the cylinder block drain plugs. Raise the hoist to support the weight of the engine. Remove the engine from the repair stand.

3. Install the alternator and mounting bracket on the engine as a unit. Install the water pump pulley-alternator pulley drive belts. Adjust the belts to obtain the specified belt tension.

4. Align the converter to flywheel mounting studs with the mounting bores in the flywheel.

5. Install the engine in the car, making certain the converter studs are seated in their respective flywheel bores. Install the lower converter housing to cylinder block mounting bolts and torque them to specifications. Install the engine lateral restrictor assembly on the converter and the underbody side rail. Torque the lateral restrictor bracket to converter mounting bolt to specifications. Torque the outer bracket mounting bolts to specifications.

6. Install the insulator to underbody side member retaining nuts and washers. Torque the nuts to specifications.

7. Remove the lifting eyes, chains and sling from the engine. Install the lower front cylinder head mounting bolts and torque them to specifications.

8. Remove the transmission support jack. Using four nuts and lock washers, secure the converter to the flywheel and torque the nuts to specifications.

9. Install the starter assembly, starter cable, dust seal and starter cable mounting bracket. Tighten the mounting bolts. Connect the starter cable to the starter.

10. Connect the resonator inlet pipes to the exhaust manifolds and torque the mounting nuts to specifications.

11. Install the converter access plate and tighten the mounting bolts. Install the transmission splash shield and tighten the mounting bolts.

12. Install the transmission oil inlet and outlet transfer lines and bracket as a unit on the cylinder block and tighten the mounting bolt.

13. Connect the lead wires to the alternator.

14. Connect the power steering

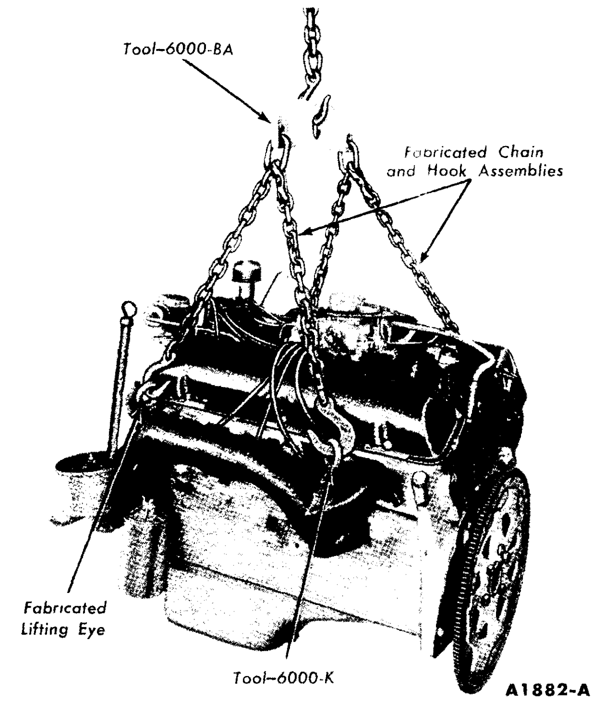


FIG. 59—Engine Lifting Tools Installed

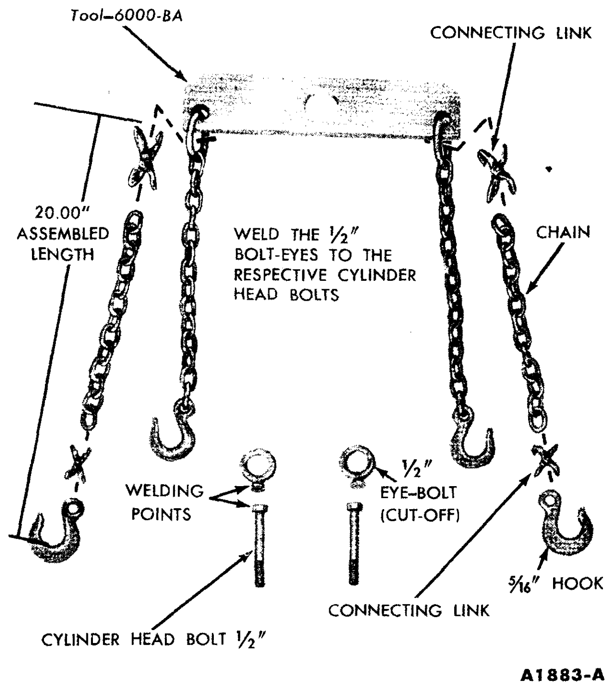


FIG. 60—Instructions for Fabricating Engine Lifting Eyes & Chains

pump outlet line to the power steering pump. Install the clamp on the power steering pump outlet line and secure the line to the mounting bracket.

15. Install the three upper converter housing to cylinder block mounting bolts and lock washers and torque them to specifications.

16. Install the transmission oil filler tube mounting bracket on the right exhaust manifold. Torque the exhaust manifold mounting bolt to specifications. Bend the locking tab of the washer. Connect the battery ground strap to the cylinder block.

17. Connect the vacuum hoses to the intake manifold fitting.

18. Connect the heater outlet hose "Y" connecting tube to the water pump inlet hose. Tighten the clamp. Connect the heater inlet hoses to the intake manifold connector. Tighten the hose clamps; then, gather the vacuum hoses and the heater inlet and outlet hoses together and install the retaining band.

19. Connect the accelerator linkage to the accelerator shaft assembly (bell crank).

20. On a car with an air conditioner, connect the fast idle control rod to the accelerator shaft assembly (bell crank).

21. Install the wiring loom assembly in the retaining clips. Connect the temperature sending unit, coil and oil pressure sending unit wires to their respective units.

22. On a car with an air conditioner, connect the lead wire to the fast idle solenoid.

Install the low pressure valve screen. Using two new gaskets between the service valves and the compressor to prevent leaks, secure the service valves to the compressor and torque the retaining screws to specifications. Purge the compressor.

Connect the air conditioner clutch lead wire to the bullet connector.

23. Install the transmission fluid filter (if the car is so equipped) on the underbody side member. Connect the inlet line to the lower filter hose and tighten the clamp.

24. Tighten the radiator drain cock and position the radiator in the engine compartment. Install the lower radiator to the condenser (if the vehicle is so equipped) mounting bolts. Install the insulators under the radiator; then, loosely install the radiator lower mounting bolts. Align the radiator and condenser upper mounting bolt holes to the mounting holes in the air deflector. Install and tighten all mounting bolts.

25. Connect the radiator outlet hose to the water pump and tighten the retaining clamp.

26. Connect the transmission inlet and outlet lines to the radiator. Connect the transmission oil filter inlet hose to the filter and tighten the clamp.

27. On a car with an air conditioner, install the fan drive clutch and fan assembly, compressor drive pulley, mounting bolts, and washers as a unit on the water pump pulley. Tighten the mounting bolts.

Install the compressor drive belt and adjust the compressor to obtain the specified belt tension. Tighten the compressor adjusting bracket and support bracket bolts.

28. Install the fan blade and spacer on the water pump pulley and torque the mounting bolts to specifications. Connect the fuel inlet hose and the vapor outlet hose to the fuel pump. Install the fuel pump heat shield.

29. Install the fuel inlet hose and bracket on the radiator and tighten the mounting bolts.

30. Connect the upper radiator inlet hose to the radiator and the supply tank. Tighten the hose clamps. Connect the battery ground strap at the battery.

31. Fill the cooling system to its required level. Add fluid to the power

steering reservoir to bring it up to the required level.

32. Fill the crankcase to the required level with the proper grade and type of lubricant.

33. Start the engine and check the oil pressure at the instrument panel indicator.

34. Run the engine until normal operating temperature is indicated and perform or check the following items:

Check for oil, coolant and vacuum leaks.

Adjust and check the initial and advance timing.

Perform carburetor idle and fuel mixture adjustments.

Perform carburetor, accelerator and transmission linkage adjustments.

35. On a car with an air conditioner, check the air conditioner system and charge it as necessary.

36. Install the carburetor air cleaner and duct assembly. Install the hood assembly and adjust it, if necessary. Remove the masking tape from the hood, fender and cowl.

37. Road test the car.

4 MAJOR REPAIR OPERATIONS

To perform the operations in this section, it will be necessary to remove the engine from the car and install it on a work stand.

CRANKSHAFT

The crankshaft and related parts are shown in Fig. 61.

REMOVAL

1. Remove the alternator and bracket. Remove the spark plugs to allow easy rotation of the crankshaft.

2. Disconnect the fuel inlet line at the carburetor. Remove the fuel pump and fuel pump push rod. Remove the water pump and fan as an assembly.

3. Remove the crankshaft damper mounting bolt and washer. Install the puller on the damper and remove the damper (Fig. 28). Remove the Woodruff key.

4. Remove the power steering pump and reservoir.

5. Remove the cylinder front cover, timing pointer, oil level dipstick tube and the cover mounting gasket. Remove the crankshaft front oil slinger.

6. Check the timing chain deflection, following steps 2, 3 and 4 under "Timing Chain, Camshaft and Crankshaft Sprockets Removal."

7. Crank the engine until the timing marks on the sprockets are positioned as shown in Fig. 31. Remove the lock plate, fuel pump eccentric, drive bushing and wear plate. Remove the camshaft sprocket and timing chain as a unit.

8. Remove the crankshaft sprocket (Fig. 33).

9. Invert the engine on the work stand. Remove the flywheel. Remove the oil pan and gasket. Remove the oil pump.

10. Make sure all bearing caps (main and connecting rod) are

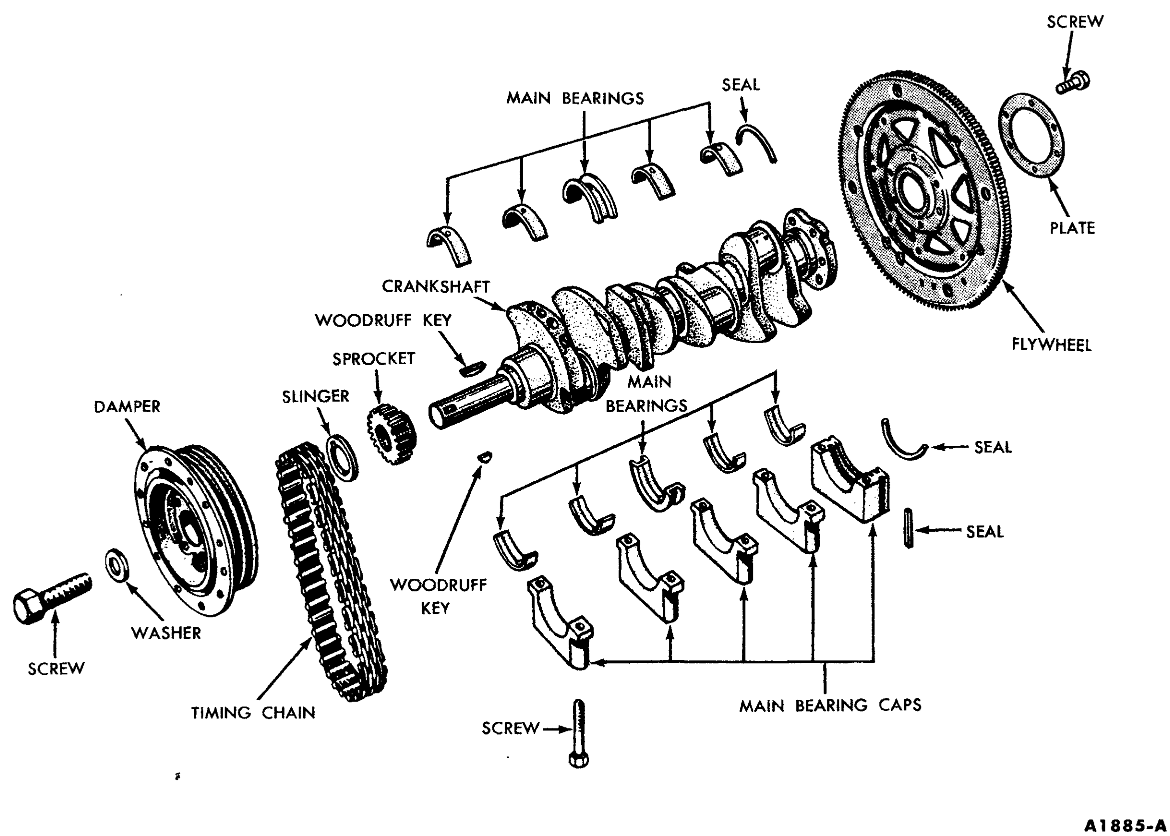


FIG. 61—Crankshaft and Related Parts

marked so that they can be installed in their original locations. Remove the connecting rod bearing caps. Turn the crankshaft until the connecting rod from which the cap is being removed is down and remove the cap. Push the connecting rod and piston assembly up into the cylinder.

11. Remove the main bearing caps.

12. Carefully lift the crankshaft out of the block so that the thrust bearing surfaces are not damaged. **Handle the crankshaft with care to avoid possible fracture or damage to the finished surfaces.**

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

REPAIRS

To finish journals, dress minor imperfections, etc., refer to Part 8-1, Section 2.

INSTALLATION

1. Remove the rear journal oil seal from the block and rear main bearing cap. Remove the rear main bearing cap to block side seals.

2. Remove the main bearing inserts from the block and bearing caps.

3. Remove the connecting rod bearing inserts from the connecting rods and caps.

4. If the crankshaft main bearing journals have been refinished to a definite undersize, install the correct undersize bearings. Be sure the bearing inserts and bearing bores are clean. Foreign material under the inserts may distort the bearing and cause a failure.

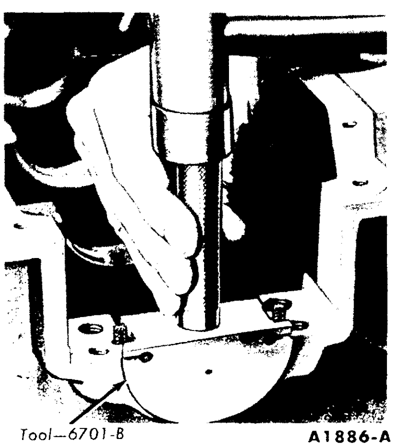


FIG. 62—Installing Rear Main Bearing Seal in Cylinder Block

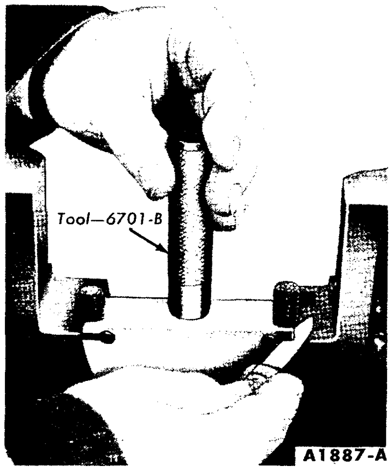


FIG. 63—Cutting Rear Main Bearing Seal in Cylinder Block

5. Place the upper main bearing inserts in position in the bores with the tang fitting in the slot provided.

6. Install the lower main bearing inserts in the bearing caps.

7. Install a new rear journal oil seal in the block (Fig. 62). After installation, cut the ends of the seals flush (Fig. 63). **It is very important that the seal be cut flush with the surface of the cylinder block. This prevents rough edges which may project from the groove and lodge between the bearing cap and cylinder block.**

8. Carefully lower the crankshaft into place. **Be careful not to damage the bearing surfaces.** Install the Woodruff key in the crankshaft. Install the crankshaft sprocket (Fig. 34) with the timing mark facing the front of the car.

9. Check the clearance of each main bearing as follows:

Place a piece of Plastigage on the crankshaft journal the full width of the journal and about ¼ inch off-center. Follow steps 10 and 11 under "Main Bearing Replacement."

10. After the bearings have been fitted, apply a light coat of engine oil to the journals and bearings. Install new seals in the rear main bearing cap and install the rear main bearing cap by following steps 15 thru 19 under "Main Bearing Replacement." Install all the bearing caps, except the thrust bearing cap (No. 3 bearing). **Be sure that the main bearing caps are installed in their original locations.** Torque the bearing cap bolts to specifications.

11. Install the thrust bearing cap with the bolts finger-tight.

12. Pry the crankshaft forward against the thrust surface of the upper half of the bearing (Fig. 64).

13. Hold the crankshaft forward and pry the thrust bearing cap to the rear (Fig. 64). This will align the thrust surfaces of both halves of the bearing.

14. Retain the forward pressure on the crankshaft. Tighten the cap bolts to specifications (Fig. 64).

15. Force the crankshaft toward the rear of the engine.

16. Install a dial indicator so that the contact point rests against the crankshaft flange and the indicator axis is parallel to the crankshaft axis (Fig. 65).

17. Zero the dial indicator. Push the crankshaft forward and note the reading on the dial.

18. If the end play exceeds the wear limit, replace the thrust bearing. If the end play is less than the minimum limit, inspect the thrust bearing faces for scratches, burrs, nicks, or dirt. If the thrust faces are not defective or dirty, they probably were not aligned properly. Install the thrust bearing and align the faces following the recommended procedure (steps 11, 12, 13 and 14), then check the end play.

19. Install new bearing inserts in the connecting rods and caps. Check the clearance of each bearing following the procedure under "Main Bearing Replacement."

20. After the connecting rod bearings have been fitted, apply a light coat of engine oil to the journals and bearings.

21. Turn the crankshaft throw to the bottom of its stroke. Push the piston all the way down until the rod bearing seats on the crankshaft journal.

22. Install the connecting rod cap. Torque the nuts to specifications.

23. After the piston and connecting rod assemblies have been installed, check the side clearance between the connecting rods on each connecting rod crankshaft journal (Fig. 41).

24. Clean the oil pan, oil pump and oil pump screen. Install the oil pump and oil pan.

25. Position the flywheel on the crankshaft. Install the retaining bolts. Torque the bolts to specifications.

26. Invert the engine on the work stand. Install the timing chain, camshaft sprocket, wear plate, fuel pump eccentric, drive bushing and lock plate by following steps 2 thru 4 un-

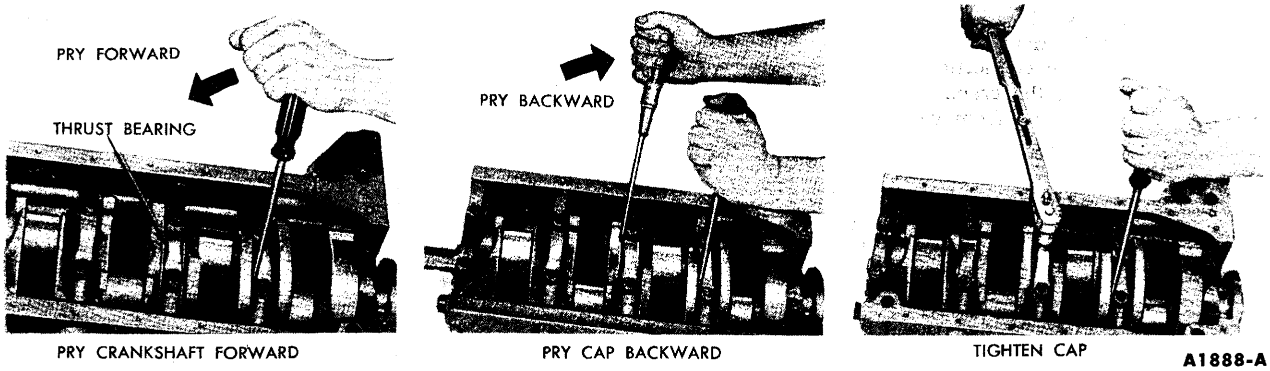


FIG. 64–Thrust Bearing Alignment

der "Timing Chain, Camshaft and Crankshaft Sprockets Installation."

27. Install the oil slinger on the crankshaft, with the concave side of the slinger facing the rear of the engine.

28. Install the cylinder front cover, power steering pump and reservoir, and crankshaft damper following steps 1 thru 4 under "Cylinder Front Cover Installation."

29. Coat new water pump gaskets with water-resistant sealer. Install the gaskets, water pump, oil level dipstick tube bracket, and power steering reservoir mounting bracket. Torque the water pump mounting bolts to specifications. Torque the power steering pump reservoir bracket mounting bolts to specifications. Tighten the bypass hose clamp.

30. Install the fuel pump push rod in the cylinder front cover. Install a new cup-type plug in the top of the cover.

31. Coat a new fuel pump gasket with an oil-resistant sealer. Install the gasket and fuel pump on the cylinder front cover and torque the mounting bolts to specifications. Connect the fuel vapor line to the fuel pump. Install the fuel pump shield.

32. Connect the fuel inlet line at the carburetor. Install the generator and bracket. Install the spark plugs.

33. Install the engine in the car.

CAMSHAFT BEARING REPLACEMENT

Camshaft bearings are prefinished to size for standard and undersize camshaft bearing journals. The bearings are not interchangeable from one cylinder block bore to another. They must be installed in the bore designated by the number stamped on the outside diameter of each bearing. The camshaft bearing inside diameters decrease in size from the front of the engine toward the rear (refer to Part 8-3).

1. Remove the camshaft, the flywheel and the crankshaft. Push the pistons to the top of the cylinders.

2. Remove the camshaft bearing bore plug from the rear of the cylinder block, with the shaft of tool 6261-F or a long rod.

3. Remove the camshaft bearings (Fig. 66).

4. Clean the camshaft rear bearing bore plug recess thoroughly. Clean and inspect the camshaft bear-

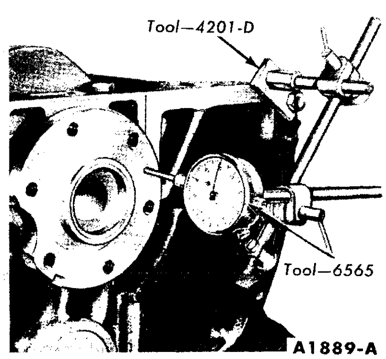


FIG. 65–Crankshaft End Play

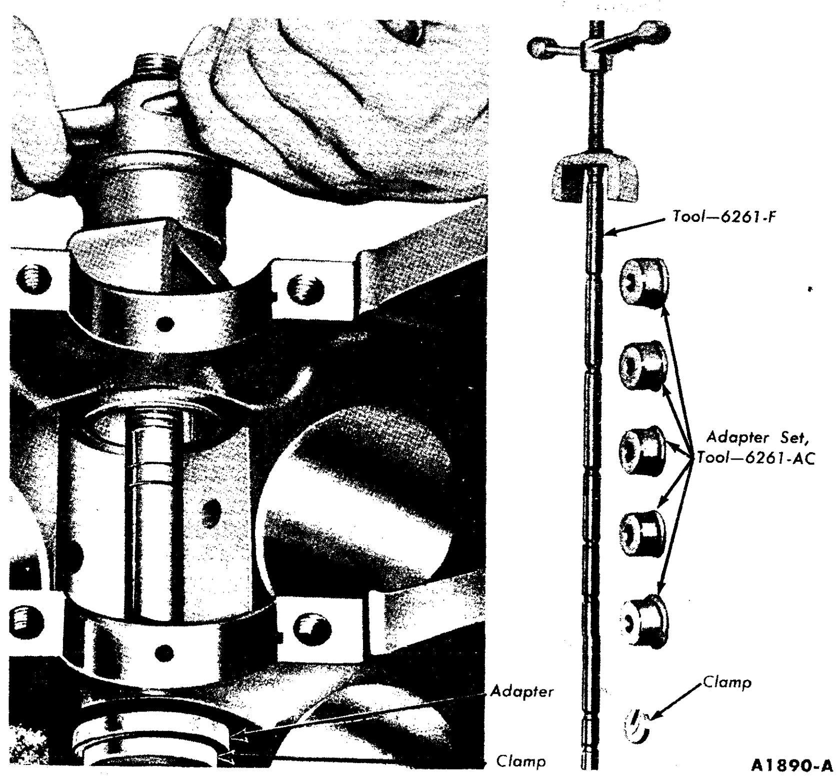


FIG. 66–Camshaft Bearing Removal and Installation

INSTALL FRONT BEARING 0.005–0.020 INCH BELOW FRONT FACE OF BLOCK

FIG. 67–Camshaft Front Bearing Measurement

ing bores of the cylinder block Make certain the oil holes and grooves are open and the cylinder bore webs are not nicked, cracked, or broken.

5. Install new camshaft bearings (Fig. 66). The notch on No. 1 bearing must face toward the front of the engine with the notch downward toward the bottom of the cylinder block. The No. 1 bearing must be at least 0.005 to 0.020 inch below the front face edge of the cylinder block bearing bore (Fig. 67). Bearings numbered 2, 3, 4 and 5 must be installed with the split in the bearing facing upward toward the top of the cylinder block.

6. Coat the edges of a new camshaft bearing bore plug with an oil-resistant sealer. Install the plug with the cup-side facing inward. Drive the plug in with a block of wood until it is flush or slightly below the surface of the cylinder block.

7. Install the camshaft, crankshaft, flywheel and related parts. Install the engine in the car.

ENGINE DISASSEMBLY

1. Install the engine on an engine repair stand. **Use the special steel bolts provided with the engine stand adapter when mounting the engine on the repair stand.**

2. Make certain that all oil and coolant has been drained from the engine.

3. Remove the spark plug wires from the rocker arm covers and spark plugs. Remove the distributor cap and spark plug wires as a unit. Disconnect the fuel line at the carburetor and the fuel filter. Disconnect the vacuum lines from the distributor and carburetor.

4. Remove the fuel pump from the cylinder front cover. Remove the access plug from the cylinder front cover, and remove the fuel pump push rod.

5. Remove the wires from the coil. Remove the overflow hose from the supply tank. Remove the mounting bolts securing the coolant supply tank and brace to the intake manifold and water pump. Remove the supply tank, coil, thermostat and gasket from the engine.

6. On a car with an air conditioner, remove the bolts securing the compressor mounting bracket to the cylinder block. Remove the compressor and bracket assembly.

7. Loosen the clamp securing the bypass hose to the intake manifold. Remove the water pump mounting bolts. Remove the water pump assembly and the oil dipstick tube bracket.

8. Remove the bolt securing the crankcase oil filler tube bracket to the intake manifold. Remove the oil filler tube and ventilation cap assembly from the cylinder block. Remove the oil level dipstick.

9. Remove the exhaust manifolds and steel gaskets from the cylinder heads.

10. Remove the clamp securing the ventilation tube to the mounting bracket at the left rear of the intake manifold. Remove the screw securing the ventilation regulator valve fitting to the intake manifold. Disconnect the rubber hoses from the carburetor spacer and the adapter plate located on the valve push rod chamber cover. Remove the ventilation tube, hoses, regulator valve and fitting from the engine as a unit.

11. Remove the distributor retaining clamp and nut. Pull the distributor gently from the cylinder block. **Notice the distance the rotor turns as the distributor is removed. This will be helpful when the distributor is installed, for the mating of the helical gears will turn the distributor shaft.**

12. Remove the intake manifold mounting bolt clamps, ventilation bracket and retaining nut. Remove the intake manifold, carburetor and related parts as a unit. Remove the mounting gaskets from the cylinder head.

13. Remove the valve rocker arm covers and gaskets from the cylinder heads.

14. Clean the valve push rod chamber cover. Remove the valve push rod chamber cover and gasket.

15. Remove the spark plugs from the cylinder heads with a spark plug deep socket wrench. **Due to the installation angles of the spark plugs, care must be used to prevent breakage.**

16. Loosen the four rocker arm support bolts on each cylinder bank, **evenly and alternately,** two turns at a time until valve spring tension is removed. Remove the rocker arm assemblies from the cylinder heads.

17. Remove the valve push rods from the cylinder heads. **Retain the push rods in their order of removal for inspection and replacement purposes.**

18. Remove the cylinder head mounting bolts. Secure the cylinder head holding fixtures to the cylinder head with intake manifold mounting bolts (Fig. 19). **All cylinder head work operations can be performed with the fixtures in place.**

19. Lift the cylinder heads off the cylinder block locating dowels and the cylinder block. Remove the gaskets. **Never pry between the cylinder heads and cylinder block. This may cause damage to the finished surfaces.**

20. Remove the hydraulic valve lifters. **Index the lifters so that they can be installed in their original bores if inspection reveals a satisfactory condition.**

21. Index the flywheel and back-up plate to the crankshaft flange for installation purposes. Remove the flywheel and plate from the crankshaft.

22. Remove the crankshaft damper mounting bolt and washer from the crankshaft. Remove the crankshaft damper (Fig. 28). Remove the Woodruff key.

23. Remove the power steering pump and reservoir.

24. Remove the cylinder block front cover, timing pointer, oil level dipstick tube and the cover mounting gasket. Remove the oil slinger.

25. Remove the wear plate, fuel pump eccentric, drive bushing and lock plate from the camshaft. Remove the camshaft sprocket and timing chain as a unit.

26. Remove the crankshaft sprocket (Fig. 33). Remove the Woodruff key.

27. Turn the cylinder block to a vertical position, front end facing upward.

28. Remove the engine oil filter, adapter and gasket. Remove the oil pan and gasket.

29. Remove the oil pump and in-

let screen assembly, intermediate shaft and the oil pump mounting gasket from the cylinder block.

30. Remove the camshaft from the cylinder block. **Use care to prevent damage to the camshaft bearings.**

31. Remove the cylinder ridge from the top of the cylinder bores (Fig. 42). **Always insert a clean cloth in the cylinder bore to catch all metal chips and shavings. Remove the cloth and wipe the bore clean before removing the piston.**

32. Rotate the crankshaft until the piston to be removed is at BDC. Remove the connecting rod bearing cap and bearing inserts. Push the connecting rod and piston out of the cylinder bore with a wooden hammer handle. **Use care to prevent the connecting rod from striking and damaging the cylinder bore.**

Place the bearing caps and inserts on the connecting rods so that the numbered sides match. **The assemblies are numbered so that they can be installed in their respective cylinders if inspection reveals a satisfactory condition.**

Repeat the procedure for the remaining cylinders.

33. Turn the cylinder block so that the bottom faces upward. Remove the main bearing caps and lower inserts. Remove the crankshaft and upper bearing inserts. **Keep all main bearing caps and inserts in their order of removal, for inspection and installation purposes.**

34. Remove the rear oil seal and side seals from the rear main bearing cap and the cylinder block.

35. If it is necessary to replace the camshaft bearings, refer to "Camshaft Bearing Replacement" in this section of the manual for the proper procedure. **This operation should only be performed after inspection of the cylinder block has been completed.**

CYLINDER BLOCK PLUGS AND FITTINGS

The location of various cylinder block plugs and fittings used in the cylinder block are shown in Fig. 68.

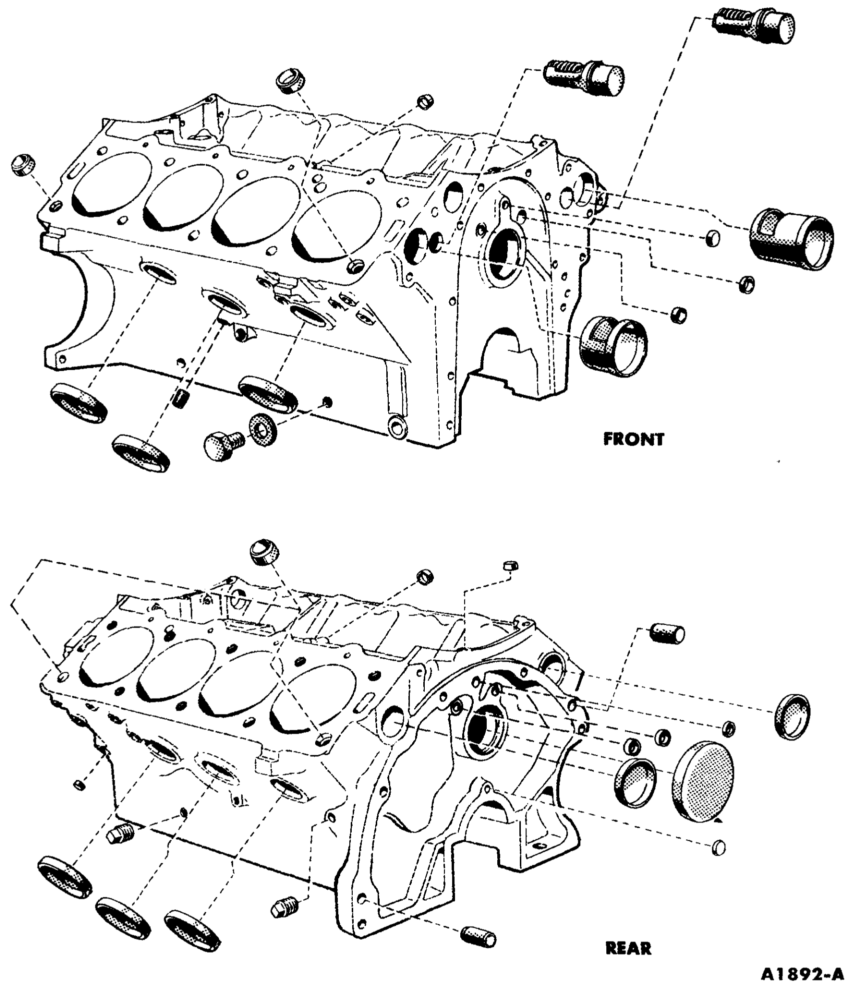


FIG. 68—Cylinder Block Plugs and Fittings

EXPANSION PLUG REPLACEMENT

1. To replace a large expansion plug, drill a ½-inch hole in the center of the plug. Remove the plug with a clutch pilot bearing remover (tool 7600-E) or pry it out with a large drift punch. Clean and inspect the cylinder block plug bore. **Coat the edges of the plug with suitable sealing compound (oil or water-resistant) and drive it into the cylinder block until it is seated.**

2. To replace a small expansion plug, drill a ¼-inch hole in the center of the plug and pry it out with a small pin punch. Clean and inspect the cylinder block plug bore. **Coat the edges of the plug with suitable sealing compound (oil or water-resistant) and drive it into the cylinder block until it is seated.**

ENGINE ASSEMBLY

1. Turn the cylinder block on the repair stand so that the bottom faces upward. Coat the cylinder block drain plugs with water-resistant sealer and install them in the cylinder block.

2. Install new camshaft bearings if the original bearings were removed because of wear or damage (Fig. 66). To install camshaft bearings, refer to "Camshaft Bearing Replacement" in this section of the manual.

3. Install a new rear crankshaft main bearing oil seal in the cylinder block (Figs. 62 and 63).

4. Place the upper main bearing inserts into position in the cylinder block bore, with the tang of the bearings in the slot provided. Lubricate the bearings lightly with engine oil. **If the crankshaft main journals have been reground to a definite undersize install the correct undersize bearing inserts to fit the journals.**

5. Carefully install the crankshaft. Install the lower main bearing inserts, and main bearing caps. **Make certain that they are installed in their original position.** Torque the mounting bolts to specifications.

6. Check the clearance of the main bearings, following the procedure under "Main Bearing Replacement."

7. Check the crankshaft end play (Fig. 65). Force the crankshaft forward as far as possible and release it. Connect a dial indicator so that the contact point rests against the crankshaft flange. Set the indicator at zero, then force the crankshaft toward the rear and release it. End play limits should not exceed specifications.

8. Turn the cylinder block to a vertical position with the front end facing upward.

9. Rotate the crankshaft to position the connecting rod journal for No. 1 cylinder at BDC. Coat all the cylinder bores, crankshaft journals, pistons, pins and piston rings with engine oil. **Make certain the piston ring gaps are spaced properly** (Fig. 52).

10. Install the piston assemblies, Nos. 1 and 5, in the cylinder block as follows:

Install the piston ring compressor on the piston, and tighten the screw. **Make certain that the notches on the edge of the tool face upward toward the top of the piston, with the wrench and turning screw positioned toward the inside of the "V" in the cylinder block** (Fig. 43).

Install the piston assembly in the cylinder bore to which it was fitted. **The arrow on the dome of the piston must face toward the front of the engine with the numbered side of the rod facing outward toward the side of the cylinder block. When installing the piston assemblies, use care to prevent the connecting rod bolts from striking the crankshaft journal. Do not hammer on the dome of the piston when installing the assembly in the cylinder bore. Apply an even pressure with a wooden hammer handle. By applying an even pressure on the piston, any obstruction will be immediately noted. The piston can then be removed, checked and installed correctly.**

Install the selective-fit connecting rod bearings and caps. **The numbered side of the cap must match and be on the numbered side of the rod.** Install the retaining nuts and tighten them until they are snug.

11. To install the remaining piston assemblies, repeat step 10. **Always rotate the crankshaft so that the crankshaft journal for each set of cylinders is at BDC during the installation procedure.**

12. Check the fit of the connecting rod bearings, following the procedure under "Connecting Rod Bearing Replacement."

13. Coat the camshaft journals and bearings with engine oil. Install the camshaft. **Use care to prevent the camshaft from damaging the bearings or dislodging the rear camshaft bearing plug.**

14. Install the timing chain, camshaft and crankshaft sprockets, wear plate, fuel pump eccentric, drive bushing, lock plate and the oil slinger, following steps 1 thru 5 under "Timing Chain, Camshaft and Crankshaft Sprockets."

15. Coat a new cylinder front cover gasket with an oil-resistant sealer and position it on the cylinder block. Install the cylinder front cover assembly, coolant overflow hose clip, and timing pointer. Torque the mounting bolts to specifications.

16. Install the power steering pump on the crankshaft. Torque the pump to cylinder front cover mounting bolts to specifications.

17. Install the Woodruff key in the crankshaft. Position the crankshaft damper on the crankshaft. **Make certain the keyway is aligned with the Woodruff key in the crankshaft.** Press the damper onto the crankshaft until it seats against the power steering pump as shown in Fig. 29. Install the damper retaining bolt and washer. Torque the bolt to specifications.

18. Rotate the engine so that the top of the cylinder block faces upward.

19. Lubricate the hydraulic valve lifters and install them in the bores from which they were removed.

20. Position the new cylinder head gaskets over the cylinder block dowels. **Cylinder head gaskets are interchangeable for use on either cylinder bank. The word "TOP" (stamped on the gasket) must always face upward when the gaskets are installed.**

21. Carefully install the cylinder head assemblies. Remove the cylinder head holding fixtures from the cylinder heads.

22. Install the cylinder head mounting bolts. Tighten the cylinder head bolts to specifications by making three cold torque applications as shown in Fig. 20.

23. Install the push rods in the bores from which they were removed. Make certain they are properly seated in the hydraulic valve lifters.

24. Position the rocker arm and shaft assemblies on the cylinder heads. Install washers on the bolts. Insert the bolts through the rocker arm shaft supports and tighten them until they are slightly engaged in the cylinder heads.

Seat the end of the push rods in the rocker arm ball sockets. **Make certain the push rods are properly seated in the hydraulic valve lifters.**

Tighten the rocker arm shaft support mounting bolts on each cylinder bank evenly and alternately, two turns at a time, until they are snug. Torque the mounting bolts to specifications.

25. Check the valve clearances and correct if necessary (Part 8-1, Section 2).

26. Coat a new valve push rod chamber cover gasket with an oil-resistant sealer and position it on the cylinder block and cylinder head. Install the chamber cover and torque the mounting bolts to specifications. **Torque the center end bolts first.**

27. Install the crankcase oil filler tube in the cylinder block.

28. Position new intake manifold gaskets on the cylinder heads, with the word "FRONT" (located on the gasket) facing toward the front of the engine.

29. Carefully install the intake manifold. **Make certain the gasket is positioned correctly.** Install the retaining clamps, crankcase oil filler tube bracket and the mounting bolts. Torque the mounting bolts in sequence (Fig. 11) to specifications.

30. Connect the previously assembled crankcase ventilation tube, rubber hoses, clamps, regulator valve and fitting to the carburetor and adapter. Adjust the assembly to position it properly and tighten the hose clamps.

31. Secure the bracket of the regulator valve fitting to the intake manifold. Secure the ventilation tube to the mounting bracket.

32. Coat the valve rocker arm cover gaskets with an oil-resistant sealer. Install the rocker arm cover and gasket on the cylinder head and torque the mounting bolts to specifications.

33. Rotate the crankshaft to position the No. 1 piston on TDC of the compression stroke. **Hold a thumb over the spark plug hole**

to determine the compression stroke. Also, observe the position of the timing marks on the crankshaft damper.

Set the distributor rotor in position to fire the No. 1 cylinder spark plug, with the points just breaking. Mark this location by scribing a line on the distributor housing. Turn the rotor counterclockwise a distance equal to the amount observed during the disassembly procedure (approximately ⅛ turn). Install the distributor. **The shaft and rotor will turn clockwise as the distributor gear meshes with the camshaft gear.**

Check the position of the rotor with the scribed line on the housing. If the installation is correct, install the distributor clamp, nut and lock washer. **Final timing of the distributor must be made after the engine is operating in the car.**

34. Install the spark plugs and torque them to specifications. **Due to the spark plug installation angle, use care to prevent breakage.**

35. Insert the fuel pump push rod into the bore of the cylinder front cover. Install an access plug in the top of the cover.

36. Coat a new fuel pump gasket with an oil-resistant sealer. Install the gasket and fuel pump on the cylinder front cover. Torque the mounting bolts to specifications.

37. Turn the engine so that the bottom faces upward.

38. Insert the distributor intermediate shaft into the oil pump. Coat a new oil pump mounting gasket with an oil-resistant sealer and position it on the cylinder block. Install the oil pump and inlet screen assembly; then, torque the mounting bolts to specifications.

39. Coat a new oil pan gasket with oil-resistant sealer and install it on the cylinder block. Install the oil pan, reinforcements and mounting bolts. Torque the mounting bolts to specifications.

40. Turn the engine so that the top faces upward.

41. Connect the vacuum line to the carburetor and the distributor. Connect the fuel line to the carburetor and the fuel filter.

42. Install the distributor cap and the spark plug wires as a unit onto the distributor. Install the spark plug wires on the valve rocker arm cover bracket and the spark plugs. **Only the No. 1 position is marked on the distributor cap. The distributor rotor rotates counterclockwise; therefore, connect the wires in the firing sequence of 1-5-4-2-6-3-7-8 following this counterclockwise rotation. Position the No. 7 and 8 wires correctly on the cover bracket to prevent inductance.**

43. Install the oil filter adapter and a new gasket on the cylinder block. Torque the mounting bolts to specifications. Install the oil pressure sending unit in the oil filter adapter. Coat the engine oil filter gasket with a light film of oil and turn the filter until it is snug; then, advance the filter ¼ turn. **Do not overtighten the filter.**

44. Insert two new cylinder block thermostats into the cylinder block, with the thermostat bulbs facing inward.

45. Install the coolant bypass hose and clamps on the intake manifold as a unit.

46. Coat new water pump gaskets with an oil-resistant sealer and install them on the cylinder block. Install the water pump, oil dipstick tube bracket and the power steering reservoir mounting bracket. Torque the water pump mounting bolts to specifications. Tighten the bypass hose clamps.

47. Install the power steering pump reservoir bracket lower mounting bolt and torque it to specifications. Connect the rubber hose to the power steering pump and reservoir. Tighten the clamps.

48. On a car with an air conditioner, install the air conditioning compressor and mounting bracket assembly on the cylinder block. Tighten the mounting bolts.

49. Install the thermostat in the intake manifold. **Make certain the thermostat is positioned correctly as noted on the front of the thermostat.**

50. Coat a new supply tank mounting gasket with water-resistant sealer and position it on the intake manifold. Remove the water pump right-upper mounting bolt.

51. Install the coolant supply tank and ignition coil as a unit on the intake manifold and torque the mounting bolts to specifications. Insert the water pump mounting bolt through the bracket and torque it to specifications.

52. Connect the overflow hose to the supply tank and insert it through the retaining clip.

53. Install the flywheel and backing plate on the rear crankshaft flange. Torque the mounting bolts to specifications.

PART 8-3 SPECIFICATIONS

NOTE: All specifications are given in inches unless otherwise noted.

GENERAL ENGINE

MODEL PREFIX	EDJ
PISTON DISPLACEMENT—Cubic Inches	430
COMPRESSION RATIO	10.1:1
BRAKE HORSEPOWER @ Specified rpm	320 @ 4600
TORQUE—Ft-lbs @ Specified rpm	465 @ 2600
BORE AND STROKE	430 x 3.70
COMPRESSION PRESSURE—Sea Level @ Cranking Speed	160-200
COMPRESSION PRESSURE TOLERANCE BETWEEN CYLINDERS — Allowable psi	20
TAXABLE HORSEPOWER	59.17
FIRING ORDER	1-5-4-2-6-3-7-8
VALVE ARRANGEMENT—Front to Rear	
Right Bank	I-E-I-E-I-E-I-E
Left Bank	E-I-E-I-E-I-E-I
ENGINE IDLE RPM*	
Transmission in Drive Range	450-475
*If equipped with an air conditioner, the air conditioner should be operated for at least 20 minutes before setting the idle speed.	
ENGINE IDLE MANIFOLD VACUUM—Minimum Inches of Mercury @ Specified Engine Neutral Idle rpm—Sea Level	18
INITIAL IGNITION TIMING—BTDC*	6°
*If the individual requirements of the car and/or the use of sub-standard fuels dictate, the initial timing may have to be retarded from the recommended setting to eliminate detonation (spark knock). If retarding is necessary, it should be done progressively and not to exceed 2°BTDC.	
CRANKCASE OIL CAPACITY*	
U.S. Measure	6 Quarts
Imperial Measure	5 Quarts
*Includes one quart required with oil filter replacement.	
OIL PRESSURE—psi hot @ 2000 rpm	35-55

CYLINDER HEAD

GASKET SURFACE FLATNESS	0.003 inch in any 6 inches or 0.006 inch overall.
VALVE GUIDE BORE STANDARD DIAMETER	
Intake and Exhaust (Coded Red)	0.3725-0.3730
(Coded Green)	0.3730-0.3735
VALVE SEAT WIDTH	
Intake and Exhaust	0.070-0.090
VALVE SEAT ANGLE	
Intake and Exhaust	45°
VALVE SEAT RUNOUT	0.002

VALVE MECHANISM

VALVE CLEARANCE*	0.078-0.178
*Clearance specified is obtained at the valve stem tip with the hydraulic valve lifter collapsed.	
VALVE STEM DIAMETER	
Standard	
Intake (Coded Red)	0.3712-0.3717
(Coded Green)	0.3717-0.3722
Exhaust (Coded Red)	0.3701-0.3705
(Coded Green)	0.3705-0.3709
0.003 Oversize	
Intake	0.3742-0.3752
Exhaust	0.3731-0.3739
0.015 Oversize	
Intake	0.3862-0.3872
Exhaust	0.3851-0.3859
0.030 Oversize	
Intake	0.4012-0.4022
Exhaust	0.4001-0.4009
VALVE STEM TO VALVE GUIDE CLEARANCE	
Intake	0.0008-0.0018—Wear Limit 0.0045
Exhaust	0.0020-0.0030—Wear Limit 0.0055
VALVE HEAD DIAMETER	
Intake	1.955-1.970
Exhaust	1.645-1.660
VALVE FACE ANGLE	
Intake and Exhaust	44°
VALVE FACE RUNOUT — MAXIMUM	
Intake	0.0015
Exhaust	0.0020
VALVE SPRING APPROXIMATE FREE LENGTH	1.88
VALVE SPRING MAXIMUM OUT-OF-SQUARE	5/64
VALVE SPRING PRESSURE (Lbs) @ SPECIFIED LENGTH	
Intake and Exhaust	65-75 @ 1.640
	Wear Limit 59 @ 1.640
	179-199 @ 1.230
	Wear Limit 162 @ 1.230
VALVE SPRING ASSEMBLED HEIGHT	
Pad to Underside of Retainer or Rotator	1 5/8-1 21/32
VALVE PUSH ROD RUNOUT — MAXIMUM	0.025
VALVE LIFTER STANDARD DIAMETER	0.8742-0.8745
VALVE LIFTER TO LIFTER BORE CLEARANCE	0.0005-0.0018 Wear Limit 0.005
VALVE LIFTER LEAK DOWN RATE	10-100 Seconds
ROCKER ARM TO ROCKER SHAFT CLEARANCE	0.0025-0.0050 Wear Limit 0.006
ROCKER ARM SHAFT OUTSIDE DIAMETER	0.839-0.840
ROCKER SHAFT BORE DIAMETER	0.8425-0.8440
ROCKER ARM LIFT RATIO	1.76:1

CAMSHAFT AND TIMING CHAIN

CAMSHAFT END PLAY	Restrained
CAMSHAFT JOURNAL STANDARD DIAMETER	
No. 1	2.3243-2.3248
No. 2	2.3093-2.3098
No. 3	2.2943-2.2948
No. 4	2.2793-2.2798
No. 5	2.6243-2.2648
CAMSHAFT JOURNAL MAXIMUM OUT-OF-ROUND	0.0005
CAMSHAFT JOURNAL RUNOUT — MAXIMUM	0.005
CAMSHAFT JOURNAL TO BEARING CLEARANCE	0.0012-0.0027 Wear Limit 0.005
CAMSHAFT LOBE LIFT	
Intake and Exhaust	0.2316 Wear Limit 0.2266
MAXIMUM ALLOWABLE LOBE LIFT LOSS	
Intake and Exhaust	0.005
VALVE LIFTER LIFT	
Intake (Opens)	0.002 @ 22° BTDC
Intake (Closes)	0.005 @ 68° ABDC
Exhaust (Opens)	0.002 @ 63° BBDC
Exhaust (Closes)	0.005 @ 27° ATDC
TIMING CHAIN DEFLECTION	0.5
SPROCKET CONTACT FACE RUNOUT	
Maximum	0.004
ASSEMBLED SPROCKET CONTACT FACE RUNOUT	
Maximum	0.008

CAMSHAFT BEARINGS

INSIDE DIAMETER	
No. 1	2.326-2.327
No. 2	2.311-2.312
No. 3	2.296-2.297
No. 4	2.281-2.282
No. 5	2.266-2.267
LOCATION IN RELATION TO FRONT FACE OF BLOCK CAM BEARING BORE—NO. 1 BEARING ONLY—BELOW	0.005-0.020

CRANKSHAFT

MAIN BEARING JOURNAL STANDARD DIAMETER	
Coded Red	2.9000-2.9003
Coded Blue	2.8994-2.8997
MAIN BEARING JOURNAL MAXIMUM RUNOUT	0.002 Wear Limit 0.003
CONNECTING ROD AND MAIN BEARING JOURNAL MAXIMUM OUT-OF-ROUND	0.0004
CONNECTING ROD AND MAIN BEARING JOURNAL TAPER	0.0005 per inch
THRUST BEARING JOURNAL LENGTH	1.124-1.126
MAIN BEARING JOURNAL THRUST FACE RUNOUT	0.001
CONNECTING ROD JOURNAL DIAMETER	
Coded Red	2.5998-2.6001
Coded Blue	2.5992-2.5995
CRANKSHAFT FREE END PLAY	0.004-0.008 Wear Limit 0.012
ASSEMBLED SPROCKET FACE RUNOUT—Maximum	0.006
SPROCKET CONTACT FACE RUNOUT—Maximum	0.001

CRANKSHAFT MAIN BEARINGS

JOURNAL CLEARANCE	0.0008-0.0024
WALL THICKNESS	
Coded Red	0.0953-0.0956
Coded Blue	0.0959-0.0962
0.002 Undersize	0.0966-0.0971

CONNECTING ROD

PISTON PIN BORE INSIDE DIAMETER	
Standard	0.9736-0.9741
BEARING BORE DIAMETER	
Coded Red	2.7522-2.7526
Coded Blue	2.7526-2.7530
BEARING BORE OUT-OF-ROUND AND TAPER—Maximum	0.0004
CENTER-TO-CENTER LENGTH	6.599-6.601
TWIST TOTAL DIFFERENCE—Maximum	0.008
BEND TOTAL DIFFERENCE—Maximum	0.004
CONNECTING ROD ASSEMBLY—Assembled to Crankshaft Side Clearance	0.005-0.015 Wear Liimt 0.018

CONNECTING ROD BEARINGS

BEARING TO CRANKSHAFT CLEARANCE	0.0007-0.0020
WALL THICKNESS	
Coded Red	0.0755-0.0758
Coded Blue	0.0761-0.0764
0.002 Undersize	0.0767-0.0772

PISTON

PISTON DIAMETER	
Coded Red	4.2983-4.2989
Coded Blue	4.2995-4.3001
0.003 Oversize	4.3007-4.3013
PISTON TO BORE CLEARANCE—¼ INCH From Bottom of Skirt	0.0011-0.0029 Wear Limit 0.006
PISTON PIN BORE DIAMETER	0.9752-0.9755
RING GROOVE WIDTH	
Upper Compression Ring	0.0795-0.0805
Lower Compression Ring	0.0950-0.0960
Oil Ring	0.188-0.189

PISTON PIN

PISTON PIN DIAMETER—Standard	0.9749-0.9752
PISTON PIN LENGTH	3.480-3.500
PISTON PIN TO PISTON CLEARANCE	0.0002-0.0004 Wear Limit 0.0008
TORQUE REQUIRED TO FULLY SEAT PIN—Minimum (Ft-lbs)	20

PISTON RINGS

RING WIDTH	
Upper Compression Ring	0.0774-0.0781
Lower Compression Ring	0.0930-0.0940
RING SIDE CLEARANCE	
Upper Compression Ring	0.0014-0.0031 Wear Limit 0.006
Lower Compression Ring	0.001-0.003 Wear Limit 0.006
Oil Ring	Snug
RING GAP WIDTH—Standard Bore	
Upper and Lower Compression Rings	0.015-0.025
Oil Ring (Steel Rail)	0.025-0.038

CYLINDER BLOCK

CYLINDER BORE DIAMETER	
Standard	4.3000-4.3024
0.003 Oversize	4.3024-4.3036
CYLINDER BORE OUT-OF-ROUND—Maximum	0.001 Wear Limit 0.005
CYLINDER BORE TAPER	0.001 Wear Limit 0.010
HEAD GASKET SURFACE FLATNESS 0.003 inch in any 6 inches or 0.006 inch overall.	

OIL PUMP

RELIEF VALVE SPRING TENSION—Lbs @ Specified Length	9.0-9.6 @ 1.53 inches
RELIEF VALVE CLEARANCE	0.0015-0.0029
DRIVE SHAFT TO HOUSING BEARING CLEARANCE	0.0015-0.0029
ROTOR ASSEMBLY END CLEARANCE	0.0011-0.0041
OUTER RACE TO HOUSING RADIAL CLEARANCE	0.006-0.012
OIL PICK-UP TUBE TO OIL PUMP	10-13

TORQUE LIMITS (Ft-lbs)

MAIN BEARING CAP BOLTS—Oiled Threads	95-105
CYLINDER HEAD BOLTS	125-135
OIL PAN TO CYLINDER BLOCK	4-6

TORQUE LIMITS (Ft-lbs) (Continued)

MANIFOLDS TO CYLINDER HEAD	
Intake	25-28
Exhaust	15-21
FLYWHEEL TO CRANKSHAFT	75-85
OIL PUMP TO CYLINDER BLOCK	23-28
OIL PUMP COVER PLATE	7.5-8.5
OIL FILTER ANGLE ADAPTER TO CYLINDER BLOCK	10-13
OIL PAN DRAIN PLUG	15-20
VALVE PUSH ROD CHAMBER COVER	3.5-5.0
POWER STEERING PUMP TO CYLINDER FRONT COVER	10-13
CYLINDER FRONT COVER	10-13
WATER OUTLET HOUSING	8-13
WATER PUMP TO CYLINDER BLOCK	23-28
CAMSHAFT SPROCKET TO CAMSHAFT	12-15
DAMPER TO CRANKSHAFT	75-90
CONNECTING ROD NUTS	40-45
VALVE ROCKER ARM COVER	2.5-4.0
VALVE ROCKER SHAFT SUPPORT TO CYLINDER HEAD	45-50
FUEL PUMP TO CYLINDER FRONT COVER	23-28
ENGINE SUPPORTS	
Front Support Insulator to Engine	45-65
Front Support Insulator to Underbody Side Member	45-60
Front Support Insulator to Support Bracket on Underbody Side Member (Convertibles Only)	45-65
Rear Support Bracket to Body Extensions	20-30
Rear Support Insulators to Transmission Extension Housing	20-30
Rear Support, Insulators and Retainers to Rear Support Bracket	10-18
Rear Support Insulator Assembly to Rear Support	30-45
ENGINE LATERAL RESTRICTOR	
Lateral Restrictor Outer Bracket to Underbody Side Member	21-29
Lateral Restrictor Inner Bracket to Transmission Converter Housing	40-50
Lateral Restrictor Compression Nut	20-30

STANDARD TORQUE LIMITS FOR VARIOUS SIZE BOLTS

CAUTION: Special torque limits listed in the preceding tables should be used in preference to these standard limits wherever they apply.

Size (Inches)	1/4-20	1/4-28	5/16-18	5/16-24	3/8-16	3/8-24
Torque (Foot-Pounds)	6-9	6-9	12-15	15-18	23-28	30-35
Size (Inches)	7/16-14	7/16-20	1/2-13	1/2-20	9/16-18	5/8-18
Torque (Foot-Pounds)	45-50	50-60	60-70	70-80	85-95	130-145

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IGNITION SYSTEM — GROUP 9

PART 9-1 GENERAL IGNITION SYSTEM SERVICE

1 DIAGNOSIS AND TESTING

GENERAL INFORMATION

CONVENTIONAL IGNITION SYSTEM

The ignition system consists of a primary (low voltage) and a secondary (high voltage) circuit (Fig. 1).

The primary circuit consists of the:

1. Battery.
2. Ignition switch.
3. Primary circuit resistance wire.
4. Primary windings of the ignition coil.
5. Breaker points.
6. Condenser.

The secondary circuit consists of the:

1. Secondary windings of the ignition coil.
2. Distributor rotor.
3. Distributor cap.
4. High tension wires.
5. Spark plugs.

When the breaker points are closed, the primary or low voltage current flows from the battery through the ignition switch to the primary windings in the coil, then to ground through the closed breaker points. When the breaker points open, the magnetic field built up in the primary windings of the coil moves through the secondary windings of the coil producing high voltage current. **High voltage current is produced each time the breaker points open.** The high voltage flows through the coil high tension lead to the distributor cap where the rotor distributes it to one of the spark plug terminals in the distributor cap. This process is repeated for every power stroke of the engine.

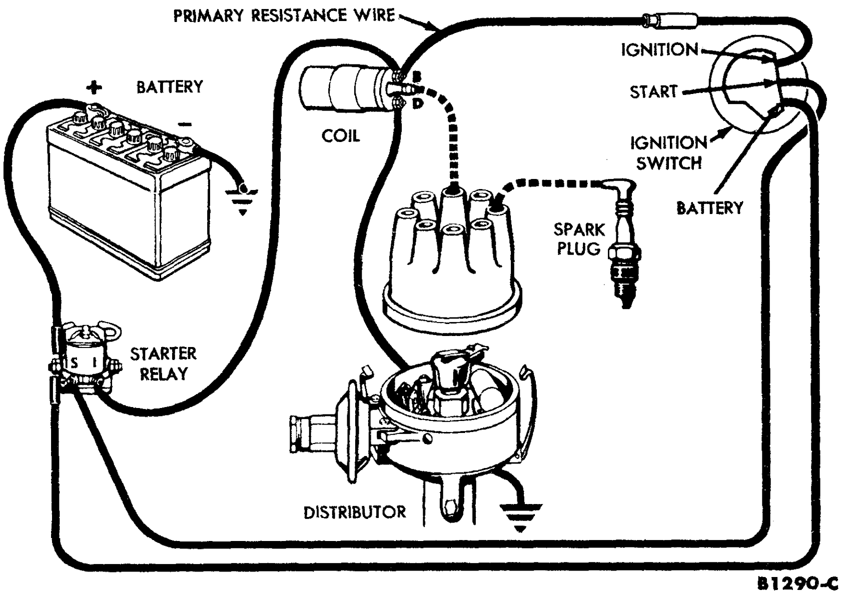


FIG. 1–Typical Ignition Circuit

TRANSISTOR IGNITION SYSTEM

The permatuned transistor ignition system is available on the 430 V-8 engine. Figure 2 shows a schematic of the transistor ignition system.

The ignition coil primary in the transistor system is designed to draw 12 amperes peak current, or approximately 5.5 amperes average current, as indicated on an ammeter, in order to provide high spark plug voltage at the higher engine speeds.

The transistor in the system acts as a heavy duty switch or relay. It is similar in action to a horn relay, except that it has no moving parts, and thus acts with very little time lag. The transistor is connected between the battery and the coil, and is used to make and break the coil

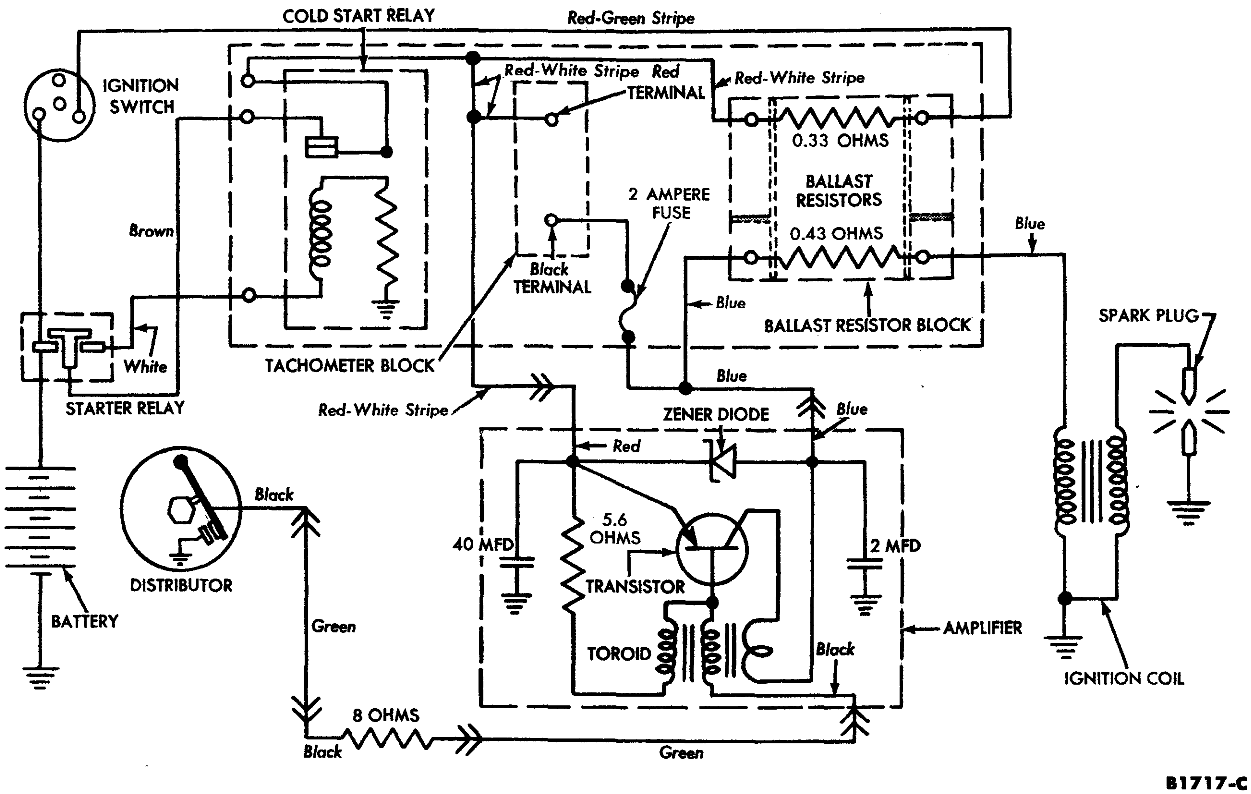


FIG. 2—Transistor Ignition System Schematic

primary circuit.

The distributor controls the transistor. The 8-ohm resistor, connected between the distributor and the transistor (in the wiring harness), limits the transistor control current (and distributor point current) to 0.5 ampere. The low distributor point current eliminates pitting and gives long distributor point life.

The distributor condenser has been increased in value to 2 mfd, and is located in the amplifier assembly. As in the standard ignition circuit, it absorbs high inductive energy during initial distributor point opening. However, it no longer has any effect on the distributor points as the transistor effectively isolates the points from the coil.

The amplifier assembly (Fig. 3) is mounted under an insulated cover on the left front fender inner panel.

A ceramic ballast resistor is mounted with the amplifier, a tachometer connector block is mounted on the firewall and a cold start relay is mounted on the right front fender in the engine compartment.

A 2-ampere fuse in the collector to tachometer block lead prevents the transistor from being damaged

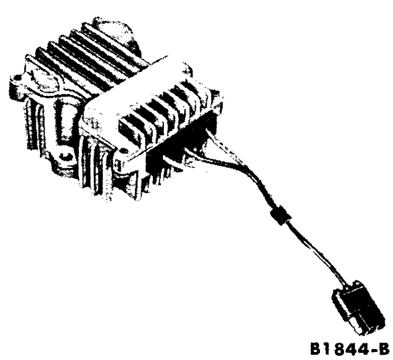


FIG. 3—Amplifier Assembly

by the application of external devices other than normal testing equipment.

The cold start relay contacts are normally closed and they are connected into the circuit only during the start cycle. When the starter relay is closed, the cold start relay is actuated and opens its contacts. If, during starting, the available voltage drops below 10.5 volts, the relay contacts close, thus by-passing the 0.33-ohm resistor in the ballast resistor block, and applying full available voltage to the system.

The tachometer block is used to connect a tachometer or other test equipment into the circuit. **Do not connect test equipment into the circuit in any other manner, or readings will be inaccurate and damage may occur to the transistor, or change its operating characteristics.**

Connect the tachometer red lead to the tachometer block red terminal and black lead to the black terminal.

TROUBLE ISOLATION

CONVENTIONAL IGNITION SYSTEM

Ignition system troubles are caused by a failure in the primary/or the secondary circuit or incorrect ignition timing. If an engine trouble has been traced to the ignition system from the "Engine Trouble Diagnosis Guide", the trouble can be found by performing an ignition system test on a scope or by further isolating the trouble to the primary or secondary circuit as follows:

1. Remove the coil high tension lead from the distributor cap.

2. Hold the high tension lead approximately $\frac{3}{16}$ inch from the cylinder head.

3. With the ignition switch on, crank the engine and check for a spark.

If the spark is good, the trouble lies in the secondary circuit.

If there is no spark or a weak spark, the trouble is in the primary circuit, coil to distributor high tension lead or the coil.

Primary Circuit. A breakdown or energy loss in the primary circuit can be caused by:

1. Defective primary wiring.
2. Burned or improperly adjusted breaker points.
3. A defective coil.
4. A defective condenser.

Secondary Circuit. A breakdown or energy loss in the secondary circuit can be caused by:

1. Fouled or improperly adjusted spark plugs.
2. Defective high tension wiring.
3. High tension leakage across the coil, distributor cap or rotor.

TRANSISTOR IGNITION SYSTEM

Do not use any testing procedures or conventional short cuts other than those listed below, or extensive damage can result to the system.

Ignition troubles are caused by a failure in the primary or secondary circuit, or incorrect ignition timing. Isolate the trouble as follows:

1. Remove the coil high tension lead from the distributor cap.
2. **Hold the high tension lead approximately ¼ inch from the cylinder head or good ground.**
3. With the ignition switch on, crank the engine and check for a spark. The engine may be cranked by the conventional method of running a jumper wire from the battery positive terminal to the "S" terminal of the starter relay, **after disconnecting the red and blue lead at the relay.**

If the spark is good, the trouble lies in the secondary (high voltage) circuit. If there is no spark or a weak spark, the trouble is in the primary (low voltage) circuit.

Primary Circuit. A breakdown or energy loss in the primary circuit can be caused by:

1. Defective primary wiring.
2. Improperly adjusted, contaminated or defective distributor points.
3. Defective amplifier assembly.

Secondary Circuit. A breakdown or energy loss in the secondary circuit can be caused by:

1. Fouled or improperly adjusted spark plugs.
2. Defective high voltage wiring.
3. High voltage leakage across the coil, distributor cap or rotor.

PRIMARY CIRCUIT TESTS

CONVENTIONAL IGNITION SYSTEM

A complete test of the primary circuit consists of checking the circuit from the battery to the coil, the circuit from the coil to ground, and the starting ignition circuit.

Excessive voltage drop in the primary circuit will reduce the secondary output of the ignition coil, resulting in hard starting and poor performance.

Battery to Coil Test

PROCEDURE

1. Connect the voltmeter leads as shown in Figs. 4 and 5.
2. Install a jumper wire from the distributor terminal of the coil to a good ground on the distributor housing.
3. Turn the lights and accessories off.
4. Turn the ignition switch on.

RESULTS. If the voltmeter reading is 6.9 volts or less, the primary circuit from the battery to the coil is satisfactory.

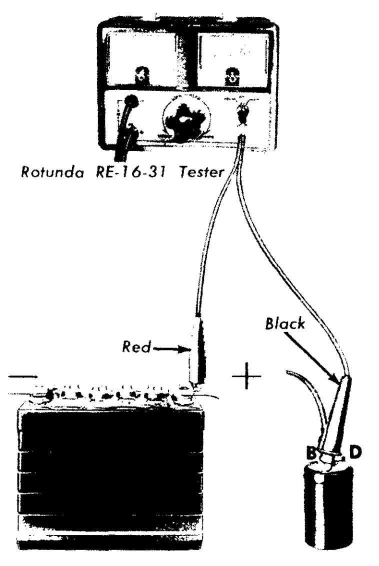


FIG. 4—Battery to Coil Test—Rotunda Tester

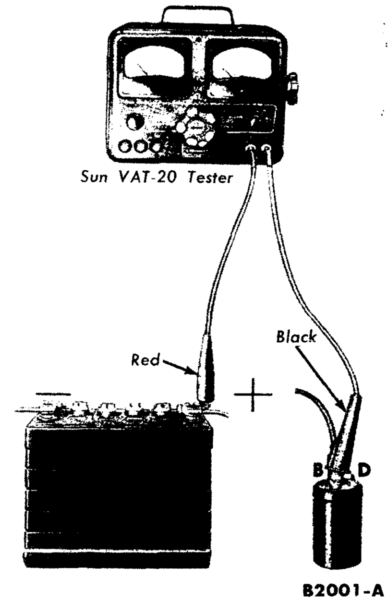


FIG. 5—Battery to Coil Test—Sun Tester

If the voltmeter reading is greater than 6.9 volts, check the following:

1. The battery and cables for loose connections or corrosion.
2. The primary wiring for worn insulation, broken strands, and loose or corroded terminals.
3. The resistance wire for defects.
4. The relay to ignition switch for defects.

Ignition Switch Test

PROCEDURE

1. Connect the voltmeter leads as shown in Figs. 6 and 7.
2. Install a jumper wire from the distributor terminal of the coil to a good ground on the distributor body.
3. Turn all of the accessories and lights off.
4. Turn the ignition switch on.

RESULTS. If the voltmeter reading is 0.3 volt or less, the ignition switch and the relay to switch wire are satisfactory.

If the voltmeter reading is greater than 0.3 volt, either the ignition switch and/or the wire are defective.

Resistance Wire Test

PROCEDURE

1. Connect the voltmeter leads as shown in Figs. 8 and 9.
2. Install a jumper wire from the distributor terminal of the coil to a good ground on the distributor housing.

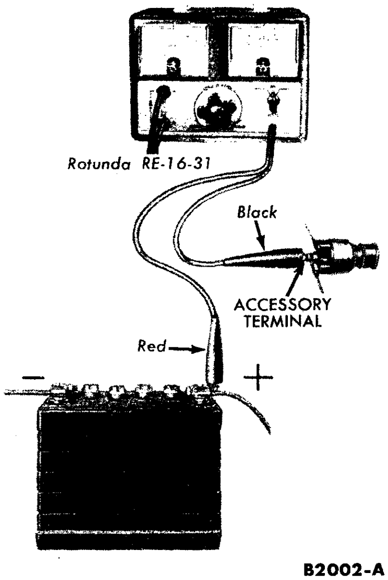


FIG. 6—Ignition Switch Test—Rotunda Tester

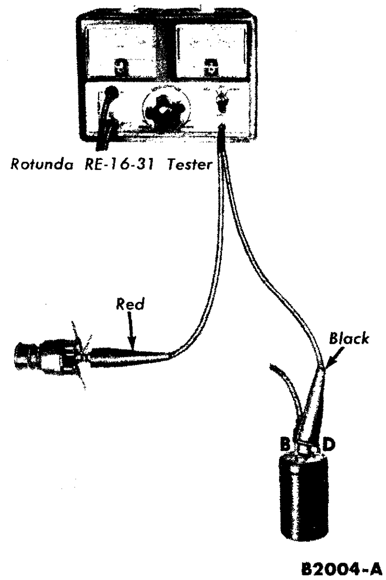


FIG. 8—Resistance Wire Test—Rotunda Tester

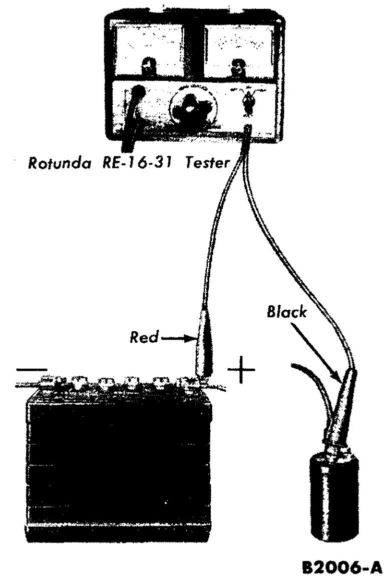


FIG. 10—Starting Ignition Circuit Test—Rotunda Tester

3. Turn all of the accessories and lights off.

4. Turn the ignition switch on.

RESULTS. If the voltmeter reading is 6.6 volts or less, the resistance wire is satisfactory.

If the voltmeter reading is greater than 6.6 volts, replace the resistance wire.

Starting Ignition Circuit Test

PROCEDURE

1. Connect the voltmeter leads as shown in Figs. 10 and 11.

2. Disconnect and ground the coil to distributor high tension lead at the distributor.

3. With the ignition switch off, crank the engine by jumping the ignition switch at the solenoid while observing the voltage drop.

RESULTS. If the voltage drop is 0.1 volt or less, the starting ignition circuit is satisfactory.

If the voltage drop is greater than 0.1 volt, clean and tighten the terminals in the circuit or replace the wiring as necessary.

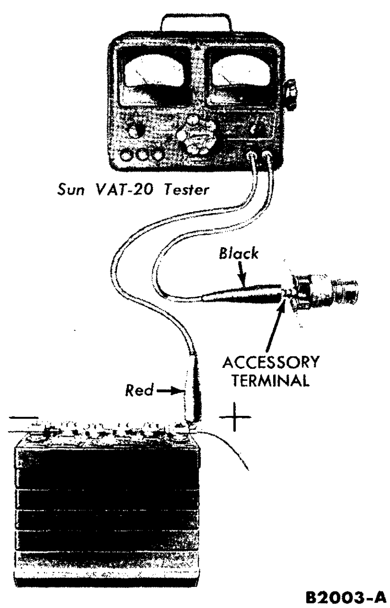


FIG. 7—Ignition Switch Test—Sun Tester

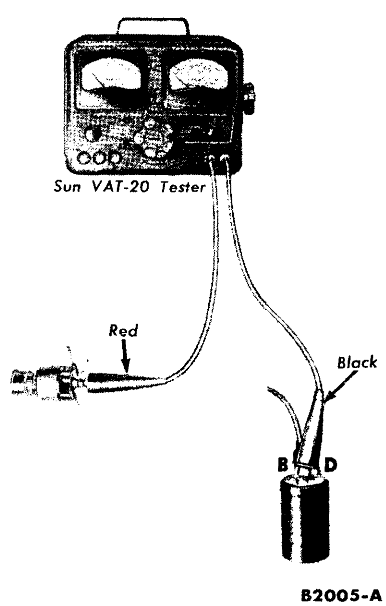


FIG. 9—Resistance Wire Test—Sun Tester

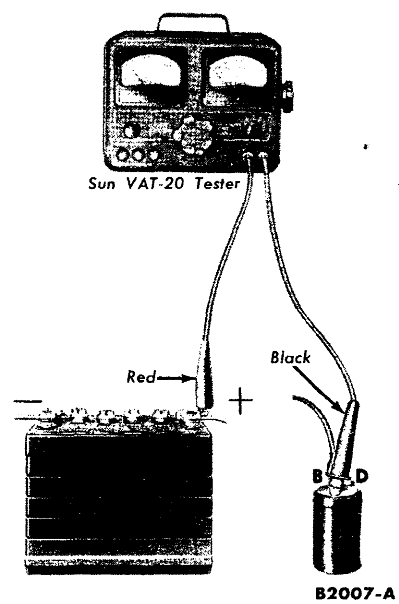


FIG. 11—Starting Ignition Circuit Test—Sun Tester

Coil to Ground Test

PROCEDURE

1. Connect the voltmeter leads as shown in Figs. 12 and 13.
2. Close the breaker points.
3. Turn all lights and accessories off.
4. Turn the ignition switch on.

RESULTS. If the voltmeter reading is 0.1 volt or less, the primary circuit from coil to ground is satisfactory.

If the voltmeter reading is greater than 0.1 volt, test the voltage drop of each of the following:

1. Coil to distributor primary wire.
2. The movable breaker point and the breaker plate.
3. The breaker plate and the distributor housing.
4. The distributor housing, and engine ground.

Breaker Points. The breaker

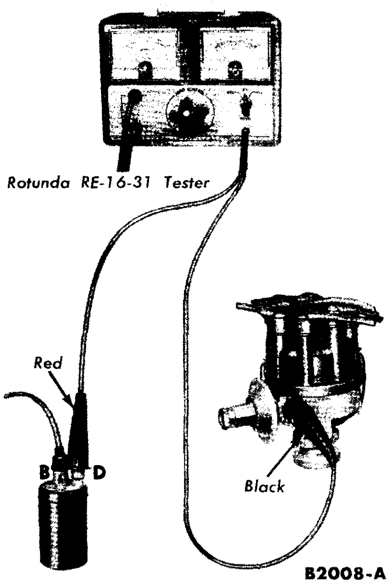


FIG. 12—Coil to Ground Test—Rotunda Tester

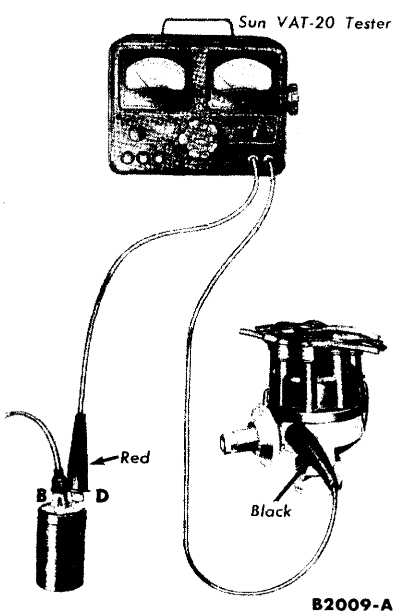


FIG. 13—Coil to Ground Test—Sun Tester

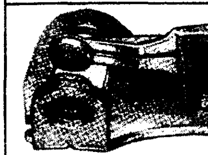
CONDITION	CAUSED BY
 BURNED	Any discoloration other than a frosted slate grey shall be considered as burned points.
 EXCESSIVE METAL TRANSFER OR PITTING	Incorrect alignment. Incorrect voltage regulator setting. Radio condenser installed to the distributor side of the coil. Ignition condenser of improper capacity. Extended operation of the engine at speeds other than normal.

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FIG. 14—Breaker Point Inspection

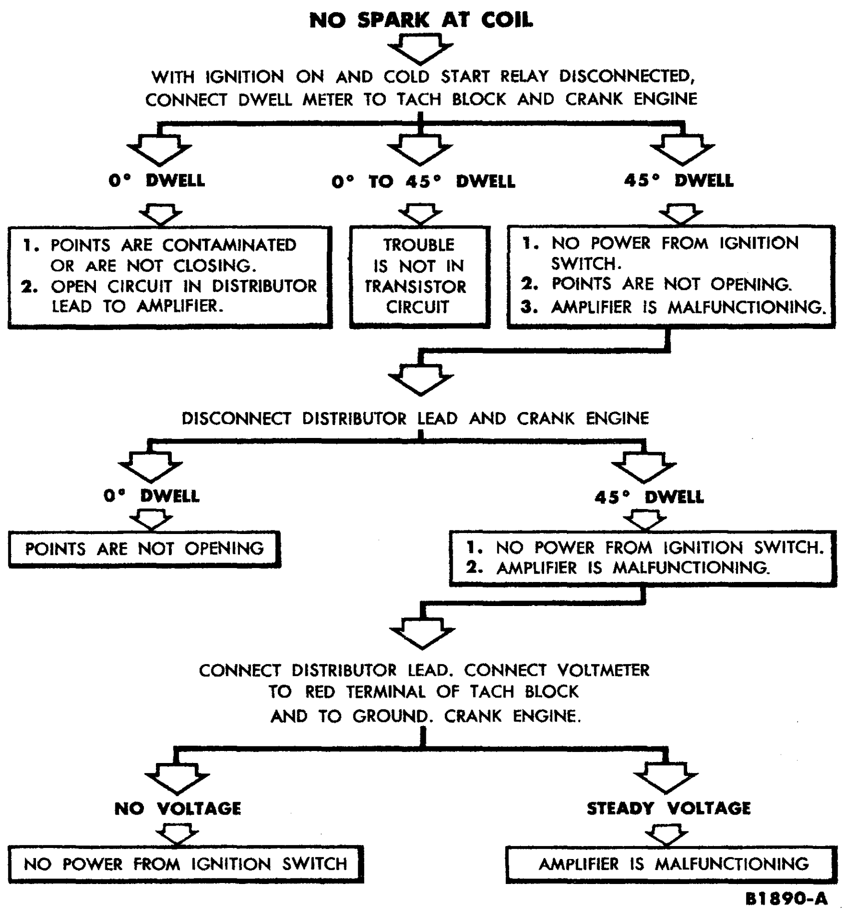


FIG. 15—Transistor Ignition System Test Procedures

point assembly consists of the stationary point bracket assembly, breaker arm and the primary wire terminal.

Breaker points should be inspected, cleaned and adjusted as necessary. Breaker points can be cleaned with chloroform and a stiff bristle brush. Replace the breaker point assembly if the contacts are badly burned or excessive metal transfer between the points is evident (Fig. 14). Metal transfer is considered excessive when it equals or exceeds the gap setting.

Coil. The coil should be tested following the instructions under "Ignition System Tests".

Condenser. The condenser should also be tested following the instructions under "Ignition System Tests".

TRANSISTOR IGNITION SYSTEM

When diagnosis procedures isolate trouble to the primary circuit, make the following tests to locate the defective items. **Do not use any other procedure, conventional short cut, or connect test equipment in any other manner than that described or extensive damage can be caused to the transistor ignition system.** Figure 15 shows the transistor ignition system tests in outline form.

Disconnect the cold start relay. Connect a dwell meter to the tachometer block. Connect the black lead to the black terminal and the red lead to the red terminal. Turn the ignition on and crank the engine. Observe the dwell meter reading.

0° Dwell. A dwell reading of 0° indicates:

1. The distributor points are contaminated or are not closing.

0° to 45° Dwell. A dwell reading between 0° and 45° indicates:

1. The transistor and the primary circuit are functioning properly.
2. The trouble could be in the secondary circuit.

45° Dwell. A dwell reading of 45° indicates:

1. No power from the ignition switch.
2. The distributor points are closed and not opening.
3. Defective amplifier assembly.

To determine which of the three items listed are causing the trouble proceed as follows:

Disconnect the distributor lead at the bullet connector, and crank the engine. If the dwell meter indicates 0° dwell, the distributor points are not opening. If 45° dwell is indicated, the amplifier is malfunctioning or there is no power from the ignition switch.

Use a voltmeter or test light to determine if the transistor (amplifier assembly) is at fault. Connect the voltmeter to the red-green lead terminal of the ballast resistor and to ground. Crank the engine.

If a steady indication of voltage is obtained, the trouble is in the amplifier. Absence of any voltage indication on the voltmeter shows there is an open circuit, or no power between the ignition switch and the amplifier. The ballast resistor could be defective. Replace it with a known good ballast resistor, and repeat the test.

If the test procedure indicates a defective amplifier, replace it with a known good amplifier, and proceed as follows:

Connect the distributor high tension lead at the bullet connector. Then, with the cold start relay disconnected and the dwell meter connected to the tachometer block, crank the engine and observe the indicated dwell. A reading between 0° and 45° indicates satisfactory ignition; thus, the amplifier is at fault.

If the dwell reading is still 45°, the wiring from the amplifier through the ballast resistor to the coil is defective. Replace the defective item.

SECONDARY CIRCUIT TESTS

The following procedure is used on both ignition systems.

PRELIMINARY CHECKS

1. Remove the coil to distributor high tension lead and the spark plug wires from the distributor cap and from the spark plugs. Inspect the terminals for looseness and corrosion. Inspect the wires for breaks and cracked insulation. Replace all defective wiring.
2. Clean the inside of the distributor cap, and inspect it for cracks, burned contacts, permanent carbon tracks or a defective center carbon brush electrode. Remove dirt or corrosion from the sockets. Replace the cap if it is defective.
3. Inspect the rotor for cracks or defects. Replace the rotor if it is defective.

SECONDARY (HIGH TENSION) WIRES

The secondary wires include the wires connecting the distributor cap to the spark plugs and the wire connecting the center terminal of the distributor cap to the center terminal of the ignition coil.

These wires are the radio resistance-type which filter out the high frequency electrical impulses that are the source of ignition noise interference. The resistance of each wire should not exceed 24,500 ohms. **When checking the resistance of the wires for setting ignition timing, do not puncture the wires with a probe. The probe may cause a separation in the conductor.**

At regular intervals, clean and inspect the wires for cracked insulation and loose terminals. Repair or replace the wires as required. A spark plug wire set is available for service.

When removing the wires from the spark plugs, grasp the moulded cap only. Do not pull on the wire because the wire connection inside the cap may become separated or the weather seal may be damaged.

Spark Intensity

1. Disconnect a spark plug wire. **Check the spark intensity of one wire at a time.**
2. Install a terminal adapter in the terminal of the wire to be checked. Hold the adapter approximately 3/16 inch from the exhaust manifold and crank the engine, using a remote starter switch. The spark should jump the gap regularly.
3. If the spark intensity of all the wires is satisfactory, the coil, condenser, rotor, distributor cap and the secondary wires are probably satisfactory.

If the spark is good at only some wires, perform a high resistance test of the faulty leads.

If the spark is equal at all wires, but weak or intermittent, make a high resistance check of the coil, distributor cap and the coil to distributor high tension wire. Follow the instructions of the test set manufacturer when making the tests.

On the transistor ignition, do not test the coil on a coil tester, as inconclusive results will be obtained due to the very low coil primary inductance. Substitute a known good coil and perform the primary circuit tests.

SPARK PLUGS

Clean, inspect and gap the plugs following the instructions in Sections

2 and 3. After the proper gap is obtained, check the plugs on a testing machine. Compare the sparking efficiency of the cleaned and gapped plug with a new plug. Replace the plug if it fails to meet 70% of the new plug performance.

Test the plugs for compression leakage at the insulator seal. Apply a coating of oil to the shoulder of the plug where the insulator projects through the shell, and to the top of the plug, where the center electrode and terminal project from the insulator. Place the spark plug under pressure with the tester's high tension wire removed from the spark plug. Leakage is indicated by air bubbling through the oil. If the test indicates compression leakage, replace the plug. If the plug is satisfactory, wipe it clean.

IGNITION TIMING

Incorrect ignition timing can be caused by:

1. Timing incorrectly adjusted.
2. Distributor bushing and / or shaft worn, or a bent distributor shaft.
3. Defective vacuum advance system.
4. Defective centrifugal advance.

IGNITION SYSTEM TESTS—ROTUNDA TESTERS

TEST CONNECTIONS–RE-235, RE-651, AND RE-881

The test connections for the RE-235 tester are shown in Fig. 16, the test connections for the RE-651 tester are shown in Fig. 17, and the test connections for the RE-881 tester are shown in Fig. 18.

1. With the tester turned off, plug the power plug into a proper AC outlet.

2. Connect the green lead to the distributor terminal of the coil.

On a car equipped with a transistor ignition, connect this green lead to the terminal on the red side of the tachometer block.

3. Remove the No. 1 plug wire from the distributor cap, place the blue pickup in the cap and place the plug wire in the pickup.

4. Now connect the black lead to a good ground.

If the car has a transistor ignition, connect the black lead to the terminal on the black side of the tachometer block.

5. Clip the red pickup over the coil-to-distributor high tension wire.

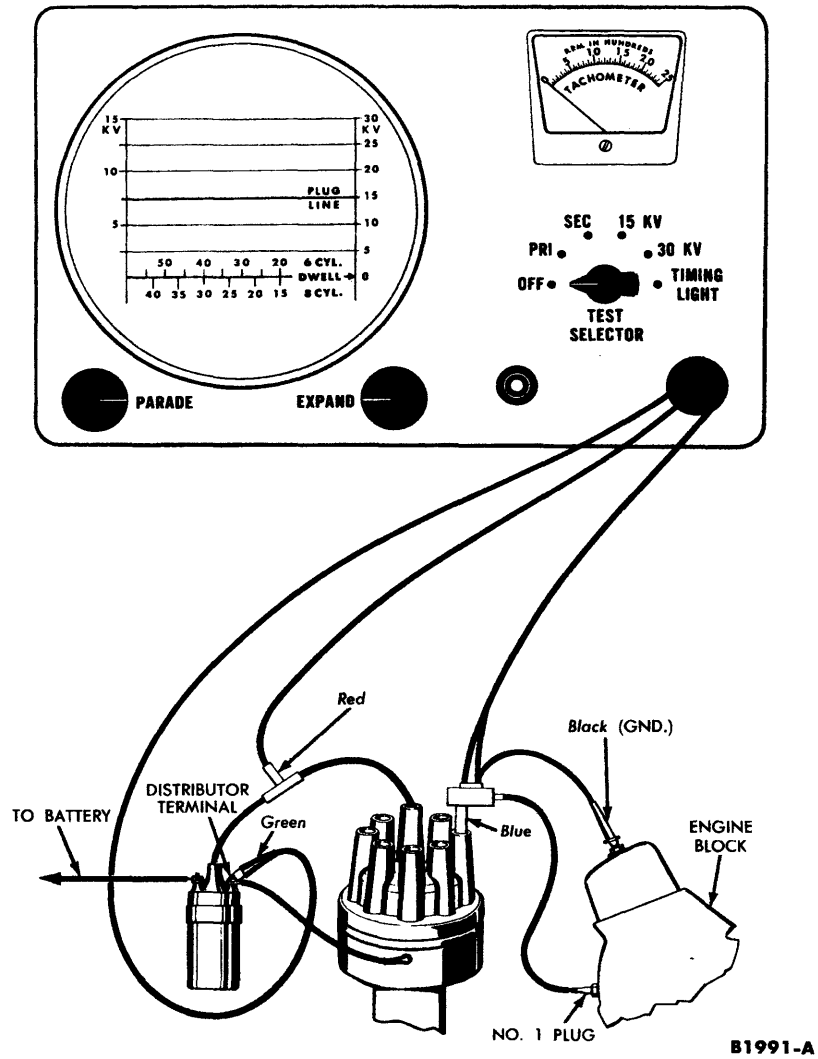


FIG. 16–Rotunda RE-235 Test Connections

6. If the engine timing is to be checked, plug the timing light into its socket.

The following steps pertain to the RE-651 and RE-881 testers only.

7. Disconnect the battery wire from the regulator and place it in the knob end of the 100 ampere shunt.

8. Place the spade terminal from the 100 ampere shunt and the yellow lead on the battery terminal of the voltage regulator.

9. Turn the ground polarity switch to the minus position. On the RE-881 tester, turn the volts switch to the 20 volt position.

POINT RESISTANCE TEST

RE-651 Tester

1. Remove and ground the high tension wire from the center of the distributor.

2. Turn the volts switch to the point resistance (PT. RES.) position. The points should be closed for this test. If the breaker points are open, the meter will read the battery voltage (0 to 40 scale).

3. "Bump" the starter with the starter switch until the voltmeter pointer decreases to the lowest reading in the black zone. **On a car equipped with a transistor ignition, this bumping is done by jumping between the "S" terminal of the solenoid and the battery with the ignition switch off and the coil lead (brown wire) disconnected from the solenoid.**

4. Depress the PT. RES. pushbutton.

5. The voltmeter pointer should read within the 12V area as shown

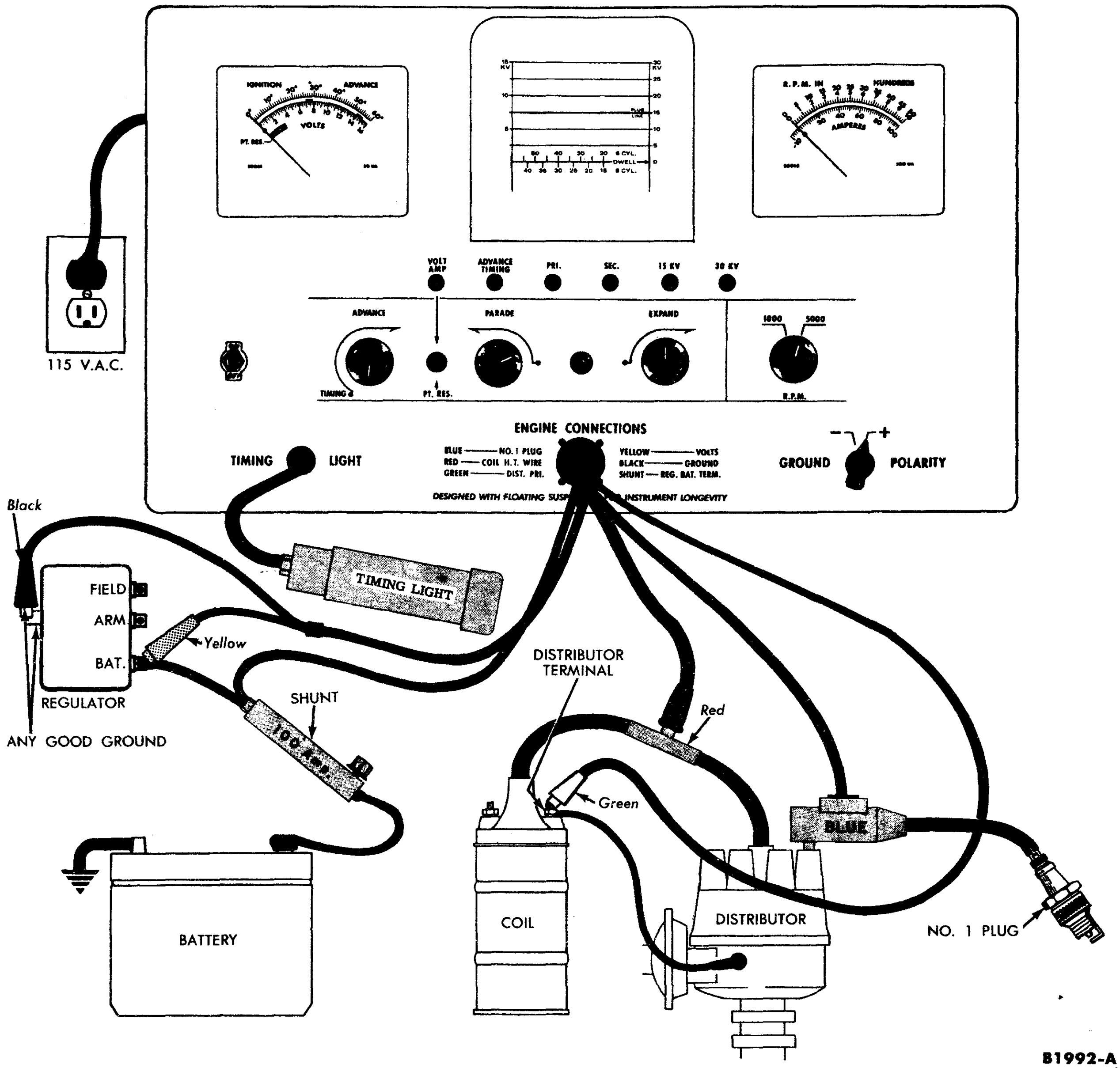


FIG. 17—Rotunda RE-651 Test Connections

in black on the meter dial. If not, check for incorrect breaker point spring tension or for burned or pitted points.

6. Connect the high tension wire to the distributor.

RE-881 Tester

1. Remove and ground the high tension wire from the center of the distributor.

2. "Bump" the starter with the starter switch to close the breaker points. This will be indicated by the lowest reading on the voltmeter. **On a car equipped with a transistor ignition system, the starter is bumped by jumping between the "S" terminal of the solenoid and the battery, with the ignition switch off and the coil lead (brown wire) disconnected from the solenoid.**

3. The voltmeter pointer should read in the black OK PT. RES. area. If it doesn't, check for improper breaker point spring tension or for burned or pitted points.

4. Connect the high tension wire to the distributor.

IGNITION TIMING

Disconnect the vacuum line. If necessary, clean and mark the desired timing mark.

RE-235 Tester

1. Start the engine and allow it to warm up.

2. Operate the engine at the specified idle speed and point the timing light toward the pointer. The desired timing mark should line up with the pointer. If it doesn't, loosen the distributor hold down bolt and rotate the distributor until the mark

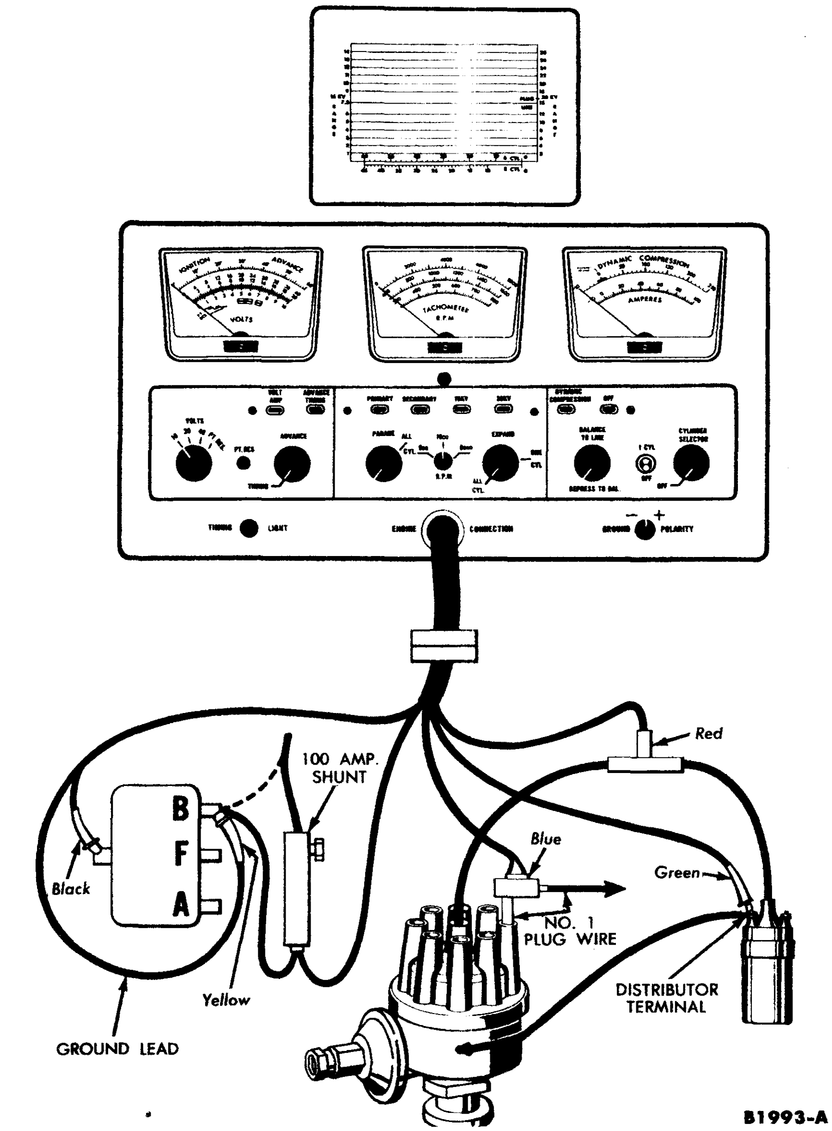


FIG. 18—Rotunda RE-881 Test Connections

lines up with the pointer. Now tighten the hold down bolt and check the timing.

RE-651 Tester

1. Turn the rpm selector to the 1000 position.
2. Depress the advance timing pushbutton.
3. Start the engine and allow it to warm up.
4. Operate the engine at the specified idle speed.
5. Turn the advance knob until the ignition advance meter reads 0°.
6. Point the timing light toward the timing pointer. The desired timing mark should line up with the pointer. If it doesn't, loosen the distributor hold down bolt and rotate the distributor until the desired timing mark and pointer line up. Tighten the distributor hold down bolt and check the timing.

RE-881 Tester. The method of testing is the same as the RE-651 tester with the exception of Step 1 which should (for the RE-881) read "turn the rpm selector to the 800 position."

SUPERIMPOSED PRIMARY PATTERN

Procedure

RE-235 TESTER

1. With the engine running at

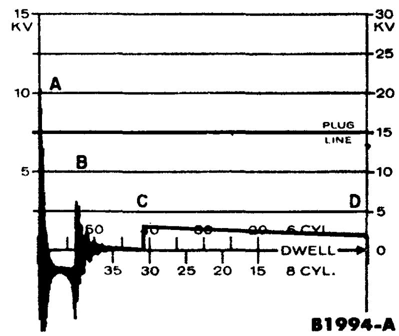


FIG. 19—Normal Superimposed Primary Pattern

1000 rpm, turn the test selector switch to the primary (PRI.) position.

2. Adjust the parade control to position the left end of the pattern at the left vertical line on the screen.
3. Adjust the expand control so that the right end of the pattern is at the right vertical line on the screen.

RE-651 TESTER

1. Turn the rpm selector to the 5000 position. Start the engine and adjust it to 1000 rpm.
2. Depress the PRI pushbutton on the console panel.
3. Adjust the parade and expand controls to position the left end of the pattern at the left vertical line on the screen and the right end of the pattern at the right vertical line on the screen.

RE-881 TESTER. The test procedure for the RE-881 is the same as the test procedure for the RE-651 except for the setting of the rpm selector. For the RE-881 tester, the rpm selector is turned to the 1600 position.

Results. A normal test pattern is shown in Fig. 19.

Point A indicates the spark plug line which is the time when the points open. At B, the coil energy is used up sufficiently so that the plug no longer fires and only the energy stored in the breaker point condenser remains. This coil/condenser oscillation which is indicated in the pattern between B and C is completely used up at C which is the points close mark. The portion of the pattern between C and D is the points close time, which is cam angle or dwell time. At D, the points again open and the firing cycle repeats.

If points A and C are below the

horizontal 0 line, the battery polarity is incorrect. This could be caused by a battery that is either installed incorrectly or improperly charged, causing a polarity reversal.

If the firing line is not below the 0 line and there are no oscillations at point C, there is an open circuit at the coil high tension tower. This could be caused by a broken wire inside the coil tower, or a broken center contact on the distributor rotor.

If the dwell time is too short, the breaker points are incorrectly set (the larger the gap, the smaller the dwell).

If point A is at a reduced height, and the distance to B is short or non-existent, and the oscillations at point C are reduced in height, there is a

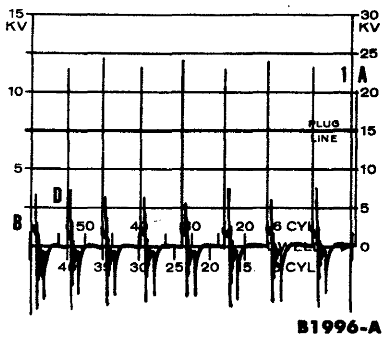


FIG. 20—Normal Superimposed Secondary Pattern

high resistance in the coil primary circuit. This could be caused by a fouled plug, defective ignition switch, or a bad wire or connection. If the scope pattern is still the same after the above ignition parts have been checked and proven satisfactory, run the 15 KV test to check for a gasket leak or a lean fuel mixture.

If point A is at a greatly reduced height and there are no oscillations at point B, the coil has a defective primary winding or the condenser has an excessive series resistance.

If there is a variation at points C and D, the cam lobes are uneven, the distributor shaft is bent, or the distributor bushings are worn.

SUPERIMPOSED SECONDARY PATTERN

Procedure

RE-235 TESTER

1. With the engine running at 1000 rpm, turn the test selector switch to the secondary (SEC.) position.

2. Adjust the parade and expand controls so that the left end of the pattern is at the left vertical line on the screen and the right end of the pattern is at the right vertical line on the screen.

RE-651 AND RE-881 TESTERS. The procedure is the same as the procedure for the primary (superimposed) pattern except the SEC. pushbutton is depressed instead of the PRI pushbutton.

Results. A normal test pattern is shown in Fig. 20.

Point A is the points open time. The height of the pattern at point A indicates the high tension voltage required to overcome the spark plug gap resistance.

Point B is the plug firing line. Notice that this portion of the pattern is quite thick. Remember that this pattern is actually 8 firing patterns superimposed one on top of the other. This increase in thickness of the pattern at B is caused by slight variations in the plug gap, distributor rotor gap and slight differences in the resistance of the individual spark plug circuits.

The pattern area between points C and D shows the coil/condenser oscillations to be correct. No point bounce at D indicates correct breaker point spring tension.

The few so called damped oscillations appearing at D are normal and are caused by the surge of current through the coil primary winding when the breaker points first close.

This current levels off and decreases slightly toward the points open position at E as indicated by the slight downward slope of the curve at about the 15° mark on the cam angle scale.

To observe the coil/condenser oscillations and the damped oscillations at D^1 in greater detail, adjust the expand control so that the pattern area between point C and D^1 nearly fills the screen.

If there is erratic action at points C and D, and there is a blotch above point E, the breaker points are burned or badly pitted.

If the length of B is reduced and the pattern between C and D is not superimposed, there is a series gap in the coil high tension tower or wire.

If the line at B is sloping downward greatly (resistor plugs will cause a slight slope), there is a high resistance in the spark plug wires, distributor cap or rotor.

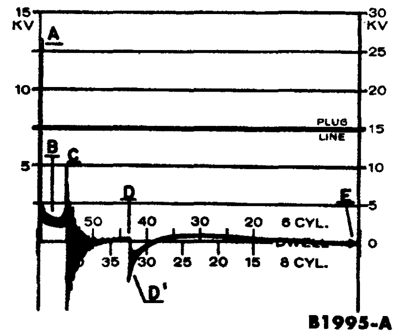


FIG. 21—15 KV Pattern

If point D^1 is varying erratically, the distributor is badly worn. If this variation is definite instead of erratic, the advance mechanism in the distributor is defective.

If the dwell line between points D^1 and E is not the smooth line shown, there is a loose connection in the primary circuit. Check the primary circuit for loose connections, damaged wires or a defective starter switch.

15 KV PATTERN

Procedure

RE-235 TESTER. With the engine operating at 1000 rpm, turn the test selector switch to the 15 KV position. Adjust the expand and parade controls to produce the pattern shown in Fig. 21.

RE-651 TESTER. With the rpm selector at the 5000 position and the engine operating at 1000 rpm, depress the 15 KV pushbutton. Adjust the expand and parade controls to produce the pattern shown in Fig. 21.

RE-881 TESTER. With the rpm selector at the 1600 position and the engine operating at 1000 rpm, depress the 15 KV pushbutton. Adjust the expand and parade controls to produce the pattern shown in Fig. 21.

Results. A normal 15 KV pattern is shown in Fig. 21. The spark plug line (A) for the No. 1 spark plug is on the extreme right hand side of the screen. The remainder of the No. 1 firing pattern is on the left side of the screen. The remainder of the patterns are shown from left to right in their firing order.

With the exception of the No. 1 spark plug line (which should be shorter than the others), the patterns should be similar. If one of the patterns differs from the others, adjust the expand and parade controls

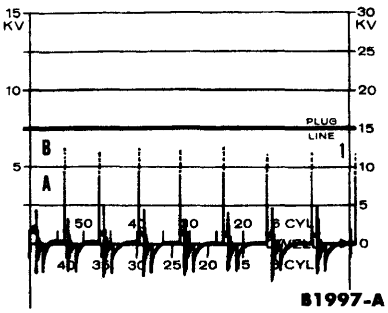


FIG. 22—30 KV Pattern

until that pattern fills the screen in the same manner as in the secondary test (Fig. 20).

The following list of symptoms will refer to Fig. 20.

If the points open line (A) is higher than the rest and the plug firing line (B) is sloped downward at an unusually large slope, there is excessive resistance in the high tension wire to that cylinder or in the distributor cap.

If the points open line (A) is low and the firing line (B) is long and nearly straight, the spark plug is shorted out.

If the points open line (A) is low and the firing line (B) is long and wide, the spark plug gap is out of adjustment.

If there are no oscillations at points C or D, the coil primary windings are partially shorted.

If the points open line (A) and the oscillations at point D are both displaced to the right on all cylinders, check the breaker points.

If all of the points open lines (A) are at varied heights, check the idle adjustment of the carburetor (always adjust the idle mixture on the rich side).

30 KV PATTERN

Procedure

RE-235 TESTER. With the engine running at 600 rpm, turn the test selector switch to the 30 KV position. Adjust the expand and parade controls to produce the pattern shown in Fig. 22.

RE-651 TESTER. With the rpm selector at the 5000 position and the engine operating at 600 rpm, depress the 30 KV pushbutton. Adjust the expand and parade controls to produce the pattern shown in Fig. 22.

RE-881 TESTER. With the rpm selector at the 1600 position and the engine operating at 600 rpm, depress the 30 KV pushbutton. Adjust the expand and parade controls to produce the pattern shown in Fig. 22.

Results. A normal 30 KV pattern is shown in Fig. 22. The spark plug line (A) for the No. 1 spark plug is on the extreme right hand side of the screen. The remainder of the No. 1 firing pattern is on the left side of the screen. The remainder of the patterns are shown from left to right in their firing order.

Notice the average height of the solid part of the points open line. Increase the speed of the engine and notice the height of the dotted lines. The difference is the required ignition output under load. The maximum output should be between 13.5 and 15 KV.

If the maximum for one or more of the plugs is above 15 KV, check the complete circuit(s) of the plug(s) for any trouble that would cause this resistance. If the maximum does not increase during the increase in engine speed, check for a fouled or improperly gapped spark plug or for very low compression.

Remove the high tension wire **at the distributor cap** for any plug except No. 1. Notice the change between the average points open line and the points open line of the cylinder with the high tension wire removed. This height difference is the coil reserve. The coil reserve should be at least 30% of the maximum output. If it is less than 30%, replace the coil.

Remove and do not ground one spark plug wire at the spark plug. If a plug firing line shows up on the scope for that cylinder, check the plug wire and distributor cap for bad insulation.

IGNITION SYSTEM TESTS—SUN 900 TESTER

TEST CONNECTIONS

Most of the ignition system can be tested by using the Sun 900 Scope Motor Tester. Make the connections as follows (Fig. 23).

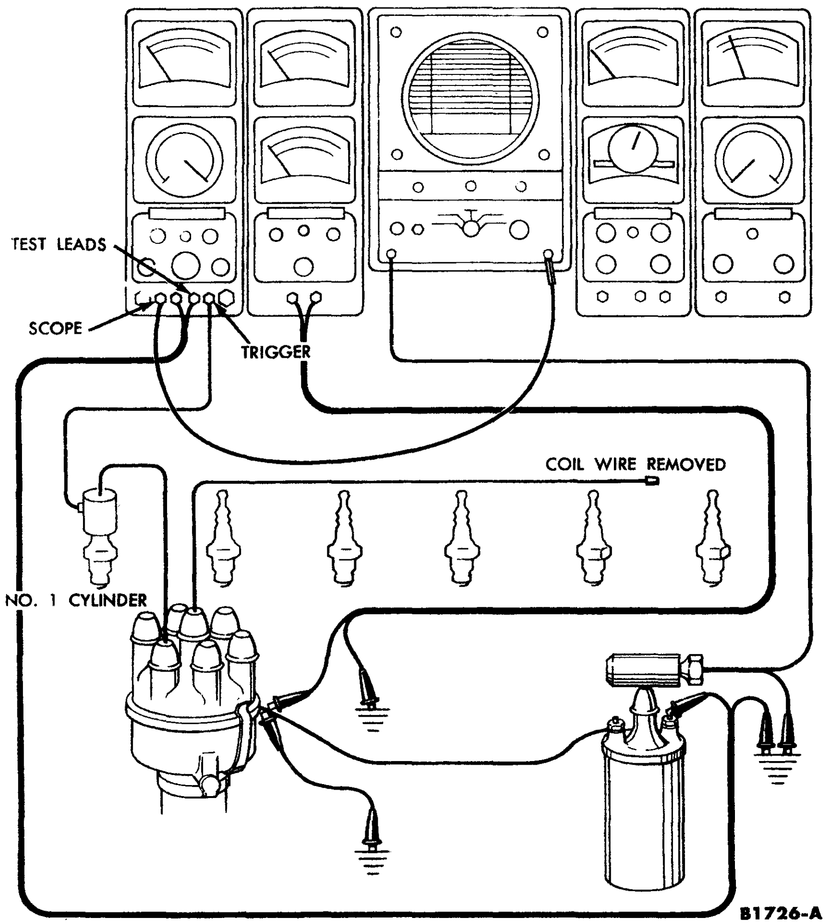


FIG. 23—Sun 900 Tester Connections

1. Plug the power cord into a proper outlet.

2. Turn the AC master switch to the ON position.

3. Turn the Tach-Dwell selector switch to the calibrator (CAL.) position and adjust the dwell calibrator until the meter pointer reads on the SET LINE.

4. Turn the Tach-Dwell rpm switch to the 5000 position.

5. Connect the Tach-Dwell leads; connect the RED insulator lead to the primary distributor lead at the coil. Connect the BLACK insulator lead to a good ground.

On a car equipped with a transistor ignition system, connect the RED insulator lead to the RED side of the tachometer block and the BLACK insulator lead to the BLACK side of the tachometer block.

6. Connect the trigger pickup into the circuit of the first spark plug in the firing order.

7. Turn the Voltage Leakage unit control counterclockwise to the TIMING position.

8. Connect a jumper lead from the distributor primary to a good ground.

9. Set the Voltage Leakage switch to the 20 V position.

10. Connect the Voltage Leakage test leads; the RED lead is connected to the battery side of the coil and the BLACK lead is connected to a good ground.

11. Remove the high tension wire from the coil and leave the wire disconnected.

12. Insert the scope pattern pickup into the coil tower and attach the ground clip to a good ground.

13. Set the scope ground polarity switch to the POSITIVE (+) position.

14. Turn the scope display selector to the SCOPE CHECK position and adjust the horizontal and vertical knobs until the trace appears on the ZERO (0) line (allow about 30 seconds for warm-up before adjustment).

CRANKING VOLTAGE

1. With the tester connected, turn the ignition switch ON. Make sure that the transmission is in neutral and that the parking brake is set.

2. Crank the engine, observe the speed and note the reading on the voltmeter.

If the meter reads less than the specified voltage, check for the following: weak battery, defective cables, connections, switch, starter, by-pass circuit, or ignition circuit to coil.

If the speed is uneven or slow, the engine or starting circuit is defective.

BREAKER POINTS

1. With the motor tester connected, turn the scope display selector to the INDIVIDUAL CYLINDER position.

2. Remove the jumper lead from the distributor to ground.

3. Insert the coil high tension wire into the scope pattern pickup.

4. Operate the engine at 1200 rpm.

5. Observe the point open and point close signals (Fig. 24). If an unusual point close signal is obtained (an unusual point close signal is one that does not have a short straight downward line followed by a series of closely grouped rapidly diminishing oscillations), check for poor point contact, misaligned points, or weak point spring tension.

If an unusual point open signal is obtained (an unusual point open signal is one that does not form a firing line that is straight up and down), check for dirty or burned points, or high series resistance.

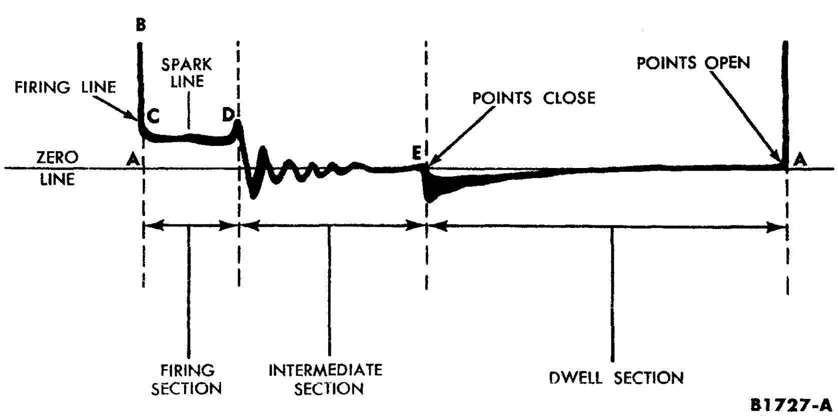


FIG. 24—Typical Scope Pattern

COIL

Polarity

1. Remove the jumper lead from the distributor to ground, if it is still connected.

2. Insert the coil high tension lead into the scope pattern pickup.

3. Adjust the engine speed to 1200 rpm.

4. Turn the scope display selector to the ALL CYLINDERS position, and adjust the pattern length control until all cylinders appear between the vertical lines on both sides of the screen.

5. Rotate the pattern shift control counterclockwise until the last pattern on the screen appears complete.

6. Observe the patterns, noting if they are upright or inverted (Fig. 24).

If they are inverted, check for the scope ground polarity switch in the MINUS (−) position, battery polarity reversed, coil improperly connected, or incorrect coil.

Primary and Secondary Tests. To check the coil for shorted or open windings and for primary or secondary resistance, calibrate the Condenser-Coil Unit as follows:

1. Turn the AC switch to ON.

2. Set the Condenser-Coil Unit selector switch at the OHMS position.

3. Set the Condenser-Coil ohms switch to the desired range.

4. Connect the test leads together.

5. Adjust the Condenser-Coil calibrator until the meter pointer reads ZERO on the ohms scale.

6. Disconnect the test leads.

7. Disconnect all leads from the coil.

SHORTED OR OPEN WINDINGS.

1. Calibrate the Condenser-Coil Unit (the ohm switch should be in the OHMS position).

2. Connect the test lead, one to each coil primary terminal. Observe the polarity.

3. Insert the coil pickup into the secondary tower of the coil and connect the ground lead of the pickup to a good ground.

4. Turn the Condenser-Coil Unit

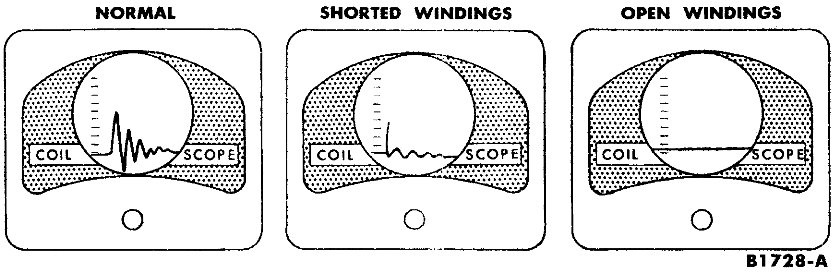


FIG. 25—Coil Test Patterns

selector switch to the COIL TEST position and observe the wave pattern visible on the coil test scope.

Refer to Fig. 25 for checking the data obtained.

PRIMARY RESISTANCE

1. Calibrate the Condenser-Coil Unit (set the ohm switch to the OHMS position.)
2. Connect the test leads, one to each primary terminal of the coil.
3. Observe the meter reading and compare it with specifications.

SECONDARY RESISTANCE

1. With the ohm switch set at the OHMS x 1000 position, calibrate the Condenser-Coil Unit.
2. Install the coil pickup test lead in the tower of the coil.
3. Connect the ohmmeter test leads, one to either primary terminal and the other to the open (pigtail) end of the coil pickup test lead.
4. Observe the meter reading and compare it with specifications.

If the meter reading exceeds 20,000 ohms, the secondary winding is open.

CONDENSER

For the condenser tests, calibrate the Condenser-Coil Unit as follows:

1. Set the selector switch to the CONDENSER position.
2. Connect the test leads together.
3. After allowing approximately one minute for the tester to warm up, adjust the calibrator until the meter pointer reads on the set line at the right end of the meter scale. **Do not change this setting during the tests.**

Resistance

1. Connect the test leads, one to the primary terminal of the distributor and the other to a ground on the distributor body.
2. With the condenser test switch in the SERIES RESISTANCE position, the meter should read in the black bar at the right end of the scale.
3. Move the condenser pigtail. If a deflection of the meter is noted, the pigtail is making poor contact and the condenser should be replaced.

If the reading is outside the black bar, move the grounded lead to the body of the condenser. If the reading improves, the condenser is not properly grounded to the distributor housing.

Capacity

1. Turn the condenser test switch to the CAPACITY position.
2. Read the red scale of the meter (0.5) for the microfarad capacity of the condenser being tested.
3. Refer to the specifications for the recommended condenser capacity.

If the readings are not within specifications replace the condenser.

Leakage

1. Turn the condenser test switch to the LEAKAGE position.
2. The meter should now read in the black bar at the left end of the scale if the condenser leakage is satisfactory.

If the meter pointer reads outside the black bar, the condenser insulation is leaking and the condenser should be replaced.

NOTE: If the condenser does not meet specifications while mounted in the distributor, remove the condenser and retest it. The same procedure is followed as above. If the condenser tests bad in the distributor, but tests good when removed, there is a short or ground in the distributor primary circuit. Inspect the insulation of the distributor primary terminal and the internal circuit of the distributor.

FIRING VOLTAGE

1. Remove the jumper from the distributor to ground.
2. Insert the coil high tension lead into the scope pickup.
3. Adjust the engine speed to 1200 rpm.
4. Turn the scope display selector to the ALL CYLINDERS position, and adjust the pattern length control until all of the cylinders appear between the vertical lines on the screen.
5. Rotate the pattern shift control counterclockwise until the last pattern on the screen appears complete.
6. Observe the height of each firing line, on the scope, and compare for uniformity and height (Fig. 24).

If the firing voltages are uniform, but high, check for worn spark plugs, late ignition timing, lean fuel mixture, too large a rotor gap, or a break in the coil wire.

If the firing voltages are uneven, check for worn spark plugs, uneven compression, breaks in spark plug wires, or a cocked or worn distributor cap.

AVAILABLE VOLTAGE

1. Make the same connections and adjustments as for the firing voltage test above.
2. Disconnect a spark plug wire with a pair of insulated pliers.
3. Hold the wire away from a ground and notice the upward extent of the pattern on the scope.

If the available voltage is less than 20 KV, check for excessive resistance in the primary circuit, low primary input voltage, defective coil, dwell less than specified, or defective secondary insulation.

SECONDARY INSULATION

1. Continue with the same connections and adjustments as in the last two tests.
2. Observe the downward extent of the pattern of the spark plug with the wire removed.
3. Connect the spark plug wire.
4. Perform this test on all of the cylinders (trigger cylinder may be tested in the SCOPE CHECK position).

If the lower extent is not at least half the size of the upper extent, check for insulation leakage in the coil, coil tower, rotor, coil wire, distributor cap, or spark plug wire.

SECONDARY RESISTANCE

1. The connections and adjustments for this test are the same as for the last three tests, except for the scope display selector switch which is now placed in the ALL CYLINDERS position.

2. Observe and compare the spark line (Fig. 24) of the patterns for length, height, angle and oscillations.

If all cylinders are affected, check for high resistance in the coil tower, coil wire, rotor, or distributor cap tower; also check for an accumulation of deposits on the spark plugs, or poor contact between the rotor and distributor cap.

If one or more cylinders are affected, check for high resistance in the distributor cap tower, spark plug wires, or spark plugs.

SPARK PLUGS

To test the spark plugs on the car, connect the motor tester in the same manner as for the firing voltage test.

1. Turn the display selector switch to the ALL CYLINDERS position; rotate the pattern shift control in the FULL CLOCKWISE position.

2. Momentarily accelerate the engine to about 2000 rpm and return to 1200 rpm.

3. Observe the rise of the firing lines during the momentary engine acceleration.

If one or more of the firing lines is higher than the others, check for wide plug gap, open spark plug resistor wire, or badly deteriorated electrodes.

If one or more of the firing lines is lower than the others, check for spark plug fouling, flashover, or cracked insulators.

DISTRIBUTOR DIAPHRAGM LEAKAGE AND FREENESS OF OPERATION

These tests can be made with the distributor installed on the engine. The tests are sufficient for an engine tune-up. However, if there are indications that the spark advance is not functioning properly, remove the distributor from the engine and check it on a distributor test set following the instructions under "Distributor Spark Advance."

Check the vacuum advance mechanism for freeness of operation by manually rotating the breaker plate in the direction of rotation. **Do not rotate the plate by pushing on the condenser or the breaker points. Use a hook or other suitable instrument to rotate the plate.** The breaker plate should turn without binding and return to its original position when released. If the breaker plate binds, remove the plate. Clean, inspect and lubricate it as described for the particular distributor.

To check the diaphragm for leakage:

1. Remove the vacuum line from the distributor. Adjust the vacuum pressure of a distributor tester to its maximum position. Hold your hand over the end of the tester's vacuum hose and note the maximum reading obtained. **Do not exceed 25 inches Hg.**

2. If the maximum reading is 25 inches Hg or less, connect the tester's vacuum line to the vacuum fitting on the diaphragm **without changing any of the adjustments.** The maximum gauge reading should not be less than it was in step 1. If it is less, the diaphragm is leaking and should be replaced.

DISTRIBUTOR BREAKER PLATE WEAR

A worn breaker plate will cause the breaker point gap and contact dwell to change as engine speed and load conditions are varied. Mount the distributor in a distributor tester following the instructions in this section of the manual.

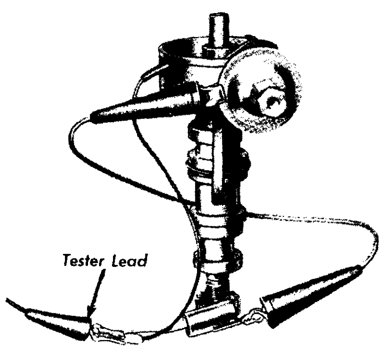


FIG. 26—Testing Transistor Ignition Distributor

Adjust the test to 0° advance, 0 inches vacuum, and 1000 rpm. Adjust the dwell angle to 26°. Apply vacuum to the distributor diaphragm and increase it very slowly while observing the indicated dwell angle. The maximum dwell angle variation should not exceed 6° when going from zero to maximum vacuum at constant rpm. If the dwell angle variation exceeds this limit, there is excessive wear at the stationary subplate pin or the diaphragm rod is bent or distorted.

DISTRIBUTOR SHAFT END PLAY

1. Remove the distributor from the engine.

2. Place the distributor in the holding tool and clamp it in a vise.

3. Push the distributor shaft upward as far as it will go, then check the end play with a feeler gauge placed between the collar and the distributor base. The end play should be within the specified limits.

If the shaft end play is not to specifications, check the location of the distributor shaft collar.

DISTRIBUTOR TESTS—ROTUNDA RE-1416 TESTER

MOUNTING DISTRIBUTOR

1. Clamp the distributor securely in the distributor support arm clamp so that it will not turn in its mounting.

2. Loosen the hand-operated locking screw on the side of the distributor support arm and adjust the support arm column up or down by turning the crank on the knob at the top of the column until the distributor shaft or adapter shaft can be securely fastened in the driving chuck. Use adapter shafts provided when driving distributors having short shafts.

3. Securely tighten the drive chuck to the distributor drive shaft by means of the chuck key, attached by a chain to the Syncrograph

4. Rotate the drive chuck by hand to make sure the distributor shaft turns freely and then tighten the locking screw on the distributor support arm.

5. Connect the Syncrograph test lead to the primary or distributor-transistor lead wire of the distributor. Since the transistor ignition distributor does not have a condenser, it will be necessary to install one in the circuit of the tester (Fig 26).

BREAKER POINT RESISTANCE

1. Turn the test selector to POINT RES. position.

2. Revolve the chuck by hand until the distributor breaker points are closed.

3. The meter pointer on the cam angle meter should read in the OK zone at the left side of the meter scale If the meter pointer does not fall in the OK zone, there is excessive resistance caused by a faulty contact across the distributor points, a faulty primary lead or a poorly grounded base plate. A faulty contact across the distributor points indicates improper spring tension or burned or pitted points

INSULATION AND LEAKAGE

1. Turn the test selector to the cam angle position and revolve the chuck by hand until the distributor breaker contacts are open

2. The cam angle meter should show a zero reading. If a zero reading is not obtained, a short circuit to ground exists

A short could be caused by poor primary or distributor-transistor lead wire insulation, a shorted condenser or a short between the breaker arm and breaker plate

MECHANICAL OPERATION

1. Turn the test selector to the SYNCHRO. position and check to make sure the drive chuck is securely tightened on the distributor shaft.

2. Turn the motor control switch to the left to correspond with the direction of rotation, as listed in the rotation column of the distributor specifications.

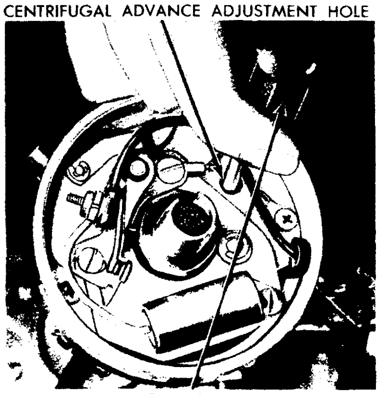
If it is necessary to reverse the rotation of the drive motor, turn the motor control switch to the OFF position and allow the chuck to come to a complete stop before reversing the switch.

3. Adjust the rpm control to vary the distributor speed between 400 and 4000 engine rpm or at the maximum speed of the engine on which the distributor is used. Erratic or thin faint flashes of light preceding the regular flashes as the speed of rotation is increased can be due to weak breaker arm spring tension or binding of the breaker arm on the pivot pin

4. Operate the distributor at approximately 2500 engine rpm.

5. Move the protractor scale with the adjustment control so that the zero degree mark on the scale is opposite one of the neon flashes. The balance of all the flashes should come within 1°, plus or minus, evenly around the protractor scale. A larger variation than 1° or erratic or wandering flashes may be caused by a worn cam or distributor shaft or a bent distributor shaft.

CENTRIFUGAL ADVANCE ADJUSTMENT HOLE



Screwdriver B2010-A

FIG. 27—Centrifugal Advance Adjustment

DWELL ANGLE

1. Turn the cylinder selector to the figure corresponding to the number of lobes on the cam of the distributor being tested.

2. Turn the test selector switch to the cam angle position and operate the distributor at approximately 1000 engine rpm.

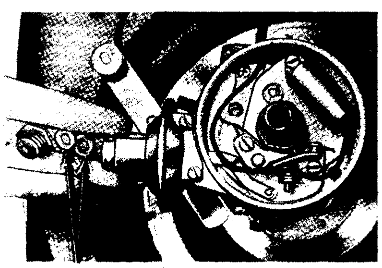
3. Adjust the distributor breaker point gap to the dwell angle shown in the specifications.

DISTRIBUTOR SPARK ADVANCE

The spark advance is checked to determine if the ignition timing advances in proper relation to engine speed and load.

1. Check the contact dwell. If the contact dwell or the breaker point gap is not within specifications, adjust the breaker points.

2. Check the breaker arm spring tension and adjust it if necessary.



SPACING WASHERS B2011-A

FIG. 28—Vacuum Advance Adjustment

The dual advance distributor has two independently operated spark advance systems. Each system is adjusted separately. **Adjust the centrifugal advance before adjusting the vacuum advance.**

Centrifugal Advance

1. Do not connect the test set vacuum line to the diaphragm. Set the test set to 0° advance and the initial rpm setting listed in the specifications.

2. Operate the distributor in the direction of rotation (counterclockwise) and slowly increase the rpm to the setting specified for the first advance reading listed in the specifications.

If the correct advance is not indicated at this rpm, stop the distributor and bend one spring adjustment bracket to change its tension (Fig. 27). **Bend the adjustment bracket away from the distributor shaft to decrease advance (increase spring tension) and toward the shaft to increase advance (decrease spring tension).** After the adjustment is made, identify the bracket.

3. After an adjustment has been made to one spring, check the minimum advance point again.

4. Operate the distributor at the specified rpm to give an advance just below the maximum. If this advance is not to specifications, stop the distributor and bend the other spring bracket to give the correct advance.

5. Check the advance at all rpm settings listed in the specifications. Operate the distributor both up and down the rpm range.

Vacuum Advance

1. Connect the test set vacuum line to the fitting on the diaphragm and turn the vacuum supply switch on.

2. Set the test set to 0° advance, 0 vacuum, and at 1000 rpm.

3. Check the advance at the first vacuum setting given in the specifications.

4. If the advance is incorrect, change the calibration washers between the vacuum chamber spring and nut (Fig. 28). After installing or removing the washers, position the gasket in place and tighten the nut. **The addition of a washer will decrease advance and the removal of a washer will increase advance.**

5. After one vacuum setting has been adjusted, the others should be checked. **Do not change the original rpm setting when going to a different vacuum setting.** If the other settings are not within limits, it indicates incorrect spring tension, leakage in the vacuum chamber and/or line, or the wrong fiber stop has been installed in the vacuum chamber of the diaphragm housing.

DISTRIBUTOR TESTS—ROTUNDA RE-236 TESTER

MOUNTING DISTRIBUTOR

1. Adjust the distributor support arm in relation to the distributor shaft length.

2. Set the distributor in the support arm and enter the lower end of the distributor shaft in the Synchrograph chuck.

3. Tighten the chuck on the distributor shaft, using the wrench located near the support arm column.

4. Align the distributor shaft by shifting the support arm and distributor, then tighten the clamp screw.

5. Clamp the distributor securely in the distributor support arm clamp so that it will not turn in its mounting.

MECHANICAL OPERATION

1. Turn the OFF, SET, CAM, SYNC. switch to SET.

2. Adjust the SET TACH control so the tachometer pointer is on the SET line.

3. Turn the OFF, SET, CAM, SYNC. switch to SYNC. position.

4. Turn the MOTOR switch to the LEFT position.

5. Adjust the speed control to vary the distributor speed between 400 and 4000 engine rpm, or at the maximum speed of the engine on which the distributor is used. Erratic or thin faint flashes of light preceding the regular flashes as the speed of rotation is increased can be due to weak breaker arm spring tension or binding of the breaker arm on the pivot pin.

6. Operate the distributor at approximately 2500 engine rpm and move the protractor scale so that the zero degree mark on the scale is opposite one of the neon flashes. The balance of all the flashes should come within 1°, plus or minus, evenly around the protractor scale. A variation larger than 1° or erratic or wandering flashes may be caused by a worn cam or distributor shaft or a bent distributor shaft.

DWELL ANGLE

1. Turn the OFF, SET, CAM, SYNC. switch to the CAM position. Operate the distributor at about 1000 rpm.

2. Adjust the breaker point gap until the cam angle is to specifications.

DISTRIBUTOR SPARK ADVANCE

The spark advance is checked to determine if the ignition timing advances in proper relation to engine speed and load.

1. Check the contact dwell. If the contact dwell or the breaker point gap is not within specifications, adjust the breaker points.

2. Check the breaker arm spring tension and adjust it, if necessary.

The dual advance distributor has two independently operated spark advance systems. Each system is adjusted separately. **Adjust the centrifugal advance before adjusting the vacuum advance.**

Centrifugal Advance

1. Do not connect the test set vacuum line to the diaphragm. Set the test set to 0° advance and the initial rpm setting listed in the specifications.

2. Operate the distributor in the direction of rotation (counterclockwise) and slowly increase the rpm to the setting specified for the first advance reading listed in the specifications.

If the correct advance is not indicated at this rpm, stop the distributor and bend one spring adjustment bracket to change its tension (Fig. 27). Bend the adjustment bracket away from the distributor shaft to decrease advance (increase spring tension) and toward the shaft to increase advance (decrease spring tension). After the adjustment is made, identify the bracket.

3. After an adjustment has been made to one spring, check the minimum advance point again.

4. Operate the distributor at the specified rpm to give an advance just below the maximum. If this advance is not to specifications, stop the distributor and bend the other spring bracket to give the correct advance.

5. Check the advance at all rpm settings listed in the specifications. Operate the distributor both up and down the rpm range.

Vacuum Advance

1. Connect the test set vacuum line to the fitting on the diaphragm.

2. Set the test set to 0° advance, 0 vacuum, and at 1000 rpm.

3. Check the advance at the first vacuum setting given in the specifications.

4. If the advance is incorrect, change the calibration washers between the vacuum chamber spring and nut (Fig. 28). After installing or removing the washers, position the gasket and tighten the nut. **The addition of a washer will decrease advance and the removal of a washer will increase advance.**

5. After one vacuum setting has been adjusted, the others should be checked. **Do not change the original rpm setting when going to a different vacuum setting.** If the other settings are not within limits, there is incorrect spring tension, leakage in the vacuum chamber and/or line, or the wrong fiber stop has been installed in the vacuum chamber of the diaphragm housing.

DISTRIBUTOR TESTS—SUN DT-600 TESTER

MOUNTING

1. Using the elevation crank, raise the clamp arms high enough to permit the shaft of the distributor to clear the drive chuck.

2. Position the distributor in the clamp with the vacuum diaphragm pointing toward the right. Tighten the clamp arms securely around the distributor body. Install the proper adapter to the vacuum diaphragm.

3. Lower the distributor with the elevation crank until the gear or ¾ inch of the tip of the distributor shaft enters the drive chuck, or until the shaft engages the adapter if an adapter is being used. **Do not bottom the distributor shaft in the chuck.**

4. Tighten the chuck. **Do not try to raise or lower the distributor after the chuck has been tightened.**

CONDENSER TESTING

Condensers should be tested for series resistance, capacity and leakage. The preparation procedure is as follows:

1. Trip the motor switch to the proper position for the rotation of the distributor being tested.

2. Turn the condenser test selector switch to the SERIES RESISTANCE position and connect the condenser test leads together.

3. Turn the condenser calibrate control clockwise from the OFF position.

4. Allow the tester to warm up for approximately 30 seconds and then adjust the calibrate control until the condenser meter reads on the SET LINE.

5. Rotate the distributor shaft until the cam holds the breaker points open.

6. Separate the test leads and connect one to the distributor primary lead and the other to the distributor body.

Series Resistance. Turn the condenser test selector switch to the

SERIES RESISTANCE position. The condenser meter should read in the black bar on the right end of the scale.

Capacity. Turn the condenser test selector switch to the CAPACITY position. The condenser meter will now read the capacity in microfarads. Compare this reading with specifications.

Leakage. Turn the condenser test selector switch to the LEAKAGE position. The condenser meter should read in the black bar at the left of the scale.

Turn the test selector switch to the SERIES RESISTANCE position and turn OFF the condenser calibrator before disconnecting the test leads.

DISTRIBUTOR RESISTANCE

1. With the motor switch in the proper position for the rotation of the distributor being tested and the speed set at ZERO rpm, clip the tester's distributor and ground lead together.
2. Set the tachometer dwell selector switch to the CALIBRATE position and adjust the dwell regulator until the dwell meter reads on the SET LINE.
3. Separate the leads and connect the tester's distributor lead to the distributor primary or distributor-transistor lead. **Since the transistor ignition distributor does not have a condenser, it will be necessary to incorporate one in the test circuit (Fig. 26).** The tester ground lead should now be connected to the distributor body.
4. Rotate the chuck by hand until the points are closed. The dwell meter should read in the black bar at the right end of the scale.

If it does not read in the black bar, move the tester's distributor wire step by step through the circuit toward the ground. When there is a measurable difference between two points, check that area for the cause of the resistance.

CAM LOBE ACCURACY

1. Connect the test leads following the directions in the distributor resistance test.
2. Turn the tachometer dwell switch to the 8 position.
3. Adjust the distributor speed to 1000 rpm.
4. Rotate the degree ring of the tester until the ZERO on the ring lines up with one of the flashes.
5. Observe the positions of the remaining flashes. If the flashes are not evenly spaced (within ±1°), check for a worn cam, worn distributor shaft or a bent distributor shaft.

DWELL ANGLE

This test has the same connections as the preceding test, therefore they can be done at the same time.

Adjust the speed to 200 rpm and notice the dwell reading. If it is not within specifications, adjust the points until the proper dwell is obtained. Now increase the speed and check the dwell reading. If the reading changes more than two degrees, check for a worn distributor shaft or worn bushings.

DISTRIBUTOR SPARK ADVANCE

The spark advance is checked to determine if the ignition timing advances in proper relation to engine speed and load.

1. Check the contact dwell. If the contact dwell or the breaker point gap is not within specifications, adjust the breaker points.
2. Check the breaker arm spring tension and adjust it if necessary.

The dual advance distributor has two independently operated spark advance systems. Each system is adjusted separately. **Adjust the centrifugal advance before adjusting the vacuum advance.**

Centrifugal Advance

1. Do not connect the test set vacuum line to the diaphragm. Set the test set to 0° advance and the initial rpm setting listed in the specifications.
2. Operate the distributor in the direction of rotation (counterclockwise) and slowly increase the rpm to the setting specified for the first advance reading listed in the specifications.

If the correct advance is not indicated at this rpm, stop the distributor and bend one spring adjustment bracket to change its tension (Fig. 27). **Bend the adjustment bracket away from the distributor shaft to decrease advance (increase spring tension) and toward the shaft to increase advance (decrease spring tension).** After the adjustment is made, identify the bracket.

3. After an adjustment has been made to one spring, check the minimum advance point again.
4. Operate the distributor at the specified rpm to give an advance just below the maximum. If this advance is not to specifications, stop the distributor and bend the other spring bracket to give the correct advance.
5. Check the advance at all rpm settings listed in the specifications. Operate the distributor both up and down the rpm range.

Vacuum Advance

1. Connect the test set vacuum line to the fitting on the diaphragm.
2. Set the test set to 0° advance, 0 vacuum, and at 1000 rpm.
3. Check the advance at the first vacuum setting given in the specifications.
4. If the advance is incorrect, change the calibration washers between the vacuum chamber spring and nut (Fig. 28). After installing or removing the washers, position the gasket and tighten the nut. **The addition of a washer will decrease the advance and the removal of a washer will increase the advance.**
5. After one vacuum setting has been adjusted, the others should be checked. **Do not change the original rpm setting when going to a different vacuum setting.** If the other settings are not within limits, it indicates incorrect spring tension, leakage in the vacuum chamber and/or line, or the wrong fiber stop has been installed in the vacuum chamber of the diaphragm housing.

2 COMMON ADJUSTMENTS AND REPAIRS

BREAKER POINTS

ADJUSTMENT

New Breaker Points. New breaker points can be adjusted with a feeler gauge, scope or a dwell meter.

To adjust the breaker points with a feeler gauge:

1. Check and adjust breaker point alignment. Rotate the distributor cam until the rubbing block rests on the peak of a cam lobe.

If the car is equipped with a transistor ignition and the starter is going to be tapped to place

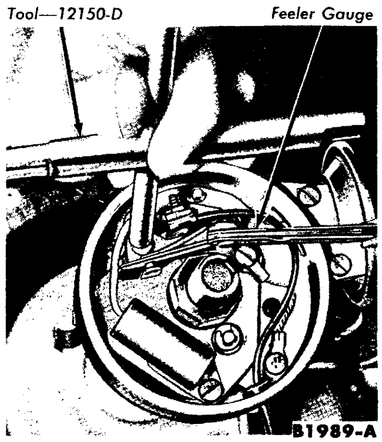


FIG. 29—Adjusting New Breaker Point Gap

the breaker point assembly on the peak of the cam, proceed as follows: connect a jumper between the "S" terminal of the solenoid and the battery with the ignition switch off and the coil lead (brown wire) disconnected from the solenoid.

2. Insert the correct blade of a clean feeler gauge between the breaker points (Fig. 29). The gap should be set to the larger opening because the rubbing block will wear down slightly while seating to the cam.

3. Apply a light film of distributor cam lubricant to the cam when new points are installed. **Do not use engine oil to lubricate the distributor cam.**

4. Set the ignition timing.

If a scope or a dwell meter is used to adjust new points, be sure the points are in proper alignment. Also,

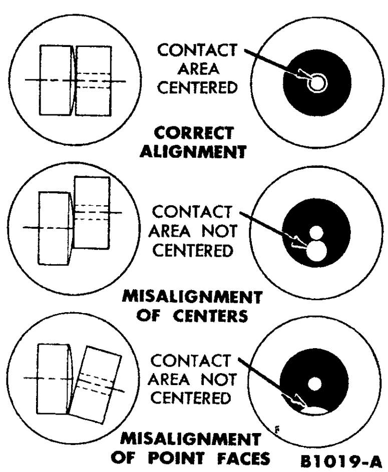


FIG. 30—Breaker Point Alignment

FIG. 31—Aligning Breaker Points

set the contact dwell to the low setting. New points must be set to the low dwell as the rubbing block will wear down slightly while seating to the cam.

Used Breaker Points. If the gap of used breaker points is being checked, use a scope or dwell meter to test the contact dwell. It is not advisable to use a feeler gauge to adjust or to check the gap of used breaker points because the roughness of the points makes an accurate gap reading or setting impossible. Clean the breaker points. Check the contact dwell following the instructions under "Ignition System Tests". The contact dwell should be to specifications. Check and adjust the ignition timing.

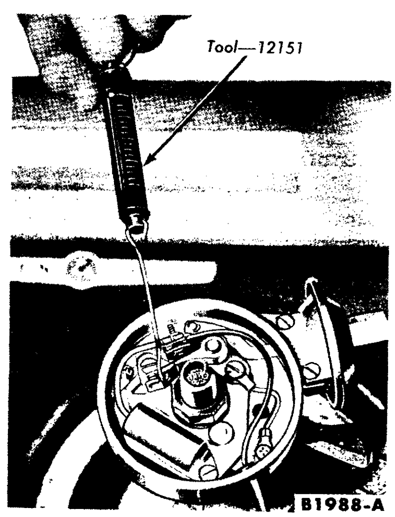


FIG. 32—Checking Breaker Point Spring Tension

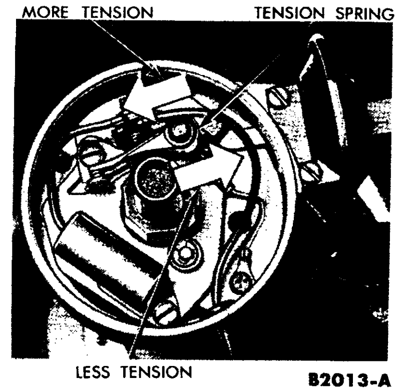


FIG. 33—Adjusting Spring Tension

ALIGNMENT

The vented-type breaker points must be accurately aligned and strike squarely in order to realize the full advantages provided by this design, and assure normal breaker point life. Any misalignment of the breaker point surfaces will cause premature wear, overheating and pitting.

1. Turn the cam so that the breaker points are closed and check the alignment of the points (Fig. 30).

If the car has a transistor ignition system, refer to the adjustment of new breaker points for the proper starter tapping procedure.

2. Align the breaker points to make full face contact by bending the stationary breaker point bracket (Fig. 31). **Do not bend the breaker arm.**

3. After the breaker points have been properly aligned, adjust the breaker point gap or dwell.

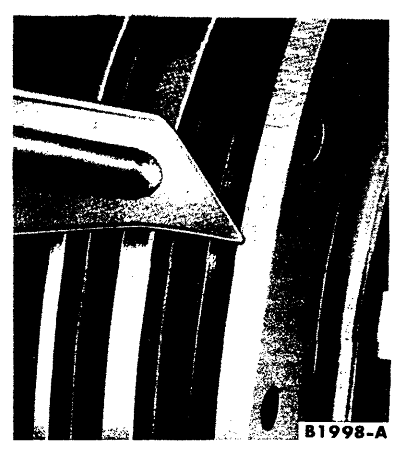


FIG. 34—Timing Marks

ADJUSTING SPRING TENSION

Correct breaker point spring tension is essential to proper engine operation and normal breaker point life. If the spring tension is too great, rapid wear of the breaker arm rubbing block will result, causing the breaker point gap to close up and retard the spark timing. If the spring tension is too weak, the breaker arm will flutter at high engine rpm resulting in an engine miss.

To check the spring tension, place the hooked end of the spring tension gauge over the movable breaker point. Pull the gauge at a right angle (90°) to the movable arm until the breaker points just start to open (Fig. 32). If the tension is not within specifications, adjust the spring tension.

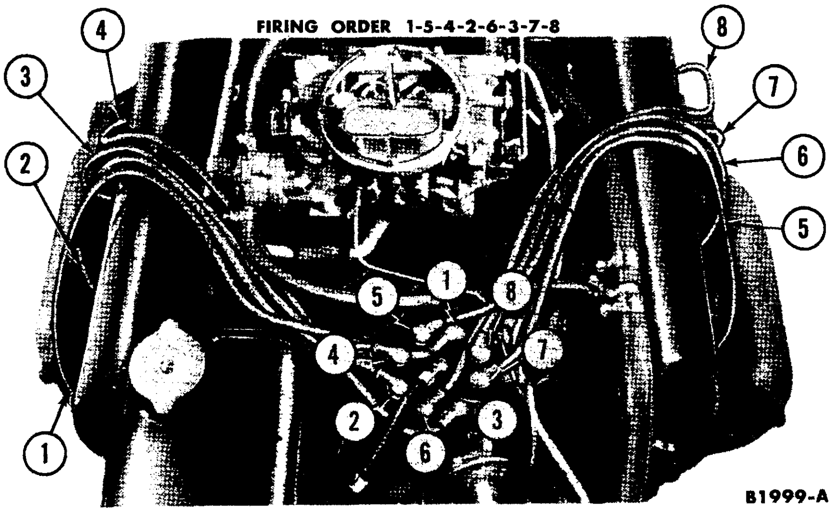


FIG. 35—Ignition Wiring

To adjust the spring tension (Fig. 33):

1. Disconnect the primary or distributor-transistor lead wire, and the condenser lead if so equipped, at the breaker point assembly primary terminal.
2. Loosen the nut holding the spring in position. **Move the spring toward the breaker arm pivot to decrease tension and in the opposite direction to increase tension.**
3. Tighten the lock nut, then check spring tension. Repeat the adjustment until the specified spring tension is obtained.
4. Install the primary or distributor-transistor lead wire, and the condenser lead (if so equipped), with the lock washer and tighten the nut securely.

IGNITION TIMING

TIMING MARK LOCATIONS

The crankshaft damper (Fig. 34) has 15 timing marks ranging from top dead center (TDC) to 30° before top dead center (BTDC). Refer to specifications for the correct ignition timing.

ADJUSTMENT

The procedure for adjusting the ignition timing is covered under "Ignition System Tests".

SPARK PLUG WIRE REPLACEMENT

When removing the wires from the spark plugs, grasp the moulded cap only. Do not pull on the wire because the wire connection inside the cap may become separated or the weather seal may be damaged.

A typical ignition wiring installation is shown in Fig. 35.

REMOVAL

1. Disconnect the wires from the spark plugs and distributor cap.
2. Pull the wires from the brackets on the valve rocker arm covers and remove the wires.
3. Remove the coil high tension lead.

INSTALLATION

1. Insert each wire in the proper socket of the distributor cap. Be sure the wires are forced all the way down into their sockets. The No. 1 socket is identified on the cap. Install the wires in a counterclockwise direction in the firing order (1-5-4-2-6-3-7-8) starting at the No. 1 socket. Cylinders are numbered from front to rear; right bank 1-2-3-4, left bank 5-6-7-8.
2. Remove the brackets from the old spark plug wire set and install them on the new set in the same relative position. Install the wires in the brackets on the valve rocker arm covers (Fig. 35). Connect the wires to the proper spark plugs. Install the coil high tension lead. **Be sure the No. 7 spark plug wire is positioned in the bracket as shown in Fig. 35.**

FIG. 36—Gapping Spark Plugs

SPARK PLUGS

REMOVAL

1. Remove the wire from each spark plug by grasping the moulded cap of the wire only. **Do not pull on the wire because the wire connection inside the cap may become separated or the weather seal may be damaged.**
2. Clean the area around each spark plug port with compressed air, then remove the spark plugs.

ADJUSTMENT

Set the spark plug gap by bending the ground electrode (Fig. 36).

INSTALLATION

1. Install the spark plugs and torque each plug to 15-20 ft-lbs.

When a new spark plug is installed in a new replacement cylinder head, torque the plug to 20-30 ft-lbs.

2. Connect the spark plug wires. Push all weather seals into position.

RESISTANCE WIRE REPLACEMENT

The primary resistance wire is checked for excessive resistance as outlined under "Resistance Wire Test".

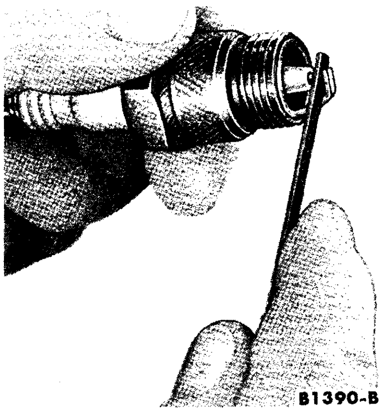


FIG. 37—Cleaning Plug Electrode

To replace the resistance wire:

1. Remove the instrument panel lower covers.
2. Disconnect the resistance wire (pink or black) from the multiple molded connector at the Power Box. This connector is the second from the top of the Power Box, and the pink or black resistance wire plugs into the upper right corner of the connector.
3. Cut off the old resistance wire at the point where it enters the main (14401) wiring loom.
4. Connect the replacement (pink or black) wire to the multiple connector at the Power Box.
5. Route the replacement wire as straight as possible under the instrument panel, to the connector near the ignition switch.
6. Disconnect the old wire at the quick disconnect (red wire with green connector) near the ignition switch and connect the replacement wire.
7. Cut off the old resistance wire where it enters the main wiring loom.
8. Tape the replacement wire to the main wiring loom.

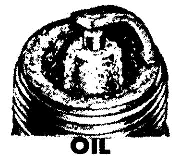
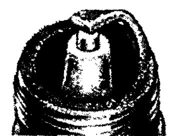
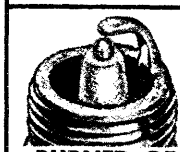
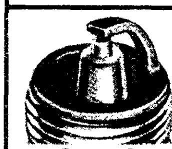
CONDITION	IDENTIFICATION	CAUSED BY
 OIL FOULING	Wet, sludgy deposits.	Excessive oil entering combustion chamber through worn rings and pistons, excessive clearance between valve guides and stems, or worn or loose bearings.
 GAS FOULING	Dry, black, fluffy deposits.	Incomplete combustion caused by too rich a fuel-air mixture or by a defective coil, breaker points or ignition cable.
 BURNED OR OVERHEATING	White, burned, or blistered insulator nose and eroded electrodes.	Inefficient engine cooling, or engine overheating caused by improper ignition timing, wrong type of fuel, loose spark plugs, or too hot a plug, low fuel pump pressure.
 NORMAL CONDITIONS	Rusty brown to grayish-tan powder deposit and minor electrode erosion.	Regular or unleaded gasoline.
 NORMAL CONDITIONS	White, powdery deposits.	Highly leaded gasolines.
 CARBON FOULING	Hard, baked on black carbon.	Too cold a plug. Weak ignition, defective fuel pump, dirty air cleaner, too rich a fuel mixture.
 SILICONE DEPOSIT	Hard and scratchy	Formed when fine sand particles combine with anti-knock compounds in the fuel. Most common industry areas. The plugs cannot be cleaned.
 SPLASHED FOULING		Deposits, accumulated after a long period of misfiring, suddenly loosened when normal combustion chamber deposits are restored after new plugs are installed. During a high speed run these deposits are thrown into the plug. B1005-E

FIG. 38—Spark Plug Inspection

3 CLEANING AND INSPECTION

SPARK PLUGS

Clean the plugs on a sand blast cleaner, following the manufacturer's instructions. **Do not prolong the use of the abrasive blast as it will erode the insulator.** Remove carbon and other deposits from the threads with a stiff wire brush. Any deposits will retard the heat flow from the plug to the cylinder head causing spark plug overheating and pre-ignition.

Clean the electrode surfaces with a small file (Fig. 37). Dress the electrodes to secure flat parallel surfaces on both the center and side electrode.

After cleaning, examine the plug carefully for cracked or broken insulators, badly pitted electrodes, and other signs of failure. Replace as required.

Examine the firing ends of the spark plugs, noting the type of deposits and the degree of electrode erosion. Refer to Fig. 38 for the various types of spark plug fouling and their causes.

DISTRIBUTORS

Soak all parts of the distributor assembly (except the condenser, breaker point assembly, lubricating wick, vacuum diaphragm, distributor base oil seal, and electrical wiring) in a mild cleaning solvent or mineral spirits. Do not use a harsh cleaning solution. Wipe all parts that can not be immersed in a solvent with a clean dry cloth.

After foreign deposits have been loosened by soaking, scrub the parts with a soft bristle brush. **Do not use a wire brush, file, or other abrasive object.** Dry the parts with compressed air.

Examine the bushing surface of the distributor shaft and the bushing for wear. The dual advance distributor has one bushing. The minimum allowable shaft diameter at the bushing is 0.4675 inch and the maximum allowable inside diameter of the bushing is 0.4690 inch. Replace worn parts.

Inspect the distributor cam lobes for scoring and signs of wear. If any lobe is scored or worn, replace the cam assembly.

Inspect the breaker plate assembly for signs of distortion. In addition, inspect the stationary sub-plate for worn nylon contact buttons. Replace the breaker plate assembly if it is defective.

The breaker point assembly and condenser (if so equipped) should be replaced whenever the distributor is overhauled.

Inspect all electrical wiring for fraying, breaks, etc., and replace any that are not in good condition.

Check the distributor base for cracks or other damage.

Check the diaphragm housing, bracket and rod for damage. Check the vacuum line fitting for stripped threads or other damage. Test the vacuum fittings, case and diaphragm for leakage as explained under "Distributor Tests". Replace all defective parts.

PART 9-2 DUAL ADVANCE DISTRIBUTORS

1 DESCRIPTION AND OPERATION

The dual advance distributor (Fig. 1) has two independently operated spark advance systems. A centrifugal advance mechanism is located below the stationary sub-plate assembly and a vacuum operated spark control diaphragm is located on the side of the distributor base. As speed increases, the centrifugal weights cause the cam to advance or move ahead with respect to the distributor drive shaft. The weights turn the cam by means of a stop plate that has two slots, which fit over pins in the weights. The slots determine the maximum amount of advance, and the rate of advance is controlled by calibrated springs.

The vacuum advance mechanism has a spring-loaded diaphragm which is connected to the breaker plate. The spring-loaded side of the diaphragm is airtight and is connected through a vacuum line to the carburetor throttle bore. When the throttle plates open, the distributor vacuum passage is exposed to manifold vacuum, which causes the diaphragm to move against the tension of the spring. This action causes the movable breaker plate to pivot on the stationary sub-plate. The breaker point rubbing block, which is positioned on the opposite side of the cam from the pivot pin, then moves against distributor rotation and advances the spark timing. As the movable breaker plate is rotated from retard position to full advance position, the dwell decreases slightly. This is because the breaker point rubbing block and the cam rotate on different axes.

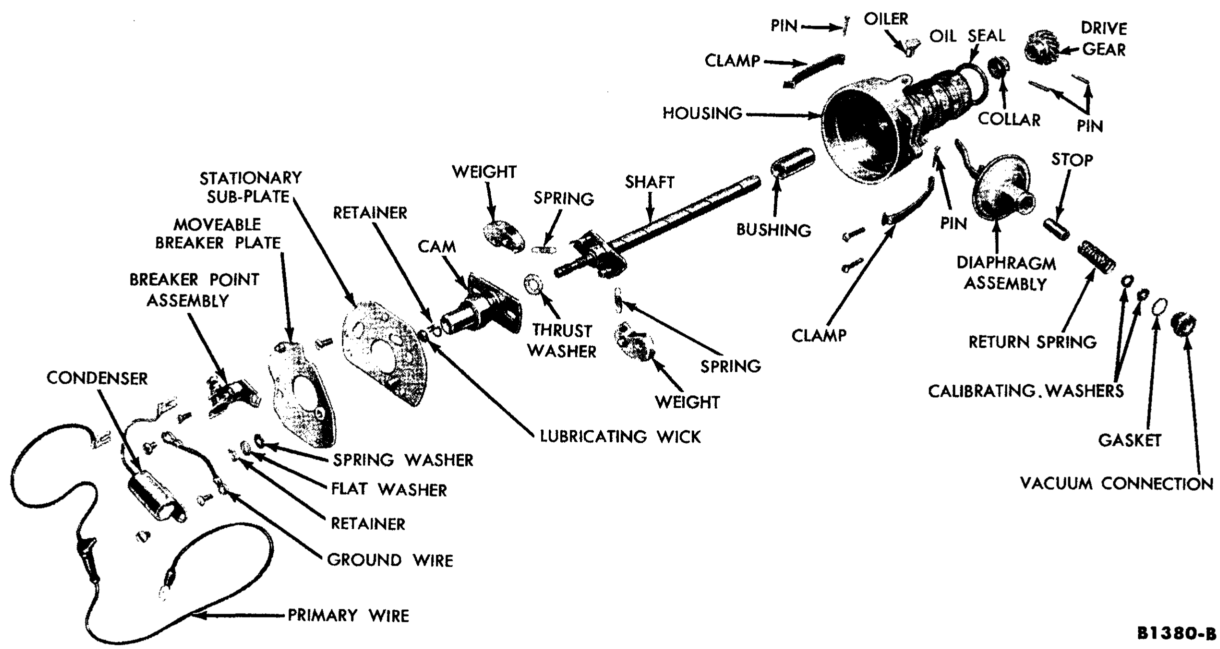


FIG. 1–Typical Dual Advance Distributor

2 IN-CAR ADJUSTMENTS AND REPAIRS

DISASSEMBLY

REMOVAL OF COMPONENTS

1. Remove the primary wire from the coil or the distributor-transistor lead from the quick disconnect. Unsnap the distributor cap retaining clips, lift the distributor cap off the distributor housing, and position the cap out of the way.

2. Loosen the nut and pull the vacuum line out of the diaphragm assembly.

3. Lift the rotor off the cam.

4. Remove the spring clip securing

the diaphragm link to the movable breaker plate. Disconnect the diaphragm assembly from the distributor housing. Lift the diaphragm link off the pin and remove the diaphragm assembly.

5. Working from the inside of the distributor, remove the primary (or distributor-transistor lead) wire by pulling it through the opening in the distributor.

6. Remove the two retaining screws and lift the entire breaker plate assembly out of the distributor housing.

7. Lift the lubricating wick out of the cam. Using needle nose pliers, remove the cam retainer and lift the cam off the distributor shaft.

8. Lift the upper thrust washer off the distributor shaft. Carefully unhook and remove the distributor weight springs. Mark each spring and the adjusting bracket to which it is attached. Lift the weights out of the housing.

DIAPHRAGM AND BREAKER PLATE ASSEMBLY

1. Remove the vacuum connection and gasket, then remove the calibrating washers, return spring and stop.

2. Remove the retaining screw and lift the condenser (if so equipped) off the breaker plate (Fig. 1).

3. Remove the retainer and washers securing the movable breaker plate to the stationary sub-plate.

ASSEMBLY

DIAPHRAGM AND BREAKER PLATE ASSEMBLY

1. Install the breaker point assembly on the breaker plate. Position a new condenser (if so equipped) and secure it in place with the retaining screw.

2. Install the stop, return spring and calibration washers, then position a new gasket on the vacuum connection. Install and tighten the vacuum connection.

INSTALLATION OF COMPONENTS

1. Install the weights in the housing, then install the distributor weight springs on the adjusting brackets from which they were removed. Install the upper thrust washer on the distributor shaft.

2. Fill the grooves in the upper portion of the distributor shaft with distributor cam lubricant. Position the cam on the distributor shaft and install the cam retainer. Apply a light film of distributor cam lubricant to the cam lobes. Install the wick in the cam assembly. Saturate the wick with SAE 10W engine oil.

3. Position the stationary sub-plate in the distributor. Install one end of the ground wire under the plate retaining screw closest to the diaphragm mounting flange.

4. Position the entire breaker plate assembly in the distributor housing and secure in place on the sub-plate by installing the washers and retainer. **Be sure the protruding edges of the spring washer are facing upward.**

5. Attach the ground wire to the breaker point attaching screw farthest from the breaker point adjustment slot. Working from inside the distributor housing, pass the primary or distributor-transistor lead wire assembly through the opening in the distributor body. From outside the distributor, pull the wire through the opening until the locating stop is flush with the inside of the distributor.

6. Connect the condenser wire (if so equipped) and the primary or distributor-transistor lead wire to the breaker points.

7. Position the diaphragm assembly and hook the diaphragm link over the pin on the breaker plate. Install the diaphragm assembly retaining screws. Secure the diaphragm link with a spring retainer.

8. Adjust the breaker point spring tension, align the breaker points and adjust the breaker point gap. Check the breaker point dwell and resistance. Check the centrifugal and vacuum advance (refer to "Distributor Tests").

9. Install the rotor and distributor cap.

10. Connect the primary or distributor-transistor wire.

3 REMOVAL AND INSTALLATION

REMOVAL

1. On a conventional ignition system, disconnect the primary wire at the coil. On a transistor ignition system, disconnect the distributor-transistor lead from the quick disconnect. Disconnect the vacuum advance line at the distributor. Remove the distributor cap.

2. Scribe a mark on the distributor body and engine block indicating the position of the body in the block, and scribe another mark on the distributor body indicating the position of the rotor. These marks can be used as guides when installing the distributor in a correctly timed engine.

3. Remove the distributor hold down cap screw and clamp. Lift the distributor out of the block.

INSTALLATION

The distributor installation is shown in Fig. 2.

1. If the crankshaft was rotated while the distributor was removed from the engine, it will be necessary to time the engine. Rotate the crankshaft until No. 1 piston is on TDC (after the compression stroke). Align the TDC mark on the timing pointer with the timing pin on the crankshaft damper. Position the distributor in the block with the rotor at the No. 1 firing position.

Make sure the oil pump intermediate shaft properly engages the distributor shaft. It may be necessary to crank the engine with the starter, after the distributor drive gear is partially engaged, in order to engage the oil pump intermediate shaft.

FIG. 2–Distributor Installation

Install, but do not tighten, the retaining clamp and screw. Rotate the distributor body counterclockwise until the breaker points are just starting to open. Tighten the clamp.

2. If the crankshaft has not been rotated, position the distributor in the block with the rotor aligned with the mark previously scribed on the distributor body, and the marks on the distributor body and engine block in alignment. Install the retaining clamp.

3. Install the distributor cap.

4. On a conventional ignition system, connect the primary wire to the coil. On a transistor ignition system, connect the distributor-transistor lead to the quick disconnect.

5. Check the ignition timing with a timing light and adjust if necessary. Connect the vacuum line, and check the advance with the timing light when the engine is accelerated.

4 MAJOR REPAIR OPERATIONS

BENCH DISASSEMBLY

1. Remove the distributor and place it in a vise.

2. Remove the rotor. Remove the spring clip securing the diaphragm link to the movable breaker plate. Disconnect the diaphragm assembly from the distributor base.

3. Lift the diaphragm link off the pin and remove the diaphragm assembly.

4. Disconnect the primary or distributor-transistor lead wire and the condenser wire (if so equipped) from the breaker point terminal.

5. Working from the inside of the distributor, remove the primary or distributor-transistor lead wire by pulling it through the opening in the distributor.

6. Remove the condenser (if so equipped).

7. Remove the breaker point assembly.

8. Remove the lubricating wick. Using needle nose pliers, remove the cam retainer.

9. Remove the movable breaker plate spring retainer and washers.

10. Remove the stationary sub-plate retaining screws. Remove the sub-plate, breaker plate and cam as an assembly.

11. Remove the upper thrust washer.

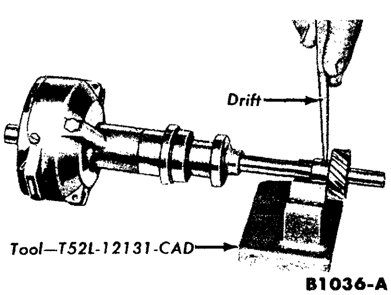


FIG. 3—Gear Pin Removal or Installation

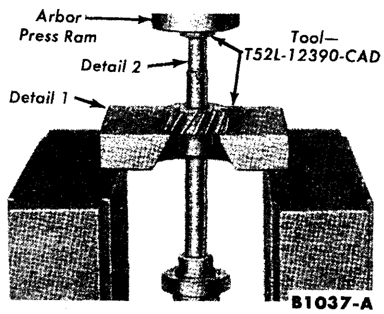


FIG. 4—Gear Removal

12. Carefully unhook and remove the distributor weight springs. Mark each spring, bracket and adjusting post to which it is attached.

13. Remove the weights.

14. Remove the distributor cap clamps.

15. **If the gear and shaft are to be used again, mark the gear and shaft so that the pin holes can be easily aligned for assembly.** Remove the gear roll pin (Fig. 3), then remove the gear (Fig. 4).

16. Remove the shaft collar roll pin (Fig. 5).

17. Invert the distributor and place it on a support plate in a position that will allow the distributor shaft to clear the support plate, and press the shaft out of the collar and the distributor housing (Fig. 6).

18. Remove the distributor shaft bushing (Fig. 7). Remove the oil seal from the distributor housing.

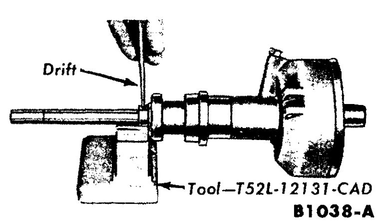


FIG. 5—Collar Retaining Pin Removal or Installation

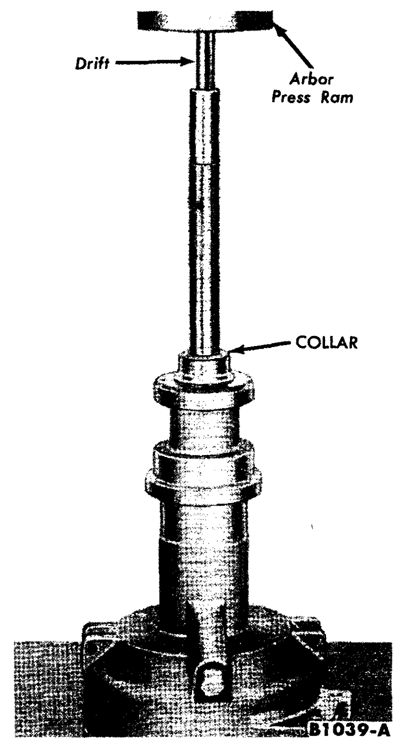


FIG. 6—Shaft Removal

BENCH ASSEMBLY

ORIGINAL SHAFT AND GEAR

1. Oil the new bushing, and install it on the bushing replacer tool. Install the bushing (Fig. 8). When the tool bottoms against the distributor base, the bushing will be installed to the correct depth.

2. Burnish the bushing to the proper size (Fig. 9).

3. Oil the shaft and slide it into the distributor body.

4. Place the collar in position on the shaft and align the holes in the collar and shaft, then install a new pin (Fig. 10). Install the distributor cap clamps.

5. Check the shaft end play with a feeler gauge placed between the collar and the base of the distributor.

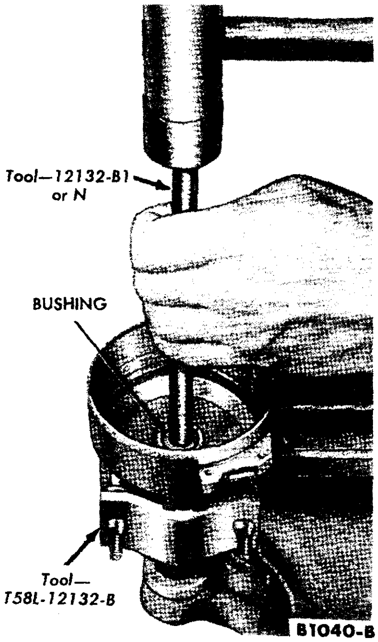


FIG. 7—Bushing Removal

If the end play is not within specifications, replace the shaft and gear.

6. Attach the distributor shaft supporting tool to the distributor. Tighten the backing screw in the tool enough to remove all shaft end play

7. Install the assembly in a press. Press the gear on the shaft (Fig. 10), using the marks made on the gear and shaft as guides to align the pin holes.

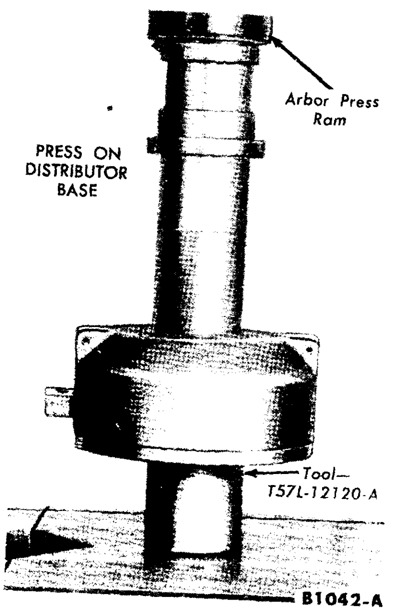


FIG. 8—Bushing Installation

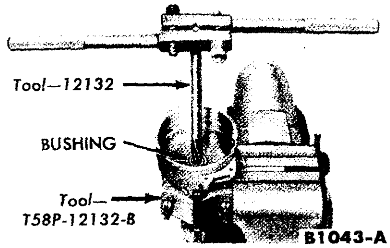


FIG. 9—Burnishing Bushing

8. Remove the distributor from the press. Install the gear retaining pin (Fig. 3).

9. Position the distributor in a vise. Fill the grooves in the weight pivot pin with distributor cam lubricant.

10. Position the weights in the distributor.

11. Install the weight springs. Be sure the proper weight, spring and adjustment bracket are assembled together.

12. Install the upper thrust washer.

13. Fill the grooves in the upper portion of the distributor shaft with a distributor cam lubricant.

14. Install the cam assembly (Fig. 11). Be sure that the slots in the cam engage the pins in the weights.

15. Install the cam retainer. Apply a light film of cam lubricant to the cam lobes. Saturate the wick with SAE 10W engine oil. Install the wick in the cam assembly. The weights, springs and cam are shown installed in Fig. 12.

16. Position the stationary subplate in the distributor. Install one end of the ground wire under the

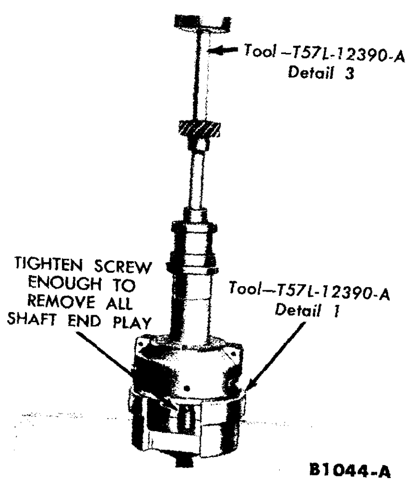


FIG. 10—Original Shaft and Gear Installation

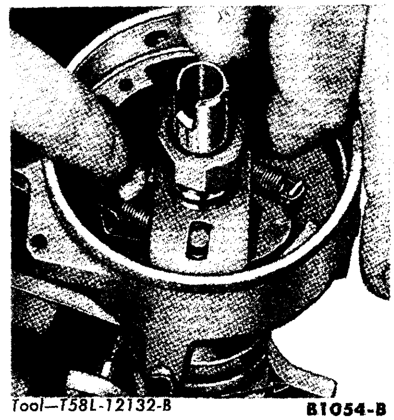


FIG. 11—Cam Installation

plate retaining screw closest to the diaphragm mounting flange (Fig. 13).

17. Position the movable breaker plate in the distributor. Install the spring washer on the pivot pin. Place the flat washer on the spring washer. Be sure the protruding edges of the spring washer are facing upward. Install the retainer.

18. Install a new breaker point assembly. Install the ground wire on the breaker point attaching screw furthest from the breaker point adjustment slot.

19. Install a new condenser (if so equipped).

20. Working from the inside to the outside of the distributor housing, pass the primary or distributor-transistor lead wire assembly through the opening in the distributor. Pull the wire through the opening until the locating stop is flush with the inside of the distributor.

21. Connect the condenser wire, if so equipped, and the primary or dis-

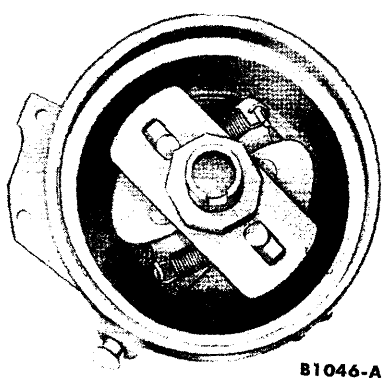


FIG. 12—Weights, Springs and Cam Installed

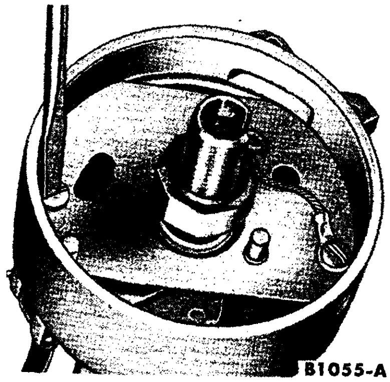


FIG. 13—Sub-Plate Installation

tributor-transistor lead wire to the breaker points.

22. Position the diaphragm assembly and hook the diaphragm link over the pin on the breaker plate. Install the diaphragm assembly retaining screws. Secure the diaphragm link with a spring retainer. Install the oil seal.

23. Refer to Part 9-1 and make the following adjustments:

Breaker point spring tension.

Align the breaker points and adjust the gap.

Check the breaker point dwell and resistance.

Centrifugal and vacuum advance.

NEW SHAFT AND GEAR

The shaft and gear are replaced as an assembly. One part should not be replaced without replacing the other. Refer to Fig. 1 for the correct location of the parts.

1. Follow steps 1, 2 and 3 under "Installing Original Shaft and Gear."

2. Attach the distributor shaft supporting tool to the distributor and install the assembly in a vise. Insert a 0.002-inch feeler gauge between the backing screw and the shaft. Tighten the backing screw on the tool enough to remove all shaft end play. Remove the feeler gauge and allow the shaft to rest on the backing screw. Slide the collar on the shaft. While holding the collar in place against the distributor base (Fig. 14), drill a ⅛-inch hole through the shaft using the access opening in the collar as a pilot.

3. Position the gear on the end of the shaft. Install the assembly in a press.

4. With the backing screw on the support tool tightened enough to remove all end play, press the gear on the shaft to the specified distance from the bottom face of the gear to the bottom face of the distributor mounting flange (Fig. 14). Drill a ⅛-inch hole through the shaft using the hole in the gear as a pilot.

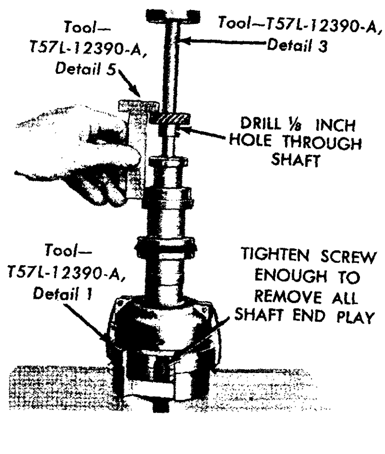


FIG. 14—New Shaft and Gear Installation

5. Remove the distributor from the press and remove the support tool. Install the collar retaining pin (Fig. 5) and the gear retaining pin (Fig. 3).

6. Complete the assembly by following steps 8 thru 23 under "Installing Original Shaft and Gear."

PART 9-3 SPECIFICATIONS

DISTRIBUTOR

GENERAL

Conventional Ignition System

Breaker Arm Spring Tension (Ounces)	17-20
Contact Spacing (Inches)	0.014-0.018
Dwell Angle at Idle Speed	26°-28½°

Transistor Ignition System

Breaker Arm Spring Tension (Ounces)	19-21
Contact Spacing (Inches)	0.019-0.021
Dwell Angle at Idle Speed	22°-24°

DIMENSIONS

Shaft End Play With Distributor Removed (Inches)	0.022-0.030
Gear Location Dimension, From Bottom of Gear to Bottom of Mounting Rib (Inches)	3.071-3.077

CONDENSER

Capacity (Microfarads)	0.21-0.25
Maximum Leakage (Megohms)	5
Maximum Series Resistance (Ohms)	1

IGNITION TIMING

Recommended Setting* ....6° BTDC

*If the individual requirements of the car and/or if sub-standard fuels dictate, the initial timing may have to be retarded from the recommended setting to eliminate detonation (spark knock). If retarding is necessary it should be done progressively and not to exceed 2° BTDC.

ADVANCE CHARACTERISTICS

Note: **The advance characteristics that are given apply to the distributor number as stamped on the distributor housing or on a plate attached to the distributor housing.**

Conventional Ignition System (Distributor No. C4VF-12127-B)

CENTRIFUGAL ADVANCE. Set the test stand to 0° at 250 rpm and 0 inches of vacuum.

Distributor (rpm)	Advance (Degrees)	Vacuum (Inches of Mercury)
500	1¼-2¼	0
600	2¾-3¾	0
800	4-5	0
1600	6¾-8¼	0
2000	8¼-9¾	0

Maximum Advance Limit ....Not applicable

ADVANCE CHARACTERISTICS (Continued)

VACUUM ADVANCE. Set the test stand to 0° at 1000 rpm and 0 inches of vacuum.

Distributor (rpm)	Advance (Degrees)	Vacuum (Inches of Mercury)
1000	½-3½	8
1000	2½-5½	10
1000	4-7	12
1000	4½-7½	20

Maximum Advance Limit ....7½°

Transistor Ignition System (Distributor No. C4VF-12127-C)

CENTRIFUGAL ADVANCE. Set the test stand to 0° at 250 rpm and 0 inches of vacuum.

Distributor (rpm)	Advance (Degrees)	Vacuum (Inches of Mercury)
500	1¼-2¼	0
600	2¾-3¾	0
800	4-5	0
1600	6¾-8¼	0
2000	8¼-9¾	0

Maximum Advance Limit ....Not applicable

VACUUM ADVANCE. Set the test stand to 0° at 1000 rpm and 0 inches of vacuum.

Distributor (rpm)	Advance (Degrees)	Vacuum (Inches of Mercury)
1000	½-3½	8
1000	2½-5½	10
1000	4-7	12
1000	4½-7½	20

Maximum Advance Limit ....7½°

SPARK PLUGS

Type	Auto Lite BF-42
Size	18 mm.
Gap (Inches)	
Conventional Ignition System	0.032-0.036
Transistor Ignition System	0.028-0.032
Torque (Ft-lbs)	15-20*

*When a new spark plug is installed in a new replacement cylinder head, torque the spark plugs to 20-30 ft-lbs.

COIL

Conventional Ignition System

Primary Resistance (Ohms)*	1.40-1.54 (75° F.)
Secondary Resistance (Ohms)	8000-8800 (75° F.)
Amperage Draw	
Engine Stopped	4.5
Engine Idling	2.5
*Primary Circuit Resistor	1.30-1.40 (75° F.)

Transistor Ignition System

Primary Resistance (Ohms)*	7.00-9.00 (75° F.)
Secondary Resistance (Ohms)	5000-7000 (75° F.)
Amperage Draw	
Engine Cranking	4.0
Engine Idling	5.0
*Primary Circuit Resistor	7.00-9.00 (75° F.)

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FUEL SYSTEM

GROUP 10

PART 10-1 GENERAL FUEL SYSTEM SERVICE

1 DIAGNOSIS AND TESTING

FUEL TANK, LINES AND FILTER

Water and dirt that accumulate in the fuel tank can cause a restricted fuel line or filter and malfunction of the vapor discharge valve, fuel pump, or carburetor. Condensation, which is the greatest source of water entering the fuel tank, is formed by moisture in the air when it strikes the cold interior walls of the fuel tank.

Leakage in the fuel inlet line can cause low vacuum, pressure and volume conditions, and loss of fuel.

A restricted fuel tank vent, located in the filler cap, can cause low fuel pump pressure and volume which may, in some instances, result in collapsed inlet line hoses or a collapsed fuel tank.

VAPOR DISCHARGE VALVE AND FUEL PUMP

Fuel pump static pressure and flow capacity specifications for the fuel pump take into consideration the effect of the thermostatic vapor discharge valve on these functions; therefore, all checks of static pressure and flow capacity must be taken with the thermostatic valve in the closed (cold) position to prevent condemnation of a good pump.

VAPOR DISCHARGE VALVE

Test. To check whether the valve is open or closed, operate the engine, and disconnect the vapor return line at the fuel pump adapter connection. **Guard against any fuel spillage by using a container to collect any fuel that is discharged during the check (Fig. 1).**

If only a small amount of fuel is being discharged at the adapter orifice, the valve is closed. **The discharged fuel (approximately four ounces in 100 seconds) is passing through the pressure leak-down bleed and can be disregarded when making the test.**

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FIG. 1–Vapor Discharge Valve Test

If a considerable amount of fuel is being discharged, the valve is open. **This condition may be due to the high temperature of the fuel within the pump or to the valve stem sticking in the open position.** In either instance, steps must be taken to close the valve, either by cooling the fuel pump or, if the valve is stuck open, cleaning or replacing the valve assembly.

If it is desired, a suitable cap or plug may be placed in the vapor discharge outlet while performing the fuel pump tests. If a cap or plug is not used, connect the vapor return line to the adapter.

FUEL PUMP

Incorrect fuel pump pressure and low volume (flow rate) are the two most likely fuel pump troubles that will affect engine performance. Low pressure will cause a lean mixture at high speeds and excessive pressure will cause high fuel consumption and carburetor flooding. Low volume will cause fuel starvation at high speeds.

Two tests: fuel pump static pressure and fuel volume are necessary to determine that the fuel pump is in satisfactory condition.

If both the fuel pump volume and pressure are within specifications, the pump and lines are in satisfactory condition and a vacuum test is not required.

If the pump volume is low, but the pressure is within specifications, a test must be made with the filter removed. If the pump volume meets specifications with the filter removed, replace the filter. If the pump volume is still below specifications with the filter removed, repeat the test, with an auxiliary fuel supply source. If the pump still does not meet specifications, replace the pump. If the pump does meet specifications, there is a restriction in the fuel supply from the tank or the tank is not venting properly.

The tests are performed with the fuel pump installed on the engine. **Make certain the replaceable fuel filter element has been changed within the recommended maintenance mileage interval. When in doubt, install a new filter prior to**

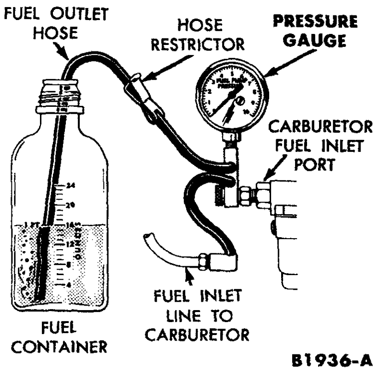

FIG. 2–Fuel Pump Pressure and Capacity Tests

performing the tests. A clogged or restricted filter is often the cause of fuel system malfunction.

Pressure Test

1. Remove the air cleaner. Disconnect the fuel inlet line at the carburetor. **Use care to prevent combustion due to fuel spillage.**
2. Connect a pressure gauge, and a flexible fuel outlet hose (Fig. 2) between the carburetor inlet connector and the fuel inlet line connector.
3. Position the flexible fuel outlet hose so that the fuel can be expelled into a suitable container (Fig. 2) for the capacity (volume) test.
4. Operate the engine. Vent the system into the container by opening the hose restrictor momentarily before taking a pressure reading.
5. Operate the engine at 500 rpm. After the pressure has stabilized, it should be to specification.

Capacity Volume Test. Perform this test only when the fuel pump pressure is within specifications.

1. Operate the engine at 500 rpm.
2. Open the hose restrictor and expel the fuel into the container (Fig. 2), while observing the time required to expel one pint; then, close the hose restrictor. One pint of fuel should be expelled within the specified time limit.
3. Remove the test equipment and connect the fuel inlet line to the carburetor.

FUEL PUMP, TANK AND LINES DIAGNOSIS GUIDE

LOW FUEL PUMP PRESSURE OR VOLUME	Diaphragm stretched or leaking. Fuel pump diaphragm spring weak. Rocker arm worn. Excessive clearance between rocker arm and fuel pump link. Fuel pump push rod and/or eccentric worn or undersized. Fittings loose or cracked. Fuel filter clogged.	Fuel line cracked or broken. Fuel pump valves improperly seated. Dirt in fuel tank and/or lines. Fuel tank vent (filler cap) restricted. Diaphragm ruptured. Vapor discharge valve malfunctioning. Main body retaining screws loose.
HIGH FUEL PUMP PRESSURE OR VOLUME	Diaphragm spring too strong or improper spring. Diaphragm surface too tight (overtensioned). Vapor discharge valve malfunc-	tioning. Pump link has no free play (frozen). Diaphragm vent (breather hole) plugged or missing.
LOW FUEL PUMP VACUUM	Diaphragm stretched or leaking. Fuel pump springs weak. Fuel pump valves improperly seated. Diaphragm ruptured. Rocker arm worn. Excessive clearance between rock-	er arm and fuel pump link. Fuel pump push rod and/or eccentric worn or undersized. Vapor discharge valve malfunctioning. Main body retaining screws loose.
LOW FUEL PUMP VOLUME WITH NORMAL PRESSURE	Fuel filter clogged. Fuel pump to carburetor inlet tube obstructed, crimped, or leaks.	Restriction in fuel supply line to fuel pump.
FUEL PUMP LEAKS FUEL	Main body retaining screws loose. Diaphragm defective. Fittings loose.	Threads on fittings stripped. Body cracked.
FUEL PUMP LEAKS OIL	Fuel pump retaining bolts loose.	Mounting gasket defective.

FUEL PUMP, TANK AND LINES DIAGNOSIS GUIDE (Continued)

FUEL PUMP NOISE	Rocker arm, eccentric or push rod worn. Mounting bolts loose.	Rocker arm spring weak or broken.
FUEL TANK AND/OR INLET LINE HOSES COLLAPSED	Fuel tank vent in filler cap obstructed.	

AIR DUCT

1. Place the air duct assembly in a container of cool water (below 75° F.). Be sure that the thermostat is covered by the water.

2. Place a thermometer in the water and observe the temperature.

3. With the water temperature at 75° F. or below, the valve should be in the HEAT-ON position.

4. Using a hot plate or other suitable device, heat the water slowly.

5. When the water temperature reaches 85° F., the valve should start to open. **If the valve does not start to open at this time, stabilize the water temperature at 85° F. for eight minutes before condemning the unit.**

6. When the water temperature reaches 100° F. or higher, the valve should be in the full HEAT-OFF position.

7. If the operation of the valve is unsatisfactory, remove the thermostat and spring assembly and check the valve plate shaft for binding.

8. If the valve plate moves freely, replace the thermostat and spring assembly. Retest the HEAT-ON and the HEAT-OFF temperatures.

9. If the valve does not operate correctly, adjust the thermostat rod. By increasing the rod length, the valve plate will be moved toward the HEAT-OFF position. By decreasing the rod length, the valve plate will be moved toward the HEAT-ON position.

CARBURETOR

Dirt accumulation in the fuel and air passages, improper idle adjustments, and improper fuel level are the major sources of carburetor troubles.

TESTS

Idle Speed-Up Control

1. Remove the air cleaner. Operate the engine and the air conditioner.

2. Place a finger on the air passage inlet tube projecting through the air horn. **If the idle speed-up control unit is operating correctly, the pull of vacuum will be sufficient to be felt by finger application and the engine rpm will decrease.** If the engine rpm does not decrease or no suction is indicated at the inlet tube, the fast idle solenoid is malfunctioning and further tests are required.

3. Check for current at the solenoid terminals with the appropriate meter. If no current is present, check the air conditioner electrical system for the cause of the malfunction. If current is present, remove the solenoid and check the solenoid valve and seat for damage. If the seat is damaged, replace the entire assembly. If the valve is damaged, replace the valve only. If both the valve and seat are undamaged and the unit is free of dirt, replace the solenoid.

Accelerating Pump Discharge

1. Remove the air cleaner.

2. Open the primary throttle plates and observe the fuel flow from the accelerating pump discharge nozzles. If the system is operating correctly, a quick steady stream of fuel will flow from the discharge nozzles.

CARBURETOR DIAGNOSIS GUIDE

FLOODING	High fuel level. Loose fuel inlet needle valve seat or seat gasket damaged or missing. Excessive fuel pump pressure. Sticking and/or restricted float operation.	Leaking carburetor float. Float tab surface rough. Dirt or foreign material in fuel holds float needle valve open. Worn needle valve and seat.
HARD STARTING	Incorrect starting procedure. Automatic choke malfunction. Incorrect choke linkage adjustment. Incorrect fast idle adjustment. High carburetor fuel level. Incorrect accelerator pump stroke adjustment.	Fuel filter or supply lines restricted with dirt, water, or ice. Carburetor leaking and/or flooding. Insufficient fuel supply to carburetor.
STALLING (ENGINE HOT)	Improperly adjusted or defective carburetor dashpot. Engine idle speed too slow. Incorrect idle fuel mixture. Insufficient fuel supply to carburetor. Coolant control thermostat defective.	Carburetor air, hot and cold valve malfunctioning. Dirt, water, or ice in fuel filter. Fuel tank vented cap restricted. Fuel lines restricted or leaking air. Carburetor icing (cold, wet, or humid weather).

CONTINUED ON NEXT PAGE

CARBURETOR DIAGNOSIS GUIDE (Continued)

STALLING (ENGINE HOT) (Continued)	Excessive looseness of throttle shaft in bores of throttle body. Incorrect throttle linkage adjustment to carburetor. Clogged air bleeds or idle passages.	Leaking intake manifold and/or gaskets. Idle compensator malfunctioning. Defective idle speed-up control. (air conditioner equipped cars).
STALLING (ENGINE COLD)	Incorrect fast (cold) idle screw adjustment. Automatic choke malfunction. Defective fuel pump and/or worn push rod.	Dirt, water, or ice in fuel filter. Incorrect idle fuel mixture. Fuel tank vented cap or fuel lines restricted. Defective idle speed–up control (air conditioner equipped cars).
ROUGH ENGINE IDLE	Engine idle speed too slow. Incorrect idle air-fuel mixture. Foreign material obstructing idle fuel and/or air system. Fresh air leakage into engine induction system. Coolant control thermostat defective. Carburetor air, hot and cold valve	malfunctioning. Incorrect or creeping carburetor fuel level. Throttle plates and/or throttle shaft bent or damaged. Throttle plates misaligned. Idle compensator malfunctioning. Positive crankcase ventilation system malfunctioning.
ACCELERATION POOR	Restricted fuel tank vented cap. Restriction in fuel line or air leak. Carburetor fuel level low. Dirt or restriction in accelerator pump system. Inoperative pump inlet check. Accelerator pump link incorrectly installed. Poor seating of accelerator pump	inlet and/or discharge check valves. Dirt, water, or ice in fuel filter. Accelerator pump plunger defective. Defective fuel pump and/or push rod. Automatic choke malfunctioning. Carburetor air, hot and cold valve malfunctioning.
INCONSISTENT ENGINE IDLE SPEED	Fast idle screw contacting low step of cam at curb idle. Incorrect throttle linkage adjustment to carburetor. Binding or sticking throttle linkage or accelerator pedal. Sticking carburetor throttle shaft. Excessive looseness of throttle shaft in bores of throttle body.	Improperly adjusted or defective carburetor dashpot. Incorrectly installed throttle plates. Idle compensator malfunctioning. Positive crankcase ventilation system malfunctioning. Defective idle speed-up control (air conditioner equipped cars).
AUTOMATIC CHOKE SLOW WARM-UP, ON TOO OFTEN	Thermostatic choke setting too rich. Choke linkage sticking or binding. Incorrect choke linkage adjustment.	Choke plate misaligned in air horn; binding. Defective coolant thermostat. Restricted coolant line.
SEVERE TRANSMISSION ENGAGEMENT AFTER COLD ENGINE START	Carburetor fast idle speed setting too high.	Throttle operating on starting step (highest step) of fast idle cam.
SURGING (CRUISING SPEEDS TO TOP SPEEDS)	Clogged main jets. Undersize main jets. Low fuel level or float setting. Low fuel pump pressure or volume.	Clogged filter screen. Distributor vacuum passage clogged.
REDUCED TOP SPEED	Low fuel pump volume. Low fuel level or float setting. Distributor advance malfunctioning.	Improper size or obstructed main jets. Faulty choke operation. Metering rod operating piston malfunctioning.

2 COMMON ADJUSTMENTS AND REPAIRS

CARBURETOR BENCH ADJUSTMENTS

All carburetor adjustments except the idle fuel mixture and the idle speed adjustments can be made with the carburetor removed from the car.

All adjustments except the float adjustments, the bench fast idle speed adjustment and the secondary throttle lever adjustment can be made with the carburetor mounted on the engine.

In the process of rebuilding a carburetor, the bench adjustments should be made in the following sequence:

FLOAT ADJUSTMENTS

There are three adjustments that should be made on each float and lever assembly. The adjustments are made in the following order:

Float Alignment

1. Sight down the side of each float shell to determine if the side of the float is parallel to the outer edge of the air horn casting (Fig. 3).

2. To adjust float alignment, bend the float lever by applying pressure to the end of the float shell with the fingers while supporting the float lever with the thumb to prevent damage to the float. **Apply only enough pressure to bend the float lever.**

3. After aligning the float, remove as much clearance as possible between the arms of the float lever and the lugs on the air horn by bending the float lever. The arms of the float lever should operate freely and be as parallel to the inner surfaces of the lugs on the air horn as possible.

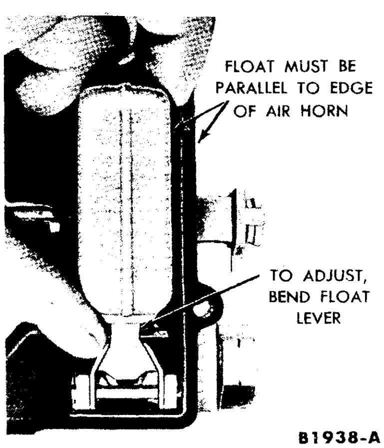

FIG. 3—Float Alignment

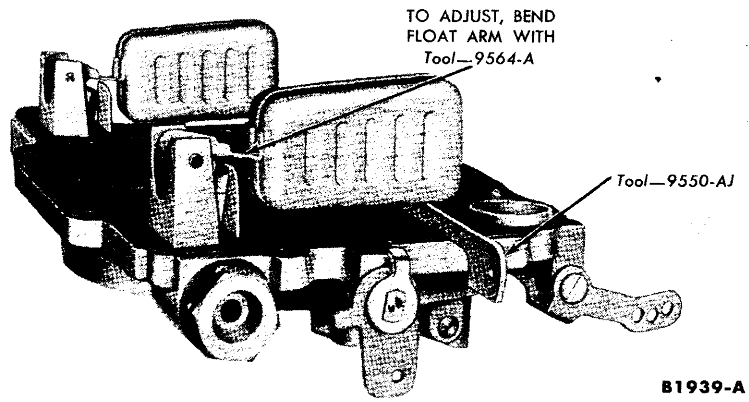

FIG. 4—Float Setting

Float Setting

1. With the air horn inverted, the air horn gasket in place, and the fuel inlet needle seated, check the clearance between the end of each float and the air horn gasket (Fig. 4). The clearance should be within specification.

2. Bend the float arm up to increase the clearance or down to decrease the clearance (Fig. 4). **Apply only enough pressure to bend the float arm.**

Float Drop

1. With the air horn held in an upright position, measure the distance between the top of each float and the air horn gasket at the free-end of each float (Fig. 5). The distance should be within specification.

2. Bend the stop tab on the float bracket, as necessary, to adjust the drop.

ACCELERATOR PUMP ADJUSTMENTS

Operating Rod

1. With the accelerator pump operating rod in the top hole (long pump stroke) of the pump arm and the throttle plates closed, measure the distance from the top surface of the air horn to the top of the plunger shaft (Fig. 6). The distance should be within specification.

2. To adjust the distance, bend the accelerator pump operating rod at the existing lower bend, as necessary (Fig. 6).

Pump Stroke. The accelerator pump stroke adjustment compensates

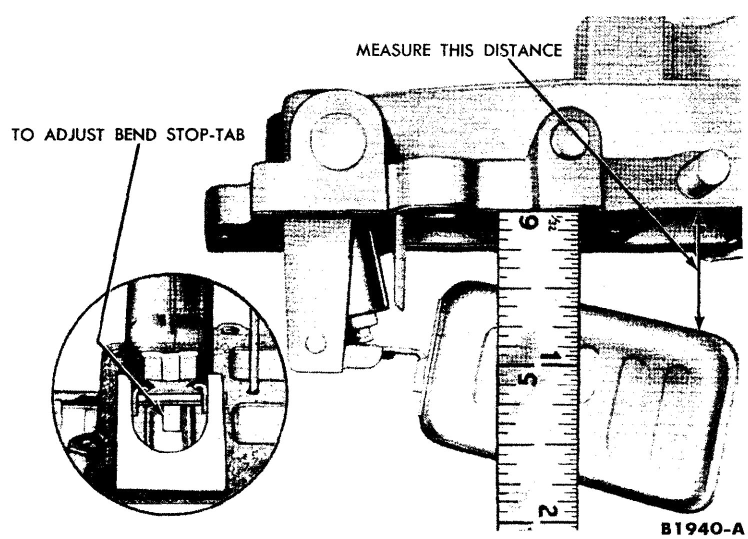

FIG. 5—Float Drop

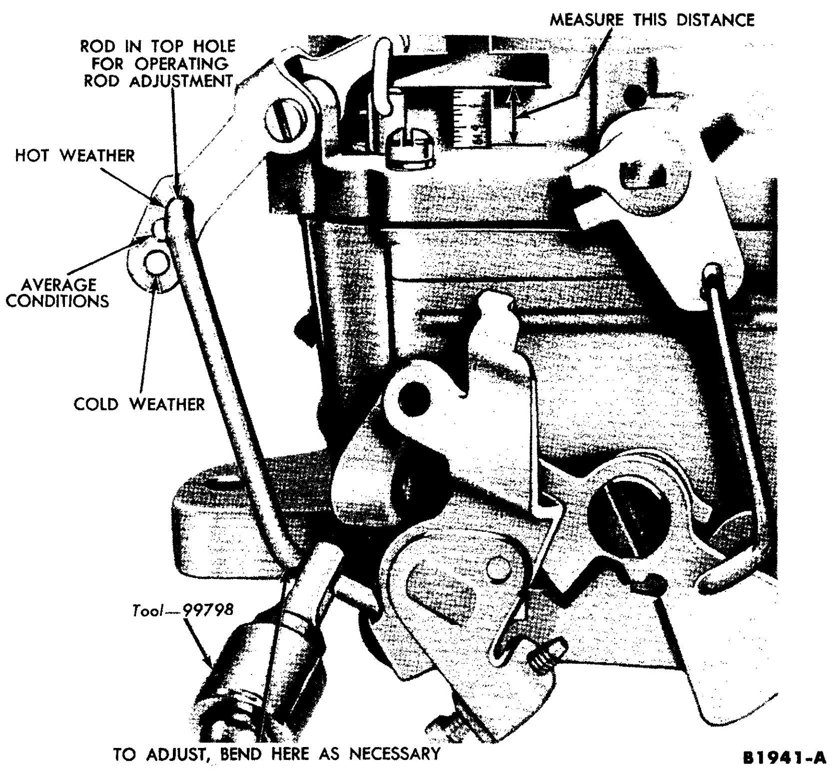

FIG. 6—Accelerating Pump Adjustment

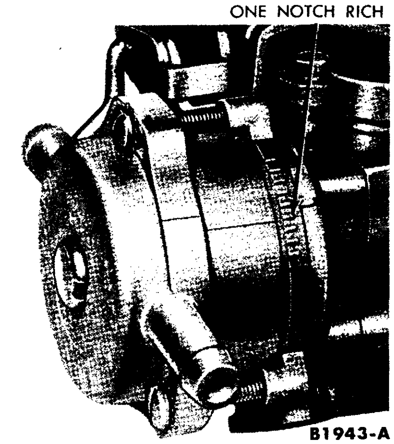

FIG. 8—Automatic Choke Adjustment

for the fuel needs of the engine during extremes of hot or cold temperature. Insert the accelerator pump operating rod into the appropriate hole in the pump arm for the climate in which the car is to be driven (Fig. 6).

CHOKE AND COUNTERSHAFT LINKAGE ADJUSTMENT

1. Bend a 0.026 inch wire gauge (tool 9597) at a 90° angle, approximately ⅛ inch from its end.
2. Block the throttle about half-open so the fast idle cam does not contact the adjusting screw. Loosen the choke countershaft lever clamp screw. Insert the bent end of the wire gauge into the choke housing piston bore so that it is between the top edge of the slot in the choke piston cylinder and the bottom of the slot in the choke piston (Fig. 7). Hold the wire gauge in place by exerting light pressure on the countershaft lever.
3. Insert the specified size drill or gauge (Fig. 7) between the upper edge of the choke plate and the inner wall of the air horn. Hold the choke plate against the drill or gauge and tighten the clamp screw on the countershaft lever. Remove the gauges.
4. Install the heat baffle, gasket, and the thermostatic coil housing assembly. **Be sure the thermostatic coil engages in the slot of the choke piston lever.** Install the retaining screws loosely, then index the thermostatic coil housing mark with the mid-position mark on the choke housing (Fig. 8).

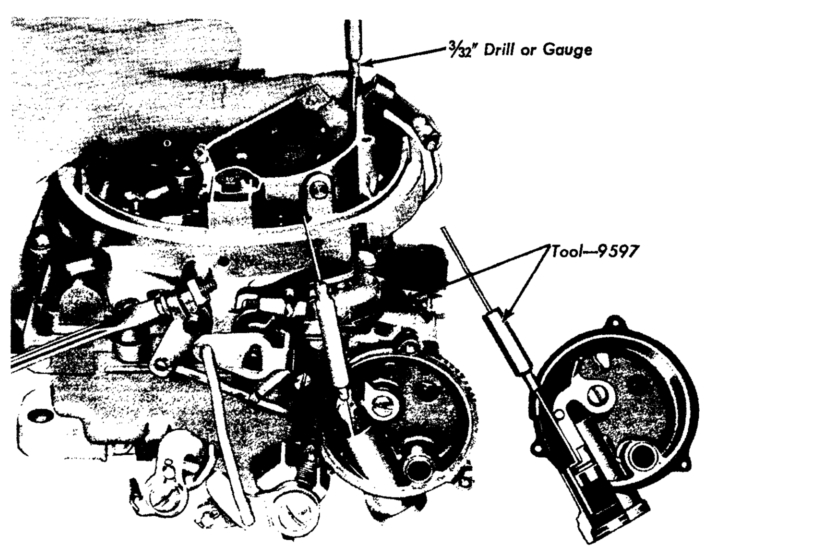

FIG. 7—Choke Piston Lever Adjustment

AUTOMATIC CHOKE ADJUSTMENT

Refer to step 4 of "Choke and Countershaft Linkage Adjustment" for the proper adjustment location (Fig. 8).

FAST IDLE LINKAGE ADJUSTMENT

Fast Idle Cam. Hold the choke plate tightly closed; the center index mark on the fast idle cam should be opposite the center of the fast idle screw (Fig. 9). If adjustment is required, bend the fast idle cam connector rod at the existing bend (Fig. 9).

Fast Idle Speed Adjustment—Bench Only. With the choke plate tightly closed, and the fast idle ad-

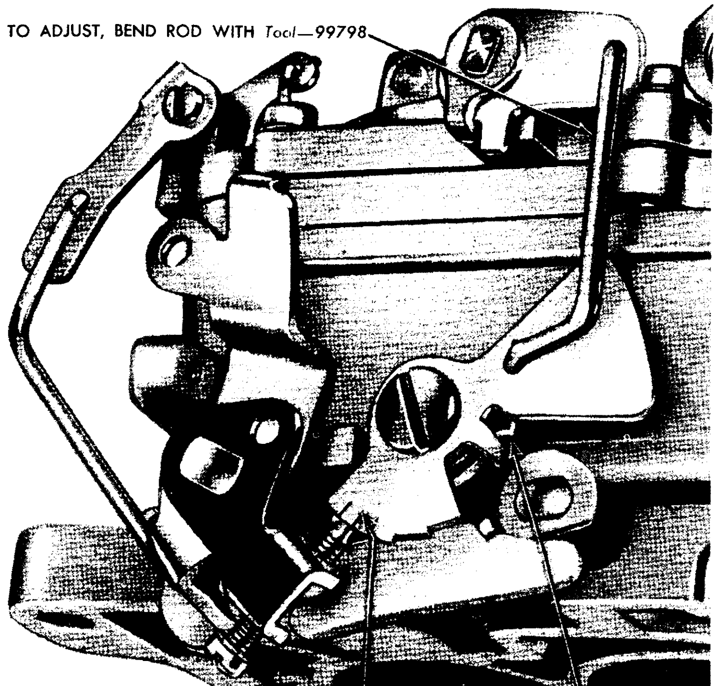

FIG. 9—Fast Idle Cam Adjustment

justing screw resting on the fast idle cam at the center index mark, there should be the specified clearance (tool 9597) between the primary plate and the throttle bore at the side opposite the idle port (Fig. 10). To adjust the clearance, turn the fast idle screw clockwise to increase the clearance and counterclockwise to decrease.

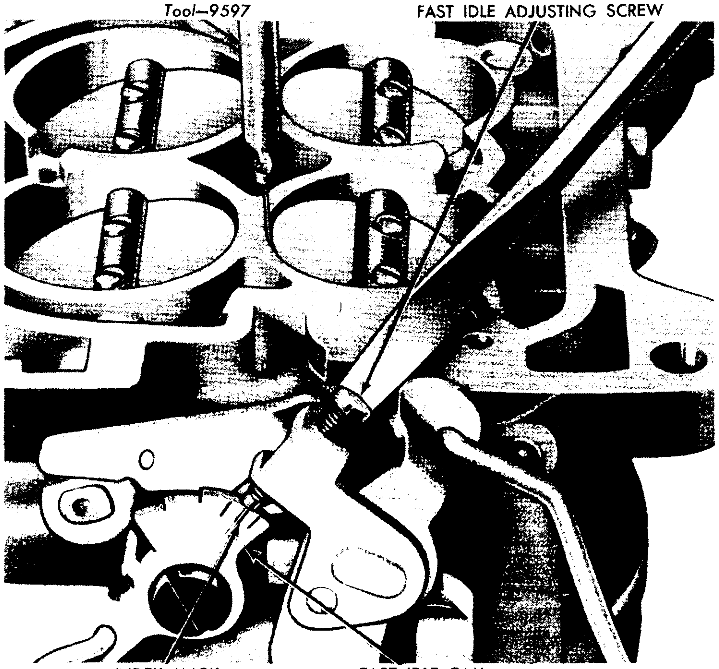

FIG. 10—Fast Idle Speed Bench Adjustment

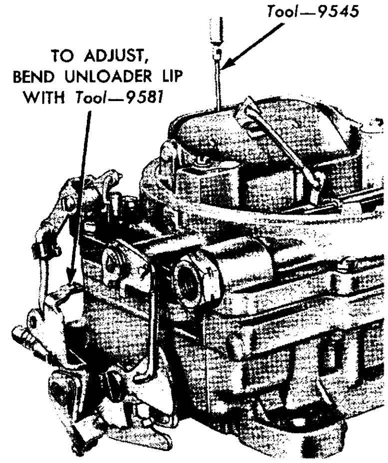

FIG. 11—Unloader Adjustment

UNLOADER ADJUSTMENT

1. With the throttle wide open, there should be the specified clearance (tool 9545) between the upper edge of the choke plate and the wall of the air horn (Fig. 11).
2. To adjust, bend the unloader arm on the throttle lever (Fig. 11).

ANTI-STALL DASHPOT ADJUSTMENT

1. With the primary throttle plates closed to their normal curb idle position, there should be the specified clearance between the dashpot plunger operating lever and the top surface of the air horn (Fig. 12). To adjust the clearance, bend the dashpot lever in the area between the lever arm base and the dashpot plunger (Fig. 12).
2. With the primary throttle plates wide open, there should be the specified clearance between the dashpot plunger operating lever and the top surface of the air horn (Fig. 12). To adjust, bend the stop tang on the opposite side of the lever arm (Fig. 12).

SECONDARY THROTTLE LEVER ADJUSTMENT — BENCH ONLY

1. Block the choke plate open.
2. Open the primary throttle plates until there is the specified distance (Fig. 13) between the lower edge of the throttle plate and the throttle bore (side opposite the idle port).

At this point, the secondary throttle plate should just start to open. To adjust, bend the throttle operating rod at the existing bend (Fig. 13).

3. When both the primary and secondary throttle plates are completely closed, there should be the specified clearance (tool 9597-B) between the positive closing shoes on the primary and secondary throttle levers (Fig. 14). To adjust, bend the shoe on the secondary throttle lever (Fig. 14).

SECONDARY THROTTLE LOCKOUT ADJUSTMENT

1. Open the throttle plates slightly, then manually open and close the choke plate. As the fast idle cam moves the lockout plate, the tang on the secondary throttle lever should freely engage in the notch (Fig. 15).

2. To adjust the secondary throttle lever, bend the lever tang as required (Fig. 15).

3. Hold the lockout plate to the left and tight against the stop on the main body casting (secondary throttle plates partially open). The clearance (Fig. 16) between the tang on the secondary throttle lever and the ramp on the lockout plate should be within specification.

4. To adjust the clearance, bend the arm at the slot on the lockout plate, as required (Fig. 16).

IDLE FUEL MIXTURE AND IDLE SPEED ADJUSTMENTS – ON THE CAR

The idle fuel mixture and idle speed adjustments are performed with the carburetor installed on the engine. Refer to Part 2, Section 2 for the proper procedure.

THROTTLE LINKAGE ADJUSTMENTS – ON THE CAR

The throttle linkage adjustments for the Turb-O-Drive transmission are covered in Group 7.

FUEL FILTER REPLACEMENT

A replaceable fuel filter is located between the fuel pump and the carburetor fuel inlet line (Fig. 17). Replace the element if it becomes clogged, and also at the recommended maintenance mileage interval.

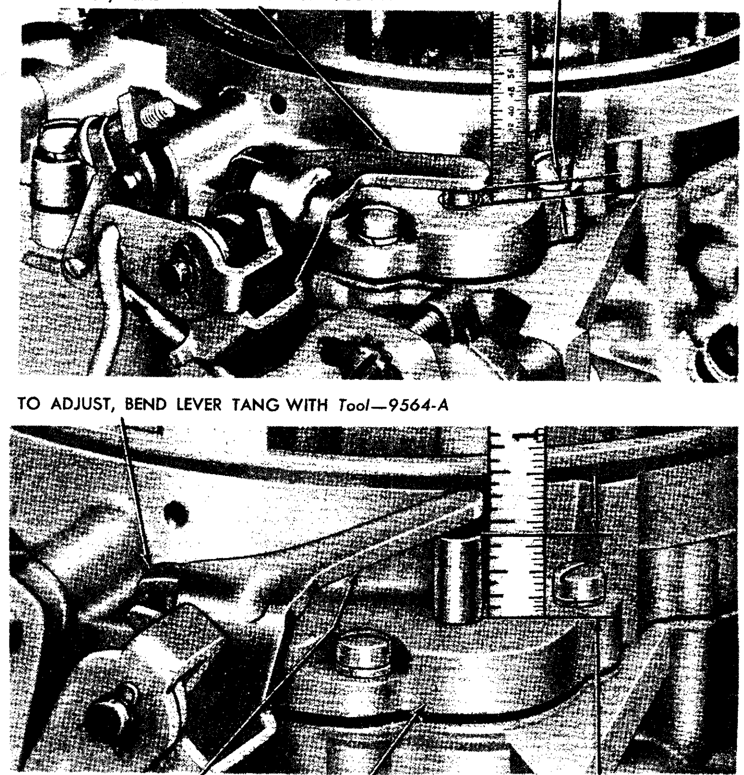

FIG. 12–Anti-Stall Dashpot Adjustment

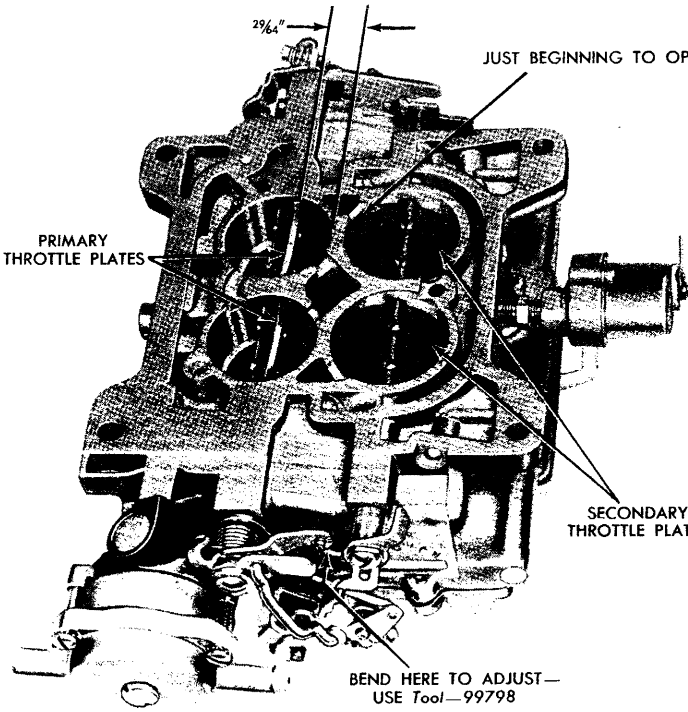

FIG. 13–Secondary Throttle Plate Adjustment

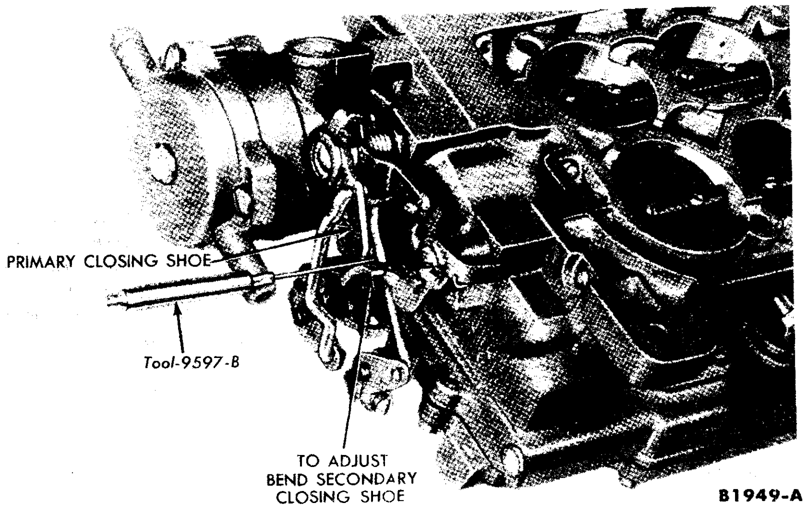

FIG. 14—Primary and Secondary Closing Shoe Clearance

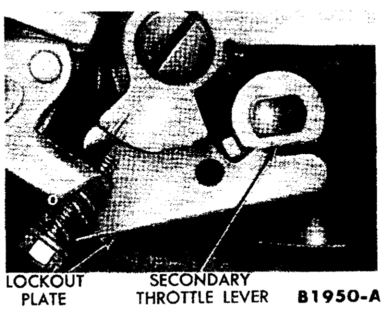

FIG. 15—Secondary Throttle Lever Adjustment

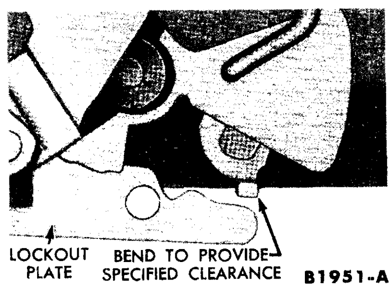

FIG. 16—Secondary Throttle Lever Tang to Lockout Plate Clearance Adjustment

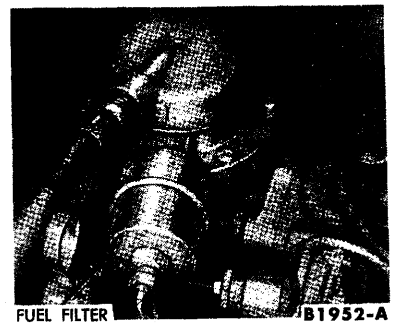

FIG. 17—Fuel Filter

MAINTENANCE

Refer to Group 19 for the recommended maintenance mileage interval.

REPLACEMENT

1. Disconnect the fuel line from the filter. Unscrew the filter from the fuel pump.

2. Screw the new filter into the fuel pump. **Do not over-tighten it.** Connect the fuel line to the fuel filter. **Use a wrench on the filter connection to prevent it from turning when connecting the line.**

3. Operate the engine and check the fuel line and filter connections for leaks.

3 CLEANING AND INSPECTION

CARBURETOR

Dirt, gum, water or carbon contamination in the carburetor or the exterior moving parts of a carburetor are often responsible for unsatisfactory performance. For this reason, efficient carburetion depends upon careful cleaning and inspection.

The cleaning and inspection of only those parts not included in the carburetor overhaul repair kit are covered here. All gaskets and parts included in the repair kit should be installed when the carburetor is assembled and the old gaskets and parts should be discarded.

Wash all the carburetor parts (except the fast idle solenoid and poppet valve, accelerating pump plunger, and the anti-stall dashpot plunger) in clean commercial carburetor cleaning solvent. If a commercial solvent is not available, lacquer thinner or denatured alcohol may be used.

Rinse the parts in kerosene to remove all traces of the cleaning solvent, then dry them with compressed air. Wipe all parts that cannot be immersed in solvent with a clean, soft, dry cloth. **Do not use compressed air to dry these parts.** Be sure all dirt, gum, carbon, and other foreign matter are removed from all parts.

Force compressed air through all passages of the carburetor. **Do not use a wire brush to clean any parts or a drill or wire to clean out any openings or passages in the carburetor.** A drill or wire may enlarge the hole or passage, changing the calibration of the carburetor.

Check the choke shaft for grooves, wear, and excessive looseness or binding. Inspect the choke plate for nicked edges and the choke plate valve for ease of operation, and free them if necessary.

Check the throttle shaft(s) in its bore for excessive looseness or binding and check the throttle plate(s) for burrs which prevent proper closure. If the throttle shafts are excessively loose or bind in the main body, or the plates prevent proper closure, replace or repair the component parts.

Inspect the main body, air horn, nozzle bars and booster venturi assemblies, choke housing and thermostatic spring housing, and the throttle body for cracks.

Check the metal floats for leaks by holding them under water that has been heated to just below the boiling point. Bubbles will appear if there is a leak. If a float leaks, replace it. Replace the float if the arm needle contact surface is grooved. If the floats are serviceable, polish the needle contact surface of the arm. Replace the float shafts if they are worn.

Replace all screws and nuts that

have stripped threads. Replace all distorted or broken springs.

Inspect all gasket mating surfaces for nicks and burrs. Repair or replace any parts that have a damaged gasket surface.

Inspect the idle tubes in each nozzle bar assembly. If they are plugged, bent, or broken, replace the booster venturi and nozzle bar assembly.

Check the remaining internal components of the carburetor and replace any that are bent, worn, cracked or restricted.

FUEL PUMP

Clean the pump body and the cover in solvent. Blow out all cover passages. Inspect the body and cover for cracks or damage and replace them if necessary. Inspect the staked areas around the valve and seal counterbores for high spots which may cause distortion of the new parts upon installation. Remove all high spots. Inspect the mounting flange for distortion. Replace the pump body or lap the distorted flange, if necessary.

VAPOR DISCHARGE VALVE

Thoroughly flush the valve assembly in clean commercial carburetor cleaning solvent. If a commercial solvent is not available, lacquer thinner or denatured alcohol may be used.

Rinse the valve assembly in kerosene to remove all traces of the cleaning solvent, then dry it with compressed air. Be sure all dirt, carbon, and other foreign matter are removed from the part.

Manually move the vapor valve stem back and forth to verify that there is no sticking of the valve stem in its guide. If a sticking or binding condition exists, and it cannot be eliminated by flushing the assembly in solvent, the valve assembly must be replaced. **The valve unit should not be disassembled in an attempt to clean it as the adjustment of the thermostatic setting is critical, and the unit is permanently sealed at the time of manufacture.**

AIR CLEANER MAINTENANCE

Refer to Group 19 for the recommended air cleaner assembly maintenance mileage interval.

REMOVAL AND INSTALLATION

Refer to Part 10-3 for the air cleaner assembly removal and installation procedures.

FILTER ELEMENT

The filter element must never be cleaned with a solvent or cleaning solution. Also, oil must not be added to the surfaces of the filter element or air cleaner body.

There are two alternate procedures that can be used to clean the air filter element. One method is performed with the use of compressed air. The other is performed by tapping the element on a smooth horizontal surface.

Compressed Air Method. Direct a stream of compressed air through the element in the direction opposite that of the intake air flow, that is from the inside outward. **Extreme care must be exercised to prevent rupture of the element material.**

Tapping Method. Hold the element in a vertical position and tap it lightly against a smooth, horizontal surface to shake the dust and dirt out. **Do not deform the element or damage the gasket surfaces by tapping too hard.** Rotate the filter after each tap until the entire outer surface has been cleaned.

Inspection. Hold the filter in front of a back-up light and carefully inspect it for any splits or cracks. If the filter is split or cracked, replace it.

BODY AND COVER

Clean the air cleaner body and cover with a solvent or compressed air. Wipe the air cleaner dry if a solvent is used. Inspect the air cleaner body and cover for distortion or damage at the gasket mating surfaces. Replace the cover or body if they are damaged beyond repair.

PART 10-2 CARTER CARBURETOR

1 DESCRIPTION AND OPERATION

DESCRIPTION

The Carter carburetor is a 4-barrel, downdraft carburetor. A green-colored code tag, fastened to one of the air horn attaching screws indicates the carburetor part number, change letter and build date. An additional red-colored tag identifies a unit that is calibrated for high altitude operation.

The carburetor has two main assemblies. They are the air horn and main body (Figs. 1, 2 and 3).

The air horn assembly, which serves as the main body cover, contains the choke plate, the fuel inlet, the float assemblies and the Vacumeter (metering rods).

The main body contains the primary and secondary throttle plates, the secondary auxiliary throttle plates, the booster venturis, the hot idle compensator, the anti-stall dashpot plunger assembly, accelerator pump assembly, the fuel bowls, balance passage, and the fuel passages. The automatic choke housing is mounted on the main body. Air conditioner equipped cars contain an idle speed-up control which is mounted on the main body.

The carburetor has a low speed (idle fuel system), an accelerating pump system, a primary high speed system (primary fuel system), and a secondary high speed system (secondary main fuel system). In addition, an automatic choke system provides the correct mixture necessary for cold engine starting and warm up. Vacuum operated metering rods (Vacumeters) in the main metering jets control the amount of fuel admitted to the nozzle. An internal anti-stall hydraulic dashpot prevents stalling on quick deceleration by slowing the closing of the throttle plates. A fuel inlet system provides the various fuel metering systems with a constant supply of fuel.

OPERATION

FUEL INLET SYSTEM

There are two separate fuel inlet systems. Each system supplies fuel to a low speed system, and a primary and secondary high speed system.

Each system has a fuel bowl, an inlet needle and seat assembly, float assembly and a fuel baffle plate (Fig. 4). The fuel enters through the fuel

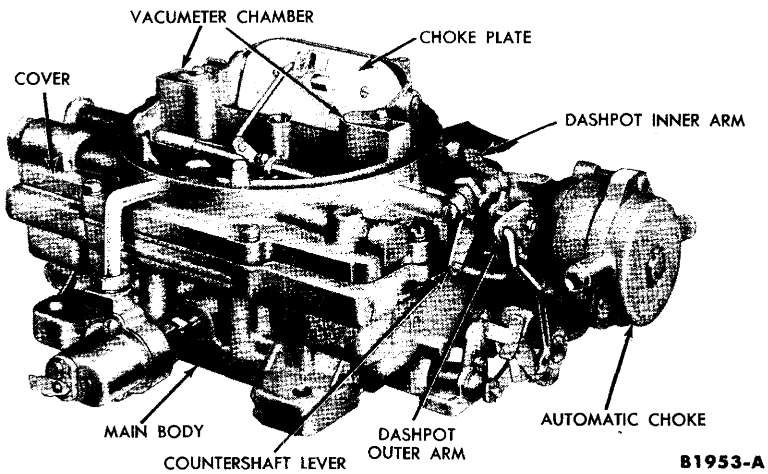

FIG. 1–Carter 4-Barrel Carburetor–Right Rear ¾ View

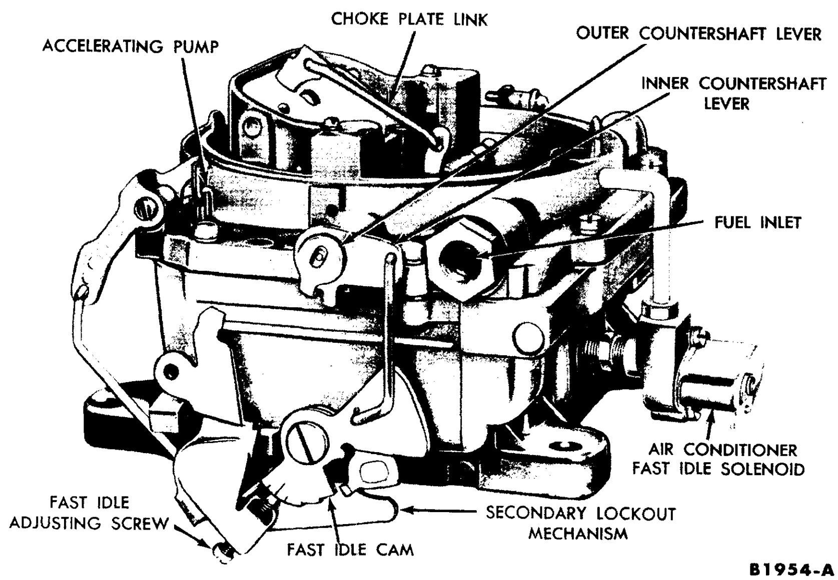

FIG. 2–Carter 4-Barrel Carburetor–Left Rear ¾ View

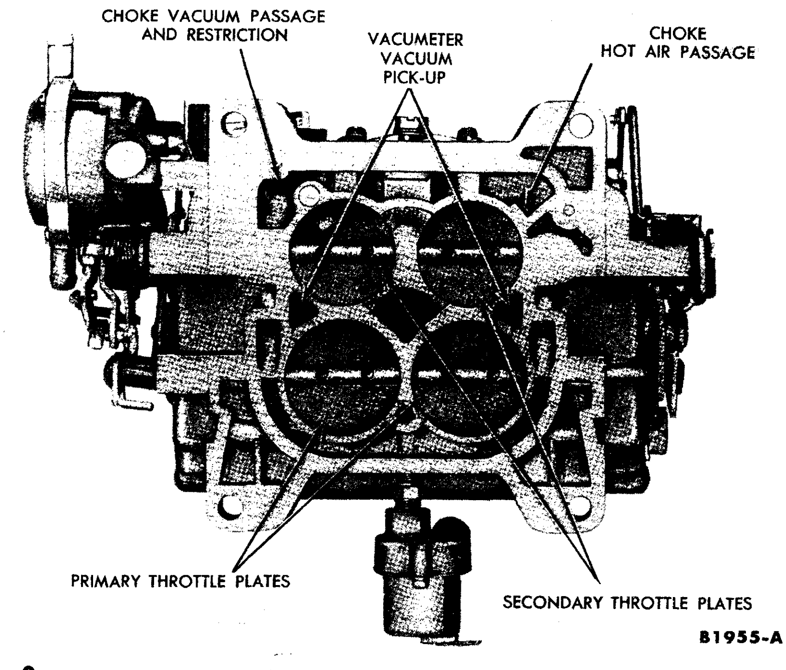

FIG. 3—Carter 4-Barrel Carburetor—Bottom View

inlet fitting. A drilled passage through the air horn assembly connects both fuel bowls.

The amount of fuel entering either fuel bowl is regulated by the distance the fuel inlet needle is lowered off its seat and by fuel pump pressure. Movement of the fuel inlet needle in relation to its seat is controlled by the float and lever assembly which rises and falls with the fuel level. When the fuel in the fuel bowl reaches a pre-set level, the float raises the fuel inlet needle to a position where is restricts the flow of fuel, admitting only enough fuel to replace that being used.

The fuel inlet needle seats are installed at an angle to provide seating of the needles (Fig. 5).

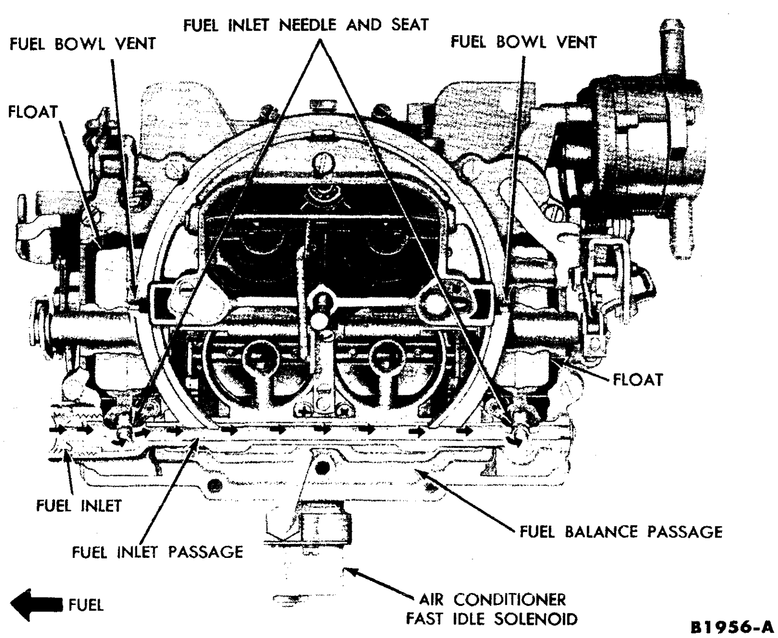

FIG. 4—Fuel Inlet System

A combination internal and external venting system vents the fuel bowls internally into the air cleaner and externally to the outside of the carburetor. An internal vent is located at the outside edge of each Vacumeter tower. An external vent is drilled into each internal vent passage just below the air cleaner mounting flange.

A balance passage in the main body connects the fuel bowls. This passage balances the fuel level between the two fuel bowls.

THERMOSTATIC CHOKE

The choke control mechanism (Figs. 6 and 7) is controlled by engine heated coolant. The heated coolant is obtained from the heater hose inlet fitting, located on the intake manifold. The coolant flows through an inlet hose to the gasket mounted water jacket that surrounds the choke thermostatic-spring coil housing. The coolant is then routed through a return hose to the heater return line connection.

Engine coolant does not contact the choke control mechanism. Only heat, radiated from within the coolant jacket, affects the spring coil. When the engine is cold, tension of the spring holds the choke plate closed. Conversely, when the engine and coolant water warms, radiated heat is absorbed by the bimetal spring; the thermostatic spring loses its tension gradually until the choke plate reaches full-open position.

The use of engine coolant to control the automatic choke results in an air-fuel mixture that accurately matches the engine requirements. Water in the jacket loses its heat slowly and delays activation of the choke during short stop operations.

A choke countershaft, located over the secondary barrels, connects the choke linkage to the choke plate (Fig. 6). When the engine is cold, tension of the thermostatic coil holds the choke plate closed. When the engine is started, air velocity against the offset choke plate causes it to open slightly against the thermostatic coil tension. Intake manifold vacuum, applied to the choke piston, also pulls the piston downward, opening the choke plate to a predetermined position. The choke plate assumes a position where tension of the thermostatic spring is balanced by the pull of vacuum on the piston and the force of air velocity on the choke plate. Enough air is drawn around the choke plate to enable the engine to operate and prevent flooding.

As the engine starts to operate, the choke operating piston is pulled downward by manifold vacuum. The piston initial pulldown travel is limited by a vacuum bypass slot in the piston cylinder wall (Fig. 7). When the top of the piston reaches the top of the vacuum slot, the vacuum pull becomes ineffective due to air that bleeds in through the slot in the piston. The choke plate will then be pulled open a definite distance, but no farther. The air from the choke piston cylinder is exhausted through a passage in the base of the carburetor flange, into the left primary barrel and across the edge of each primary throttle plate.

As the engine warms up, the tension of the bimetal, thermostatic-coil gradually decreases as the temperature of the coolant in the water jacket rises. This action gradually allows the choke plate to open.

When the engine reaches its normal operating temperature, the thermostatic-coil spring exerts tension on the choke plate, forcing it to the full-open position.

If the engine is accelerated during the engine warm-up period, the corresponding drop in manifold vacuum applied to the choke piston allows the thermostatic coil to momentarily, partially close the choke plate. This action provides a richer air-fuel mixture.

UNLOADER

If during the starting period the engine becomes flooded, the choke plate may be opened manually to clean out excessive fuel in the intake manifold. This is accomplished by fully depressing the accelerator pedal and engaging the starter. The unloader projection on the throttle lever contacts the unloader lug on the fast idle cam and in turn partially opens the choke plate.

During the warm-up period, it is necessary to provide a fast idle speed to prevent engine stalling. This is accomplished by a fast idle cam connected to the choke countershaft. The fast idle adjusting screw on the throttle lever contacts the fast idle cam and prevents the throttle plates from returning to a normal warm engine idle position while the automatic choke is in operation.

LOW SPEED (IDLE) FUEL SYSTEM

A low speed system (Fig. 8) is provided to supply fuel for idle-speed and early part-throttle operation. Air bleeds, restrictions, and adjustments are provided to control and meter the fuel-air mixture. The air flow required for minimum idle speed operation is controlled by an idle air adjusting screw.

At idle and part throttle operation, the throttle plates are almost closed. This produces strong manifold vacuum below the throttle plates which creates a great enough difference in pressure between the fuel bowls and

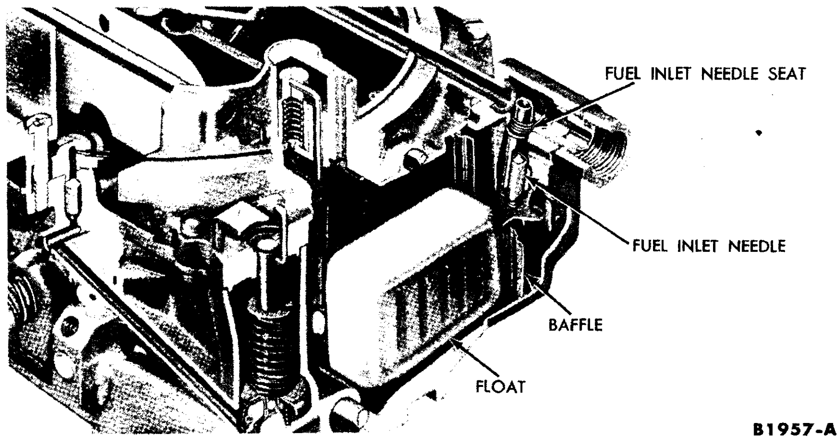

FIG. 5–Float Assembly

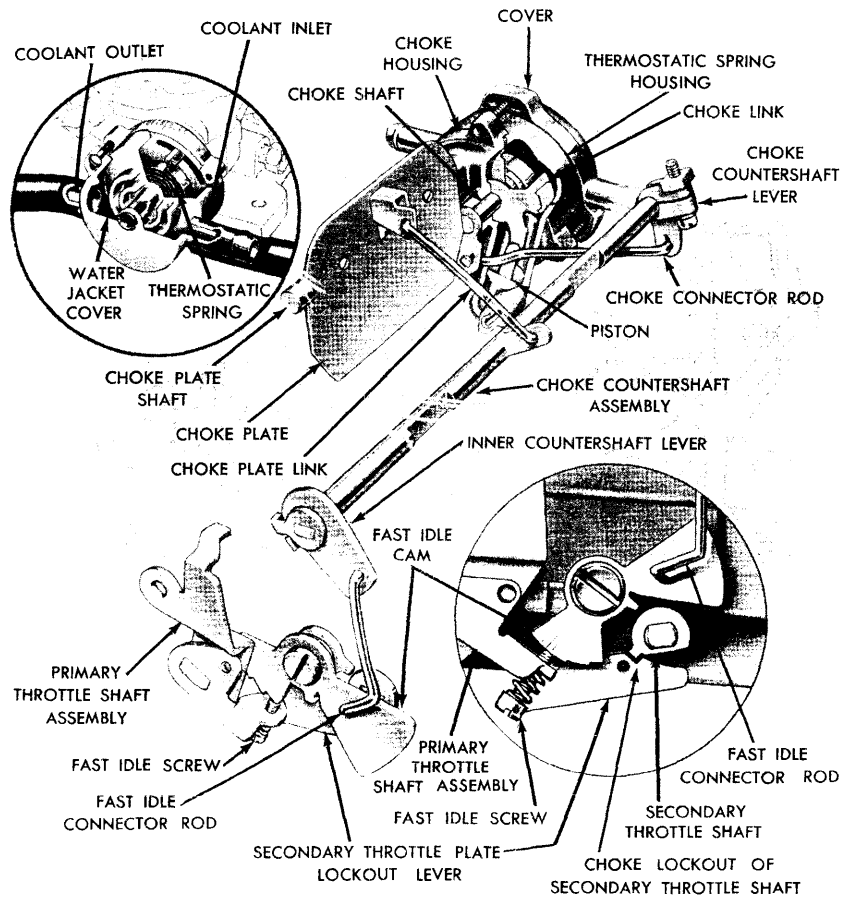

FIG. 6–Thermostatic Choke Unit and Linkage

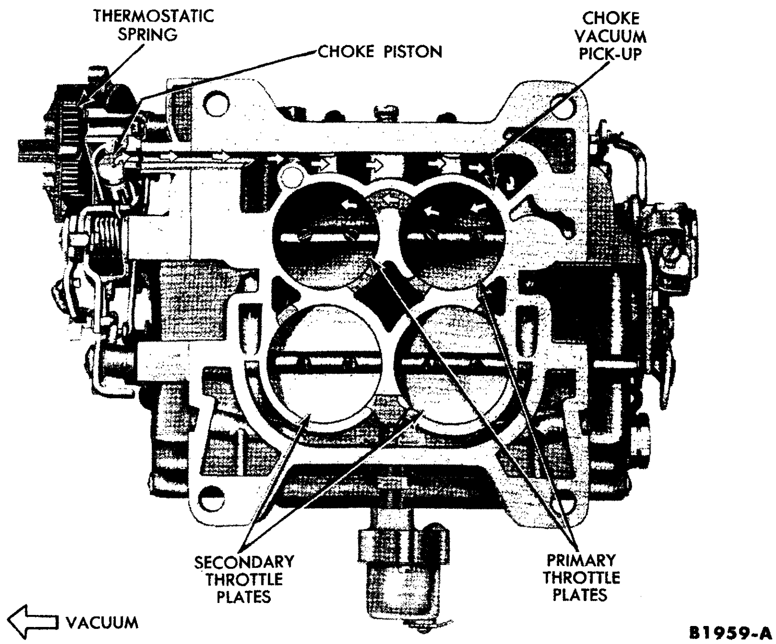

FIG. 7—Choke System

the idle discharge ports to operate the low speed or idle fuel system (Fig. 8). The low speed system is located in the primary barrel (Fig. 9).

Fuel is forced from the fuel bowl through the main jet to the bottom of the main well. From here it flows through a short diagonal passage to the low speed jet which meters the fuel for idle and part throttle operation. The fuel flows up the low speed jet where it is mixed with metered air from the bypass air bleed. The bypass air bleed acts as an anti-siphoning device during off-idle operation and when the engine is stopped.

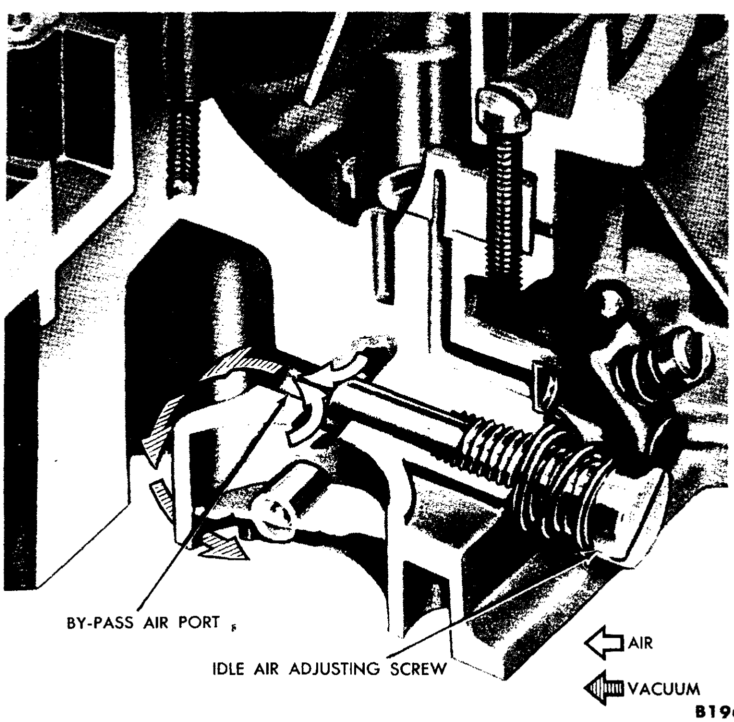

FIG. 8—Low Speed System

From the low speed jet, the air and fuel flows through an economizer passage (restriction). After leaving the restriction, air is bled into the mixture from an additional air bleed. The mixture then flows down a vertical passage to the idle passage in the main body, then to the upper and lower discharge ports. The upper discharge is a vertical slot-type port which is located so that the upper portion is above the throttle plate at idle. The throttle plates are milled at the location of the upper discharge ports so that a small portion of the port is exposed to manifold vacuum at curb idle. At curb idle, the upper portion of the port acts as an additional air bleed. The lower discharge port is exposed to manifold vacuum at all times.

The idle speed is adjusted by turning the idle air adjusting screw (air control valve) to admit more or less air, as required, below the throttle plates (Fig. 8). In other words, it bypasses the primary throttle plates. **It is particularly important that the idle speed and mixture adjustments are adjusted at the same time. Opening the air valve to increase the idle speed leans the mixture, thus requiring that the mixture screws also be turned outward to provide additional fuel.**

As the throttle is opened, a larger portion of the upper discharge port is exposed to manifold vacuum and a correspondingly larger quantity of fuel is discharged into the air stream. Further opening of the throttle plate results in a decrease in manifold vacuum and a decrease in the amount of idle fuel discharged. As the idle fuel tapers off, the main metering circuit begins discharging fuel.

A thermostatically controlled hot idle compensator is located in the web between the secondary booster venturis (Fig. 10). At carburetor air high inlet temperatures, the hot idle compensator will open and allow additional air to bypass the throttle plates and be exhausted directly into the intake manifold. This improves idle stability and minimizes the effect of fuel vaporation due to high under-hood temperatures. **It is necessary that the valve be shut when adjusting the curb idle speed.**

IDLE SPEED-UP CONTROL – WITH AIR CONDITIONING

On vehicles equipped with an air conditioner, a mechanism is used to increase the engine idle speed sufficiently to overcome the additional torque load incurred when the air conditioner unit is on. This device is an electrical solenoid switch which operates an air valve in an external bypass system of the carburetor, to increase air flow below the throttle plates (Fig. 10).

The idle speed-up valve operates only when the air conditioner unit clutch is engaged. The solenoid is not affected by throttle position or manifold vacuum; it is controlled solely by the clutch. **It is not necessary to operate the air conditioning system when adjusting the curb idle speed.**

ACCELERATING PUMP SYSTEM

The accelerating pump system, located in the primary side, provides a measured amount of fuel necessary for smooth engine operation on acceleration at low speeds (Fig. 11).

When the throttle is closed, the pump plunger moves upward in its cylinder and fuel is drawn into the pump cylinder through the intake check valve. The discharge check needle valve is seated at this time to prevent air from being drawn into the cylinder. When the throttle is opened, the pump plunger moves downward, forcing the fuel out through the discharge passage. The fuel is forced through a diagonal passage to the discharge needle. The force of the fuel unseats the needle and fuel is free to flow through a restriction into the discharge nozzles. When the plunger moves downward, the intake check valve is closed, preventing fuel from being forced back into the bowl.

At high speed, accelerating pump discharge is not necessary for smooth acceleration. When the throttle plates are opened a predetermined amount, the accelerating plunger bottoms in the cylinder, eliminating discharge.

During high speed operation, a vacuum exists at the discharge nozzles. To prevent fuel from being drawn through the system, the discharge nozzles are vented by a cavity between the pump restrictions and discharge nozzles. This allows air instead of fuel to be drawn through the discharge nozzles.

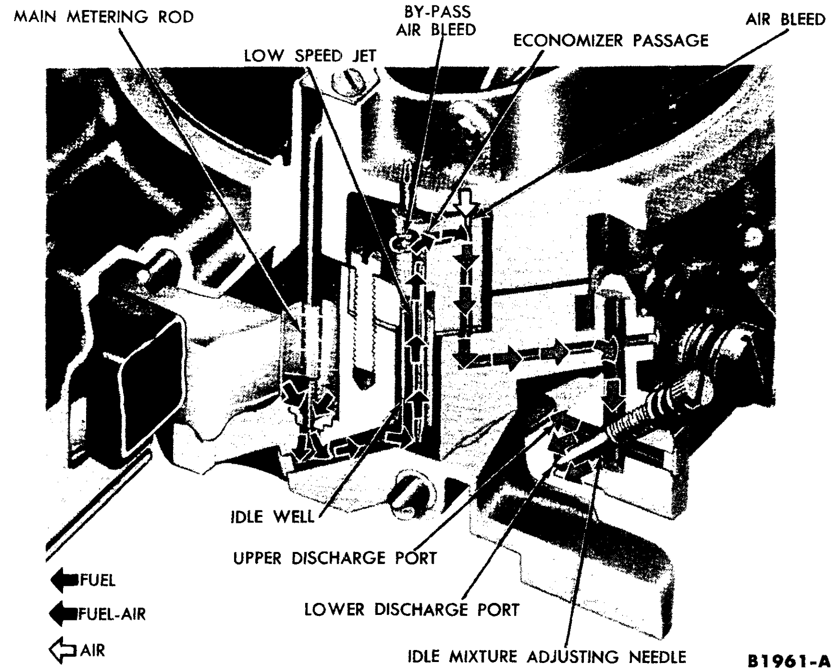

FIG. 9—Low Speed Idle Mixture System

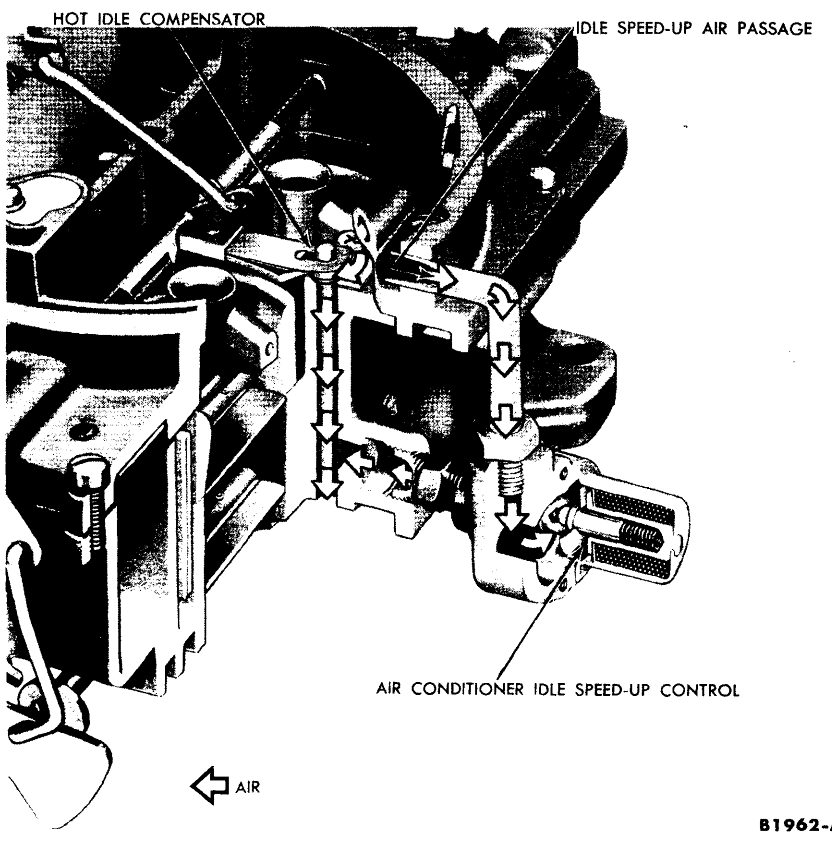

FIG. 10—Idle Speed-Up System

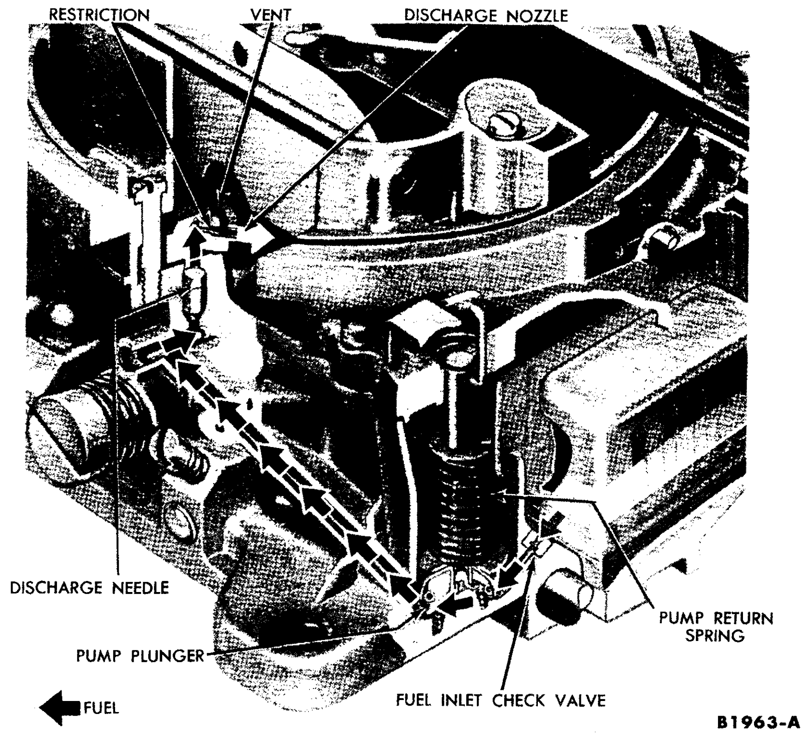

FIG. 11—Accelerating Pump System

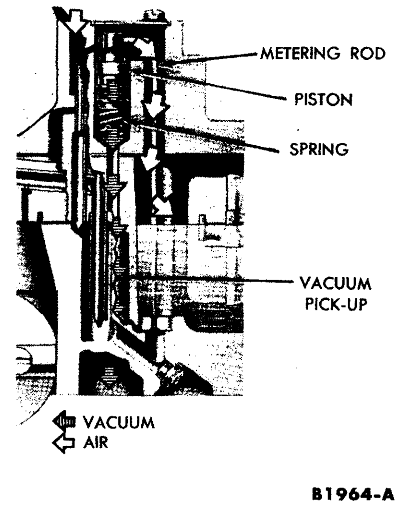

FIG. 12—Vacumeter—Metering Rods

HIGH SPEED SYSTEM

Primary Side. The position of the metering rod (Vacumeter) in the main metering jet controls the amount of fuel admitted to the nozzles. The position of the metering rod is controlled by manifold vacuum applied to the Vacumeter piston (Fig. 12).

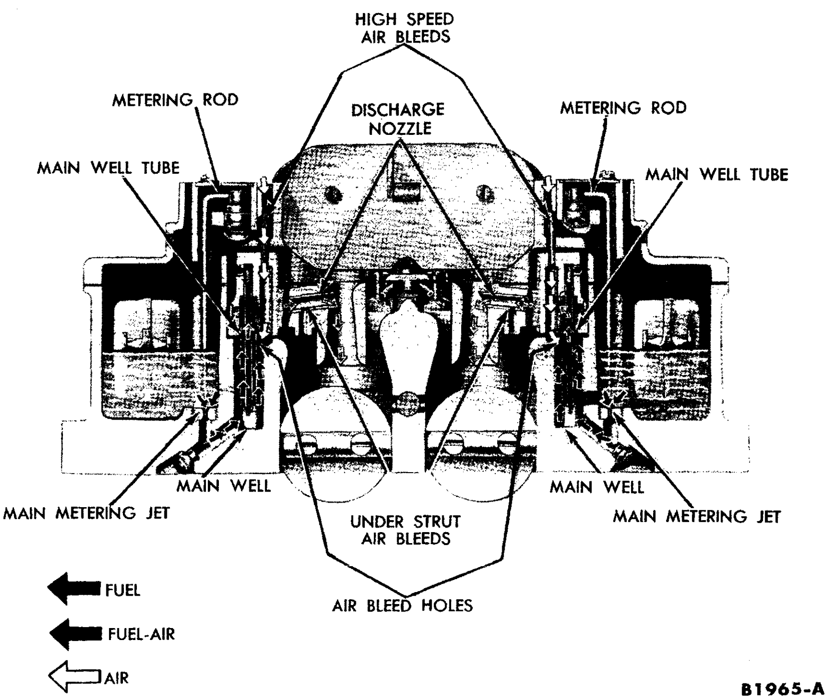

FIG. 13—Primary High Speed System

During part throttle operation, manifold vacuum pulls the piston and rod assembly down, holding the large diameter of the metering rod in the main metering jet. This is true at all times when the vacuum under the piston is strong enough to overcome the tension of the Vacumeter piston spring. Fuel is then metered around the large diameter of the metering rod in the jet.

Under any operating condition where the tension of the spring overcomes the pull of vacuum under the piston, the metering rod will move up so that its smaller diameter or power step is in the jet. This allows more fuel to flow through the jet.

As engine speed increases, the air passing through the booster venturi creates a vacuum. The amount of vacuum is determined by the airflow through the venturi, which in turn is regulated by the speed of the engine. The difference in pressure between the venturi and fuel bowl causes fuel to flow through the primary high speed circuit (Fig. 13).

At a predetermined venturi vacuum, fuel flows from the fuel bowl, through the primary high speed jet into the bottom of the main well. The fuel moves up the main well tube, past air bleed holes. Filtered air from the high speed air bleed enters the fuel flow in the main well tube through holes in the side of the tube.

The fuel and air mixture continues up the main well tube and is discharged into the booster venturi where it is atomized and mixed with the air flowing through the carburetor. The high speed air bleed also acts as an anti-percolating vent when a hot engine is stopped or at idling speed. This helps to vent fuel vapors in the main well before the pressure is sufficient to push fuel out of the nozzles, into the intake manifold.

The throttle plates control the amount of fuel-air mixture admitted to the intake manifold, regulating the speed and power of the engine.

An air bleed is also located under the strut of each primary booster venturi assembly. The air bleed connects to the main discharge nozzle passage and smooths out the flow of fuel. The air that is bled into the passage is proportional to the vacuum at the nozzle.

Secondary Side. To provide sufficient fuel-air mixture to operate the engine at maximum power, the mixture supplied by the primary stage of the carburetor is supplemented by an additional quantity of fuel-air mixture from the secondary high-speed system (Fig. 14).

The secondary throttle plates are mechanically connected to the primary throttle shaft. Secondary auxiliary throttle plates are located above the secondary throttle plates, just below the secondary booster venturis. A counterweight is located on each end of the auxiliary throttle plate shaft. The auxiliary throttle plates start to open when the air pressure on top of the plates is great enough to overcome the effect of the counterweights.

When the primary throttle plates are ¾ full throttle and the choke plate is open, the secondary throttle plates start to open. The secondary side of the carburetor does not start to discharge fuel until the auxiliary throttle plates start to open. The amount of opening achieved by the off-set auxiliary throttle plates is controlled by the air velocity through the secondary barrels.

A secondary throttle lockout lever is located on the right side of the carburetor. The lever prevents the secondary throttle plates from opening until the choke plate is open. This improves cold engine driveaway at wide open throttle.

Two transition holes are located in each secondary booster venturi, just above the auxiliary throttle plates. As the auxiliary throttle plates begin to open and are moved slightly beyond each transition hole, fuel is drawn from the transition hole by venturi vacuum. The fuel flows from the fuel bowl, through the secondary high-speed jet into the transition fuel tube. The fuel flows up the tube where air is introduced through the transition discharge air bleed. The fuel and air are then discharged through the transition holes.

As the auxiliary plates are opened still further, fuel is discharged through the main secondary discharge nozzles. The fuel flows up the secondary main well tube. Air is introduced from the secondary high-speed air bleed through holes in the side of the tube. The fuel and air are discharged into the main secondary discharge nozzles. The high-speed air bleed also acts as an anti-percolator vent when a hot engine is stopped or at idling speed. This will help vent fuel vapor pressure in the high-speed system before it is suffi-

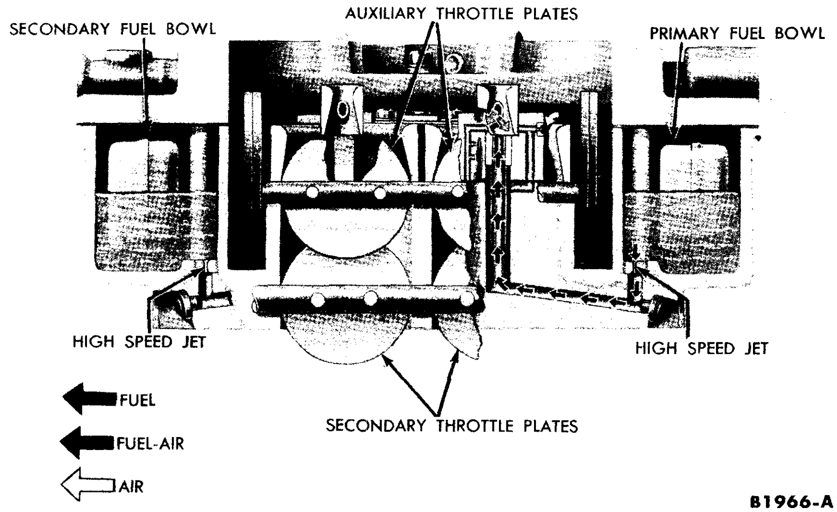

FIG. 14—Secondary High Speed System

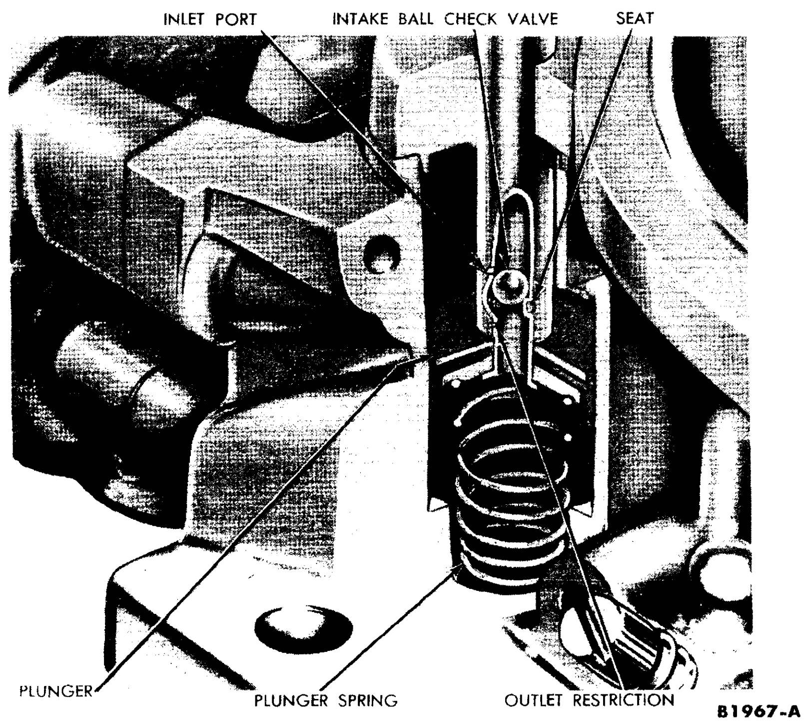

FIG. 15—Anti-Stall Dashpot

cient to push fuel out of the nozzles.

Fuel flow from the transition holes tapers off as the fuel is discharged through the secondary nozzles.

When the primary throttle plates begin to close on deceleration, the secondary plates close mechanically. The auxiliary secondary throttle plates are closed by counterweights, located on the ends of the shaft.

ANTI-STALL DASHPOT

An internal hydraulic anti-stall dashpot is incorporated in the carburetor (Fig. 15) to slow the closing of the throttle plates to idle position.

When the throttle is opened, the anti-stall dashpot plunger spring pushes the plunger upward. The intake ball check valve opens, allowing fuel above the plunger to fill the cylinder below the plunger. When the throttle is closed, the plunger is pushed downward. The intake ball check valve is closed and fuel below the plunger is forced through a small restriction, delaying the downward movement of the plunger and closing of the throttle plates.

2 IN-CAR ADJUSTMENTS AND REPAIRS

All carburetor adjustments except the float adjustments, the bench fast idle speed adjustment and the secondary throttle lever adjustment can be made with the carburetor mounted on the engine. Refer to Part 10-1, Section 1, for "Carter Carburetor Bench Adjustments."

IDLE FUEL MIXTURE AND IDLE SPEED ADJUSTMENTS

The idle fuel mixture is controlled by the idle mixture adjusting screws (Fig. 16). Turn the screws inward to lean the mixture, and outward to enrich the mixture supplied to the intake manifold.

The idle speed (air) adjustment screw (Fig. 16) is used to adjust idle speed. Turn the screw outward to increase speed. Conversely, turn the screw inward to decrease speed. Turning the screw outward leans the mixture, thus requiring an adjustment at the idle mixture screws.

If one of the idle adjustments is changed, the other idle adjustments may also be affected. It is necessary that the adjustments be made in the order listed, and all of the idle adjustments that follow the one being made must be checked:

1. Idle Mixture Adjustment.
2. Hot Idle rpm Adjustment.
3. Fast Idle rpm Adjustment.

When setting the engine idle speed on vehicles equipped with an air conditioner, the air conditioner should be turned off and the air cleaner removed. **If the air conditioner is turned on (with the air cleaner removed), a slight roughness of the engine idle may be noted. This may be disregarded, since the air cleaner traps vapor and allows them to enrich the mixture to again regain a smooth idle.**

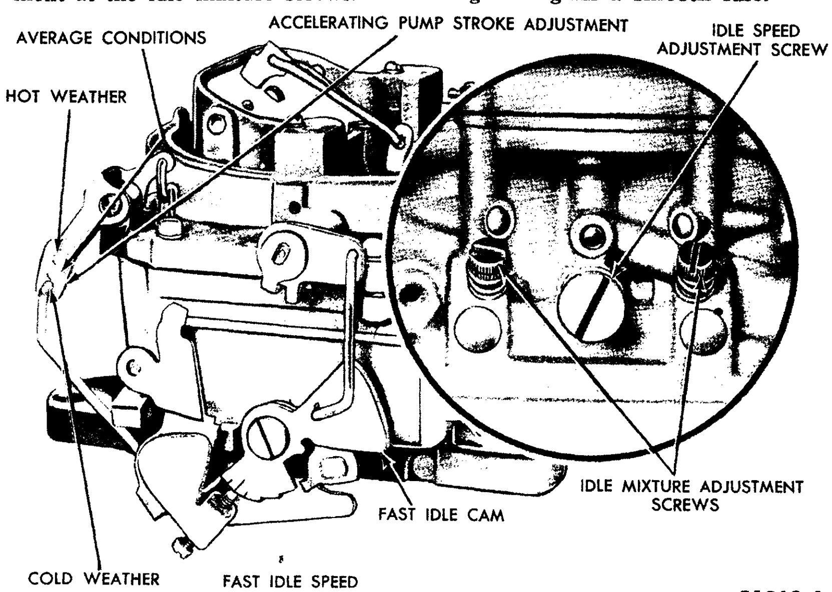

FIG. 16—Idle Fuel Mixture, Idle Speed and Accelerator Pump Stroke Adjustment

INITIAL IDLE SPEED AND MIXTURE SETTINGS

1. Make an initial idle fuel mixture adjustment, if necessary, by turning both screws inward until they lightly touch their seat; then, back them outward 1½ to 2½ turns.

2. Make an initial idle air mixture adjustment, if necessary, by turning the idle air mixture screw inward until it lightly touches its seat, then turn it open 3½ turns.

HOT IDLE RPM ADJUSTMENT

1. Run the engine until it reaches normal operating temperature. If the engine is cold, it should be run for approximately one-half hour at 1200 rpm to stabilize the temperature.

2. Allow the throttle to drop back to the normal idle speed position. Attach a tachometer to the engine. Remove the vacuum line from the vacuum power unit of the automatic vacuum release parking brake assembly and plug the vacuum line. Set the parking brake. **It is necessary to inactivate the vacuum power unit to keep the parking brake engaged during the adjustment procedures.**

3. Place a small weight on the idle compensator spring to hold the compensator closed. **If the compensator is open, because of high underhood temperatures, the idle speed adjustment would be incorrect when the compensator closes.**

4. Adjust the idle speed and mixture screws (Fig. 16) to obtain the specified engine idle speed with the transmission selector in DRIVE position. **The final mixture setting should be slightly on the rich side.**

5. Remove the weight from the compensator spring.

FAST IDLE RPM ADJUSTMENT

This adjustment is made only after the engine has been run for thirty minutes at 1200 rpm.

1. With the engine at a stabilized, normal operating temperature and the fast idle screw resting on the lowest (slowest) step of the cam, adjust the fast idle screw (Fig. 16) to obtain the specified fast idle rpm with the transmission in DRIVE range.

2. Remove the tachometer. Turn off the engine. Connect the vacuum line to the vacuum power unit of the vacuum release parking brake assembly.

3. Install the air cleaner assembly.

THROTTLE LINKAGE ADJUSTMENTS

The throttle linkage adjustments for the Turb-O-Drive transmission are covered in Group 7.

3 REMOVAL AND INSTALLATION

REMOVAL

Flooding, stumble on acceleration, and other performance complaints are, in many instances, caused by the presence of dirt, water, or other foreign matter in the carburetor. To aid in diagnosing the cause of complaint, the carburetor should be carefully removed from the engine without removing the fuel from the bowls. The contents of the bowl may then be examined for contamination as the carburetor is disassembled.

1. Remove the carburetor air cleaner. Remove the radiator coolant supply tank cap to depressurize the cooling system.

2. Carefully remove the inlet and outlet hoses from the automatic choke and plug each line with a 7/16-inch bolt to prevent loss of coolant.

3. Disconnect the distributor advance vacuum line, and the fuel inlet line from the carburetor. Disconnect the emission reduction system hose at the carburetor spacer inlet tube.

4. On cars equipped with an air conditioner, disconnect the compressor clutch lead wire from the fast idle solenoid.

5. Disconnect the throttle control rod and retaining clip from the carburetor throttle shaft and control lever assembly. Disconnect the throttle spring and the transmission control (kickdown) spring from their retaining bracket.

6. Remove the carburetor retaining nuts; then, remove the throttle spring bracket, carburetor, upper and lower gaskets, and the spacer. **Whenever the carburetor is removed from the engine, care must be exercised to prevent damage to the throttle plates. The lower edges of the primary throttle plates project below the carburetor body whenever they are open.**

INSTALLATION

1. Make certain all old gasket material has been removed from the carburetor base, spacer, and the intake manifold flange.

2. Install the new carburetor lower gasket, spacer, and new upper gasket on the intake manifold. **Do not use sealer or any form of sealing compound on the gasket.**

3. Position the carburetor on the manifold. Loosely connect the fuel line, and distributor vacuum advance line to the carburetor.

4. Install the throttle spring bracket and the carburetor retaining nuts. To prevent leakage, distortion, or damage to the carburetor body flange, snug the nuts; then, alternately tighten each mounting nut in a criss-cross pattern. Torque each nut to specification.

5. Connect the emission reduction system inlet hose to the carburetor spacer and tighten the clamp. Tighten the fuel line and distributor vacuum advance line connections at the carburetor.

6. Attach the throttle control shaft rod to the throttle lever and secure it with a retaining clip. Install the throttle spring and the transmission control (kick-down) spring on the retaining bracket.

7. Connect the automatic choke coolant inlet and outlet hoses, then tighten the retaining clamps.

8. On cars equipped with an air conditioner, connect the compressor clutch lead wire to the fast idle solenoid.

9. Install the cap on the radiator coolant supply tank.

10. Refer to Part 1, Section 2 and Part 2, Section 2 of the manual for the carburetor bench adjustments and the in-the-car adjustments. Adjust the automatic choke, idle fuel mixture, idle (hot) rpm, fast idle rpm, and dashpot.

11. Install the air cleaner assembly.

4 MAJOR REPAIR OPERATIONS

DISASSEMBLY

To facilitate working on the carburetor, and to prevent damage to the throttle plates, install carburetor legs on the base. If legs are unavailable, install four 5/16 x 2½ inch bolts and 8 nuts; install nuts on the bolts, above and below the carburetor base.

Use a separate container for the component parts of the various assemblies, to facilitate cleaning, inspection, and assembly.

The following is a step-by-step sequence of operations for completely overhauling the carburetor. **However, certain components of the carburetor may be serviced without a complete disassembly of the entire unit.** Refer to Fig. 17 for parts identification.

AIR HORN

1. Remove the air cleaner anchor screw. Remove the Vacumeter assemblies.

2. From the automatic choke side of the carburetor, remove the anti-stall dashpot outer arm, anti-stall dashpot inner operating arm, and the choke countershaft lever.

3. From the fuel inlet side, disconnect the fast-idle connector rod at the inner-countershaft lever, and disconnect the accelerating pump operating rod at the accelerating pump arm.

4. On cars equipped with an air conditioner, loosen the fitting that secures the vacuum inlet tube to the idle speed-up control housing.

5. Remove the 10 retaining screws, then remove the air horn from the main body. **To avoid bending the floats, be sure the bowl cover gasket does not stick to the air horn casting and catch onto the floats.**

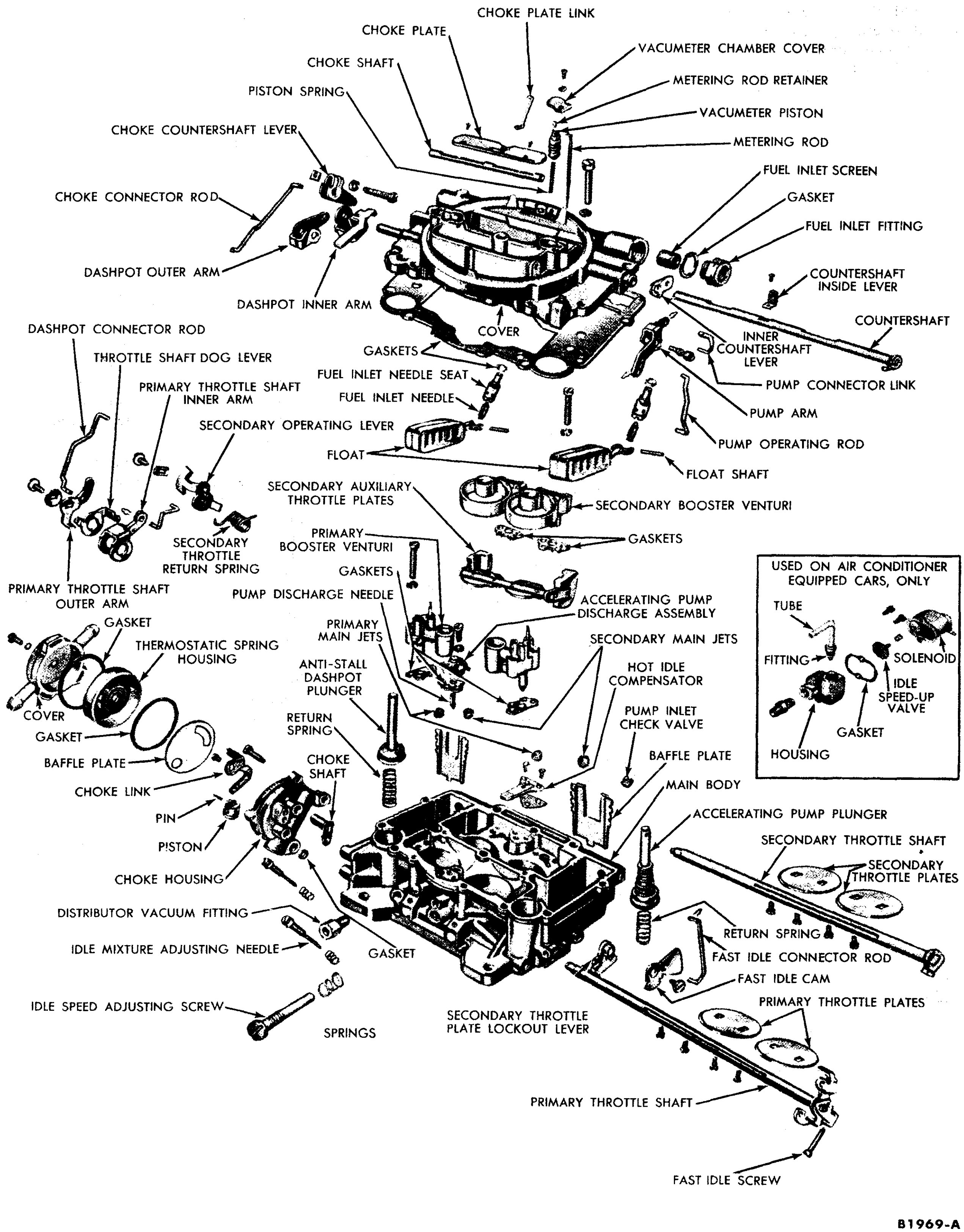

FIG. 17—Carter Carburetor Assembly

6. Remove the accelerating pump plunger, the floats, the fuel inlet needle and seat assemblies and gaskets; then, remove the air horn gasket. **The needles and seats are matched assemblies.** If they are to be used again, be sure the correct needle is kept with its seat.

7. Remove the fuel inlet fitting and gasket. **Under normal service, the carburetor air horn may be cleaned without further disassembly. If complete disassembly is necessary, proceed with the following steps:**

8. Remove the choke plate connector link, then slide the choke plate countershaft out of the air horn assembly.

9. Do not disassemble the choke countershaft and choke plates unless they have to be replaced. If replacement is required, remove the stake marks from the choke plate screws, then remove the screws and choke plates. Slide the choke shaft (countershaft) out of the air horn assembly.

MAIN BODY

1. Remove the accelerating pump spring, and the anti-stall dashpot piston and spring. **Check the fuel in the bowl for contamination by dirt, water, gum, or other foreign matter. A magnet swept around the bowl will pick up iron oxide dust which may have contributed to float inlet needle and seat leaks. Drain the fuel from the bowl.**

2. Remove the primary booster venturi assemblies and gaskets. **Do not attempt to disassemble the venturis.** Remove the accelerating pump discharge nozzle assembly, gasket, and discharge needle.

3. Remove the hot idle compensator and the secondary booster venturis. **Do not attempt to disassemble the venturis.**

4. Lift the secondary auxiliary throttle plates out of the main body.

5. Remove the primary and secondary main jets with the use of tool 9510-G (¼ inch screwdriver bit). **Primary jets have larger openings than secondary jets. Never mix these parts.**

6. Remove the accelerating pump inlet check valve from the left-fuel bowl.

7. Remove the fuel bowl baffles.

8. Remove the idle mixture adjusting needles and springs. Remove the idle speed adjusting screw and spring.

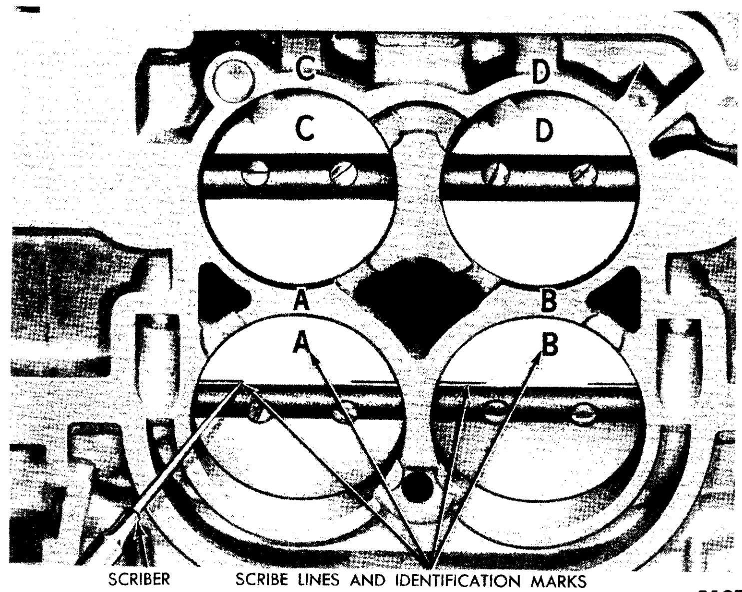

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FIG. 18—Throttle Plate Removal

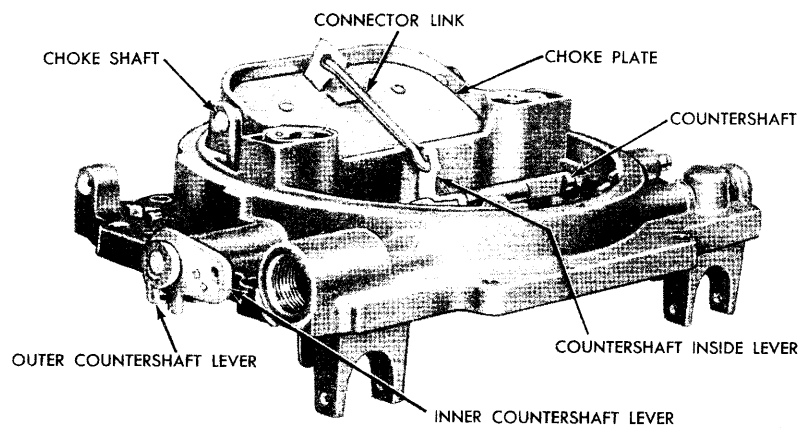

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FIG. 19—Choke Plate and Shaft Installation

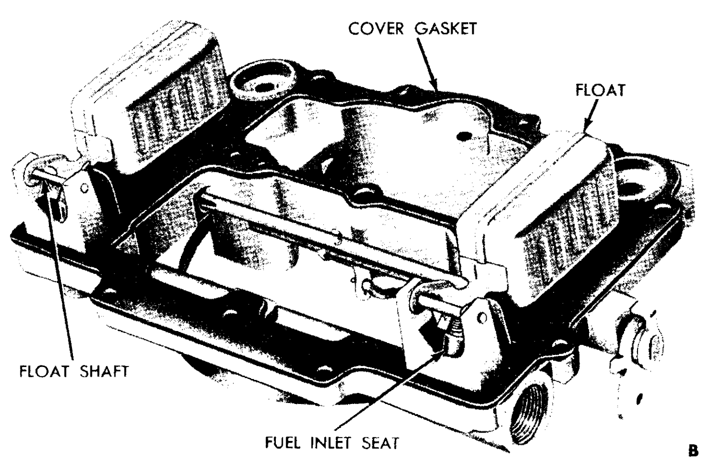

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FIG. 20—Fuel Inlet Needle, Seats, and Float Installed

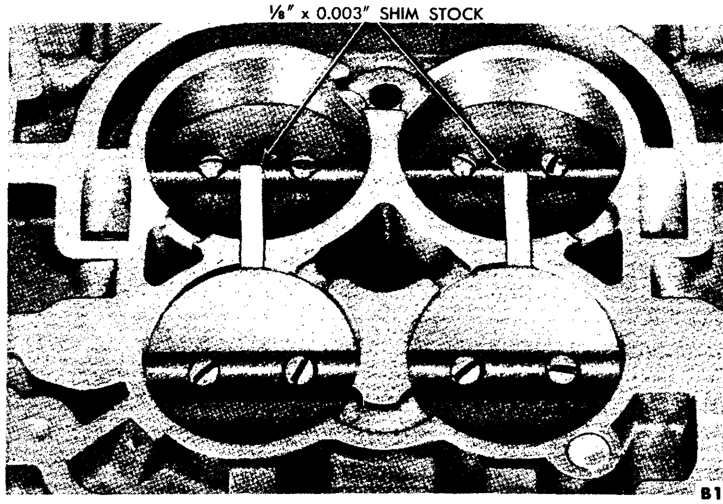

FIG. 21–Positioning Primary Throttle Plates

9. Air conditioner equipped cars, remove the fast idle speed-up valve and solenoid assembly. It is not necessary to disassemble the fast idle speed-up valve and solenoid unless a malfunction exists. If a malfunction exists, remove the solenoid from the valve. **Note the position of the poppet valve and spring for assembly purposes.**

10. Remove the water jacket and thermostatic spring housing as a unit. Remove the spring housing gasket and the heat baffle. **Disassemble the water jacket, gasket, and thermostatic spring housing only if the jacket gasket requires replacement, or the jacket requires cleaning. To remove the special screw, slot out the center portion of a suitable size screwdriver blade.**

11. Remove the choke housing from the main body.

12. Remove the choke connector rod from the choke housing shaft, then remove the shaft, and piston and lever assembly. **Under normal service, the carburetor body assembly may be cleaned without further disassembly. If complete disassembly is necessary, perform the remaining operations.**

13. Remove the throttle connecting rod.

14. Remove the primary throttle shaft arm retaining screw, spacer, outer arm, inner arm, and spring.

15. Remove the secondary throttle operating lever screw and spacer.

16. Remove the secondary throttle operating lever and spring.

17. Remove the fast idle cam and connector rod, and the secondary throttle plate lock-out lever.

18. Remove the accelerating pump operating rod and the fast idle adjusting screw.

19. If it is necessary to remove the throttle plates, lightly scribe the primary and secondary throttle plates along the throttle shaft and mark the plates and their corresponding bore with a number or letter for proper installation (Fig. 18). File the stake marks from the retaining screws, then remove the screws and remove the throttle plates. **Do not scratch the edge of the plates or walls of the barrels.** Remove the throttle shafts.

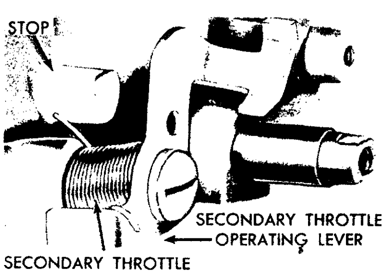

FIG. 22–Secondary Throttle Return Spring Installed

PARTS REPAIR OR REPLACEMENT

Clean and inspect the carburetor component parts. Refer to Part 10-1, Section 3 for the proper procedure. Replace all worn or damaged parts.

ASSEMBLY

Make sure all holes in the new gaskets have been properly punched and that no foreign material has adhered to the gaskets.

The carburetor parts have either a "C" enclosed in a circle or a numeral stamped on them. When the parts are installed, these identification marks always face toward the top or toward the outside of the carburetor, depending upon where the part is installed.

During assembly of the carburetor, certain adjustments are required. The details of these adjustments are covered in Part 1, Section 2, "Carburetor Bench Adjustments".

AIR HORN

1. Slide the choke plate shaft into the air horn. Position the choke plate on the shaft with the identification "C" facing up. Install the screws. Stake the retaining screws with the use of Tool 9586.

2. Slide the countershaft inside lever on the shaft so that the identification "C" is to the outside.

3. Slide the countershaft in the air horn from the fuel inlet side.

4. Connect the choke plate connector link to the choke plate and to the countershaft center lever, then install the lever on the countershaft (Fig. 19).

5. Install the fuel inlet gasket and fitting.

6. Place a new air horn gasket on the air horn (Fig. 20), then install the fuel inlet needle seats, gaskets, and needles. **Install the fuel inlet needles in their matched seats. Do not install the left needle in the right seat or vice versa. Inlet needles and seats are matched assemblies.** Install the floats on the same side of the carburetor from which they were removed; then, refer to Part 10-1, Section 2, "Carburetor Bench Adjustments" and adjust the float alignment, float setting, and float drop.

MAIN BODY

1. If the throttle shaft and plates have been removed, slide the primary and secondary shafts into the main body. **If the original throttle plates are being installed, place each plate in the same bore from which it was removed.** Refer to the lines scribed on each throttle plate and install the plates in their proper location with the screws snug, but not tight.

2. Hold the secondary throttle plates tightly closed, and tap both plates with a screwdriver handle. When the plates are correctly seated,

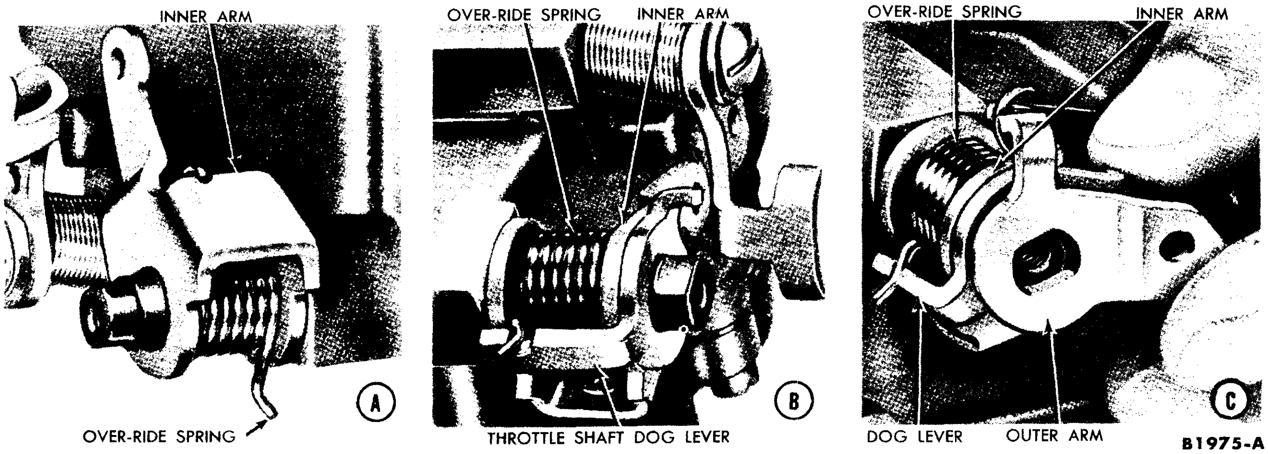

FIG. 23—Secondary Over-Ride Spring Installed

tighten the attaching screws, then stake them.

3. Place a 0.003 inch thick by 1/8 inch wide piece of shim stock between each primary throttle plate and the bore at the idle transfer slot (Fig. 21). Hold the plates firmly against the feeler stock and tighten the retaining screws. Stake the screws.

4. Install the secondary throttle plate lock-out lever on the boss on the main body with the identification "C" to the outside and the slot in the lever engaging the tang on the secondary throttle shaft lever.

5. Install the fast idle cam with the steps toward the fast idle screw.

6. Position the secondary throttle return spring on the shaft, straight tang end against the carburetor and underneath the stop (Fig. 22).

7. Position the secondary throttle operating lever on the shaft, with the curved shoe portion up. Wind the secondary throttle return spring clockwise. Catch the bent tang end over the lug of the secondary throttle operating lever (Fig. 22).

8. Install the secondary throttle lever spacer and screw.

9. Position the secondary over-ride spring in the primary throttle shaft inner arm. Slide the assembly on the primary throttle shaft (Fig. 23).

10. Invert the carburetor and position the throttle shaft dog lever on the primary throttle shaft and hook the inside tang of the spring in the groove on the lever arm (Fig. 23). Hook the primary throttle shaft outer arm on the outside tang of the spring and position the arm on the primary throttle shaft (Fig. 23).

11. Position the spacer on the primary throttle shaft. Install the retaining screw.

12. Position the secondary throttle connector rod in the secondary operating lever and the primary throttle shaft inner arm, with the retaining grooves to the outside. Install the retainers.

13. Position the choke piston and lever assembly in the choke housing. Slide the choke lever and shaft into the choke housing and position the piston lever on the shaft. Install the retaining screw.

14. Install the curved end of the choke connector rod in the choke housing lever with the upset end away from the choke housing.

15. Install a new gasket in the recess in the choke housing vacuum passage. Position the choke housing on the main body and install the attaching screws. **The thermostatic spring housing and related parts are installed after the choke countershaft linkage is adjusted.**

16. Install the primary, and secondary jets, and the accelerating pump inlet check valve.

17. Install the fuel bowl baffle plates with the identification "C" toward the front of the carburetor and the cut-out portion facing upward.

18. Position the primary booster venturi gaskets in the main body. The primary gaskets are interchangeable from side to side. Position the booster venturis in the main body with the high speed air bleed tube to the inside. A cut-out notch on each booster venturi mates with a step in the main body. **The primary booster venturi assemblies are not interchangeable from side to side.**

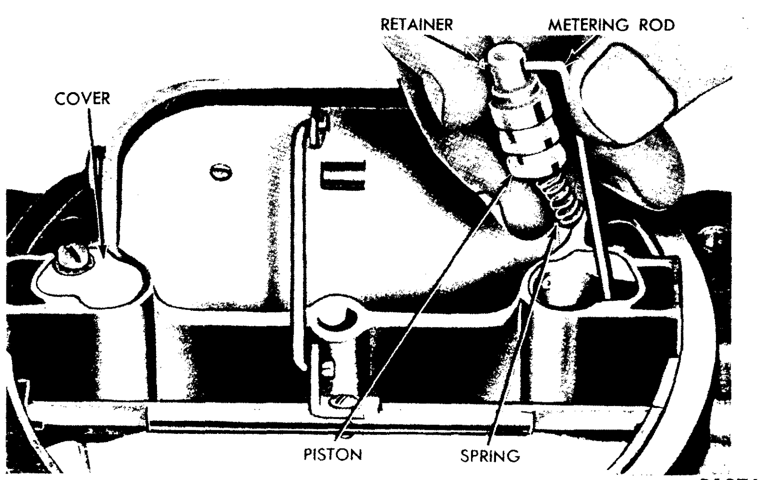

FIG. 24—Vacumeter (Metering Rod) Installation

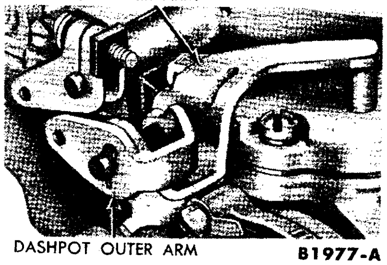

FIG. 25—Dashpot Arms Installation

Install the retaining screws.

19. Position the secondary auxiliary throttle shaft with the identification "C" on the plates facing upward.

20. Position the secondary booster venturi gaskets in the main body. **The secondary gaskets are interchangeable from side to side.** Place the secondary booster venturis in the main body. A drop-out notch on each secondary booster venturi mates with a step in the main body. **The secondary booster venturi assemblies are not interchangeable from side to side.** Install the retaining screws.

21. Position the hot idle compensator in place between the secondary booster venturis: Install the hot idle compensator.

22. Drop the accelerating pump discharge needle into its passage, then install the gasket and pump discharge nozzle assembly.

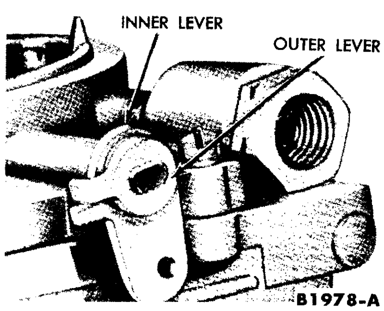

FIG. 26—Countershaft Lever Installation

23. Place the accelerating pump spring in the accelerating pump chamber (on left side of carburetor). **The accelerating pump spring is shorter than the anti-stall dashpot spring. A new accelerating pump spring can be identified by its red color.** Place the accelerating pump plunger over the spring.

24. Place the anti-stall dashpot spring in the dashpot chamber (on right side of carburetor). Place the dashpot plunger on the spring.

25. Install the idle adjusting needles and springs. Turn each needle inward gently with the fingers until it touches the seat, then back it out 1½-2½ turns.

26. Install the idle speed adjusting screw and spring. Do not tighten. Turn the screw until it lightly touches its seat; then, turn it outward 3½ turns.

27. Carefully position the air horn on the main body. **Be sure the anti-stall dashpot plunger stem, the accelerating pump stem, and the primary booster venturi air bleed tubes enter their respective holes in the air horn. Be sure that the upper baffle plates are on the float side of the lower baffle plates when the air horn is positioned on the main body.**

28. Install the identification tag(s), retaining screws and lockwashers. Install the two longest screws at the center retaining screw hole locations. Tighten the screws evenly, working from the center toward the outside.

29. Place the springs in the Vacumeter pistons, then place the pistons and metering rods in their chambers (Fig. 24). Install the Vacumeter covers. **Do not force the metering rods into position.**

30. Place one leg of the dashpot outer arm in between the two legs of the dashpot inner arm and slide them into position on the air horn (Fig. 25). The identification "C" on both parts should be to the outside and the inner dashpot arm lever contacting the dashpot plunger. Install the retainer.

31. Install the dashpot connector rod on the dashpot outer lever and the primary throttle shaft outer lever. The long angular portion of the rod is to the top and the ends of the rod face the carburetor. Install the retainers.

32. Connect the choke connector rod to the countershaft lever. Slide the countershaft lever on the countershaft with the "C" identification facing outward. While working on the other end of the countershaft lever, be sure the tang on the countershaft outer lever is over the tang on the countershaft inner lever (Fig. 26). Tighten the countershaft lever snug, but not tight.

33. Install the fast idle cam connector rod in the fast idle cam and the countershaft inner lever. Install the retainer at the countershaft inner lever end of the rod.

34. Position the accelerating pump arm on the boss on the air horn and install the retaining screw.

35. Insert the retainer end of the accelerating pump connector link in the accelerating pump arm and the other end of the link in the accelerating pump plunger. Install the retainer.

36. Install the accelerating pump operating rod in the throttle lever and install the retainer. Install the other end of the rod in the top hole of the accelerating pump arm.

37. On air conditioner equipped cars, install the vacuum inlet tube and fitting, as a unit, in the air horn. Install the idle speed-up valve that was disassembled, install the poppet valve and spring in the housing; then place the gasket in position and install the solenoid.

BENCH ADJUSTMENTS

All carburetor adjustments except the idle fuel mixture and the idle speed adjustments can be made with the carburetor removed from the car. Refer to Part 1, Section 2 for the "Carburetor Bench Adjustments".

PART 10-3 AIR CLEANER AND AIR DUCT

1 DESCRIPTION AND OPERATION

DESCRIPTION

The engine is equipped with a dry-type carburetor air cleaner assembly and thermostatically controlled carburetor air inlet dust assembly (Fig. 1).

The air cleaner body is mounted on a sealing gasket located on the carburetor air horn. The air cleaner assembly is retained on the engine by a stud in the carburetor body and a wing nut above the filter cover. The replaceable filter element assembly consists of pleated filter paper encased in a wire mesh screen, with integral plastic gaskets located on the top and bottom of the element. The gaskets prevent entry of dirt and unfiltered air into the engine.

The thermostatically controlled air inlet duct and shroud assembly is attached to the air cleaner body with a wing nut. The shroud is positioned on the left exhaust manifold. The air inlet duct control mechanism consists of a valve plate, thermostat, adjustable thermostat rod, two springs and a retaining clip.

OPERATION

AIR CLEANER

The air received from the air duct passes through a silencing chamber in the air cleaner body and then through the filter element. After leaving the filter element, the air is deflected down into the carburetor. Dust particles and other foreign materials are trapped in the filter element as the air rushes through it.

AIR DUCT

The temperature of the air entering the air cleaner is thermostatically controlled by the carburetor air duct assembly (Figs. 1 and 2). Air from the engine compartment, or heated air from a shroud around the exhaust manifold, is available to the engine.

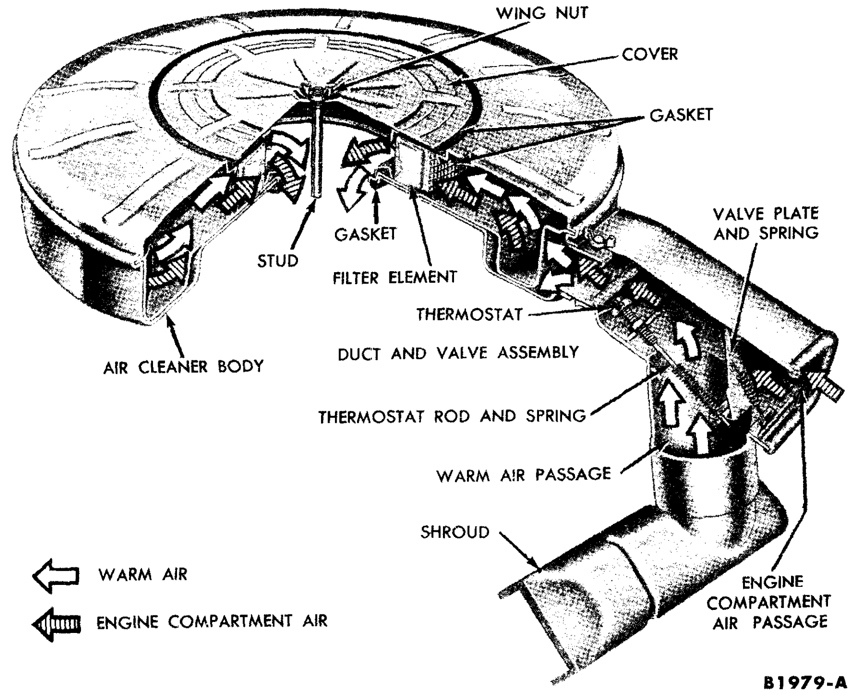

FIG. 1–Air Inlet Duct and Air Cleaner–Sectional View

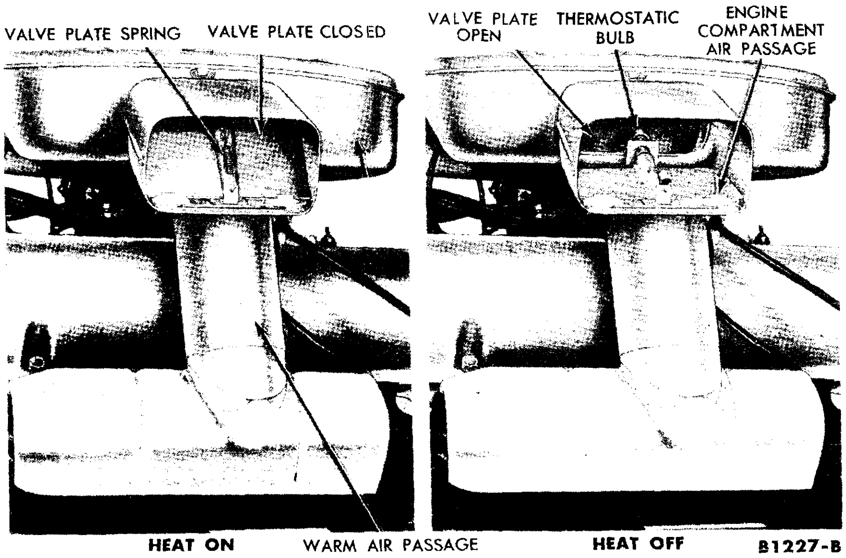

FIG. 2–Air Inlet Duct Installed

A thermostatic bulb in the air duct is exposed to the incoming air. A spring-loaded valve plate is connected to the thermostatic bulb through linkage. The valve plate spring holds the valve in the closed position (heat-on) until the thermostatic bulb overcomes the valve tension.

During the engine warm-up period when the air temperature entering the air duct is less than 75° F., the thermostat is in the retracted position and the valve plate is held in the up position (heat-on) by the valve plate spring, thus shutting off the air from the engine compartment (Fig. 2). All air is then drawn from the shroud around the exhaust manifold.

As the temperature of the air passing the thermostatic bulb approaches 85° F., the thermostat starts to expand and pulls the valve plate down. This allows cooler air from the engine compartment to enter the air cleaner. When the temperature of the air reaches approximately 105° F., the valve plate will be in the down position (heat-off) so that only engine compartment air is allowed to enter the air cleaner.

2 REMOVAL AND INSTALLATION

AIR CLEANER

FILTER MAINTENANCE

Refer to Group 19 for the recommended maintenance mileage interval.

REMOVAL

1. Remove the wing nuts retaining the air cleaner assembly to the carburetor and the air duct (Fig. 1).
2. Remove the air cleaner assembly from the carburetor. **To prevent dirt from entering the carburetor, the filter element must never be removed when the air cleaner body is mounted on the carburetor.**
3. Remove the cover and filter element. Discard the air cleaner mounting gasket on the carburetor if it is excessively worn or damaged.

PARTS REPAIR OR REPLACEMENT

Refer to Part 10-1, Section 3 for the recommended cleaning and inspection procedure. Replace all worn or damaged parts.

INSTALLATION

1. Install a new air cleaner mounting gasket on the carburetor, if necessary. Install the air cleaner body on the carburetor so that the word "FRONT" faces the front of the car.
2. Place the element in the air cleaner body. **Make sure the element gasket is properly seated.** Install the cover and connect the air duct to the air cleaner. Tighten the retaining wing nuts.

AIR DUCT

REMOVAL

1. Remove the wing nut securing the air cleaner to the carburetor (Fig. 1).
2. Carefully lift the air cleaner and air duct as an assembly from the engine.
3. Remove the wing bolt securing the air duct assembly to the air cleaner and separate the air duct from the air cleaner.
4. Remove the air cleaner cover and filter element.

DIAGNOSIS AND TESTING

Refer to Part 10-1, Section 1 for the air duct testing procedures.

INSTALLATION

1. Center the air duct shroud on the exhaust manifold and push it into place. **Use care to prevent damage to the spark plug ignition wires.**
2. Install the valve assembly on the air duct.
3. Carefully place the air cleaner body on the carburetor. Check the alignment of the valve assembly to the air cleaner and tighten the wing nut securing the valve assembly to the air cleaner.
4. Install the air cleaner filter element and cover.

3 MAJOR REPAIR OPERATIONS

AIR DUCT

DIAGNOSIS AND TESTING

It is necessary to test the air duct prior to disassembling the unit. Refer to "Air Duct" in Part 10-1, Section 1.

DISASSEMBLY

1. Disconnect the valve plate spring (Fig. 1).
2. Remove the retainer securing the thermostat rod assembly to the valve plate, and disconnect the rod from the plate. Slide the thermostat rod assembly from the thermostat and remove the rod from the air duct.
3. Carefully bend up the tabs holding the thermostat and spring assembly in the air duct. Remove the thermostat and spring assembly.

ASSEMBLY

1. Place the thermostat and spring assembly in the air duct and carefully bend the tabs to hold the thermostat and spring assembly in place.
2. Insert the thermostat rod assembly through the air duct into the thermostat and spring assembly. Connect the opposite end of the rod to the valve plate. Secure the rod to the plate with the retainer.
3. Test the air duct and adjust it, as necessary. Refer to "Air Duct" in Part 10-1, Section 1 for the proper procedure.

PART 10-4 FUEL PUMP AND VAPOR DISCHARGE VALVE

1 DESCRIPTION AND OPERATION

DESCRIPTION

The fuel pump (Fig. 1) is mounted on the upper-portion of the cylinder front cover.

A vapor discharge valve and return line adapter assembly (Fig. 1) are contained within the fuel return port of the pump body. The in-line replaceable fuel filter is connected directly to the fuel outlet port in the pulsator cover.

A heat shield (Fig. 1) is mounted on the pump body and is retained by three studs, nuts and washers.

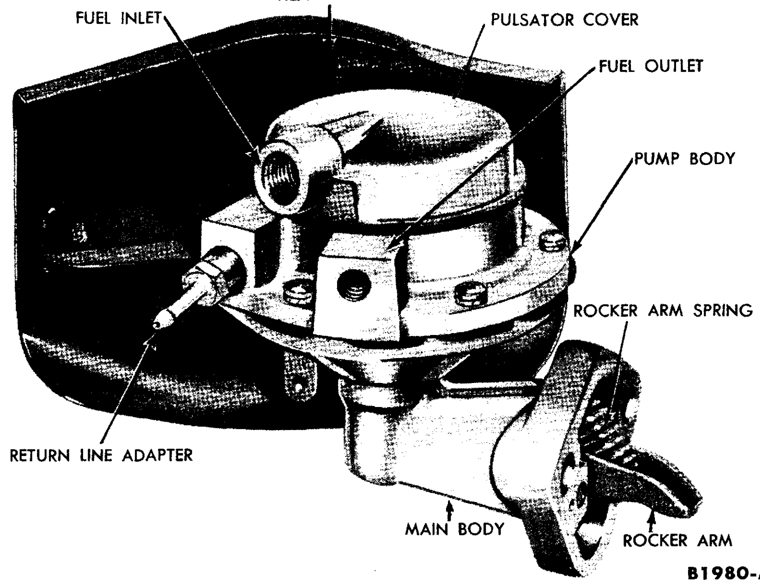

FIG. 1—Fuel Pump and Vapor Discharge Valve

OPERATION

FUEL PUMP

The fuel pump (Fig. 2) is mechanically actuated by the fuel pump rocker arm, a push rod and an eccentric sleeve mounted on the front of the camshaft.

The flexible fuel pump diaphragm is operated by a combination of rocker arm action and calibrated diaphragm spring tension.

On the fuel intake stroke, the camshaft eccentric raises the rocker arm push rod and causes the rocker arm to pull the fuel pump diaphragm against the diaphragm spring pressure. This action draws fuel through the intake valve into the pump chamber and closes the outlet valve. At the same time, fuel is drawn from the fuel tank through the fuel intake line to replace the fuel drawn into the chamber.

As the camshaft eccentric continues to rotate, the rocker arm relieves the pressure on the diaphragm spring and allows the spring to move the diaphragm toward the inlet and outlet valves, against the pressure of the fuel built up in the fuel inlet chamber. This action causes the pump inlet valve to close and opens the outlet valve. The fuel is then forced through the pump outlet to the fuel filter and carburetor. **Fuel is delivered to the carburetor only when the fuel inlet valve in the carburetor is open. The carburetor inlet valve is closed by pressure of fuel on the float when the specified fuel level in the carburetor float chamber is reached.**

The fuel pump rocker arm serves only to pull the diaphragm against the diaphragm spring pressure during the fuel inlet stroke. When there is no demand for fuel from the carburetor, the diaphragm spring tension is not strong enough to force the diaphragm upward against the fuel pressure built up in the inlet chamber of the pump. Thus, the up and down rocker arm action continues, but the diaphragm remains stationary until pressure against the carburetor float is relieved by a demand for fuel at the carburetor.

The pulsator diaphragm in the fuel pump dampens the effect of fuel pump pulsations on the carburetor fuel inlet needle.

A relief vent is located in the main body below the diaphragm. The vent prevents air pressure build up below the diaphragm.

VAPOR DISCHARGE VALVE

Hot vapors, which may form in the pump due to atmospheric and engine operating conditions, are released from the fuel pump and returned to the fuel tank by means of the vapor discharge valve and adapter (Fig. 2) and a fuel return line.

When the hot vapors reach a predetermined temperature within the pump, the calibrated thermostatic spring gradually expands and moves the valve plunger stem off of the orifice in the valve seat insert. This allows a metered flow of fuel and vapors through the orifice, adapter, and return line into the tank.

As fuel and vapors within the

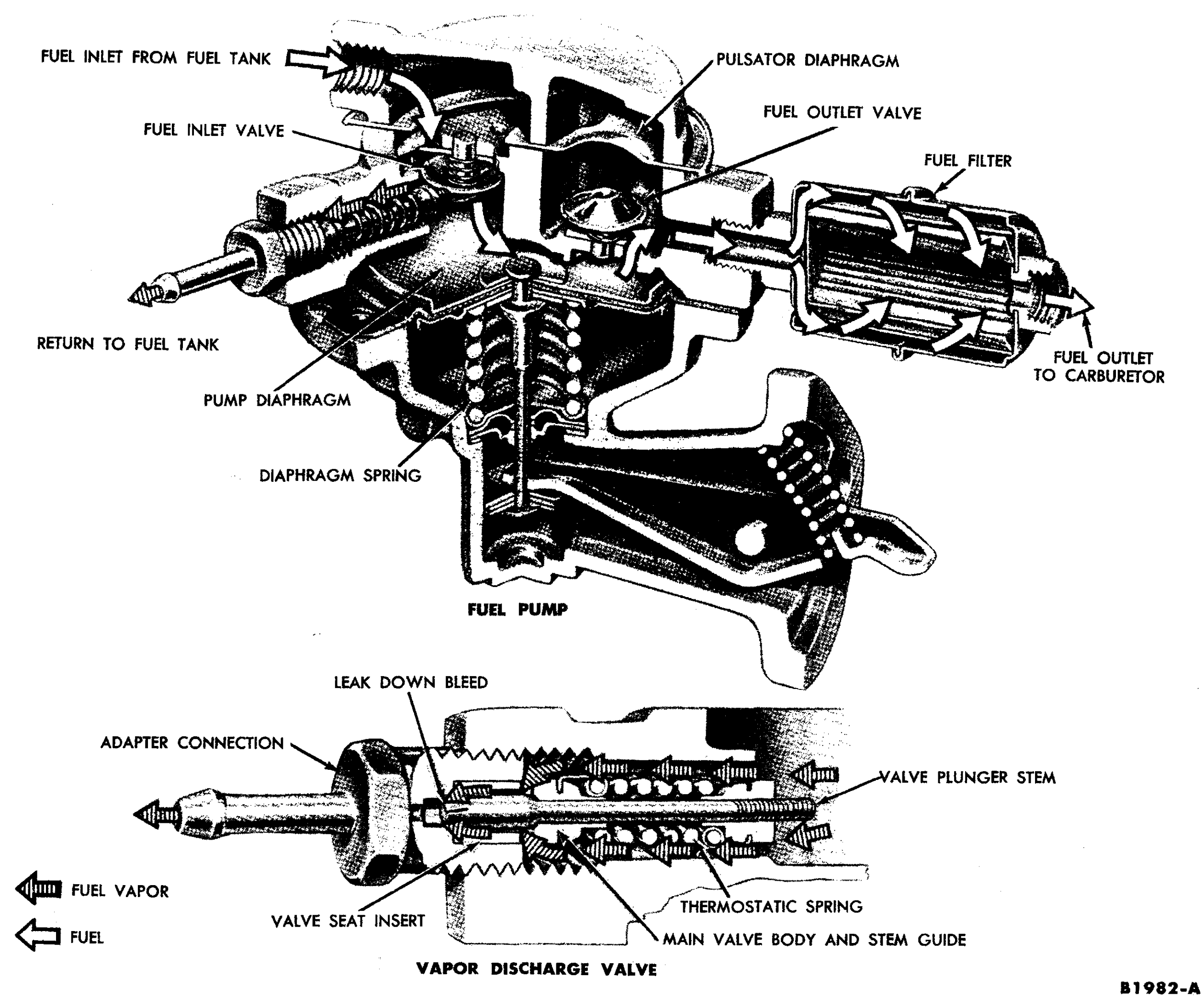

FIG. 2—Fuel Pump and Vapor Discharge Valve—Sectional View

fuel pump cool, the thermostatic spring gradually retracts; thus, seating the valve plunger in the orifice of the valve seat insert. This action restricts the flow of fuel and vapors into the fuel tank. A positive flow of fuel and vapors is provided through the leak down bleed in the vapor discharge valve when it is closed. This prevents a pressure build-up in the pump due to heat after the engine is stopped.

2 REMOVAL AND INSTALLATION

FUEL PUMP

TESTS

Fuel pump tests are covered in Part 10-1, Section 1.

REMOVAL

1. Remove the hose clamps and fuel line hoses from the inlet and vapor discharge connections. Disconnect the fuel filter from the carburetor fuel inlet line.
2. Loosen, but do not remove, the retaining screws securing the fuel pump to the cylinder front cover.
3. Using an auxiliary starter switch, crank the engine until the fuel pump eccentric on the camshaft is in a position which applies the least tension on the fuel pump rocker arm. Remove the retaining screws and fuel pump. Discard the mounting gasket.
4. If the fuel pump is to be replaced, remove the heat shield retaining nuts and remove the heat shield. If inspection or replacement of the fuel pump push rod is required, remove the access cover from the cylinder front cover, and remove the push rod.

INSTALLATION

1. Remove all gasket material from the cylinder front cover and fuel pump mounting flange.
2. If a new fuel pump is to be installed, install the adapter and vapor discharge valve in the pump body.

Install the heat shield and tighten the retaining nuts. If the fuel pump push rod was removed, install the rod on the eccentric sleeve, and install the access cover on the cylinder front cover.

3. Apply sealer to both sides of a new gasket. Position the gasket on the fuel pump flange, and hold the fuel pump in position on the cylinder front cover. **Make sure the rocker arm is riding on the push rod.**

4. Press the pump tight against the cylinder front cover. Install the retaining screws and torque them to specification.

5. Connect the fuel line hoses to the fuel inlet and vapor discharge connections. Connect the fuel filter to the fuel pump. **Do not over-tighten it.** Connect the fuel line to the fuel filter.

6. Operate the engine and check for leaks.

VAPOR DISCHARGE VALVE

REMOVAL

1. Remove the hose clamp and disconnect the fuel line hose from the vapor discharge valve connection.

2. Remove the vapor discharge valve from the pump body (Fig. 3).

INSTALLATION

1. Install the vapor discharge valve in the adapter port of the fuel pump body.

2. Connect the fuel line hose to the adapter and tighten the retaining clamp.

3. Operate the engine and check for leaks.

3 MAJOR REPAIR OPERATIONS

FUEL PUMP

DISASSEMBLY

1. Remove the heat shield retaining nuts and the heat shield from the fuel pump (Fig. 3).

2. Unscrew the vapor discharge valve from the pump body.

3. Scribe identification marks on the main body, fuel pump body and pulsator chamber cover (Fig. 4) so that these parts may be assembled in their original position.

4. Remove the retaining screws that secure the main body to the pump body and separate the bodies. Remove the screws retaining the pulsator chamber cover to the pump body. Separate the cover and body, and note the position of the pulsator diaphragm so that it may be assembled in its proper position. **Do not remove the fuel valves from the valve housing. The valves and housing are replaced as an assembly.**

5. Remove the rocker arm return spring.

6. Remove the rocker arm pin seal plug (Fig. 5).

7. Press the fuel pump diaphragm into the fuel pump body to release the tension on the rocker arm and allow the rocker arm pin to fall out. If the pin does not come out freely, use needle nose pliers (Fig. 6).

8. Press the diaphragm into the fuel pump body and pull the rocker arm out to unhook the rod from the rocker arm link (Fig. 7).

9. Remove the fuel pump diaphragm assembly. **Do not disassemble it. The diaphragm and spring are serviced as an assembly.**

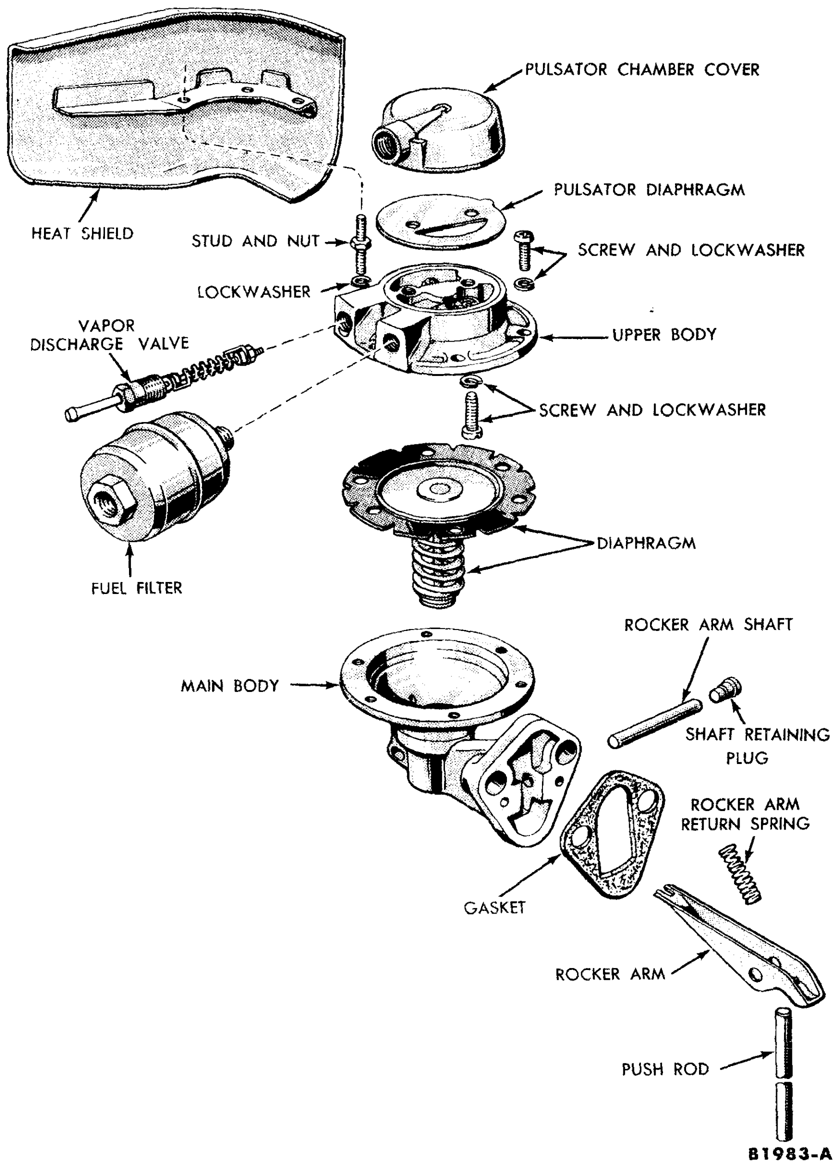

FIG. 3–Fuel Pump, Vapor Return Valve, and Filter

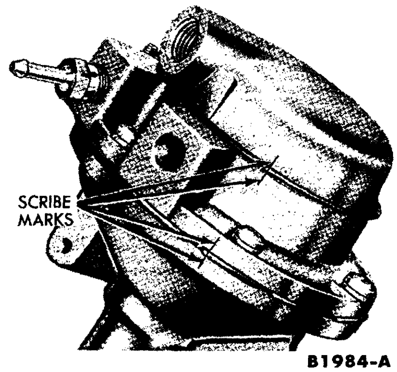

FIG. 4—Scribe Marked Fuel Pump

PARTS REPAIR OR REPLACEMENT

Clean and inspect the fuel pump component parts. Refer to Part 10-1, Section 3 for the proper procedure. Replace all worn or damaged parts.

ASSEMBLY

1. Position the fuel pump diaphragm assembly into the main body; then, apply pressure on the diaphragm spring so that the rocker arm can be hooked on the rod (Fig. 7).

2. Align the rocker arm pin holes by applying slight pressure on the diaphragm spring; then, install the rocker arm pin (Fig. 6).

3. Install new rocker arm pin seal plugs and seat the plugs securely (Fig. 8).

4. Position the rocker arm return spring on the boss in the main body. Compress the spring and slip it over the tang on the rocker arm.

5. Place a new pulsator diaphragm on the valve housing in the position noted on disassembly (opening in the diaphragm over the fuel inlet chamber).

6. Position the cover on the valve housing, aligning the scribed lines on the cover with the line on the valve housing. **Be sure the pulsator diaphragm extends evenly around the edge of the cover.** Install and tighten the valve housing to cover retaining screws.

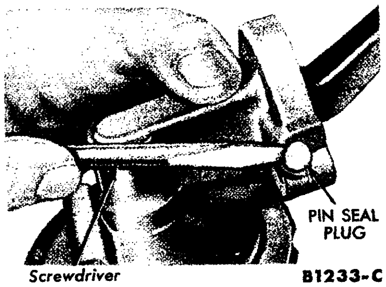

FIG. 5—Rocker Arm Pin Seal Plug Removal

7. Align the scribe line on the valve housing and the line on the fuel pump body. Install the valve body screws and nuts finger tight. **Be sure the diaphragm extends evenly around the edge of the valve housing.** Tighten the retaining screws and nuts.

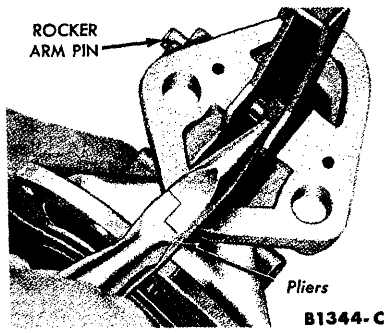

FIG. 6—Rocker Arm Pin Removal or Installation

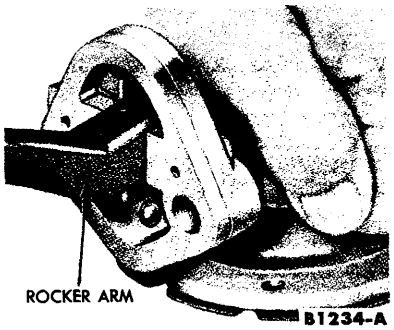

FIG. 7—Fuel Pump Diaphragm Removal or Installation

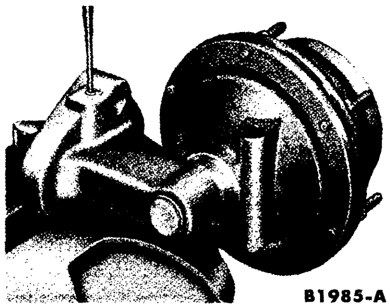

FIG. 8—Staking Shaft Retainer Plug

8. Install the vapor discharge valve in the adapter port of the valve housing.

9. Install the heat shield on the fuel pump and tighten the retaining nuts.

PART 10-5 FUEL TANK AND LINES

1 DESCRIPTION AND OPERATION

All Lincoln Continental models are equipped with a 24-gallon fuel tank (Fig. 1). The tank is held in a vertical position by two steel straps. An insulating pad is positioned between the top of the tank and the underside of the luggage compartment floor pan and also between the rear vertical wall of the tank and front wall of the spare tire well.

The fuel sender unit is located on the front side of the tank. It is accessible from underneath the car.

The fuel line and vapor return line both fasten to connecting hoses that are attached to lines which enter the fuel tank through the fuel sender unit assembly (Fig. 1). A filter is located in the tank, on the fuel sender unit pick-up tube. **This filter does not require servicing.**

The fuel tank filler pipe opening is located behind a door in the left-rear quarter panel, just above and rearward of the wheel housing opening. The tank is vented through the fuel filler pipe cap. The filler pipe is attached to the filler pipe housing of the quarter panel with a gasket between the pipe flange and housing. The filler pipe is sealed at the tank with an O-ring.

Two lines, a fuel supply line and a vapor return line, with connecting hoses and clamps, make up the fuel line system.

These two lines are routed together from the tank, passing beneath the left side of the underbody, then under the left fender and through the forward part of the fender apron. All segments of the fuel lines are replaceable. However, only the damaged segments are usually replaced.

2 REMOVAL AND INSTALLATION

FILLER PIPE

REMOVAL

In some instances, removal of the fuel filler pipe may prove difficult. A fuel tank filler pipe removal or installation tool can be fabricated locally from standard steel shapes that are readily available. Figure 2 outlines instructions for fabricating the tool.

1. Partially drain the fuel tank to a level below the filler pipe connection in the tank (Fig. 1).
2. Remove the retaining screws securing the filler pipe to the filler pipe housing. Insert the fabricated filler pipe removal tool in the filler pipe opening. Rotate the filler pipe with the removal tool and pull it outward to remove it from the fuel tank and housing.
3. Remove and discard the O-ring seal located in the filler pipe opening of the fuel tank. Replace the filler pipe mounting gasket if it is worn or damaged.

INSTALLATION

1. Install a new O-ring seal in the fuel tank (Fig. 1). Install a new gasket, if necessary, on the filler pipe mounting flange.
2. Position the filler pipe and rotate the pipe into the fuel tank with the fabricated tool. **Make certain the O-ring seal is properly seated.** Install and tighten the filler pipe retaining screws.
3. Fill the fuel tank and install the filler cap. Check for fuel leaks.

FUEL TANK

REMOVAL

1. Remove the fuel tank filler cap (Fig. 1). Drain the fuel in the tank into a suitable container with a siphon.
2. Raise the front of the car and keep the rear wheels lowered. Disconnect the rear shock absorbers at the top.
3. Remove fuel sender unit wire and ground wire, low fuel level device wire, fuel line and vapor return line from the sender unit.
4. Remove the filler pipe to fill pipe housing retaining screws. Rotate the filler pipe with the fabricated tool and pull it outward to remove it from the fuel tank and housing.
5. Loosen the nuts and release the tank retaining strap bolts (hooks) from the slotted underbody member at the front of the fuel tank.
6. Remove the tank and discard the filler pipe opening O-ring seal. If the fuel tank is to be replaced, remove the fuel gauge sending unit and discard the gasket. **Note the position of the insulating pad and the insulation between the tank and retaining straps.**

INSTALLATION

1. If the retaining strap(s) required replacement, install the flanged end(s) of the new strap(s) in the slot(s) of the underbody member (Fig. 1). If necessary, properly position the tank insulating pad.
2. If a new tank is to be installed, adhere new insulating pressure-sensitive black tape, of the specified width and length, to the sides of the fuel tank. Install the fuel gauge sending unit and new gasket on the tank.
3. Install a new O-ring in the filler pipe opening of the tank. Position the mounting gasket on the filler pipe. Insert the filler pipe into the filler pipe housing. Carefully position the tank on the retaining straps and hook the strap bolts in the slots of the underbody member. Align the tank and filler pipe and tighten the tank strap bolt retaining nuts.

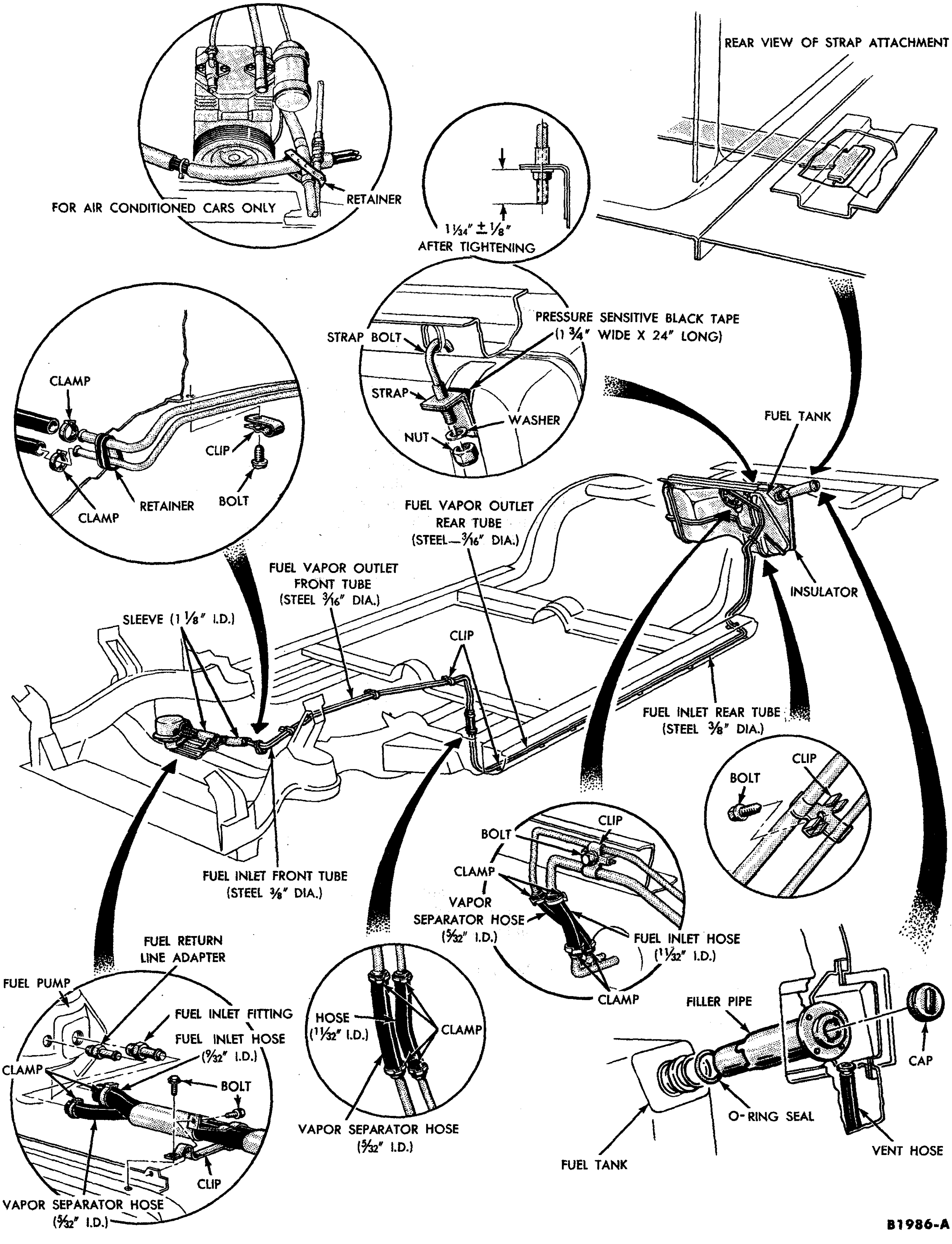

FIG. 1—Fuel System Installation

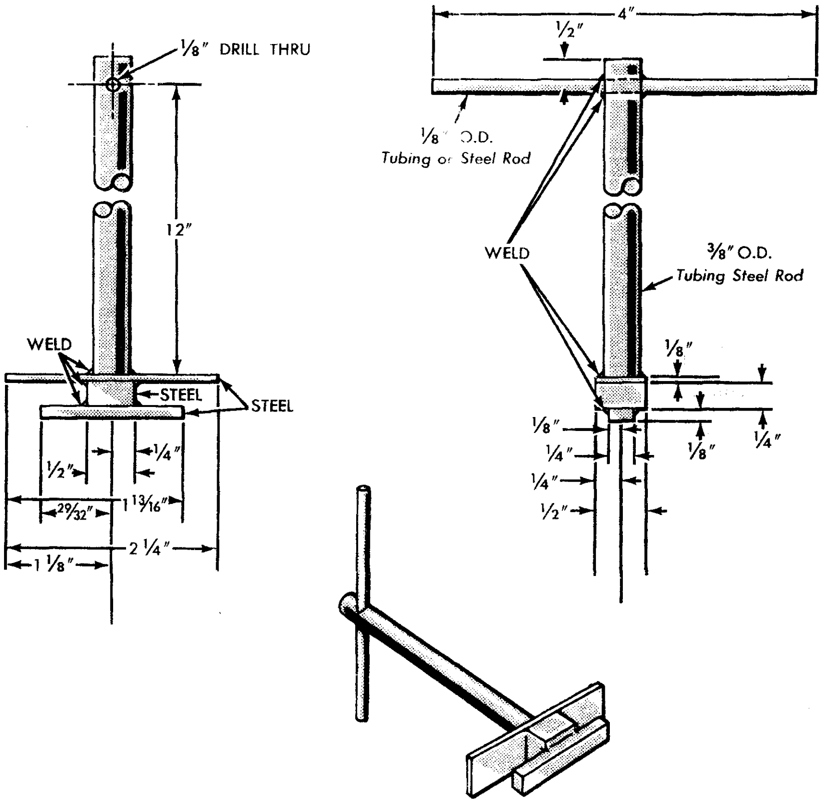

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FIG. 2—Fuel Tank Filler Pipe Puller—Fabricated

4. Position the filler pipe and rotate it into the tank with the fabricated tool. **Make certain the O-ring is properly seated in the fuel tank opening.** Install and tighten the filler pipe retaining screws.

5. Connect the sender unit wire, ground wire, low fuel level device wire, fuel line and vapor return line to the sender unit. Install the shock absorbers and torque the retaining nuts to specification.

6. Lower the car. Fill the fuel tank and install the filler cap. Check for fuel leaks.

FUEL LINES

The various fuel lines are not serviced as assemblies. They must be cut, squared and formed out of rolls of fuel system service tubing and hose material of the specified size (Fig. 2), available at dealerships.

A damaged section of tubing longer than 12 inches can be cut out of the existing line and replaced by a comparable **service tubing section,** spliced into the line by means of connecting hoses and retaining clamps.

A damaged section of tubing shorter than 12 inches can be cut out of the line and replaced by a length of **service hose** and two retaining clamps. **All replacement hoses must be cut to a length that will ensure proper clamp retention beyond the flared ends of the connecting tubing.**

REMOVAL

1. Drain the fuel from the tank.
2. Disconnect the lines at the fuel gauge sender unit and the fuel pump. Remove the lines from the holding clips along the underbody. Remove all damaged hose sections and tube sections.

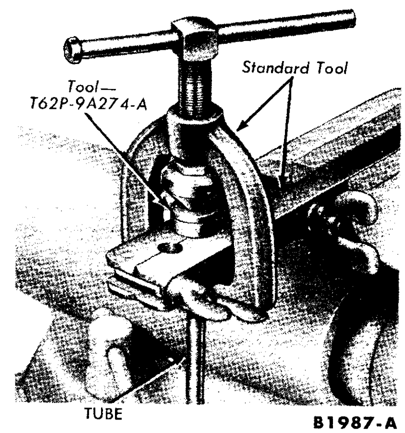

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FIG. 3—Fuel Line Tube Die

INSTALLATION

1. Cut a new section of tubing to approximately the same length as the section to be replaced. **Allow extra length for flaring the ends of the tubing.** Square the ends of the cut tubing with a file.

2. Ream the inside edges of the cut tubing with the reamer blade on the tube cutter. **Be sure metal chips are removed from inside the tube(s).** Flare the ends of the cut tubing, as required, with a standard tube flaring kit and tool T62P-9A-274-A (Fig. 3).

3. Bend the tube section to conform to the contour of the original tube. Cut an ample length of hose to form a coupling between the flared ends of the fuel lines. Connect the hose couplings to the tubing and install the retaining clamps.

4. Position the lines in the underbody clips and tighten the clips. Connect the lines to the fuel gauge sender unit and the fuel pump. Fill the tank and check for leaks.

PART 10-6 FUEL SYSTEM SPECIFICATIONS

FUEL PUMP

VACUUM — Minimum (Inches of Mercury) at 500 Engine rpm	6.0
FUEL PUMP STATIC PRESSURE — psi at 500 Engine rpm	4.5-6.5
MINIMUM FUEL PUMP VOLUME — Flow at 500 Engine rpm	1 pint in 20 seconds
ECCENTRIC TOTAL LIFT	0.234-0.260
PUSH ROD	
Diameter	0.374-0.376
Clearance to Bearing	0.002-0.006

CARBURETOR

CARTER FOUR-BARREL CARBURETOR

The basic part number of the carburetor is 9510. The part number prefix and suffix appears on the identification tag mounted on the air horn.

Main Metering Jet and Metering Rod Identification No.	
Main Metering Jets	
0-5,000 feet	120-164
5,000-10,000 feet	120-164
Secondary Main Metering Jet	
0-5,000 feet	120-158
5,000-10,000	120-158
Metering Rods	
0-5,000 feet	16-225
5,000 feet	16-227
Secondary Throttle Lever Adjustment:	
Lower edge of primary throttle plates to throttle bore clearance	29/64
Primary and secondary throttle lever closing shoe clearance	0.010-0.030
Secondary Throttle Lock Out Adjustment:	
Secondary throttle to lever to ramp on lockout plate clearance	0.015-0.040
Dry Float Setting	
5/16 inch between top of float and surface of gasket, air horn inverted. Allowable tolerance plus 1/64.	
Venturi Size — Diameter	
Primary	1 3/16
Secondary	1 9/16
Choke Thermostatic Spring Housing Initial Setting	
Number of notches rich	1

CARBURETOR (Continued)

Anti-stall Dashpot Clearance	7/16 inch between dashpot operating lever and air horn with throttle wide open, 1/8 inch with throttle closed.
Initial Idle Mixture Adjustment	1½ turns open.
Fast Idle Adjustment — Choke Plate Closed	
Bench	0.026 clearance between primary throttle plate and bore (opposite idle port) with fast idle screw resting on center index mark on cam.
In Vehicle	675-700 in drive with fast idle screw resting on center index mark on cam.
Engine Idle rpm	
Transmission In Drive	450-575
Accelerating Pump Adjustment	
From top of air horn to top of plunger shaft with pump operating rod in top hole	17/32
Pump Operating Rod and Throttle Return Spring Settings	
Summer or winter	Appropriate hole.
Power System Manifold Vacuum Limits — Inches of Mercury	4-6

FUEL TANK CAPACITY

U.S. MEASURE	24 gallons
IMPERIAL MEASURE	20 gallons

TORQUE SPECIFICATIONS

	Inch-Pounds	Foot-Pounds
Air Horn Attaching Screw and Washer	25-30	
Booster Venturi Attaching Screw and Washer	15-20	
Choke Cover Housing Attaching Screw	15-20	
Choke Plate Attaching Screw	3-6	
Fast Idle Cam Attaching Screw	50-60	
Carburetor Mounting Flange Nuts		12-15
Fuel Inlet Needle Seat	45-60	
Metering Rod Jet	30-40	
Throttle Plate Attaching Screw	8-15	
Fuel Inlet Fitting	180-215	
Fuel Pump to Cylinder Front Cover		23-28

COOLING SYSTEM GROUP 11

PART 11-1 GENERAL COOLING SYSTEM SERVICE

1 DIAGNOSIS AND TESTING

DIAGNOSIS

Engine overheating and slow engine warm-up are the two engine troubles most commonly attributed to the cooling system.

Loss of coolant, thermostat stuck in the closed position, or the accumulation of rust and scale in the system are the main causes of overheating. Coolant loss may be caused by external leakage at the radiator, radiator supply tank, water pump, hose connections, heater and core plugs. Coolant loss may also be caused by internal leakage due to a defective cylinder head gasket, improper tightening of the cylinder head bolts, or a warped cylinder head or cylinder block gasket surface.

Internal leakage can be detected by operating the engine at fast idle and looking for the formation of bubbles in the radiator supply tank. Oil in the radiator supply tank may indicate leakage in the engine block or a leak in the automatic transmission oil cooler. Water formation on the oil level dipstick could be an indication of internal leakage.

Rust and scale that form in the engine coolant passages are carried into the radiator passages by the circulation of the coolant. This clogs the radiator passages and causes overheating. Rust can be detected by the appearance of the coolant. If the coolant has a rusty or muddy appearance, rust is present.

A defective thermostat that remains open will cause slow engine warm-up.

DIAGNOSIS GUIDE

ENGINE OVERHEATS	Insufficient coolant. Belt tension incorrect. Radiator fins obstructed. Thermostat stuck closed. Cooling system passages blocked by rust, scale, or other foreign matter. Water pump inoperative. Faulty fan drive clutch.
ENGINE FAILS TO REACH NORMAL OPERATING TEMPERATURE	Thermostat stuck open, or of incorrect heat range. Temperature sending unit defective (causing gauge to indicate low engine temperature). Temperature gauge defective (not indicating true engine temperature).
LOSS OF COOLANT	Leaking radiator or radiator supply tank. Loose or damaged hose connections. Water pump leaking. Cylinder head gasket defective. Improper tightening of cylinder head bolts. Cylinder block core plugs leaking. Cracked cylinder head or block, or warped cylinder head or block gasket surface. Radiator pressure cap defective or wrong type.

TESTING

COOLING SYSTEM PRESSURE TEST

It is recommended that a cooling system pressure test gauge be used to properly test the system for:

1. Blown or leaking cooling system sealing gaskets.
2. Internal or external coolant leakage.
3. Pressure cap malfunction.

Many types of pressure gauges are available for use. Therefore, it is recommended that the gauge manufacturer's instructions be followed when performing the test. **Never exceed the rated pressure indicated on the pressure cap when performing the pressure test.**

THERMOSTAT TESTS

Main Thermostat. Remove the thermostat and immerse it in boiling water. Replace the thermostat if it does not open more than ¼ inch.

If the problem being investigated is insufficient heat, the thermostat should be checked for leakage. This may be done by holding the thermostat up to a lighted background. Light leakage around the thermostat valve (thermostat at room temperature) is unacceptable and the thermostat should be replaced. It is possible, on some thermostats, that a slight leakage of light at one or two locations on the perimeter of the valve may be detected. This should be considered normal.

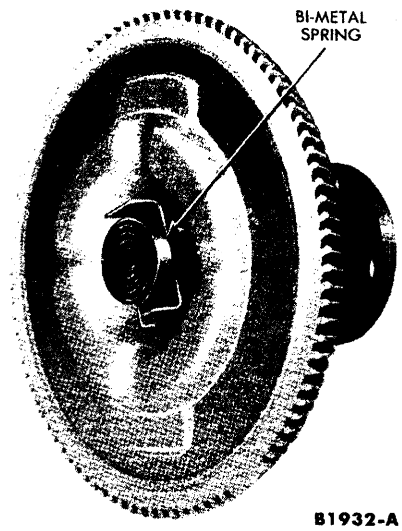

FIG. 1—Power Booster Fan Drive Clutch

Cylinder Block Thermostats. It is impossible to check the operation of used cylinder block thermostats due to the distortion that occurs to the units during their removal from the cylinder block. **Do not attempt to repair them. Install new thermostats.**

If new thermostats are tested, follow the procedure for the main thermostat test.

FAN DRIVE CLUTCH TEST

The recommended testing procedure for the fan drive clutch (Fig. 1) is as follows:

1. The viscosity of the silicone oil within the drive chamber of the unit directly affects its drive characteristics. Therefore, the unit should not be cold when tested. When ambient air temperatures are below 65° F, operate the engine at approximately 1000 rpm for 20 minutes. This should produce the desired temperatures within the unit. **However, regardless of the ambient air temperature, the unit must be operated for at least 5 minutes prior to testing.**
2. Run the engine at approximately 1000 rpm until normal operating temperature is reached. This process can be speeded up by blocking off the front of the radiator with cardboard.
3. Stop the engine and, using a cloth to protect the hand, immediately check the effort required to turn the cooling fan. If considerable effort is required, it can be assumed that the coupling is operating satisfactorily. If very little effort is required to turn the fan, it is an indication that the coupling is not operating properly and it should be replaced.

2 MAINTENANCE

COOLANT

Correct coolant level is essential for maximum circulation and adequate cooling. In addition, for the cooling system to perform its function, it must receive proper care. This includes keeping the radiator fins clean and a periodic inspection of the cooling system for leakage.

Use care when removing the radiator cap to avoid injury from escaping steam or hot water.

In production, the cooling system is filled with a new long-life coolant. This coolant protects to −35° F. It will not be necessary to provide special anti-freeze protection except in areas where temperatures fall below this level. For year round protection from corrosion and overheating, and for low-temperature protection to −35° F, all coolant added should be a mixture of 50% Ford Rotunda coolant concentrate and water. **Use of greater than a 50-50 concentrate should be avoided to prevent possible overheating during warm weather. Do not mix permanent-type anti-freeze with the methanol type.**

In areas where protection to −35° F is not required, but some protection is necessary, refer to the coolant mixture chart on the Ford Rotunda coolant can for the recommended mixture proportions.

A standard ethylene glycol hydrometer can be used to check the protection level of the long-life coolant.

Refer to Group 19 for the recommended cooling system drain interval.

DRAINING AND FILLING THE COOLING SYSTEM

1. Remove the radiator cap. Open the radiator drain cock and remove the cylinder block drain plugs to drain the cooling system.
2. Clean or flush the cooling system, if required.
3. To fill the cooling system:

Close the radiator drain cock and install the cylinder block drain plugs.

Move the heater control dial indicator clockwise to the "MAX" heat zone.

Fill the system with coolant to a point one inch below the bottom of the supply tank filler neck.

Install the pressure cap and turn it clockwise until the first stop is reached. **This will allow the cooling system to vent entrapped air into the atmosphere. Do not tighten the cap fully.**

Operate the engine until normal operating temperatures are reached. **After the initial fill, the coolant level drops due to the displacement of entrapped air.** Add more coolant to fill the supply tank to the required level. Tighten the pressure cap.

4. Check the cooling system for leakage. Move the heater control dial indicator to the "MIN" heat zone. Turn the ignition key to the "OFF" position.

FAN DRIVE BELTS

If the fan drive belts are noisy, check the tension of the belts to make certain they are within specifications. Also, check for misaligned pulleys. If the drive belts are worn or frayed, replace them following the procedures in Part 11-1, Section 3.

3 COMMON ADJUSTMENTS AND REPAIRS

ADJUSTMENTS

DRIVE BELTS

The belts must be properly adjusted at all times. Loose belts cause improper fan, water pump and alternator operation. A belt that is too tight places a severe strain on the water pump and the alternator bearings.

Properly tensioned drive belts minimize noise and also prolong the service life of the belt. Therefore, it is recommended that a belt tension gauge be used to check and adjust the belt tension (Fig. 2). **Any belt that has operated for a minimum of 10 minutes is considered a used belt, and when adjusted, it must be adjusted to the reset tension shown in the specifications.**

Belt Tension

1. Remove the alternator splash shield. Loosen the alternator mounting bolts.

2. Loosen the alternator adjusting bracket bolt.

3. Install the belt tension gauge on the fan drive belts. Move the alternator toward or away from the engine until the specified belt tension is obtained. Remove the gauge. Tighten the alternator adjusting bracket bolt; then tighten the alternator mounting bolts.

Install the tension gauge and check the belt tension.

4. **On a car with an air conditioner,** remove the bolts securing the compressor to the support bracket that is attached to the cylinder head. Loosen the bolts securing the compressor to the compressor mounting bracket.

Install the tension gauge on the compressor clutch drive belt. Move the compressor toward or away from the engine until the specified belt tension is obtained. Remove the gauge. Tighten the compressor to support bracket bolts. Install the tension gauge and check the belt tension.

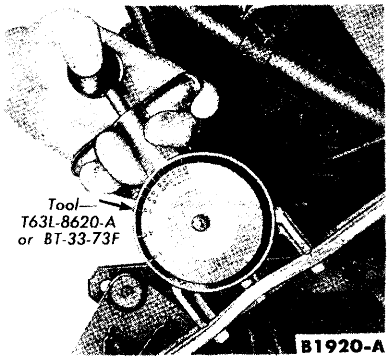

FIG. 2–Fan Drive Belt Tension Adjustment

5. **New belt(s):** Operate the engine for ten minutes, then check the tension of the belts to make certain that they are within the reset specifications. Adjust the belts, if required.

6. Install the alternator splash shield.

REPAIRS

FAN REPLACEMENT

Removal

1. Remove the ground cable from the battery.

2. Loosen the bolts securing the fan blades and spacer to the water pump pulley. Remove the fan, spacer, and mounting bolts as a unit.

On a car with an air conditioner, loosen the bolts securing the fan drive clutch to the water pump pulley. Remove the fan, drive clutch and mounting bolts as a unit.

Installation

1. Position the spacer (or drive clutch) and fan on the water pump pulley and install the mounting bolts. Tighten the bolts.

2. Connect the ground cable to the battery.

FAN BELT REPLACEMENT

1. On a car with an air conditioner, loosen the air compressor to bracket mounting bolts. Move the air compressor toward the engine and remove the compressor drive belt.

2. Remove the alternator splash shield. Loosen the alternator mounting bolts and adjusting bracket bolts.

3. Move the alternator toward the engine, and remove the fan drive belts.

4. Install the fan drive belts on the water pump pulley, crankshaft damper and alternator pulley. Adjust the belt tension to specifications, and tighten the alternator mounting bolts and adjusting bracket bolts.

5. On a car with an air conditioner, install the air compressor drive belt on the water pump pulley and the air compressor clutch. Adjust the drive belt tension to specifications, and tighten the air compressor to bracket mounting bolts.

6. Install the alternator splash shield.

RADIATOR HOSE REPLACEMENT

The radiator hoses should be replaced whenever they become cracked, rotted, or have a tendency to collapse.

1. Drain the radiator. Loosen the clamps on each end of the hose to be removed. Slide the clamps in toward the center of the hose.

2. Slide the hose(s) off the radiator connection(s). Remove the upper hose from the supply tank. Remove the lower hose from the water pump.

3. Position the hose clamps on the center of the radiator hose(s). Install the hose(s) on the respective connections and tighten the clamps firmly. **Make sure the clamps are located beyond the bead on the connections.**

4. Fill the radiator to the required level with coolant. Start the engine and check for coolant leaks. Check for proper coolant level after the engine has reached normal operating temperature. Add coolant as required.

4 CLEANING AND INSPECTION

COOLING SYSTEM FLUSHING PROCEDURES

The design of the cooling system requires that specific steps be taken to reverse flush the engine. Engine cooling system thermostats open in the direction of coolant flow. Due to this factor, it will be necessary to remove all thermostats to prevent back-pressure.

The water pump must be removed to reach the cylinder block thermostat. Due to this condition, it is more practical to reverse flush the engine separately from the radiator.

REVERSE FLUSHING PROCEDURE

1. Remove the water pump. (Refer to "Water Pump Removal" in Part 11-2 for the proper procedure.)

2. Remove the cylinder block thermostats. (Refer to "Cylinder Block Thermostats Removal" in Part 11-3 for the proper procedure.)

3. Remove the coolant supply tank and thermostat. (Refer to "Radiator Supply Tank and Thermostat Removal" in Part 11-3 for the proper procedure.)

4. Plug the coolant bypass tube. Connect a water pressure gun attachment to the intake manifold as illustrated in Fig. 3.

5. Flush the cylinder block until the system is clean. Remove the pressure gun attachment.

6. Clean the gasket surfaces of the water pump, cylinder block, coolant supply tank and the intake manifold.

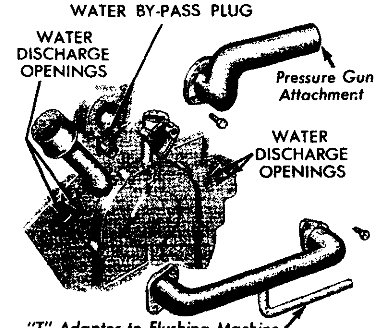

FIG. 3–Reverse Flushing Procedures

7. Install the cylinder block thermostats. (Refer to "Cylinder Block Thermostats Installation" in Part 11-3 for the proper procedure.)

8. Install the water pump. (Refer to "Water Pump Installation" in Part 11-2 for the proper procedure.)

9. Install the coolant supply tank and thermostat. (Refer to "Radiator Supply Tank and Thermostat Installation" in Part 11-3 for the proper procedure.)

POWER FLUSHING PROCEDURE

Modern cooling system power flushing equipment uses rust removing solvents. Most equipment has sight glasses to observe and determine when the system is clean. Power flushing is more efficient than the reverse flushing method.

If a power flushing machine is used, a "T" adapter (part of the flushing equipment) must be attached to the cylinder block as shown in Fig. 3.

Perform the power flushing procedure as follows:

1. Perform Steps 1 through 4 of the "Reverse Flushing Procedure".

2. Install a "T" connection on the cylinder block as shown in Fig. 3.

3. Flush the engine until the water or solvent runs clean.

4. Remove the flushing machine connections. Perform Steps 6 through 9 of the "Reverse Flushing Procedure".

RADIATOR FLUSHING PROCEDURE

1. Attach the pressure gun to the upper radiator hose connection.

2. Attach an outlet hose to the radiator lower hose connection.

3. Flush the radiator until the water or solvent runs clean. **Do not use pressures in excess of 12 psi when flushing the radiator.**

WATER PUMP

1. Clean the gasket mounting surfaces of the water pump and cylinder block.

2. Clean and inspect the seal seating surface of the water pump.

3. Clean the pump housing and inspect it for cracks, sand holes, improper machining, and damaged surfaces. If the water pump housing is damaged beyond repair, replace the complete water pump.

PART 11-2 WATER PUMP

1 DESCRIPTION AND OPERATION

The water pump is a centrifugal-type with a cast iron impeller. The impeller shaft is supported by a double-row, sealed ball bearing that is permanently lubricated. **It requires no additional lubrication.**

The water pump is mounted on the front of the cylinder block. The inlet port of the water pump is connected to the radiator left side tank and draws coolant from the radiator when the thermostat in the intake manifold is open. A bypass port on the water pump is connected to the intake manifold to draw coolant from it when the thermostat is closed, bypassing the radiator.

The water pump has two outlet ports to distribute the coolant flow, from the pump impeller, equally to both cylinder banks.

The water pump pulley is pressed a specified distance onto the water pump shaft. The pulley is driven by the crankshaft damper through two V-belts. The water pump pulley mounts the cooling fan and spacer (or fan drive clutch).

2 REMOVAL AND INSTALLATION

REMOVAL

1. Remove the ground cable from the battery. Drain the cooling system.

2. **On a car with an air conditioner**, remove the power booster fan clutch, fan blade and compressor drive pulley. (Refer to "Fan Drive Clutch Removal" in Part 11-4 for the proper procedure.) Remove the radiator supply tank. (Refer to "Radiator Supply Tank and Thermostat Removal" in Part 11-3 for the proper procedure).

3. If the vehicle is equipped with standard cooling components, remove the fan and spacer. (Refer to "Fan Removal" in Part 11-1 for the proper removal procedure).

4. Loosen the clamp securing the bypass hose to the water pump.

5. Remove the alternator splash shield. Loosen the alternator adjusting bracket and mounting bracket bolts. Push the alternator inward and remove the drive belts.

6. Disconnect the radiator outlet hose at the water pump. Disconnect the heater hose at the water pump fitting.

7. Remove the water pump retaining bolts. Position the oil dipstick tube bracket and power steering pump bracket to allow clearance for removal of the water pump. Remove the water pump and mounting gaskets.

INSTALLATION

1. Coat two new water pump gaskets with water-resistant sealer. Install the gaskets on the water pump.

2. Insert the water pump bypass tube into the bypass hose. **Make certain the retaining clamp is on the hose.** Position the water pump and gaskets on the cylinder block.

3. Position the oil dipstick tube bracket, power steering reservoir bracket, and alternator adjusting bracket on the water pump. Install the water pump mounting bolts and torque them to specifications.

4. Connect the heater outlet hose to the water pump fitting. Tighten the bypass hose clamp.

5. Connect the radiator outlet hose to the water pump. Install the water pump and alternator drive belts on the pulley sheaves. Close the radiator drain cock.

6. Adjust the alternator to obtain the specified belt tension. Tighten the alternator adjusting bracket bolt. Tighten the alternator mounting bolts. Install the alternator splash shield.

7. **On a car with an air conditioner,** install the compressor drive pulley, fan drive clutch and fan assembly and compressor drive belt. Install the radiator supply tank, ignition coil, overflow hose and the radiator inlet hose. Refer to "Radiator Supply Tank and Thermostat Installation" in Part 11-3 for the proper installation procedure. Fill the cooling system to the required level. Start the engine and check for coolant leakage. Refer to "Fan Drive Clutch Installation" in Part 11-4 for the proper installation procedure.

8. If the vehicle is equipped with standard cooling components, install the fan and spacer. Fill the cooling system to the required level. Start the engine and check for leakage. Refer to "Fan Installation" in Part 11-1 for the proper installation procedure.

3 MAJOR REPAIR OPERATIONS

DISASSEMBLY

The water pump assembly is shown in Fig. 4.

1. Remove the impeller cover plate and gasket.

2. Remove the water pump drive pulley with the use of steering wheel remover tool 3600-AA as shown in Fig. 5.

3. Install the water pump on an arbor press and press out the impeller, seal and shaft and bearing as a unit (Fig. 6). Discard the shaft and bearing assembly.

CLEANING AND INSPECTION

Refer to Part 11-1, Section 4 for the cleaning and inspection procedures.

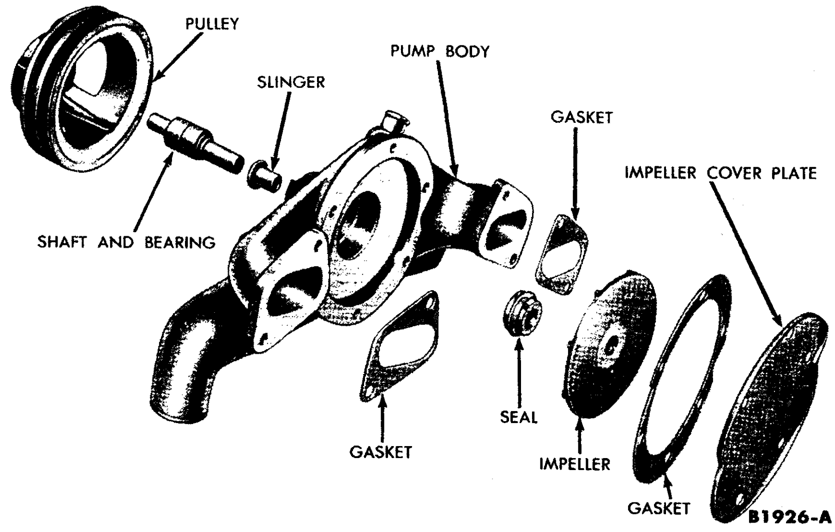

FIG. 4—Water Pump and Pulley

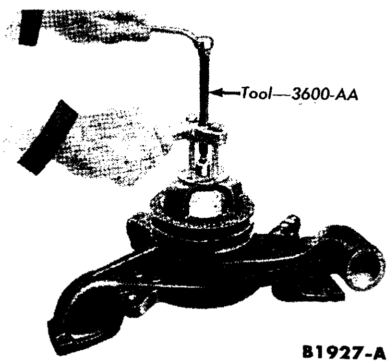

FIG. 5—Water Pump Pulley Removal

ASSEMBLY

When assembling the water pump, always use new gaskets, seal, shaft and bearing assembly, and impeller.

1. Support the water pump on an arbor press (Fig. 7). Position the shaft and bearing assembly in the water pump with the slinger facing downward. Press the shaft, bearing and slinger assembly into the water pump housing until the bearing is flush with the hub edge of the housing.

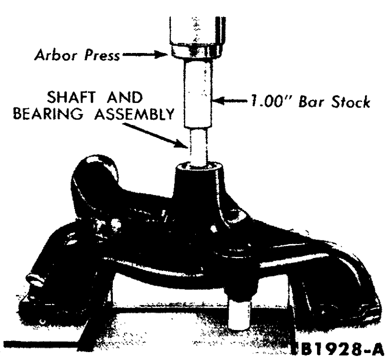

FIG. 6—Shaft and Bearing, Seal and Impeller Removal

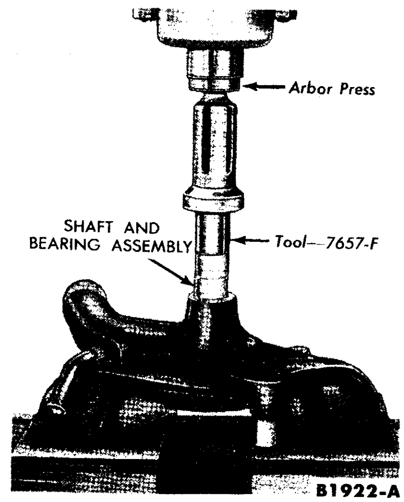

FIG. 7—Installing Water Pump Shaft and Bearing

2. Support the water pump housing on its hub edge and insert the seal assembly over the shaft with the brass flange of the seal facing upward. Place the recessed end of the tool 8501-DD-18 over the seal and press the seal inward until it seats (Fig. 8).

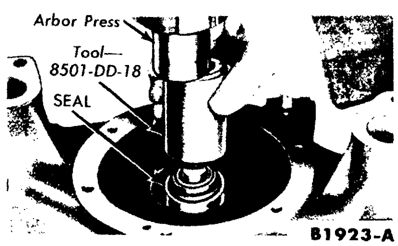

FIG. 8—Water Pump Seal Installation

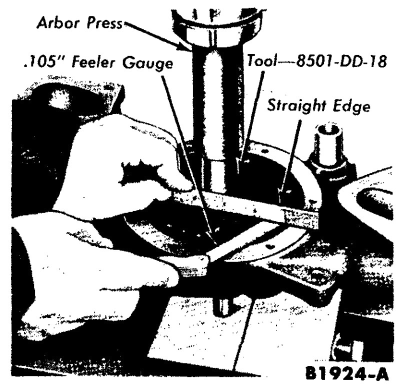

FIG. 9—Water Pump Impeller Installation

3. Position the water pump assembly on an arbor press with the pulley mounting end of the shaft and bearing assembly resting on a steel plate. Carefully press the impeller onto the shaft until the rear face of the impeller sets 0.105 to 0.115 inch below the cover mounting face of the water pump. Check the dimension, using a straight edge and a feeler gauge (Fig. 9).

4. Position the water pump on an arbor press with a steel block supporting the shaft and bearing assembly at the impeller mounting end. Position the water pump pulley on the shaft and press the pulley onto the shaft until a dimension of $7\frac{3}{32}$ inch is obtained between the front face of the pulley and the mounting face of the water pump "legs" (Fig. 10).

5. Coat the water pump cover gasket with a water-resistant, non-hardening sealing compound. Install the gasket and cover. Tighten the mounting bolts.

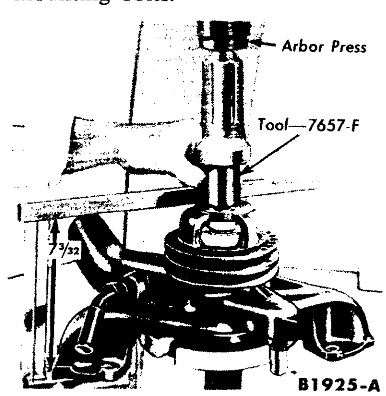

FIG. 10—Water Pump Pulley Installation

PART 11-3 RADIATOR, SUPPLY TANK AND THERMOSTATS

1 DESCRIPTION AND OPERATION

RADIATOR

A cellular-tubular, crossflow radiator (Fig. 11) is used in all car models. An extra-cooling radiator is available as optional equipment to satisfy climatic and extra cooling requirements. Extra-cooling radiators are standard equipment on air conditioner-equipped cars.

Two header tanks, one on each side of the radiator (Fig. 11), provide uniform distribution of the coolant to the crossflow tubes. A heat exchanger located within the left side header tank of the radiator provides means of cooling the transmission fluid. Inlet and outlet fittings are provided at the rear of the radiator left side header tank (Fig. 11).

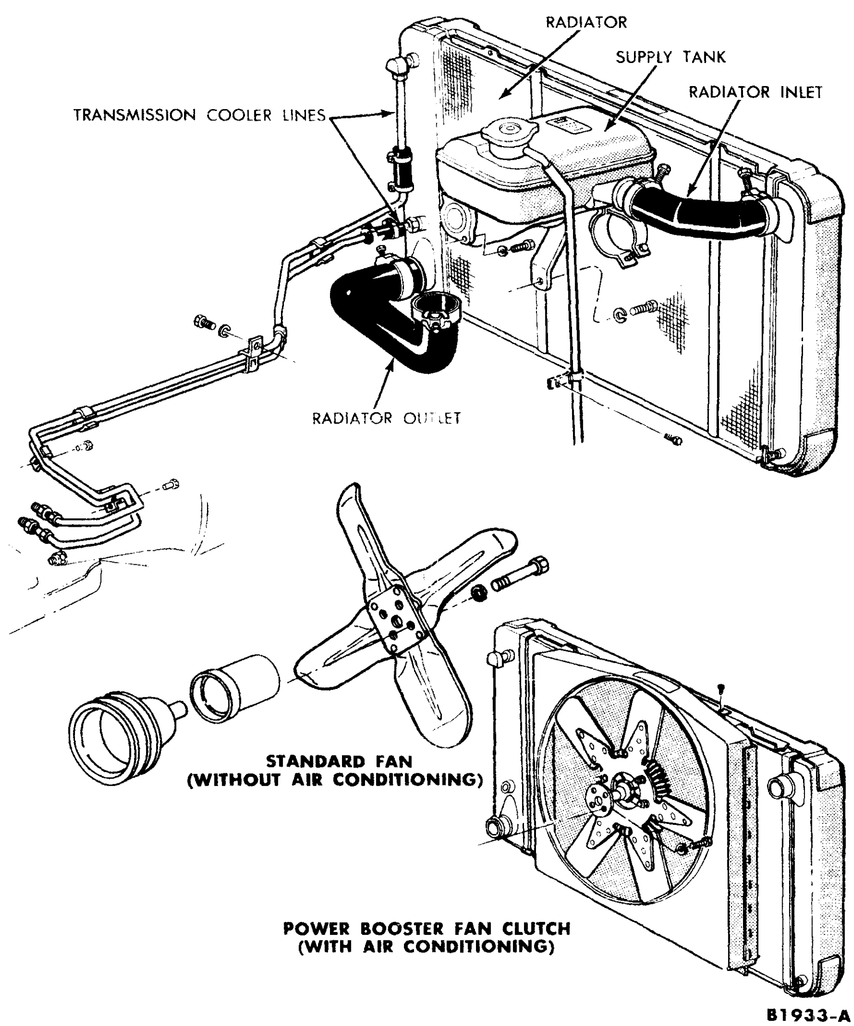

FIG. 11–Radiator and Supply Tank

The radiator drain cock is located at the lower rear of the radiator right side header tank. Cylinder block drain plugs are located on each bank of the cylinder block.

SUPPLY TANK

A radiator supply tank (Fig. 11) is provided on all models to control surging of the coolant. The supply tank is mounted to the intake manifold coolant outlet port which contains the main thermostat. The supply tank mounting bracket is secured to the water pump. A radiator rubber inlet hose connects the supply tank and the right side header tank of the radiator.

An overflow hose is connected to the supply tank and is secured to the cylinder front cover by means of a clip. The ignition coil is secured to the underside of the supply tank by a clamp and bracket.

THERMOSTATS

A standard, high-temperature thermostat is located in the intake manifold coolant outlet. **When non-permanent-type anti-freeze is to be used in the cooling system, the high-temperature thermostat must be removed and replaced by a low-temperature thermostat to eliminate the possibility of the cooling system boiling off the anti-freeze.** Also, two thermostats are located in the front face of the cylinder block, one in each cylinder bank (Fig. 12).

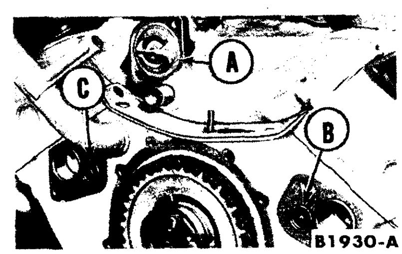

FIG. 12–Thermostat Locations

2 REMOVAL AND INSTALLATION

RADIATOR

REMOVAL

1. Raise the front of the car. Open the radiator drain cock and drain the cooling system.

2. Disconnect and remove the radiator inlet hose. Disconnect the transmission fluid inlet and outlet lines at the radiator. **Plug the lines to prevent drainage and the entrance of foreign material.**

3. Disconnect the radiator outlet hose at the water pump.

4. Remove the three radiator lower mounting bolts.

5. **On a car with an air conditioner,** remove the two condenser to radiator lower mounting bolts.

6. Remove the radiator support shield. Disconnect the fuel line bracket from the radiator. Remove the radiator from the car. **Use care to prevent radiator damage.**

INSTALLATION

1. Close the radiator drain cock and position the radiator in the car.

2. **On a car with an air conditioner,** install the condenser and radiator support shield on the radiator and insert the three mounting bolts. Do not tighten the bolts. Install the two condenser lower mounting bolts. Tighten the condenser upper and lower mounting bolts.

3. Install the radiator support shield on the radiator and loosely install the three mounting bolts.

4. Position the radiator insulators between the radiator support brackets and the car underbody. Make certain they are aligned with the mounting bolt holes. Install the radiator lower bolts. Tighten the radiator lower and upper mounting bolts. Secure the radiator support shield to the car body upper support panel and tighten the five mounting bolts.

5. Install the radiator outlet hose, transmission fluid inlet and outlet lines and the radiator inlet hose. Tighten the hose clamps.

6. Install the fuel line bracket on the radiator.

7. Lower the car. Fill the cooling system to its required level. Start the engine and check for leakage.

RADIATOR SUPPLY TANK AND THERMOSTAT

REMOVAL

1. Disconnect the battery ground cable at the battery.

2. Remove the pressure cap from the radiator supply tank. Drain the cooling system to below the supply tank level.

3. Disconnect the overflow hose from the radiator supply tank. Remove the water pump mounting bolt securing the supply tank brace, engine ground strap and battery ground cable to the water pump.

4. Disconnect the radiator inlet hose from the radiator and supply tank.

5. Disconnect the primary and secondary wires from the ignition coil.

6. Remove the retaining bolts securing the radiator supply tank to the intake manifold. Remove the tank, gasket and thermostat. Remove the ignition coil from the supply tank.

INSTALLATION

1. **Install the thermostat in the intake manifold with the copper pellet or element towards the engine. It is important that the thermostat be positioned correctly in the intake manifold. If it is improperly positioned, it will cause a retarded flow of coolant.**

2. Coat the radiator supply tank gasket with water-resistant sealer and install it on the intake manifold.

3. Install the ignition coil in the supply tank mounting bracket and tighten the clamp.

4. Position the supply tank on the intake manifold and loosely install the mounting bolts. Position the supply tank brace, engine ground straps and battery ground cable on the water pump. Install the mounting bolt and torque it to specifications. Torque the supply tank mounting bolts to specifications.

5. Connect the overflow hose to the supply tank. Connect the radiator inlet hose to the supply tank and radiator. Tighten the hose clamps.

6. Connect the primary and secondary wires to the ignition coil. Close the radiator drain cock. Connect the battery ground cable to the battery.

7. Fill the supply tank to its required level with coolant and install the pressure cap. Start the engine and check for coolant leakage.

CYLINDER BLOCK THERMOSTATS

REMOVAL

1. Remove the water pump, following the procedures in Part 11-2, "Water Pump Removal".

2. Pry the thermostats from the cylinder block with a screwdriver or thin blade chisel. **It is impossible to check used thermostats due to the damage that occurs to the units during their removal. Do not attempt to repair them. Install new thermostats.**

INSTALLATION

1. Clean the thermostat bores to remove rust and foreign material.

2. Install the thermostats with the temperature bulb located inside of the cylinder block.

3. Carefully tap the thermostats into position in the cylinder block. **Avoid damaging the thermostats during this operation.**

4. Install the water pump, following the procedures in Part 11-2, "Water Pump Installation".

PART 11-4 FAN DRIVE CLUTCH

1 DESCRIPTION AND OPERATION

Air-conditioner-equipped vehicles contain a fan drive clutch assembly, a six-bladed fan, a compressor drive pulley, and a compressor clutch drive belt.

The six-bladed fan is mounted at the rear of the fan drive clutch. The clutch assembly and compressor drive pulley are secured to the water pump drive pulley with four capscrews.

The fan drive clutch and fan assembly is regulated by underhood temperatures to control the fan rpm as engine cooling requirements change. The unit also increases usable engine horsepower during high speed operation.

The fan drive clutch is controlled by a heat-sensitive, bi-metal spring located on the clutch front cover. As underhood temperatures increase, this spring expands, causing a plate within the unit to uncover an opening between the oil reservoir and drive chambers. Centrifugal force of the drive chamber, as it revolves at water pump pulley speed, causes the fluid to enter the drive chamber. Lands and grooves in the drive plate located within the chamber cause sufficient friction buildup to rotate the housing and mounted fan. Conversely, a decrease in underhood temperatures allows the heat-sensitive spring to close the valve and permits the return of the oil to the reservoir section of the unit. As the drive chamber empties, the drive plate rotates freely and the fan no longer receives torque from the engine. **The unit permits slippage so that some fan rotation will be experienced, even under low temperature operation.**

2 REMOVAL AND INSTALLATION

The fan drive clutch assembly is serviced only as a unit. If malfunction occurs, the unit must be replaced.

REMOVAL

1. Disconnect the ground cable at the battery.
2. Loosen the compressor support bracket bolts and adjusting bracket bolts. Move the compressor inward toward the engine. Remove the compressor drive belt.
3. Remove the four bolts securing the fan drive clutch and compressor drive pulley to the water pump pulley. Remove the fan drive clutch, fan and pulley as a unit.
4. Remove the four capscrews and disassemble the fan from the fan drive clutch.

CLEANING AND INSPECTION

Refer to Part 11-1, Section 4 for the cleaning and inspection procedures.

INSTALLATION

1. Install the fan on the fan drive clutch and tighten the capscrews.
2. Install the clutch assembly and compressor drive pulley on the water pump pulley and tighten the mounting bolts.
3. Install the compressor drive belt on the compressor clutch and the drive pulley. Adjust the compressor to obtain the specified belt tension and tighten the compressor to mounting bracket attaching bolts. Tighten the support bracket bolts.
4. Connect the ground cable to the battery. Remove the fender covers and close the hood.

PART 11-5 SPECIFICATIONS

COOLING FAN

	OUTSIDE DIAMETER	NO. OF BLADES
Standard	17.50 inches	4
Air Conditioner-Equipped	18.25 inches	5

WATER PUMP

WATER PUMP DRIVE ARRANGEMENT

Dual belts drive water pump, fan and alternator

WATER PUMP PULLEY TO ENGINE RATIO

Extra Cooling (With Air Conditioning) 1.25:1
Standard Cooling 1.25:1

WATER PUMP ASSEMBLY DIMENSIONS

Front Face of Pulley Hub to
Pump Housing Face .... 7.094 inches
Impeller to Housing Clearance . . 0.105-0.115 inches

DRIVE BELT TENSION

BETWEEN ALTERNATOR AND WATER PUMP PULLEY

New–Front 110-135
Rear 105-140
*Used–Front 90-110
Rear 85-115

BETWEEN WATER PUMP AND AIR COMPRESSOR PULLEY

New 120-150
*Used 90-120

*Belt operated for a minimum of 10 minutes is considered a used belt.

COOLING SYSTEM CAPACITY

Cooling System	Approximate Capacity (Quarts)	
	U.S. Measure	Imperial Measure
Standard	21	17½

THERMOSTATS

MAIN THERMOSTATS

Low Temperature

Opens °F .... 155°-162°
Fully Open °F .... 182°

High Temperature

Opens °F .... 185°-192°
Fully Open °F .... 212°

CYLINDER BLOCK THERMOSTATS

Opens °F .... 137°-142°
Fully Open °F .... 162°

TORQUE VALUES

NOTE: All specifications are given in ft-lbs unless otherwise noted.

Water Pump to Cylinder Block 23-28
Water Outlet Housing 12-15
Fan and Pulley to Pulley Hub.............. 10-15
Radiator Lower Attachment 10-15
Radiator Supply Tank to Engine 20-28
Radiator Support to Air Deflector 10-15
Transmission Oil Cooler Hose Tube
to Radiator 18-25
Transmission Oil Cooler Hose Fitting
to Radiator 10-12
Radiator Hose Clamps to Radiator
and Engine 1.0-2.5
Transmission Oil Cooler Tubes
Hose Clamps .... 15-20 in-lbs

EXHAUST SYSTEM — GROUP 12

PART 12-1 EXHAUST SYSTEM

1 DESCRIPTION

A dual exhaust system (Fig. 1) is used on all Lincoln Continental Models. The system consists of a separate resonator inlet pipe, resonator assembly and muffler assembly for each exhaust manifold.

The right and left resonators contain an integral inlet extension pipe, outlet extension pipe and crossover pipe. The resonator assemblies are one-piece units, and are serviced as such.

The right and left exhaust mufflers contain an integral inlet extension pipe and an outlet pipe. The muffler and pipe assemblies are one-piece units and are serviced as such.

The right and left resonator crossover pipes are connected to each other and are secured by a U-bolt and clamp. The ball-type ends of the right and left resonator inlet pipes fit into the exhaust manifold outlet. The resonator inlet pipe flanges are secured to the exhaust manifold flanges by means of studs and retaining nuts. The connecting flanges of the resonator and muffler pipes are sealed by means of gaskets and are secured with bolts and nuts.

Hinge-type, insulated, hanger and support bracket assemblies are secured to the welded integral mounting flanges on the rear of the resonators. The muffler outlet pipes are secured to the rear hinge-type exhaust system support bracket assemblies by means of retaining clamp brackets.

2 IN-CAR ADJUSTMENTS AND REPAIRS

The exhaust system must be free of leakage, binds, grounding and excessive vibration.

Exhaust system vibration, grounding, or binds are usually caused by: loose, broken or improperly aligned clamps or brackets; improper installation of the resonator inlet pipe flange on the exhaust manifold outlet flange, or improperly connected resonator crossover pipes. Any of the aforementioned conditions may cause changes to the clearances of the exhaust system components (Fig. 2). If any of these conditions exist, the clearance of the exhaust system components must be checked, adjusted and neutralized (strain relieved), or replaced to make certain the specified clearances are maintained.

EXHAUST SYSTEM ALIGNMENT

The exhaust system components and clearance specifications are shown in Figs. 1 and 2. Perform the following procedure to adjust and neutralize the exhaust system components:

1. Raise the car. Loosen the retaining nuts securing the muffler outlet pipe lower clamp brackets to the hinge bracket assemblies. Loosen the retaining nuts and bolts securing the upper clamp brackets to the lower clamp brackets.

2. Loosen the retaining nuts and bolts securing the resonator hinge brackets to the plate brackets. Loosen the resonator crossover pipe retaining clamp.

3. Check the assembled length of the mounting studs in the exhaust manifolds. If necessary, disconnect the resonator inlet pipe(s), and turn the studs inward or outward to obtain the specified length.

4. Tighten the retaining nuts at the right and left inlet pipe to manifold flanges, evenly and alternately, to obtain the specified distance from the bottoms of the inlet pipe flanges to the tips of the mounting studs. Progressively tighten the retaining nuts to the specified torque.

5. Adjust the resonator crossover pipes at their connection to obtain the specified distance at the connecting flanges of the resonator inlet pipes, and the specified clearances for the resonator inlet pipes and resonators. Torque the resonator crossover pipe clamp retaining nuts to specification; then torque the reso-

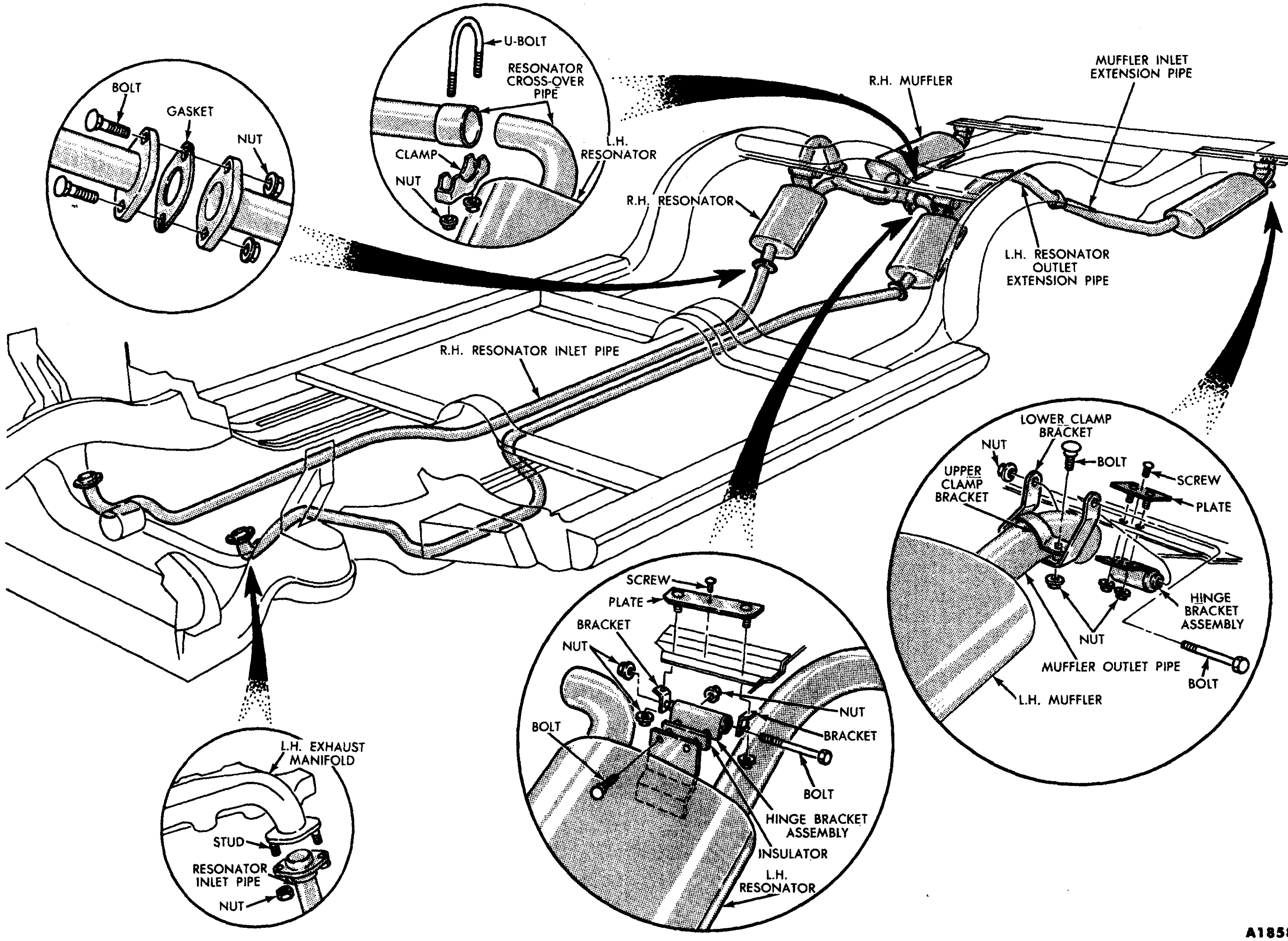

FIG. 1—Lincoln Continental Exhaust System

nator hinge-bracket to pipe bracket retaining nuts and bolts to specification.

6. Torque the right and left outlet pipe hinge bracket to lower clamp bracket retaining bolts and nuts to specification. Check the clearance of the resonator outlet pipes, muffler inlet extension pipes and the mufflers. Torque the retaining bolts and nuts of the lower clamp brackets to specification.

7. Lower the car. Check the exhaust system for leaks, grounding or excessive vibration.

3 REMOVAL AND INSTALLATION

The replacement procedures given apply to all Lincoln Continental Models and to both right and left assemblies of the dual exhaust system, except as noted. Refer to Figs. 1 and 2 for views of the exhaust system components and their clearance specifications.

RESONATOR INLET PIPE

REMOVAL

1. Raise the car. To remove the left-hand resonator inlet pipe, remove the transmission linkage splash shield.

2. Remove the retaining nuts securing the inlet pipe to the exhaust manifold. Remove the bolts and nuts securing the resonator inlet pipe to the resonator inlet pipe extension; remove the resonator inlet pipe, and discard the mounting gasket.

INSTALLATION

1. Clean the mounting surfaces of the exhaust manifold and the inlet pipes. Position the resonator inlet pipe flange on the studs of the exhaust manifold, and loosely install the retaining nuts. Position a new gasket between the flanges of the resonator inlet pipes, and loosely install the retaining nuts and bolts.

2. Tighten the inlet pipe to manifold flange retaining nuts, equally and alternately, to obtain the specified distance from the bottom of the inlet pipe flanges to the tips of the mounting studs. Tighten the retaining nuts, equally and alternately to the specified torque.

3. Torque the resonator inlet pipe to resonator inlet extension pipe retaining bolts to specification. Check the resonator inlet pipe clearance. Adjust and neutralize the exhaust system, if necessary.

If the left-hand resonator inlet pipe was removed, install the transmission linkage splash shield.

4. Lower the car.

RESONATOR

REMOVAL

1. Raise the car at the rear underbody side members. **This will allow the rear suspension to hang downward of its own weight to provide clearance for removal of the resonator assembly.**

2. Remove the retaining bolts securing the resonator inlet pipe and gasket to the resonator inlet extension pipe. Discard the gasket. Remove the bolts securing the resonator outlet pipe and gasket to the muffler inlet extension pipe. Discard the gasket.

3. Remove the retaining clamp from the resonator crossover pipe. Remove the nuts securing the resonator bracket to the plate.

4. Disconnect the crossover pipe, and remove the resonator and mounting bracket as a unit. Remove the hinge-bracket assembly and insulator from the resonator, and replace any damaged or worn parts.

INSTALLATION

1. Clean the mounting surfaces of the crossover pipes, resonator inlet and outlet pipes, and the muffler inlet extension pipe. Install the insulator and hinge-bracket assembly on the resonator flange and torque the mounting bolts to specification.

2. Position the retaining clamp on the crossover pipe. Install the resonator in the car and connect the resonator crossover pipe. Install the plate brackets on the plate and torque the retaining nuts to specification.

3. Position the resonator inlet extension pipe and gasket on the inlet pipe, and torque the retaining bolts and nuts to specification. Position the resonator outlet pipe and gasket on the muffler inlet extension pipe and torque the retaining bolts to specification.

4. Adjust the resonator crossover pipes at their connection to obtain the specified distance at the connecting flanges of the resonator inlet pipes, and torque the retaining clamp nuts to specification.

5. Check the clearances of the exhaust system components. Adjust and neutralize the exhaust system, if necessary.

6. Lower the car.

EXHAUST MUFFLER

REMOVAL

1. Raise the car. Remove the bolts securing the resonator outlet extension pipe and gasket to the muffler inlet extension pipe. Discard the gasket.

2. Remove the retaining bolt securing the outlet pipe lower clamp bracket to the hinge-bracket assembly. Remove the outlet pipe retaining clamp brackets and the muffler assembly as a unit. Remove the upper and lower clamp brackets. Inspect the clamp brackets and hinge-bracket, and replace any damaged or worn parts.

INSTALLATION

1. Clean the mounting flanges of the resonator outlet extension pipe and the muffler inlet extension pipe. Position the upper and lower clamp brackets on the muffler outlet pipe, and loosely install the retaining bolt and nut.

2. Position the muffler and clamp bracket on the hanger assembly. Install the lower clamp bracket on the hinge-bracket assembly. Install and torque the clamp bracket retaining bolt and nut to specification.

3. Install a new gasket, muffler inlet pipe extension and retaining bolts on the resonator outlet extension pipe, and torque the retaining bolt and nut to specification.

4. Check the clearance of the resonator outlet extension pipe, muffler inlet extension pipe and the muffler. Torque the outlet pipe lower clamp bracket retaining bolt and nut to specification.

5. Lower the car.

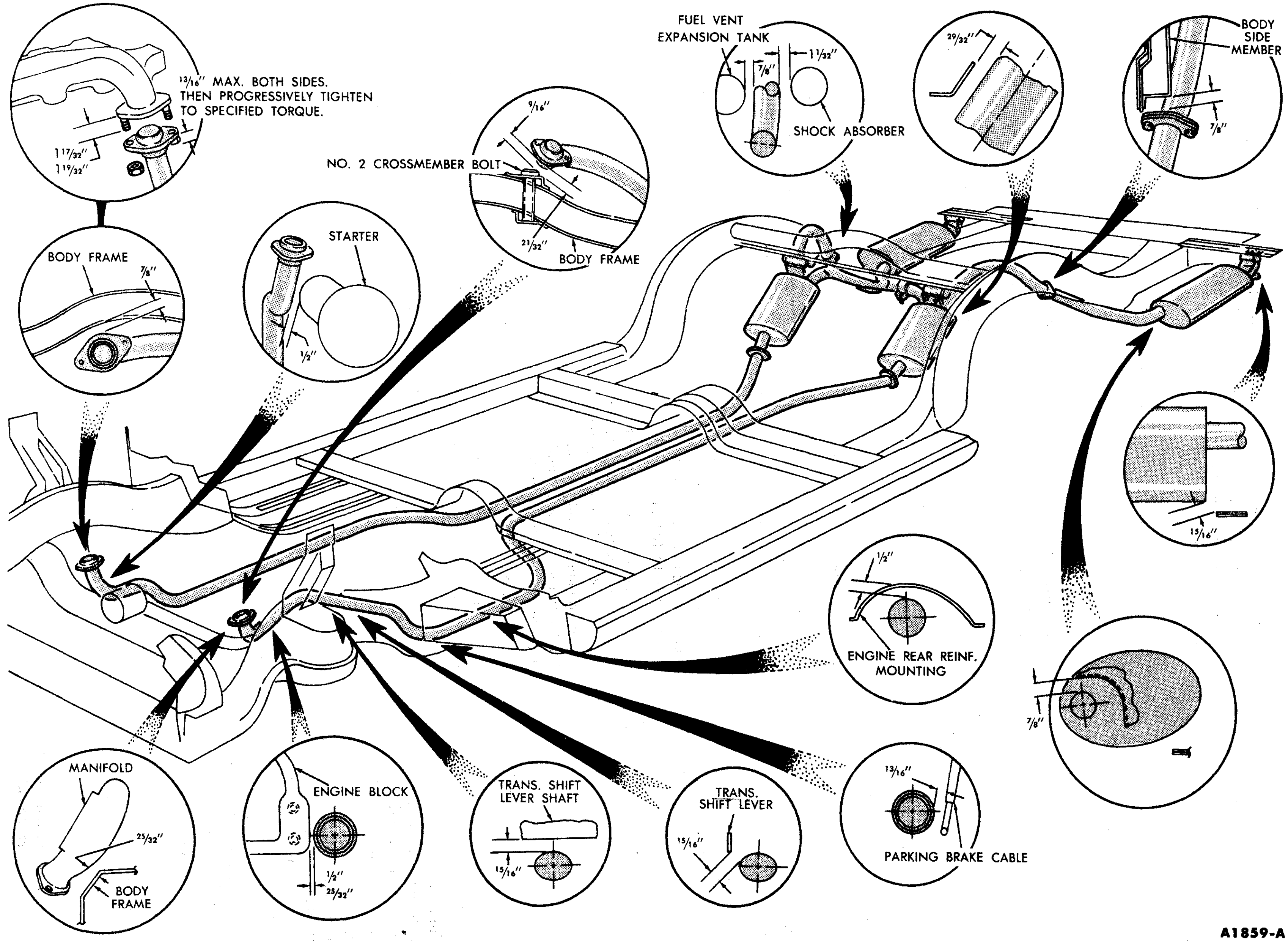

FIG. 2—Lincoln Continental Exhaust System Clearance Dimensions

PART 12-2 SPECIFICATIONS

TORQUE LIMITS	Ft-lbs
Resonator Inlet Pipe to Exhaust Manifold	17-25
Resonator Inlet Pipe Flanges	12-22
Resonator to Hinge-Bracket	12-22
Resonator Hinge-Bracket to Plate Bracket	12-22
Resonator Plate to Plate Bracket	12-22
Muffler Upper Clamp Plate to Hinge-Bracket	12-22
Muffler Hinge-Bracket to Lower Clamp Bracket	12-22
Muffler Upper Clamp Bracket to Lower Clamp Bracket	12-22

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CHARGING SYSTEM

GROUP 13

PART 13-1 GENERAL CHARGING SYSTEM SERVICE

1 DIAGNOSIS AND TESTING

TROUBLE DIAGNOSIS GUIDE

BATTERY LOW IN CHARGE

Indications of a battery low in charge are slow cranking, hard starting, and headlights dim at engine idle speed. Causes are:

1. The alternator belt worn, or loose and slipping over the pulley.
2. The battery in such poor condition that it will not hold or take a charge.
3. The alternator not producing its rated output.
4. Regulator unit out of adjustment, and excessive resistance in the alternator-to-battery circuit or in the battery-to-ground circuit.

First check the alternator belt adjustment and condition.

RECHARGE OR REPLACE BATTERY

Perform a battery Before Charge Test (page 13-6). Replace the battery if the test indicates it is worn out or under capacity. If the battery capacity is normal, proceed as follows:

TEST ALTERNATOR OUTPUT

Test the alternator output (page 13-2) to determine if the alternator is at fault. If the output is normal or greater than the rating of the alternator, proceed with an alternator regulator test under the heading "Test Alternator Regulator." If the output is low proceed as follows:

ALTERNATOR OUTPUT LOW

Connect a heavy jumper wire from the battery ground post to the alternator ground terminal. Repeat the alternator output test. If the output now reaches or exceeds rated output, either the alternator or the battery is not properly grounded to the engine frame. Replace the battery-to-ground cable if it is corroded or partially broken. Clean the cable connections at the battery and engine, and tighten the connections. Tighten the alternator mounting bolts.

If the alternator output is still less than normal, the alternator output could be low due to an open or short circuit in the field, stator, brushes, or brush holders, or the brushes can be worn too short or may be sticking in the brush holder and not making good contact on the slip rings. Remove the alternator for repair.

CONTINUED ON NEXT PAGE

TROUBLE DIAGNOSIS GUIDE (Continued)

BATTERY LOW IN CHARGE (Continued)	**TEST CIRCUIT RESISTANCE** If the alternator output is normal, check the external circuit to determine the circuit resistance (page 13-6). **RESISTANCE EXCESSIVE** If the resistance (voltage drop) is greater than that specified for the car, locate the trouble by performing a complete external circuit resistance test (page13-6). Repair or replace the defective part. **RESISTANCE NORMAL** If the resistance (voltage drop) is equal to or less than that specified for the car, test the alternator regulator.	**TEST ALTERNATOR REGULATOR** If the circuit resistance is normal, test the regulator to determine if it is properly adjusted. After checking both regulator units, adjust or replace the regulator as necessary. If the regulator is not at fault, the battery is low in charge due to improper operation such as: 1. Excessive use of accessories. 2. Short trips. 3. Accidental discharge of battery. 4. Incorrect engine lubricant for ambient temperature encountered. 5. Regulator calibration set too close to low limit for vehicle operating conditions.
HIGH CHARGING RATE	Indications of a high charging rate are: 1. Lights and fuses burn out repeatedly. 2. Battery requires too frequent refilling. 3. The ignition contacts have a short life. To determine the possible cause of the high charging rate, check the following items:	1. Make certain that all connections, including the regulator ground, are tight. 2. Check the voltage limiter. If the voltage limit is high, check the contacts and replace the regulator if the contacts are burned. 3. If the contacts are in good condition, adjust the regulator to the specified limits (page 13-11).

ALTERNATOR TESTS

Figure 1 shows the alternator charging circuit schematic. Figure 2 shows the alternator output connector block.

ALTERNATOR OUTPUT TEST

When an alternator output test is conducted off the car, a test bench must be used. Follow the procedure given by the test bench equipment manufacturer. **When the alternator is removed from the car for this purpose, always disconnect a battery cable, as the alternator output connector is connected to the battery at all times.**

To test the output of the alternator on the car, proceed as follows:

1. Charge the battery if necessary. Make the connections as shown in Fig. 3. Be sure that the Generator Field Control is in the OPEN position at the start of this test.

2. Close the battery adapter switch. Start the engine, then open the battery adapter switch. All electrical accessories including door operated

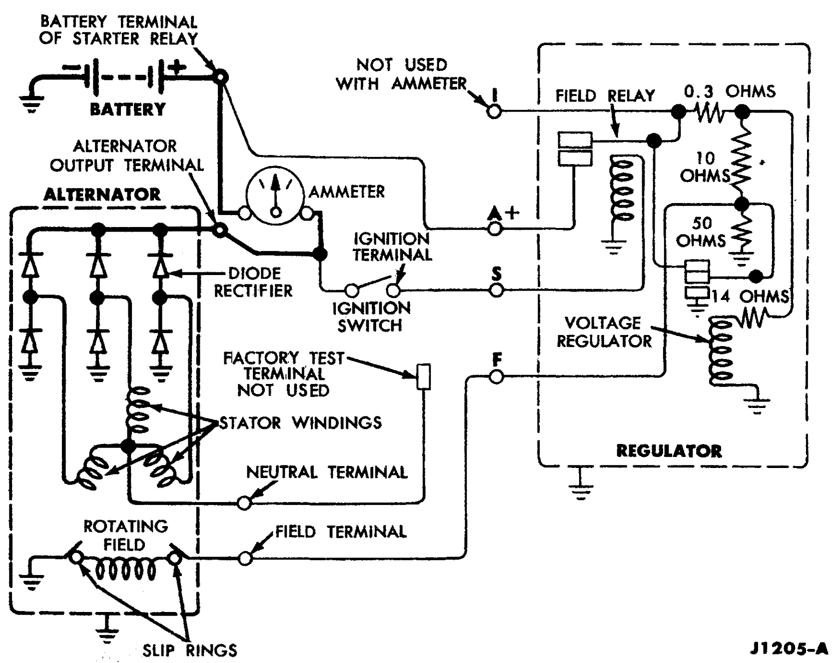

FIG. 1–Alternator System Schematic

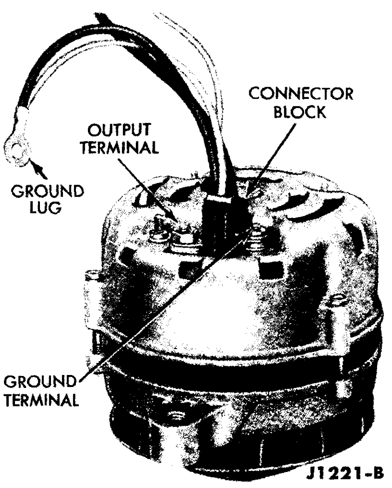

FIG. 2–Alternator Electrical Connections

interior lights must be turned off.

3. Gradually increase the engine speed to a tachometer reading of 2500 rpm. **Do not exceed this speed.**

4. Adjust the Generator Field Control until the voltmeter reads exactly 15 volts. Observe the ammeter reading. Add 5 amperes to this reading to obtain total alternator output. The 5 ampere factor represents the field current and the ignition system current, and must be added to the ammeter reading as these currents are not indicated on the ammeter. **Make this test in the shortest possible time and do not exceed 2500 engine rpm.**

If the battery was fully charged, it might not be possible to obtain maximum current output. If specified current is not obtained, make the following test before condemning the alternator:

5. Turn the Generator Field Control to the OPEN position. Rotate the tester control knob to the LOAD position. Maintain 2500 rpm engine speed.

6. Adjust the Generator Field Control and the LOAD control, maintaining a voltmeter reading of 15 volts maximum, until the Generator Field Control is at its maximum clockwise position.

7. Readjust the LOAD control until the voltmeter reads exactly 15 volts. Observe the ammeter reading. Add 5 amperes to this reading to obtain total alternator output.

8. Stop the engine, return the Generator Field Control to the OPEN position and disconnect the test equipment.

An output of two to five amperes below specifications usually indicates an open diode rectifier. An output of approximately 10 amperes below specifications usually indicates a shorted diode rectifier. An alternator with a shorted diode will usually

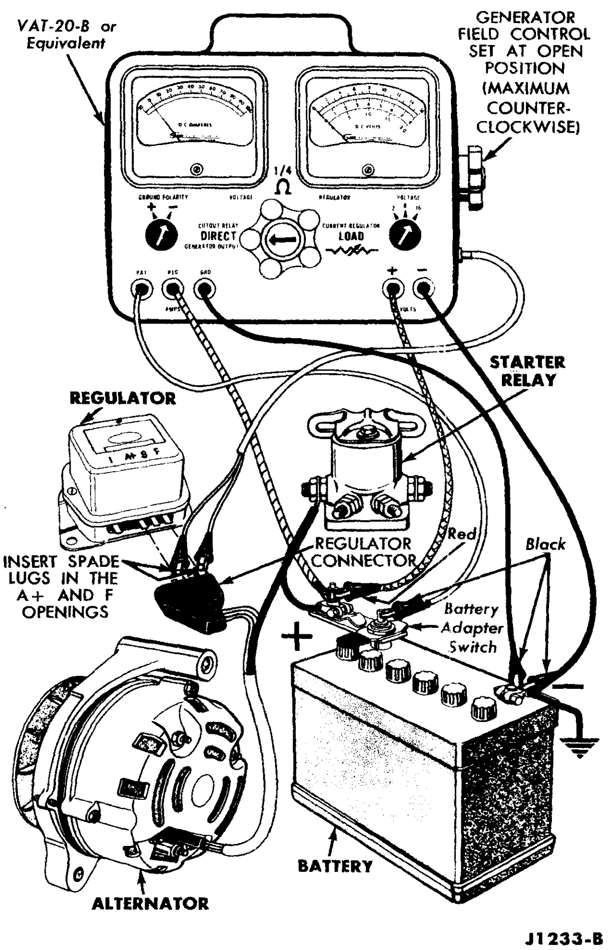

FIG. 3–Alternator Output Test

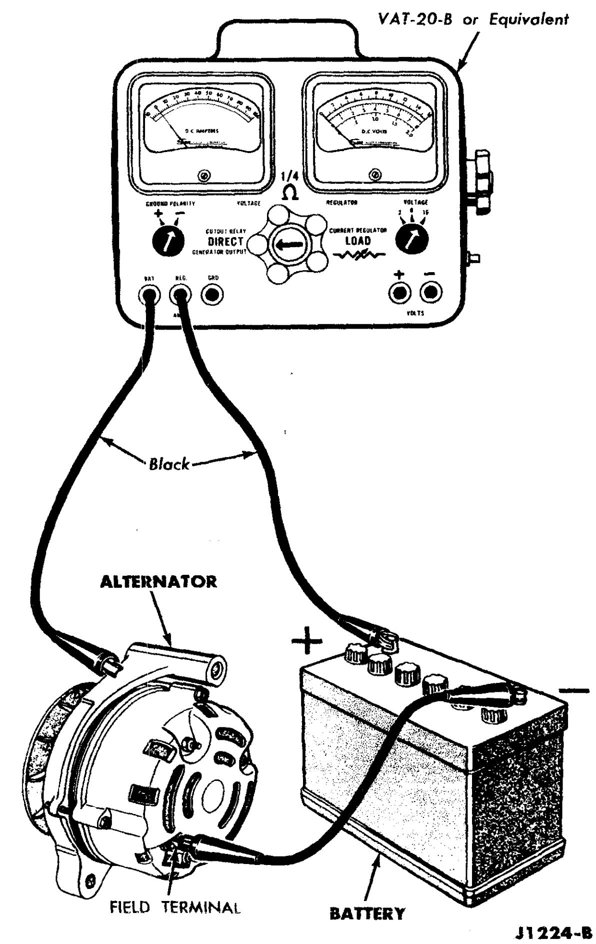

FIG. 4–Field Open or Short Circuit Test

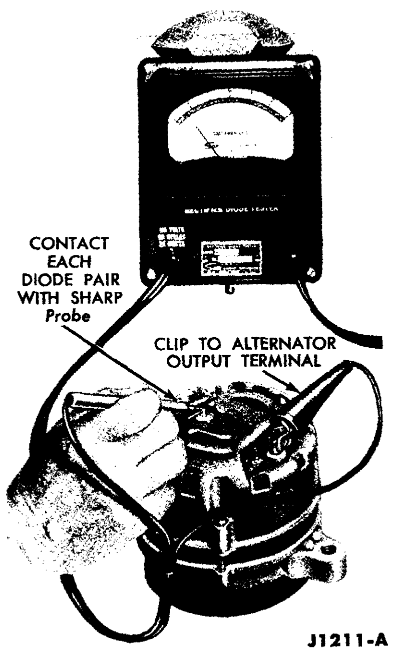

FIG. 5—Positive Diode Test

whine, which will be most noticeable at idle speed.

DIODE TEST

To test the positive diodes, make the connections shown in Fig. 5. Contact the probe to each diode lead. Make sure that the tip of the probe is sharp and that it penetrates the varnish at the diode terminal.

To test the negative diodes, make the connections shown in Fig. 6. Follow the same procedure as for the positive diodes.

Good diodes will be indicated as on the meter in Figs. 5 and 6 (2 amps or more and readings alike within 2 scale divisions).

FIELD OPEN OR SHORT CIRCUIT TEST

Make the connections as shown in Fig. 4. The normal current draw, as indicated by the ammeter, should be 2.9-3.1 amperes at 12 volts. If there is little or no current flow, the

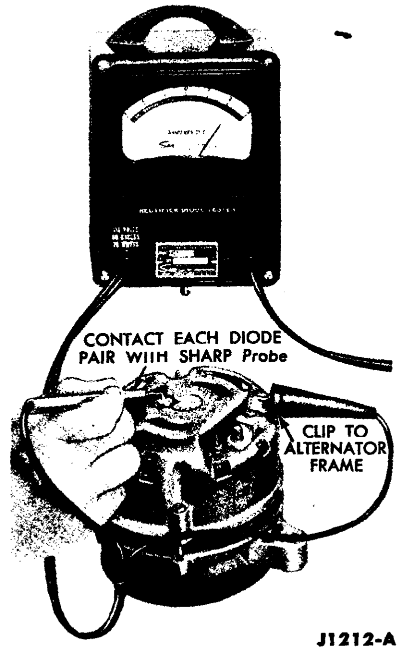

FIG. 6—Negative Diode Test

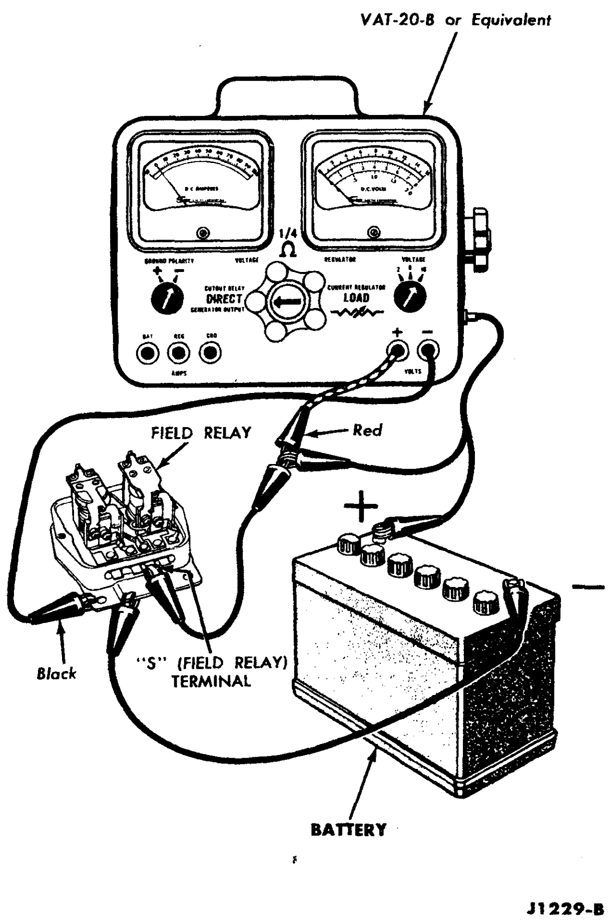

FIG. 7—Field Relay Test

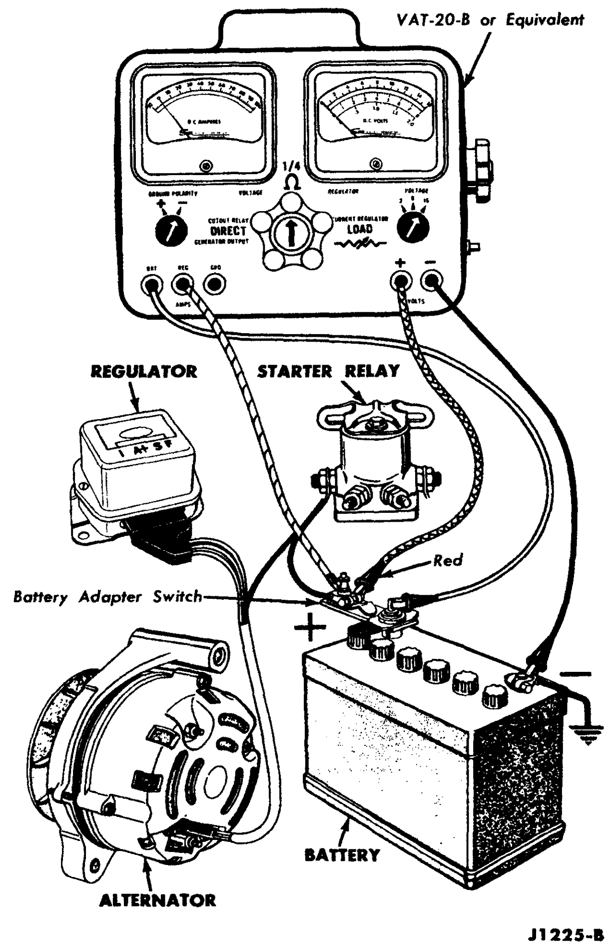

FIG. 8—Voltage Limiter Test

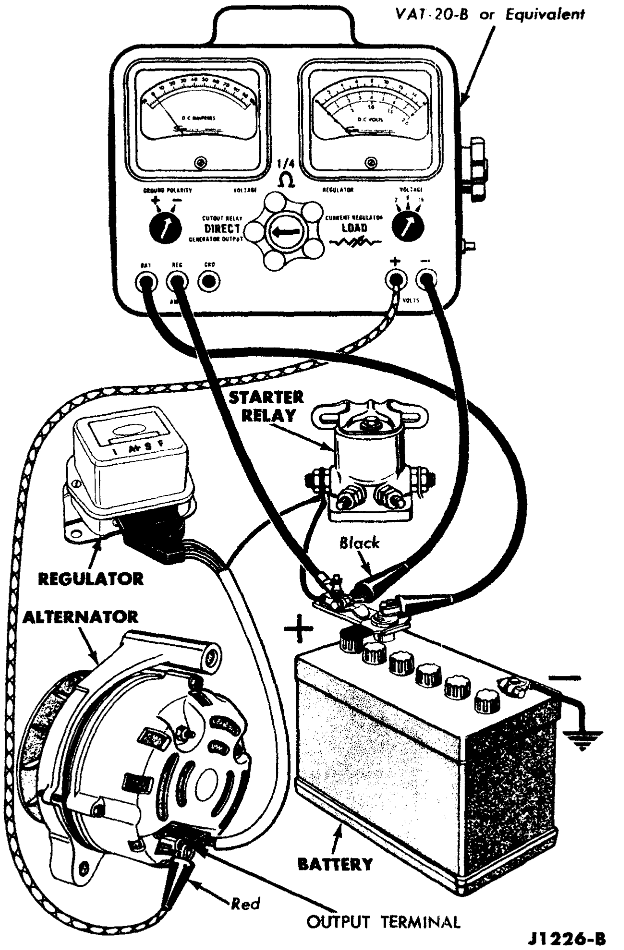

FIG. 9—Voltage Drop Test—Alternator to Battery Positive Terminal

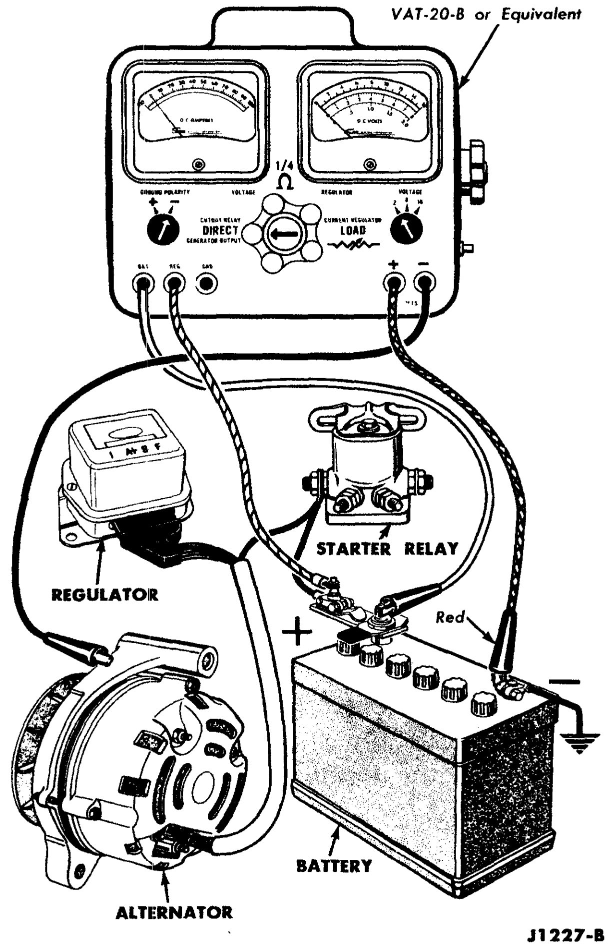

FIG. 10—Voltage Drop Test—Alternator to Battery Ground Terminal

field has a high resistance or is open, or the brushes are not making proper contact with the slip rings. A current flow considerably higher than that specified above, indicates shorted or grounded turns. If the test shows that the field is shorted **and the field brush assembly is not at fault,** the entire rotor must be replaced.

REGULATOR AND CIRCUIT TESTS

The tests presented are outlined for on-the-car operation. Be sure that the regulator is at "normal" operating temperature (equivalent to the temperature after 20 minutes of operation on the car with the hood down).

FIELD RELAY TEST

Disconnect the regulator terminal plug, and remove the regulator cover. Make the connections as shown in Fig. 7. Slowly rotate the field resistance control clockwise from the OPEN position until the field relay contacts close. Observe the voltmeter reading at the moment that the relay closes. This is the relay closing voltage. If the relay closes immediately, even with the field resistance close to the OPEN position, use a 6-volt battery for this test. If the closing voltage is not to specifications, adjust the relay.

VOLTAGE LIMITER TEST

For test purposes, the lower stage (armature vibrating on the lower contact) regulation is used. Voltage limiter calibration tests must be made with the regulator cover in place and the regulator at "normal" operating temperature (equivalent to the temperature after 20 minutes of operation on the car with a 10 ampere load).

Make the test connections as shown in Fig. 8. Turn all accessories off, including door operated dome lights. Close the battery adapter switch, start the engine, then open the adapter switch. Attach the voltage regulation thermometer to the regulator cover. Operate the engine at 2000 rpm for 5 minutes. Turn the master control to the DIRECT position. If the ammeter indicates more than 10 amperes, stop the engine, remove the battery cables and charge the battery.

When the battery is charged, and the voltage regulator has been temperature stabilized, rotate the master control to the ¼-OHM position, the ammeter should indicate approximately 2 amperes.

Cycle the regulator as follows: Stop the engine, close the adapter switch, start the engine, and open the adapter switch. Allow the battery to normalize for a short time, then read the voltmeter. Read the thermometer, and compare the voltmeter reading with the voltage given in Table 1 for the ambient temperature indicated on the thermometer. If the regulated voltage is not within specifications, make a voltage limiter adjustment. After each adjustment, be sure to cycle the regulator before each reading. The readings must be made with the cover in place.

TABLE 1—Voltage Limiter Setting Versus Ambient Air Temperature

Ambient Air Temperature °F	Voltage Regulation Setting (Volts)
50	14.3-15.1
75	14.1-14.9
100	13.9-14.7
125	13.8-14.6
150	13.6-14.4
175	13.5-14.3

CIRCUIT RESISTANCE TESTS

For the purpose of this test, the resistance values of the circuits have been converted to voltage drop readings for a current flow of 20 amperes. If the battery is fully charged disconnect the regulator and run a jumper from the A+ terminal to the F terminal of the cable connector, before making the tests.

Alternator to Battery Positive Terminal. Make the connections as shown in Fig. 9. Turn off all electrical accessories, and lights. Close the battery adapter switch, start the engine, then open the battery adapter switch. Slowly increase the engine speed until the ammeter reads 20 amperes. Note the voltmeter reading at this point. The voltage reading should be no greater than 0.7 volt.

Alternator to Battery Ground Terminal. Make the connections as shown in Fig. 10. Close the battery adapter switch, start the engine and open the adapter switch. Slowly increase the engine speed until the ammeter reads 20 amperes. The voltage indicated on the voltmeter should be less than 0.1 volt.

BATTERY TESTS AND CONCLUSIONS

Tests are made on a battery to determine the state of charge and also the condition. The ultimate result of these tests is to show that the battery is good, needs recharging, or must be replaced.

If a battery has failed, is low in charge, or requires water frequently, good service demands that the reason for this condition be found. It may be necessary to follow trouble shooting procedures to locate the cause of the trouble (Section 1 in this part).

Some battery test equipment combines the necessary instruments and controls in a single unit. Be sure to follow the directions of the manufacturer when using such combined equipment.

Hydrogen and oxygen gases are produced in the course of normal battery operation. This gas mixture can explode if flames or sparks are brought near the vent openings of the battery. The sulphuric acid in the battery electrolyte can cause a serious burn if spilled on the skin or spattered in the eyes. It should be flushed away immediately with large quantities of clear water.

BEFORE CHARGE TESTS

Battery Capacity Test. A high-rate discharge tester in conjunction with a voltmeter is used for this test. **If the battery solution is not within 60° F. to 100° F., let it stand until warm before making this test.** Add water if necessary to bring the battery solution to the proper lever. **Fill only to the narrow ring near the bottom of each vent well.** Fig. 11 shows the battery capacity test in outline form.

1. Connect the high-rate discharge tester and the appropriate voltmeter to the battery terminals.
2. Adjust the discharge tester to draw three times the ampere hour rating of the battery (an 80-ampere hour battery should be tested at a 240-ampere load). After 15 seconds and with the battery still under load, read the battery terminal voltage. **The voltmeter clips must contact the battery posts and not the high-rate discharge tester clips. Unless this is done the actual battery terminal voltage will not be indicated.**
3. If the terminal voltage is 9.6 volts or more, the battery has good output capacity and will accept a normal charge. Test the specific gravity if water has not been recently added, and recharge if necessary.
4. If the terminal voltage is below 9.6 volts, make a test charge on the battery.

Battery Test Charge. The condition of a discharged battery may be tested by passing current through it.

1. Connect a fast charger to the battery and charge the battery for 3 minutes at a rate of 30 amperes.
2. After 3 minutes of fast charge, and with the fast charger still operating, test the individual cell voltages of the battery.
3. If the cell voltages vary more than 0.1 volt, replace the battery. If

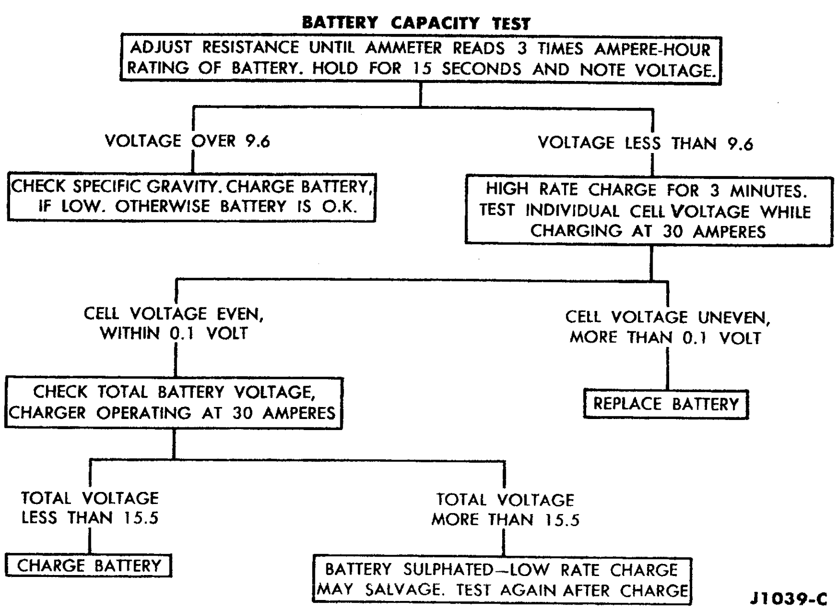

FIG. 11—Battery Capacity Test Outline

the cell voltages are even within 0.1 volt, test the total battery voltage (charger still operating).

4. If the total battery voltage is now under 15.5 volts, the battery is satisfactory and may be safely fast charged (see Specifications in this group). **Always follow the fast charge with sufficient slow charge to bring the battery to a full charge.**

5. If the total battery voltage is over 15.5 volts, the battery is probably sulphated. Place the battery on continued slow charge.

AFTER CHARGE TESTS

When the battery is fully charged (check with a hydrometer or battery charge tester) make a capacity test. If the terminal voltage is 9.6 volts or above, place the battery back in service. If the terminal voltage is below 9.6 volts, replace the battery.

Battery charge tests. Battery charge may be tested by measuring the battery electrolyte solution specific gravity (hydrometer) or by measuring the voltage of the battery cells on open circuit (no current flow) with a battery charge tester (open circuit voltage tester).

A discharged 12-volt battery can freeze during cold weather. The Specifications (in this group), show the temperatures at which batteries of various specific gravities will begin to freeze.

BATTERY CHARGING

A battery that is not sulphated may be charged by either a fast charging or slow charging method. Most fast charge units may be adjusted for making a slow charge.

Fast charging. Follow the instructions of the fast charger manufacturer, as fast chargers vary slightly with different manufacturers.

Test the battery cells for specific gravity. Then, fast charge the battery at 30 to 40 amperes maximum for the length of time shown in the Specifications (in this group), corresponding to the specific gravity condition of the battery.

Slow charging. Always follow a fast charge with a slow charge at 3 amperes for 12-volt batteries of less than 70-ampere-hour capacity. Batteries of 70-ampere-hour capacity or higher require a 4-ampere slow charge. Continue the slow charge until the battery is fully charged. A battery is considered fully charged when the specific gravity readings of all the cells, taken at hourly intervals, do not increase over a 3-hour period.

2 COMMON ADJUSTMENTS AND REPAIRS

BELT ADJUSTMENT

1. Loosen the alternator mounting bolt and the adjusting arm bolts.

2. Apply pressure on the alternator front housing only and tighten the adjusting arm to alternator bolt.

3. Check the belt tension using tool T63L-8620-A. Adjust the belt for specified tension.

4. Tighten all mounting bolts.

3 CLEANING AND INSPECTION

ALTERNATOR

1. The rotor, stator, and bearings must not be cleaned with solvent. Wipe these parts off with a clean cloth.

2. Rotate the front bearing on the drive shaft. Check for any scraping noise, looseness or roughness that will indicate that the bearing is excessively worn. As the bearing is being rotated, look for any lubricant leakage. If any of these conditions exist, replace the bearing.

3. Place the rear end bearing on the slip-ring end of the shaft and rotate the bearing on the shaft. Make the same check for noise, looseness or roughness as was made for the front bearing. Inspect the rollers and cage for damage. Replace the bearing if these conditions exist, or if the lubricant is lost or contaminated.

4. Check both the front and rear housings for cracks. Check the front housing for stripped threads in the mounting ear. Replace defective housings.

5. A pulley is not suitable for reuse if more than ¼ of the shaft length will enter the pulley bore with light pressure. Replace any pulley that is bent out of shape.

6. Check all wire leads on both the stator and rotor assemblies for loose soldered connections, and for burned insulation. Resolder poor connections. Replace parts that show burned insulation.

7. Check the slip rings for nicks and surface roughness. Nicks and scratches may be removed by turning down the slip rings. Do not go beyond the minimum diameter limit of 1.22 inches.

If the slip rings are badly damaged, the entire rotor will have to be replaced, as they are serviced as a complete assembly.

8. Replace any parts that are burned or cracked. Replace brushes and brush springs that are not to specification.

PART 13-2 ALTERNATOR

1 DESCRIPTION AND OPERATION

The charging system is a negative (—) ground system, and consists of an alternator, a regulator, a storage battery and associated wiring.

An alternator with an integral pulley and cooling-fan assembly is belt driven from the engine. The alternator mounting is shown in Fig. 1.

The mechanical construction of the alternator differs from a generator in that the field rotates, and the generating windings are stationary. Energy is supplied from the system to the rotating field through two brushes to two slip rings. The slip rings are mounted on the rotor shaft (Fig. 2).

The alternator produces power in the form of alternating current. The alternating current is rectified to direct current by six diodes (Fig. 2) for use in charging the battery and supplying power to the electrical system.

2 IN-CAR ADJUSTMENT AND REPAIR

BELT ADJUSTMENT

1. Loosen the alternator mounting bolt and the adjusting arm bolts.

2. Apply pressure on the alternator front housing only and tighten the adjusting arm to alternator bolt.

3. Check the belt tension using tool T63L-8620-A. Adjust the belt for specified tension.

4. Tighten all mounting bolts.

3 REMOVAL AND INSTALLATION

REMOVAL

1. Disconnect the battery ground cable.

2. Remove the shield (Fig. 1).

3. Loosen the alternator mounting bolts and remove the adjustment arm to alternator bolt.

4. Disengage the alternator belt. Remove the alternator mounting bolt, disconnect the alternator cable and remove the alternator.

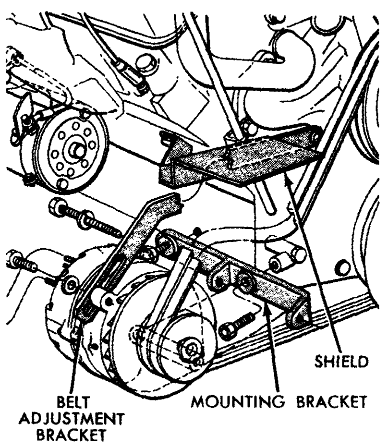

FIG. 1—Alternator Mounting

INSTALLATION

1. Attach the alternator wiring harness plug. Position the alternator to the engine, and install the alternator mounting bolt finger-tight (Fig. 1).

2. Install the adjustment arm to alternator bolt.

3. Adjust the belt tension using tool T63L-8620-A. Apply pressure on the alternator front housing only. Tighten the adjusting arm bolts and the mounting bolt.

4. Position the shield over the adjusting arm and install the attaching bolts.

5. Connect the battery ground cable.

4 MAJOR REPAIR OPERATIONS

DISASSEMBLY

1. Mark both end housings with a scribe mark for assembly. Reach through a ventilation slot, raise both brushes off the slip rings, and install a short length of ⅛-inch rod or stiff wire through the hole in the brush end housing, to hold the brushes off the slip rings (Fig. 3).

2. Remove the three housing through bolts.

3. Separate the drive end housing and rotor from the stator and brush end housing. Make certain that the brushes do not contact the greasy rotor shaft.

4. Remove the nuts from the rectifier to brush end housing mounting studs, and remove the brush end housing. Remove the two spacer sleeves from the rectifier plate studs.

5. If replacement is necessary, press the bearing from the brush end housing (Fig. 4).

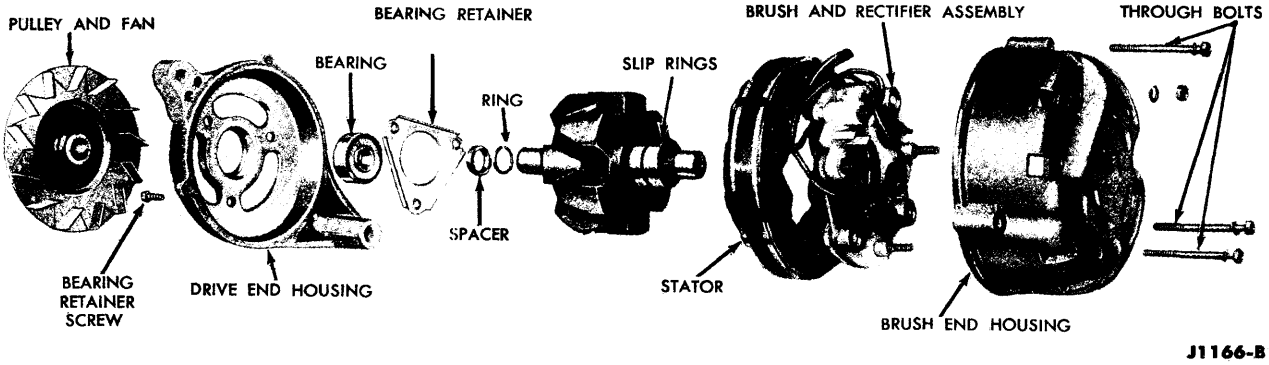

FIG. 2—Disassembled Alternator

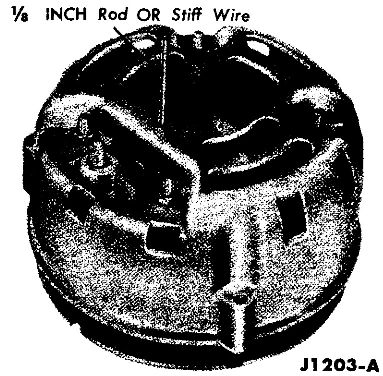

FIG. 3—Retracting Alternator Brushes

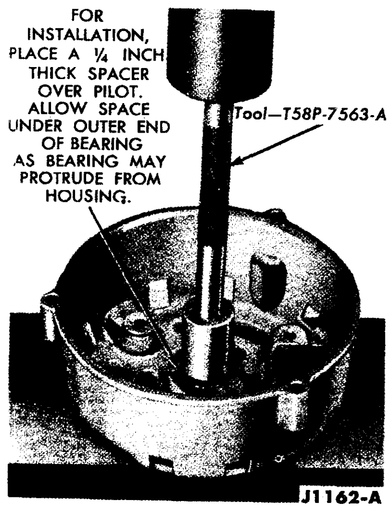

FIG. 4—Rear Bearing Replacement

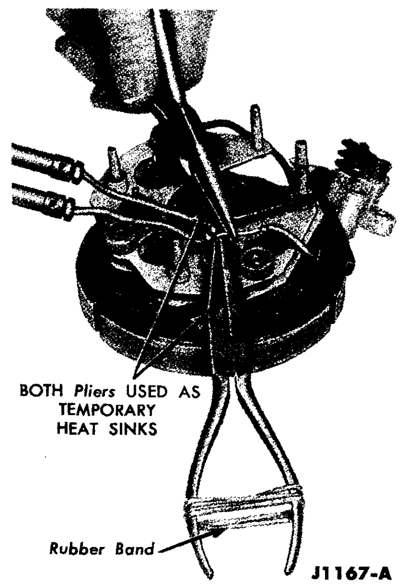

FIG. 5—Soldering Diode Leads

6. Remove the terminal spacer from the studs and unsolder the neutral wire from the spacer block neutral terminal.

7. If the brushes are being replaced, straighten the field brush terminal blade locking tabs, with a pair of pliers, and remove the terminal blade from the terminal spacer block. Remove the brushes and holders from the assembly.

8. If either diode plate is being replaced, carefully unsolder the leads from the diodes (Fig. 5). Use only a 100-watt soldering iron. Leave the soldering iron in contact with the diode terminals only long enough to remove the wires. Both pliers are used as temporary heat sinks in order to protect the diodes. **Excess heat can damage a good diode.**

9. Remove the three insulated diode plate screws and the insulators, and separate the diode plates.

10. Remove the drive pulley (Fig. 6).

11. Remove the three screws that hold the drive end bearing retainer, and remove the drive end housing.

12. If the bearing is being replaced, pull the bearing using a bearing puller (Fig. 7). Remove the bearing retainer and spacer. It will not be necessary to remove the stop-ring, unless it has been damaged.

PARTS REPAIR OR REPLACEMENT

Nicks and scratches may be removed from the rotor slip rings by turning down the slip rings. Do not go beyond the minimum diameter limit of 1.22 inches. If the slip rings are badly damaged, the entire rotor must be replaced as it is serviced as an assembly. All other assemblies are to be replaced rather than repaired.

ASSEMBLY

1. If the stop-ring on the drive shaft was damaged, install a new stop-ring. Push the new ring on the

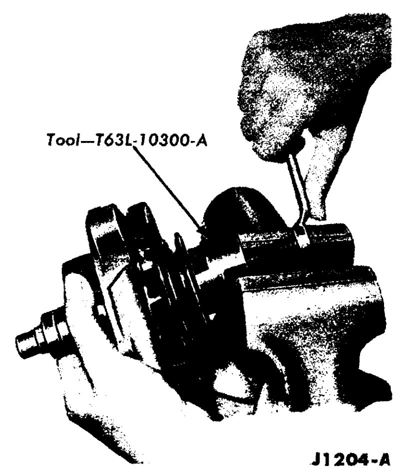

FIG. 6—Pulley Removal

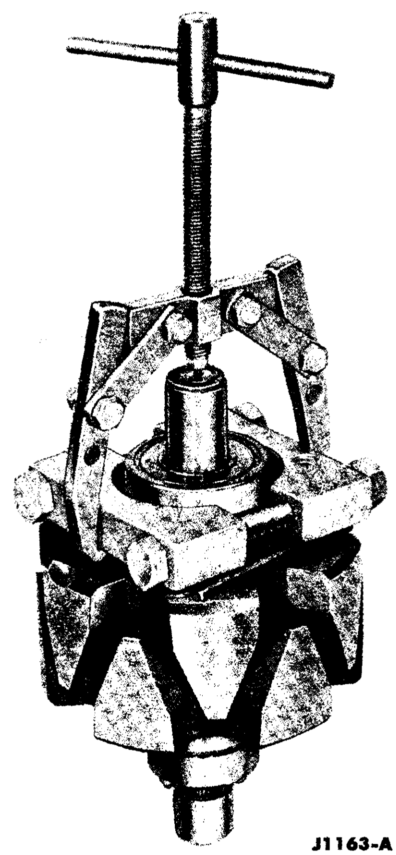

FIG. 7—Front Bearing Removal

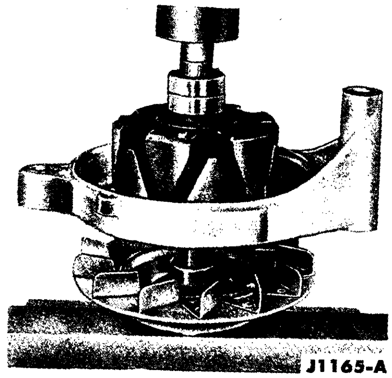

FIG. 8—Pulley Installation

that the open end of the bearing is flush with the inner surface of the housing boss (Fig. 4). Allow space under the outer end of the bearing during installation.

12. Place the rectifier plate and stator assembly in the brush end housing and mount the rectifier plates to the housing.

13. Retract the brushes and insert a short length of ⅛-inch rod or stiff wire through the hole in the brush end housing to hold the brushes in the retracted position (Fig. 10).

14. Wipe clean the brush end bearing surface of the rotor shaft.

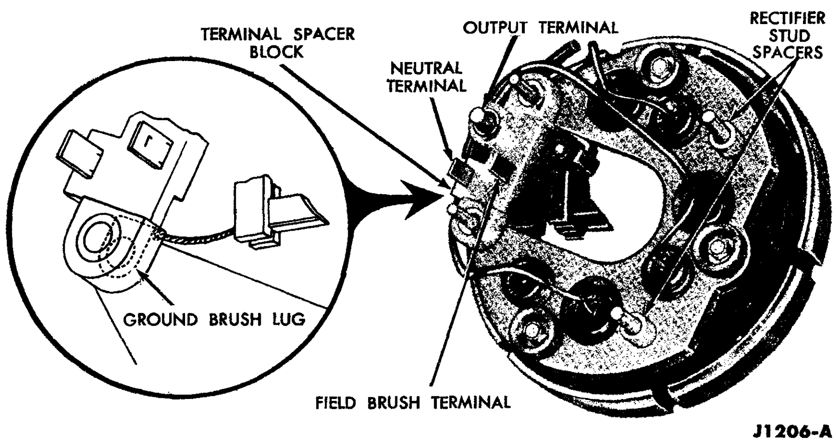

FIG. 9—Stator, Heat Sink, and Terminal Spacer Block Assembly

shaft and into the groove. **Do not open the ring with snap-ring pliers.**

2. Position the drive end bearing spacer on the drive shaft against the stop-ring, and position the bearing retainer on the shaft with the flat surface of the retainer outward.

3. Putting pressure on the inner race only, press the new bearing onto the shaft until it contacts the spacer.

4. Place the drive end housing over the shaft, with the bearing positioned in the front housing cavity. Install the bearing retainer mounting screws.

5. Press the pulley onto the shaft until the hub just touches the inner race of the front bearing (Fig. 8). **A new pulley must be installed if more than ¼ of the shaft length will enter the old pulley bore with light pressure.**

6. If a new diode plate is being installed, mount the two plates together so that they are insulated from each other (insulating spacer between the plates and cupped insulator under the screw head) as shown in Fig. 9. Do not tighten the screws at this time. Place a ¼-inch thick wood spacer between the stator coils and the rectifier plate, to obtain proper lead wire position. Solder the wire leads to the diodes as shown in Fig. 5 in order to avoid excessive heat to the diode. Use only a 100-watt iron.

7. Insert the new field brush terminal blade into the slot in the terminal spacer block, with the brush pigtail extending toward the brush holder pivots (Fig. 9).

8. Install the brush holders and brush spring on the terminal spacer block, then position the brushes in the brush holders (Fig. 9).

9. Solder the neutral wire to the neutral terminal. Position the terminal spacer block assembly on the rectifier plate mounting studs, with the ground brush lug over the mounting stud farthest from the output terminal as shown in Fig. 9. Tighten the diode plate assembly screws.

10. Place the spacers on the rectifier mounting studs farthest from the terminal block (Fig. 9).

11. Install the brush end bearing so

15. Position the brush end housing and stator assembly over the rotor and align the scribe marks made during disassembly. Seat the machined portion of the stator core into the step in the front and rear housings. Install the housing through bolts. Remove the brush retracting rod.

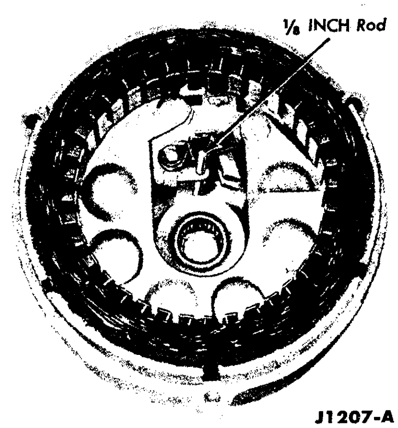

FIG. 10—Brushes Retracted for Assembly

PART 13-3 REGULATOR

1 DESCRIPTION AND OPERATION

The alternator regulator is composed of two control units, a field relay and a voltage limiter, mounted as an assembly (Fig. 1). Because the reverse current through the rectifier is small, a reverse current cutout relay is not needed. The alternator is self current limiting, thus a current limiter is not needed.

FIELD RELAY

The field relay serves to connect the battery and alternator output to the field circuit when the engine is running (Fig. 1, Part 13-1). When the ignition switch is closed, the field relay is energized. Closing of the relay contacts, connects the battery and alternator output to the field through the voltage limiter contacts.

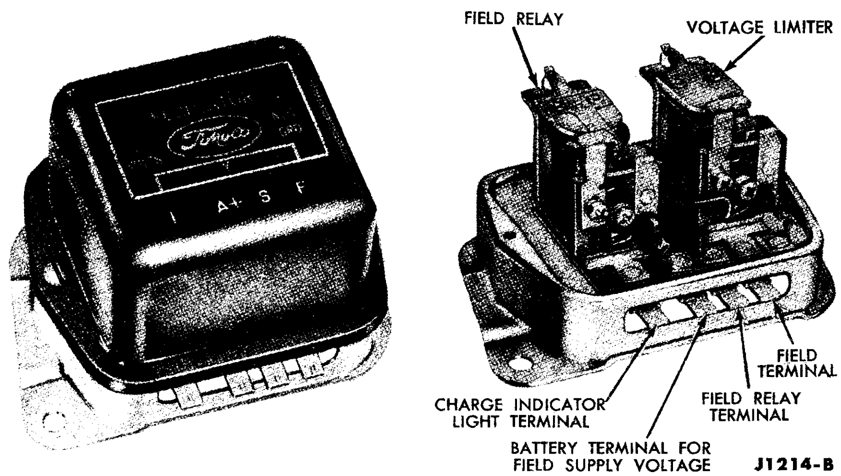

FIG. 1—Alternator Regulator

VOLTAGE LIMITER

The temperature compensated voltage limiter is a double contact unit. Limiting is accomplished by controlling the amount of current supplied to the rotating field.

When the upper contacts are closed (Fig. 1, Part 13-1), full system voltage is applied to the field and maximum field current will flow. When the limiter armature floats between the contacts, field current is reduced by flowing through the field resistor. When the limiter lower contacts are closed, zero current flows to the field. At low engine speed and with a load applied, the armature vibrates on the upper contact. At high engine speed and light or no load, the armature vibrates on the lower contact.

A 50-ohm resistor is connected from the field terminal to ground to absorb electrical surges in the alternator circuits as the voltage limiter armature vibrates on the contacts.

2 IN-CAR ADJUSTMENT AND REPAIR

REGULATOR ADJUSTMENTS

Erratic operation of the regulator, indicated by erratic movement of the voltmeter during a voltage limiter test, may be caused by dirty or pitted regulator contacts. Use a very fine abrasive paper such as silicon carbide, 400 grade, to clean the field relay and the voltage limiter contacts. Wear off the sharp edges of the abrasive by rubbing it against another piece of abrasive paper. Fold the abrasive paper over and pull the paper through the contacts to clean them. Keep all oil or grease from contacting the points. Do not use compressed air to clean the regulator. When adjusting the gap spacing use only hospital clean feeler gauges.

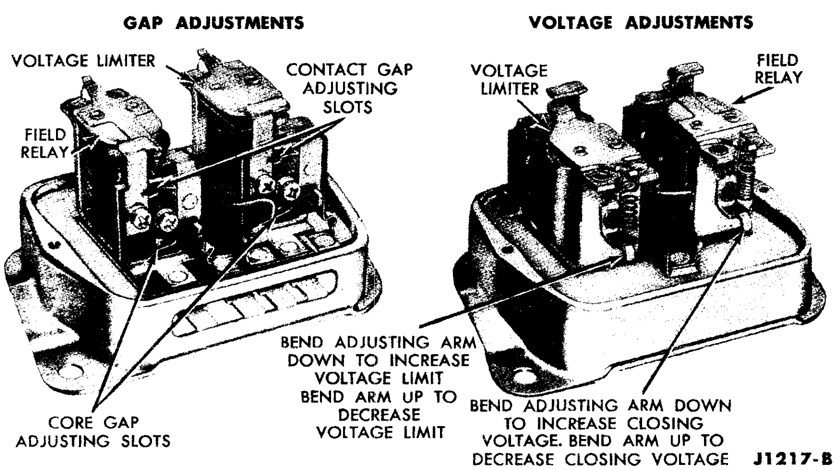

FIG. 2—Regulator Adjustments

REGULATOR GAP ADJUSTMENTS

The difference between the upper stage and lower stage regulation (0.3 volt), is determined by the voltage limiter point and core gaps. Make the gap adjustments with the regulator removed from the car.

Adjust the point gap first. Loosen the left side screw ¼ turn. Use a screwdriver blade in the adjustment slot above the lock screw. Adjust the upper contact until there is 0.010 to 0.015-inch gap between the lower contacts. Tighten the lock screw and recheck the contact gap.

Adjust the core gap with the upper contacts closed. Loosen the center lock screw ¼ turn. Use a screwdriver blade in the adjustment slot under the lock screw. Adjust the core gap for 0.045 to 0.052-inch clearance between the armature and the core at the edge of the core closest to the contact points. Tighten the lock screw and recheck the core gap.

REGULATOR VOLTAGE ADJUSTMENTS

Final adjustment of the regulator must be made with the regulator at normal operating temperature.

The field relay closing voltage is adjusted by bending the spring arm (Fig. 2). To increase the closing voltage, bend the spring arm down. To decrease the closing voltage, bend the spring arm up.

The voltage limit is adjusted by bending the voltage limiter spring arm (Fig. 2). To increase the voltage setting, bend the adjusting arm downward. To decrease the voltage setting, bend the adjusting arm upward.

Before setting the voltage and before making a final voltage test, the alternator speed must be reduced to zero and the ignition switch opened momentarily, to cycle the regulator.

3 REMOVAL AND INSTALLATION

1. Remove the battery ground cable.
2. Remove the regulator mounting screws.
3. Remove the cable disconnect from the regulator.
4. Attach the cable disconnect to the new regulator.
5. Mount the regulator to the radiator left air deflector. The bottom mounting screw mounts through the radio condenser bracket, the ground wire lug, an external tooth lock washer, then the regulator base.
6. Connect the battery ground cable, and test the system for proper voltage regulation.

PART 13-4 SPECIFICATIONS

ALTERNATOR

Vendor	Amperes (@ 15V)	Watts (@ 15V)	Field Current (Amps. @ 12V 75°F.)	Cut-In Speed (Alternator rpm)*	Rated Output Speed (Alternator rpm)*	Belt Width (Inches)	Belt Tension (Pounds)†	Brushes			
								Number Used	Original Length (Inches)	Wear Limit (Inches)	Spring Tension (Ounces)
Ford	40	600	2.9-3.1	950	6500 Hot 3700 Cold	⅜	80-110	2	⅝	⅜	7 to 12
Ford	42	630	2.9-3.1	850	6500 Hot 3500 Cold	⅜	80-110	2	⅝	⅜	7 to 12

*To find the equivalent engine rpm, divide the alternator pulley diameter by the crankshaft pulley diameter and then multiply by the alternator rpm.
†Used Belt. New Belt 110-140. A used belt is one that has been in operation for more than 10 minutes.
Minimum slip-ring turn-down diameter 1.22 inches.

REGULATOR

Vendor	Current Rating	Voltage Regulation	Voltage Limiter		Field Relay		
			Contact Gap (Inches)	Air Gap (Inches)	Contact Gap (Inches)	Air Gap (Inches)	Closing Volts @ 75° F
Ford	Used with both 40- and 42-ampere alternators	14.1 to 14.7	0.010 to 0.015	0.045 to 0.052	0.015 to 0.022	0.022 to 0.030	3-4

*Field Relay Closing Volts 3-4.

BATTERY

Filler Cap Color	Number of Plates	Ampere Hours
Black	78	80

BATTERY FREEZING TEMPERATURES

Specific Gravity	Freezing Temp.
1.280	−90° F
1.250	−62° F
1.200	−16° F
1.150	+ 5° F
1.110	+19° F

VOLTAGE REGULATION SETTING

Ambient Temperature °F.	Standard Ford Alternator Regulator
25	14.4-15.0
50	14.3-14.9
75	14.1-14.7
100	13.9-14.5
125	13.8-14.4
150	13.6-14.2
175	13.5-14.1

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STARTING SYSTEM GROUP 14

PART 14-1 GENERAL STARTING SYSTEM SERVICE

1 DIAGNOSIS AND TESTING

If the engine cranks but will not start, the trouble is in the engine (fuel, or ignition system) and not in the starting system. If the engine will not crank even with a booster battery connected, engine parts may be seized or the starter may be faulty. If the engine cranks but cannot be started with a booster battery connected, attempt to start it by pushing the car. If it will not start, push or tow the car to the shop for a complete diagnosis.

Do not push or tow the car for more than 12 miles, without raising the rear wheels off the ground, or disconnecting the driveshaft.

STARTER TROUBLE DIAGNOSIS GUIDE

ENGINE WILL NOT CRANK AND STARTER RELAY DOES NOT CLICK	1. The battery may be discharged. 2. The ignition switch, starter neutral switch or starter relay may be inoperative. 3. The circuit may be open or contain high resistance. **CHECK BATTERY** Perform a Battery Capacity Test (Group 13, Part 1, Page 6). If the battery does not test as having good capacity, make a Battery Test Charge (Group 13, Part 1, Page 6). Replace the battery if the test indicates that it is worn out or under capacity. **CHECK STARTER RELAY** 1. Disconnect and ground the high tension lead from the spark coil so that the engine cannot start. On cars with a transistor ignition, also disconnect the brown wire from the starter relay I terminal. Place the transmission lever in the N or P position. 2. With a fully charged battery, operate the starter switch to crank the engine. If the engine will not crank and the relay does not click, connect a jumper lead from the battery terminal of the relay to the starter switch terminal of the relay (Fig. 1, connection 1). If the engine does not crank, the starter relay is probably defective. 3. If the engine cranks in step 2, remove the quick disconnect from the starter neutral switch which is located on the steering column under the instrument panel. Connect a jumper wire between the quick disconnect terminals that are connected to the two red-blue stripe wires. Operate the starter switch to crank the engine. 4. If the engine cranks in Step 3,

CONTINUED ON NEXT PAGE

STARTER TROUBLE DIAGNOSIS GUIDE (Continued)

ENGINE WILL NOT CRANK AND STARTER RELAY DOES NOT CLICK (Continued)	the starter neutral switch is defective or out of adjustment. 5. If the engine does not crank in Step 3, there are three possible defects: The wire from the battery terminal of the ignition switch to the battery terminal of the starter relay is loose or broken. The ignition switch starter terminal is defective. The wire from the starter switch to the automatic transmission neutral switch or from the neutral switch to the starter relay is loose or broken.
ENGINE WILL NOT CRANK BUT STARTER RELAY CLICKS	If the relay clicks when the ignition switch is operated, connect a heavy jumper from the relay battery terminal to the relay starter motor terminal (Fig. 2, connection 2). If the engine cranks, replace the relay. If the engine does not crank, observe the spark when connecting and disconnecting the jumper. If there is a heavy spark, see Check Engine and Starter Drive below. If the spark is weak or if there is no spark at all, proceed as follows: **CHECK CABLES AND CONNECTIONS** If the spark at the relay is weak when the jumper is connected, inspect the battery starter cables for corrosion and broken conductors. Check the ground cable to see if it is broken or badly corroded. Inspect all cable connections. Clean and tighten them if necessary. Replace any broken or frayed cables. If the engine still will not crank, the trouble is in the starter, and it must be repaired or replaced. **CHECK ENGINE AND STARTER DRIVE** If a heavy spark is obtained when the jumper wire is connected, loosen the starter mounting bolts to free the starter pinion. If the starter drive is locked, remove the starter from the engine, and examine the starter drive pinion for burred or worn teeth. Examine the teeth on the flywheel ring gear for burrs and wear. Replace the pinion or the flywheel ring gear if they are worn or damaged. If the starter drive is not locked, remove the starter from the engine, and perform the no-load current test. The starter should run freely. If the current reading at no-load speed is below specifications, the starter has high resistance and should be repaired. If the current reading is above normal, and the starter is running slower than it should at no-load, it is probably due to tight or defective bearings, a bent shaft, or the armature rubbing the field poles. A shorted coil in the starter also causes the current reading to be high. Disassemble the starter and determine the cause. Repair it if possible, or replace the starter. If the no-load current reading of the starter is normal, install the starter and remove all the spark plugs, and attempt to crank the engine with the starter. If the engine cranks with the spark plugs removed, water has probably leaked into the cylinders causing a hydrostatic lock. The cylinder heads must be removed, and the cause of internal coolant leakage eliminated. If the engine will still not crank, the engine is seized and cannot be turned by the starter. Disassemble the engine and repair or replace the defective parts.
STARTER SPINS BUT DOES NOT CRANK THE ENGINE	If the starter spins but will not crank the engine, the starter drive is worn or dirty and is sticking on the starter shaft, or is broken. Clean or repair the starter drive as required.
ENGINE CRANKS SLOWLY	Several causes may result in this symptom: 1. The battery may be low in charge. 2. There may be excessive resistance in the starter circuit. 3. The starter may be faulty. 4. The engine may have excessive friction. **CHECK BATTERY** Test the state of charge of the battery. If the battery is discharged, re-

CONTINUED ON NEXT PAGE

STARTER TROUBLE DIAGNOSIS GUIDE (Continued)

ENGINE CRANKS SLOWLY (Continued)

charge the battery, and check the starter relay for possible internal shorts to ground that may have caused the battery to discharge. Perform a Battery Capacity Test (Group 13, Part 1, Page 6). If the battery does not test as having good capacity, make a Battery Test Charge (Group 13, Part 1, Page 6).

Replace the battery if the test indicates it to be worn out or under capacity.

CHECK EXTERNAL CIRCUIT VOLTAGE DROP

If the battery was fully charged in the previous test, test the starter cranking circuit voltage drop. The voltage drop will be either excessive or normal.

VOLTAGE DROP (RESISTANCE) EXCESSIVE

Locate the exact part of the circuit with the excessive resistance.

To correct excessive resistance in the battery to starter relay cable, starter relay to starter cable or battery to ground cable, clean and tighten the cable connections. Recheck the voltage drop. If it is still excessive, replace the cables.

To correct excessive resistance of the starter relay contacts, replace the starter relay.

VOLTAGE DROP (RESISTANCE) NORMAL

If the voltage drop (resistance) is normal, make a starter load test. If the starter current is below specifications, proceed as follows:

Cranking Current Low. Remove the starter from the engine, and repair or replace it.

Cranking Current Normal or High. Test the starter current draw at no-load. If the no-load current draw is above or below specifications, repair or replace the starter.

If the current draw at no-load is normal, the starter is not at fault. The engine has excessive friction, and the cause must be determined. Repair or replace faulty parts.

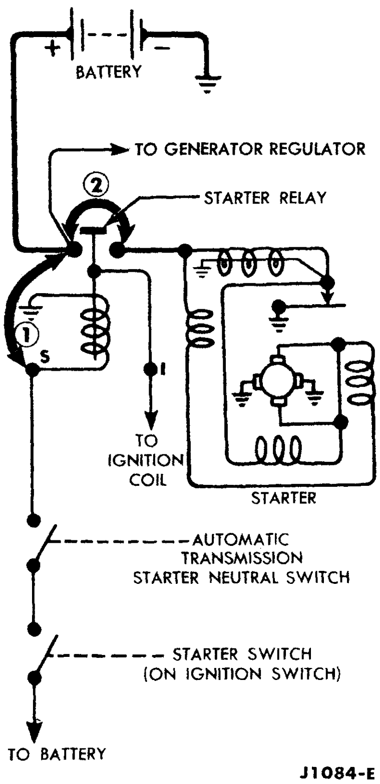

FIG. 1—Starting Control Circuit Test

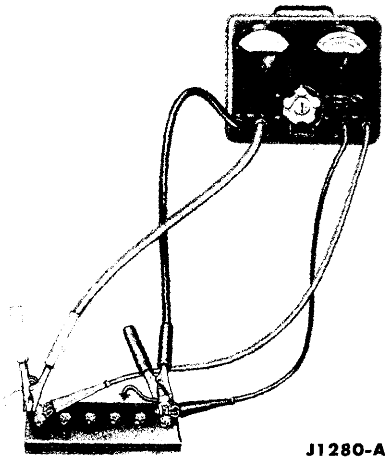

FIG. 2—Starter Load Test

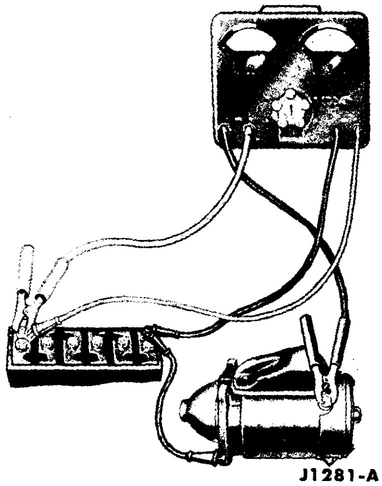

FIG. 3—Starter No-Load Test

STARTER LOAD TEST

Connect the test equipment as shown in Fig. 2. Be sure that no current is flowing through the ammeter and heavy-duty carbon pile rheostat portion of the circuit (rheostat at maximum resistance).

Crank the engine with the ignition OFF, and determine the exact reading on the voltmeter. This test is accomplished by disconnecting and grounding the high tension lead from the spark coil, and by connecting a jumper from the battery terminal of the starter relay to the ignition switch terminal of the relay.

Stop cranking the engine, and reduce the resistance of the carbon pile until the voltmeter indicates the same reading as that obtained while the starter cranked the engine. The ammeter will indicate the starter current draw under load. This reading should

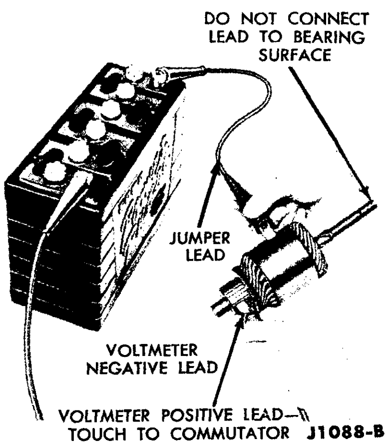

FIG. 4—Armature Grounded Circuit Test

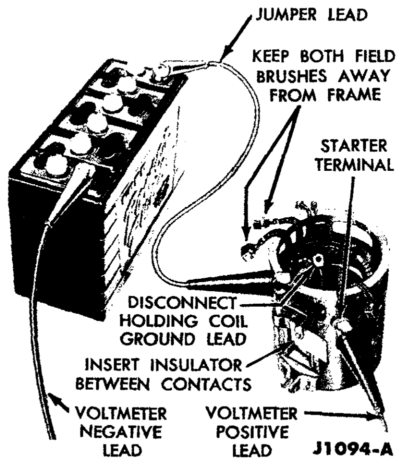

FIG. 5—Field Grounded Circuit Test

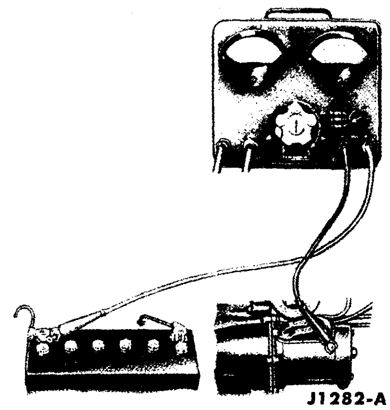

FIG. 6—Starter Cranking Circuit Test

be 250 amperes maximum with the engine at normal operating temperature.

STARTER NO-LOAD TEST

The starter no-load test will uncover such faults as open or shorted windings, rubbing armature, and bent armature shaft. The starter can be tested, at no-load, on the test bench only.

Make the test connections as shown in Fig. 3. The starter will run at no-load, and the current draw indicated on the ammeter should be 70 amperes maximum at 12 volts. **It is advisable to use an ammeter with a maximum scale reading of 500 amperes for this test, as the current necessary to operate the movable pole shoe is considerably higher than the steady state no-load current draw.**

ARMATURE OPEN CIRCUIT TEST—ON TEST BENCH

An open circuit armature may sometimes be detected by examining the commutator for evidence of burning. The spot burned on the commutator is caused by an arc formed every time the commutator segment connected to the open-circuit winding passes under a brush.

ARMATURE AND FIELD GROUNDED CIRCUIT TEST—ON TEST BENCH

This test will determine if the winding insulation has failed, permitting a conductor to touch the frame or armature core.

To determine if the armature windings are grounded, make the connections as shown in Fig. 4. If the voltmeter indicates any voltage, the windings are grounded.

Grounded field windings can be detected by making the connections as shown in Fig. 5. If the voltmeter indicates any voltage, the field windings are grounded.

STARTER CRANKING CIRCUIT TEST

Excessive resistance in the starter circuit can be determined from the results of this test. Make the test connections as shown in Fig. 6. Crank the engine with the ignition OFF. This is accomplished by disconnecting and grounding the high tension lead from the spark coil and by connecting a jumper from the battery terminal of the starter relay to the ignition switch terminal of the relay.

The voltage drop in the circuit will be indicated by the voltmeter (0 to 1 volt range). Maximum allowable voltage drop should be:

1. With the voltmeter negative lead connected to the starter terminal and the positive lead connected to the battery positive terminal ...... 0.5 volts.
2. With the voltmeter negative lead connected to the battery terminal of the starter relay and the positive lead connected to the positive terminal of the battery ...... 0.1 volt.
3. With the voltmeter negative lead connected to the starter terminal of the starter relay and the positive lead connected to the positive terminal of the battery ...... 0.3 volt.
4. With the voltmeter negative lead connected to the negative terminal of the battery and the positive lead connected to the engine ground ...... 0.1 volt.

2 COMMON ADJUSTMENTS AND REPAIRS

STARTER DRIVE REPLACEMENT

The starter drive is shown in Fig. 7.

1. Loosen and remove the brush cover band and the starter drive actuating lever cover.
2. Loosen the through bolts enough to allow removal of the drive gear housing and the starter drive actuating lever return spring.
3. Remove the pivot pin retaining the starter drive actuating lever and remove the lever.
4. Remove the drive gear stop ring retainer and stop ring from the end of the armature shaft and remove the drive gear assembly.
5. Apply a thin coating of Lubriplate 777 on the armature shaft splines. Install the drive gear assembly on the armature shaft and install a new stop ring.
6. Position the starter gear actuating lever on the starter frame and install the retaining pivot pin. **Be sure that the actuating lever properly**

engages the starter drive assembly.

7. Install a new retaining clip retainer. Position the starter drive actuating return spring and drive gear housing to the starter frame, and then tighten the through bolts to specification.

8. Position the starter drive actuating lever cover and brush cover band with gasket on the starter. Tighten the brush cover band retaining screw.

BRUSH REPLACEMENT

Replace the starter brushes when they are worn to half size. Always install a complete set of new brushes.

1. Loosen and remove the brush cover band and starter drive actuating lever cover. Remove the brushes from their holders.

2. Remove the two through bolts from the starter frame.

3. Remove the drive gear housing, and the actuating lever return spring.

4. Remove the starter drive actuating lever pivot retaining pin and lever, and remove the armature.

5. Remove the brush end plate.

6. Remove the ground brush retaining screws from the frame and remove the brushes (cut the ground brush nearest the starter terminal from the brush terminal block, as close to the lead terminal as possible).

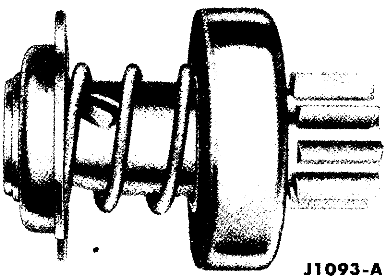

FIG. 7—Starter Drive

7. Unsolder (or cut) the insulated brush leads from the field coils, as close to the field connection point as possible.

8. Clean and inspect the starter motor.

9. Replace the brush end plate if the insulator between the field holder brush and the end plate is cracked or broken.

10. Solder the new field brushes to the field coils using rosin core solder (Fig. 5). Use a 300-watt iron.

11. Install the ground brush leads to the frame with the retaining screws.

12. Clean the commutator with #00 or #000 sandpaper.

13. Position the brush end plate to the starter frame, with the end plate boss in the frame slot.

14. Position the fiber washer on the commutator end of the armature shaft and install the armature in the starter frame.

15. Install the starter drive gear actuating lever to the frame and starter drive assembly, and install the pivot pin.

16. Position the return spring on the actuating lever and the drive gear housing to the starter frame. Install the through bolts and tighten to specified torque. Be sure that the snap ring retainer is seated properly in the drive gear housing.

17. Install the commutator brushes in the brush holders. Center the brush springs on the brushes.

18. Position the actuating lever cover and the brush cover band with gasket on the starter. Tighten the band retaining screw.

19. Check the starter no-load amperage draw.

ARMATURE REPLACEMENT

1. Loosen the brush cover band retaining screw and remove the brush cover band and the starter drive actuating lever cover (Fig. 3). Remove the brushes from their holders.

2. Remove the through bolts, starter drive gear housing, and the starter drive actuating lever return spring.

3. Remove the pivot pin retaining the starter gear actuating lever and remove the lever.

4. Remove the armature. If the starter drive gear assembly is being re-used, remove the stop ring retainer and stop ring from the end of the armature shaft and remove the assembly.

5. Place the starter drive gear assembly on the new armature with a new stop ring.

6. Install the fiber thrust washer on the commutator end of the armature shaft and install the armature.

7. Position the starter gear actuating lever to the frame and drive gear assembly and install the retaining pivot pin.

8. Position the starter drive actuating lever return spring, starter drive gear housing, and brush plate to the starter frame, and then install and tighten the through bolts to specification. Be sure that the stop ring retainer is seated properly in the drive gear housing.

9. Place the brushes in their holders, and center the brush springs on the brushes.

10. Position the actuating lever cover and brush cover band, with gasket, and then tighten the retaining screw.

3 CLEANING AND INSPECTION

1. Wipe the field coils, armature, armature shaft, and drive with a clean cloth. Wash all other parts in solvent and dry the parts.

2. Check the field coils for continuity. Check the armature for grounds and open circuits.

3. Check the commutator runout (Fig. 8) and, if necessary, turn down the commutator.

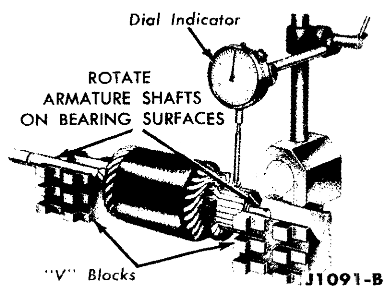

FIG. 8—Commutator Runout Check

4. Inspect the armature shaft and bearings for scoring and excessive wear.

5. Check the brush holders for broken springs and the insulated brush holders for shorts to ground.

6. Check the brush spring tension. It should be 45 ounces minimum. Replace the springs if the tension is not within limits.

PART 14-2 STARTER

1 DESCRIPTION AND OPERATION

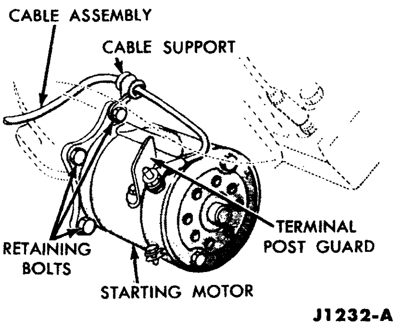

FIG. 1–Starter Mounting

The function of the starting system is to crank the engine at a high enough speed to permit it to start. The system includes the starter motor and drive, the battery, a remote control starter switch, and heavy circuit wiring.

The starter mounting is shown in Fig. 1. Figure 2 shows the starter circuit schematic.

The starter utilizes an integral positive-engagement drive (Fig. 3). When the starter is not in use, one of the field coils is connected directly to ground through a set of contacts (Fig. 2). When the starter is first connected to the battery a large current flows through the grounded field coil, actuating a movable pole shoe. The pole shoe is attached to the starter drive actuating lever and thus the drive is forced into engagement with the flywheel.

When the movable pole shoe is fully seated, it opens the field coil grounding contacts and the starter is then in normal operation. A holding coil is used to maintain the movable pole shoe in the fully seated position, during the time that the starter is turning the engine.

A starter neutral switch, in the starter control circuit, prevents operation of the starter if the selector lever is not in the N (neutral) or P (park) position.

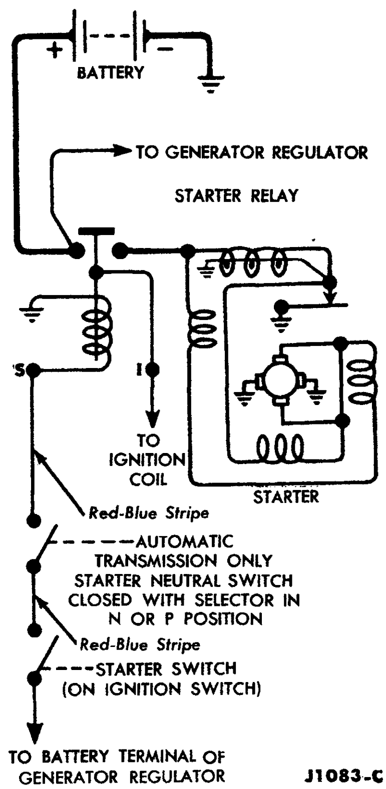

FIG. 2–Starting Circuit Schematic

2 REMOVAL AND INSTALLATION

1. Disconnect the starter cable at the starter terminal, remove the starter mounting bolts, then remove the starter assembly.
2. Position the starter assembly to the flywheel housing, and start the mounting bolts. The cable support bracket is mounted under the starter upper mounting bolt (Fig. 1).
3. Snug all bolts and then tighten to 15 to 20 foot-pounds torque, tightening the middle bolt first. Connect the starter cable.

3 MAJOR REPAIR OPERATIONS

Use the following procedure when it becomes necessary to completely overhaul the starter. Fig. 3 illustrates a partially disassembled starter.

DISASSEMBLY

1. Loosen the brush cover band retaining screw and remove the brush cover band and the starter drive actuating lever cover. Observe the lead dress for assembly and then remove the commutator brushes from the brush holders.
2. Remove the through bolts, starter drive gear housing, and the starter drive actuating lever return spring.
3. Remove the pivot pin retaining the starter gear actuating lever and remove the lever and the armature.
4. Remove the stop ring retainer. Remove and discard the stop ring retaining the starter drive gear to the

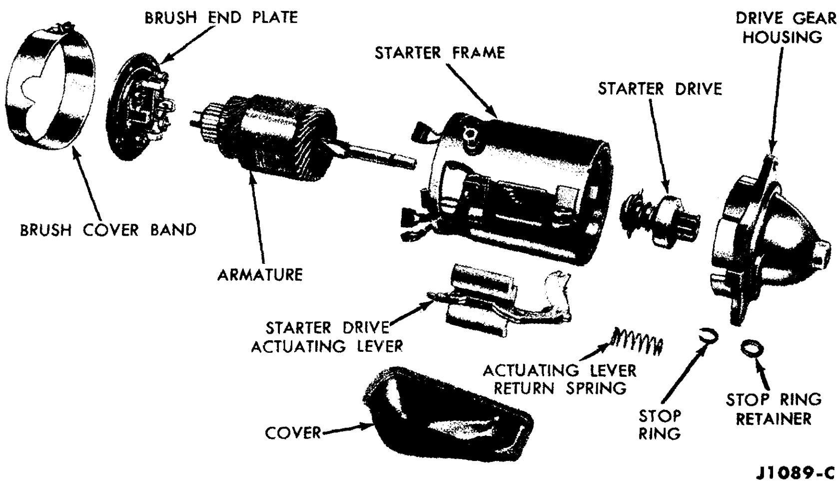

FIG. 3—Disassembled Starter

end of the armature shaft, and remove the starter drive gear assembly.

5. Remove the brush end plate.

6. Remove the two screws retaining the ground brushes to the frame.

7. On the field coil that operates the starter drive gear actuating lever, bend the tab up on the field retainer and remove the field coil retainer.

8. Remove the three coil retaining screws, using tool 10044-A and an arbor press (Fig. 4). The arbor press prevents the wrench from slipping out of the screw. Unsolder the field coil leads from the terminal screw, and remove the pole shoes and coils from the frame. Use a 300-watt iron.

9. Remove the starter terminal nut, washer, insulator and terminal from the starter frame. Remove any excess solder from the terminal slot.

PARTS REPAIR OR REPLACEMENT

Nicks and scratches may be removed from the commutator by turning it down. All other assemblies are to be replaced rather than repaired.

ASSEMBLY

1. Install the starter terminal, insulator, washers, and retaining nut in the frame (Fig. 5). Be sure to position the slot in the screw perpendicular to the frame end surface.

2. Position the coils and pole pieces, with the coil leads in the terminal screw slot, and then install the retaining screws. As the pole shoe screws are tightened, strike the frame several sharp blows with a soft-faced hammer to seat and align the pole shoes, then stake the screws.

3. Install the solenoid coil and retainer and bend the tabs to retain the coils to the frame.

4. Solder the field coils and solenoid wire to the starter terminal using rosin core solder. Use a 300-watt iron.

5. Check for continuity and grounds in the assembled coils.

6. Position the solenoid coil ground terminal over the nearest ground screw hole.

7. Position the ground brushes to the starter frame and install the retaining screws (Fig. 5).

8. Position the starter brush end plate to the frame, with the end plate boss in the frame slot.

9. Apply a thin coating of Lubriplate 777 on the armature shaft splines. Install the starter motor drive gear assembly to the armature shaft and install a new retaining stop ring. Install the stop ring retainer.

10. Position the fiber thrust washer on the commutator end of the armature shaft and position the armature in the starter frame.

11. Position the starter drive gear actuating lever to the frame and starter drive assembly, and install the pivot pin.

12. Position the starter drive actuating lever return spring and the drive gear housing to the frame and install and tighten the through bolts to specification. **Do not pinch the brush leads between the brush plate and the frame.** Be sure that the stop ring retainer is seated properly in the drive gear housing.

13. Install the brushes in the brush holders. **Be sure to center the brush springs on the brushes.**

14. Position the drive gear actuating lever cover on the starter and install the brush cover band with a gasket. Tighten the band retaining screw.

15. Check the starter no-load amperage draw.

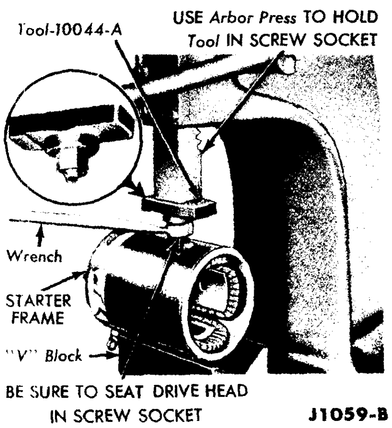

FIG. 4—Pole Shoe Screw Removal

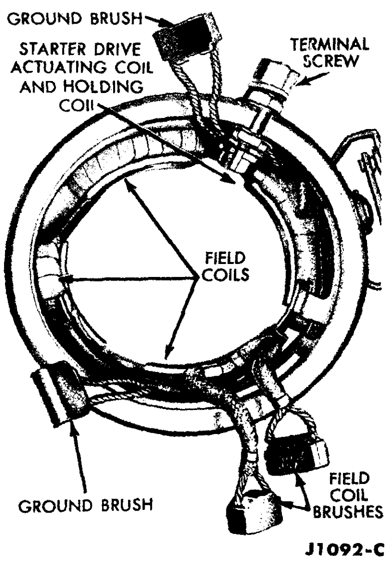

FIG. 5—Field Coil Assembly

PART 14-3 SPECIFICATIONS

STARTERS

Vendor	Current Draw Under Normal Load (Amperes)	Normal Engine Cranking Speed (rpm)	Minimum Stall Torque @ 5 Volts (Foot Pounds)	Maximum Load (Amperes)	No Load (Amperes)	Brushes		
						Mfg. Length (Inches)	Wear Limit (Inches)	Brush Spring Tension (Ounces)
Ford Positive Engagement 4.5 inch Diameter	250	250-290	15.5	670	70	0.5	0.25	40

Maximum Commutator Run-Out in Inches is 0.005.
Maximum starting circuit voltage drop (battery + terminal to starter terminal) @ normal engine temperature, 0.5 volt.

LIGHTING SYSTEM, HORNS, AND INSTRUMENTS

GROUP 15

PART 15-1 GENERAL LIGHTING SYSTEM, HORNS, AND INSTRUMENTS SERVICE

1 DIAGNOSIS AND TESTING

LIGHT TROUBLE DIAGNOSIS GUIDE

ALL HEADLIGHTS DO NOT LIGHT	1. Loose battery cable. 2. Loose quick disconnect or broken wire from the battery to the headlight switch. 3. Defective headlight switch. 4. Disconnected or broken wire from the headlight switch to the beam selector switch. 5. Loose or broken wire to the bulbs. 6. Defective beam selector switch. 7. All headlight bulbs burned out. This may be caused by a defective or improperly adjusted alternator voltage regulator (Group 13).
INDIVIDUAL LIGHTS DO NOT LIGHT	1. Burned out bulb. 2. Loose or broken wires to the bulb. 3. Poor ground.
LIGHTS BURN OUT REPEATEDLY	1. Loose or corroded electrical connections. 2. Excessive vibration. 3. Improperly adjusted or defective alternator voltage regulator (Group 13).

INSTRUMENT TROUBLE DIAGNOSIS GUIDE

FUEL GAUGE ERRATIC OR INOPERATIVE	1. Loose or broken wire from the constant voltage regulator to the fuel gauge. 2. Defective fuel gauge (Part 15-4). 3. Loose, broken, or shorted wire from fuel gauge to the fuel tank sending unit. 4. Defective constant voltage regulator (Part 15-4). 5. Defective fuel tank sending unit. 6. Defective radio suppression choke. 7. Poor ground between fuel tank and body.

CONTINUED ON NEXT PAGE

INSTRUMENT TROUBLE DIAGNOSIS GUIDE (Continued)

TEMPERATURE GAUGE ERRATIC OR INOPERATIVE	1. Loose or broken wire from constant voltage regulator to the temperature gauge. 2. Defective temperature gauge (Part 15-4). 3. Loose or broken wire from the temperature sending unit to the temperature gauge. 4. Defective temperature sending unit. 5. Defective constant voltage regulator (Part 15-4). 6. Defective radio suppression choke.
FUEL, TEMPERATURE, AND OIL PRESSURE GAUGES ERRATIC	1. Loose or corroded constant voltage regulator ground. 2. Defective constant voltage regulator (Part 15-4). 3. Broken or loose wire from or to the constant voltage regulator. 4. Defective ignition switch. 5. Defective radio suppression choke.
OIL PRESSURE INDICATOR GAUGE INOPERATIVE	1. Loose or broken wire from the constant voltage regulator to the oil pressure gauge. 2. Grounded or broken wire from the oil pressure sending unit. 3. Defective oil pressure gauge (Part 15-4). 4. Defective oil pressure sending unit (Part 15-4). 5. Defective radio suppression choke.
CHARGE INDICATOR GAUGE INOPERATIVE	1. Defective charge indicator gauge (Part 15-4). 2. Loose or broken wires. 3. Alternator system malfunction (Group 13).

HORN TROUBLE DIAGNOSIS GUIDE

HORNS DO NOT SOUND	1. Loose connections at horn button contact. 2. Open wire (blue-yellow stripe) from horn relay to horn button. 3. Open wire (yellow) from battery to horn relay. 4. Inoperative relay. 5. Horns defective or out of adjustment. 6. Open wire (yellow-green stripe) from horn relay to high or low-pitch horn.
ONE HORN FAILS TO OPERATE	1. Broken or loose wire to the horn. 2. Horn defective or out of adjustment.
HORNS OPERATE CONTINUOUSLY	1. Shorted wire to horn button (blue-yellow stripe). 2. Shorted relay.

TURN INDICATOR TROUBLE DIAGNOSIS GUIDE

TURN INDICATOR LIGHTS INOPERATIVE	1. Burned out fuse. 2. Loose or broken wire from ignition switch to flasher. 3. Defective flasher. 4. Loose or broken wire from flasher to turn indicator switch. 5. Defective turn indicator switch. 6. Broken, shorted, or loose wires from switch to lights. 7. Burned out bulbs, or loose sockets.
TURN INDICATOR LIGHTS OPERATE INCORRECTLY	1. Loose, broken, or shorted wires from switch to light. 2. Defective indicator switch. 3. Defective flasher. 4. Burned out bulb.
TURN INDICATOR CANCELS IMPROPERLY	1. Cam improperly positioned on steering wheel hub. 2. Coil spring on switch plate assembly loose or weak.

CONTINUED ON NEXT PAGE

WINDSHIELD WIPER TROUBLE DIAGNOSIS GUIDE

If, at any time, the power steering pump is working properly and the windshield wipers are not:

1. Check the control cable from the instrument panel to the wiper motor.
2. Check the wiper for binding.
3. If the control cable is functioning properly, and no binding condition exists, and the windshield wipers are still not functioning properly, replace the wiper motor.

TESTING

HORN TEST

The only test necessary on the horns is for current draw. The current adjustment also adjusts the tone of the horn.

Current Draw Test. Connect a voltmeter and ammeter to the horn and to a voltage supply as shown in Fig. 1. The normal current draw for the horns at 12 volts is 9.0-10.0 amperes.

Always connect the positive battery lead to the horn terminal as shown in Fig. 1. If this is not done, damage may result to the horn.

HEADLIGHT AND BEAM SELECTOR SWITCH TESTS

The following tests may be made to determine whether a headlight switch or a beam selector switch is defective:

Set the headlight switch to the headlight position, and operate the beam selector switch. If none of the headlights turn on when the beam selector switch is operated, yet the instrument panel lights operate, the headlight switch or the red-yellow stripe wire from the headlight switch to the beam selector switch is probably defective. Substitute a known good switch for the suspected switch to determine whether the switch or the wiring is at fault.

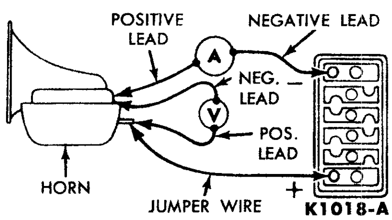

FIG. 1–Horn Current Draw Test

If the headlights operate only with the beam selector switch in one position, the switch or the wiring from the switch to the headlight is defective. Substitute a known good switch for the suspected switch to determine whether the switch or the wiring is at fault.

CONSTANT VOLTAGE REGULATOR TEST

Turn the ignition switch ON. Check for voltage at the gauge feed wire (black with green stripe) at one of the gauges. The voltage should oscillate between zero and about 10 volts. If it does not, the constant voltage regulator is defective, the radio suppression choke is defective, or there is a short to ground between the voltage regulator and the gauges.

If the gauge unit is inaccurate or does not indicate, replace it with a new unit. If the gauge unit still is erratic in its operation, the sending unit or wiring to the sending unit is faulty.

If the fuel gauge, the temperature gauge, and the oil pressure gauge indicate improperly and in the same direction, the constant voltage regulator could be defective, as it supplies the three gauges.

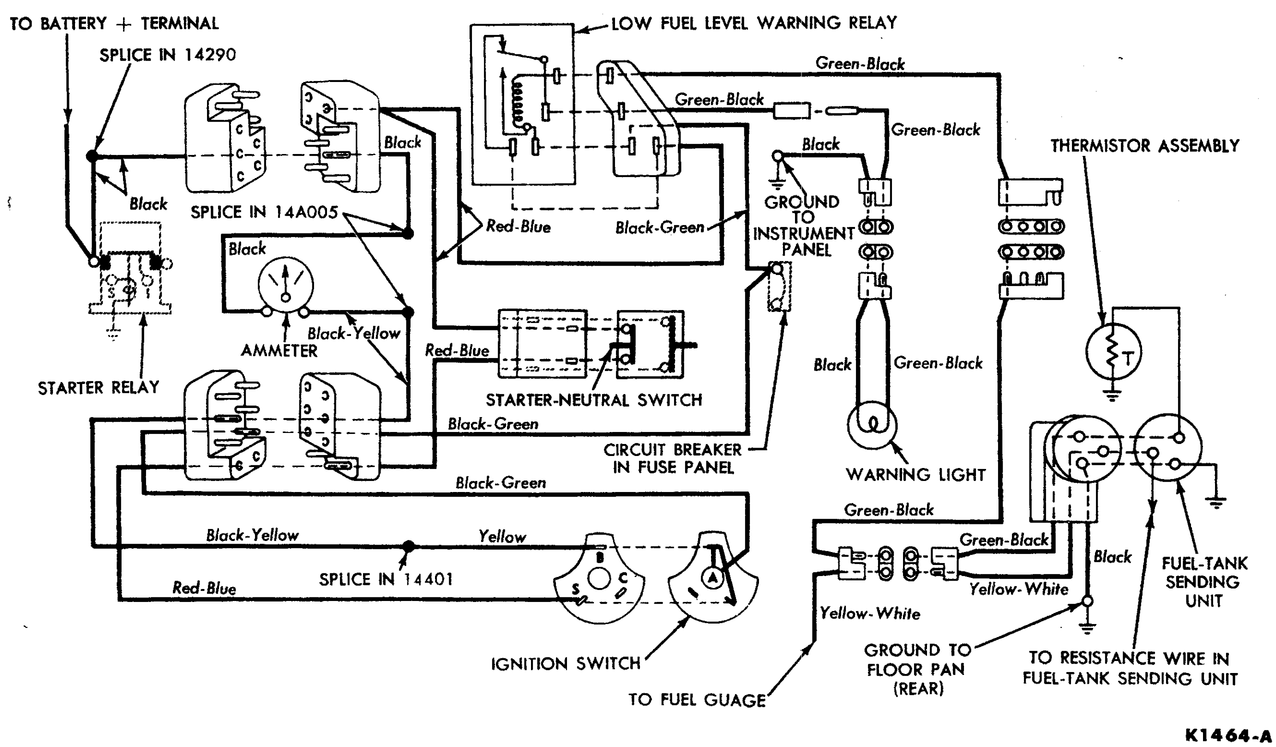

FIG. 2–Low Fuel Level Warning System Schematic

FUEL GAUGE AND FUEL LEVEL SENDING UNIT TEST

Disconnect the wire from the fuel level sending unit and connect it to a known good sending unit. Connect a jumper wire from the sending unit mounting plate to the car frame. Raise the float arm to the upper stop; with the arm in this position, the instrument panel gauge should read full. Lower the float arm to the bottom stop; the gauge should then read empty.

If the gauge reads properly, the sending unit in the gas tank is defective.

If the gauge unit still indicates improperly or is erratic in its operation, the gauge unit or the wiring to the gauge unit is faulty, repair the wire or replace the gauge unit.

LOW FUEL LEVEL WARNING SYSTEM TEST

The low fuel warning system circuit diagram is shown in Fig. 2. The warning light circuit is tested each time the ignition switch is turned to the start position. When the switch is turned from ON to START, the warning light is illuminated. This proves that both the circuit and the light are functioning properly.

In the event of system failure, make the following tests:

1. Check to see that the bulb lights with the ignition switch in the start position.
2. Check for loose connections.
3. Turn the ignition switch to the ACC or ON position. Disconnect the wiring at the fuel level sender assembly and ground the relay thermistor lead (green-black stripe). If the warning light lights, replace the sender assembly. If the warning light does not light, replace the relay. Figure 4, Part 15-4 shows the location of the thermistor terminal with the fuel level sender mounted in the tank.

TEMPERATURE GAUGE TEST

With the ignition switch in the off position, connect the terminals of two, series connected, flashlight cells to the gauge terminals. The three volts should cause the gauge to read approximately full scale.

TEMPERATURE SENDING UNIT TEST

The sending unit can be tested by first making a temperature gauge test to check the accuracy of the gauge. Start the engine and allow it to warm up to normal temperature. If no reading is indicated on the gauge, check the sending unit to gauge wire by removing the wire from the sending unit and momentarily grounding the wire. If the gauge still does not indicate, the wire is defective. Repair or replace the wire. If the gauge now indicates, the sending unit is faulty.

OIL PRESSURE INDICATOR GAUGE TEST

Perform the same test as that described for the temperature gauge. The oil gauge pointer should read approximately full scale.

OIL PRESSURE SENDING UNIT TEST

The sending unit can be tested by making a gauge unit test to determine whether the gauge unit is good. If the gauge unit is good, start the engine to determine if the gauge registers oil pressure. If the reading is obtained, check the sending unit to gauge wire. If the wire is not broken and all connections are tight, replace the sending unit (Fig. 5, Part 15-4).

AMMETER TEST

To test the ammeter, turn the headlights ON with the engine stopped. The meter pointer should move toward the "D" or discharge scale. If no movement of the needle is observed, check the loop on the rear of the meter housing to see if the battery to circuit breaker wire passes inside the loop. If the wire is in the loop, and the meter does not indicate a discharge, the meter is inoperative. **If the meter pointer moves toward the "C" or charge scale when the headlights are turned ON, the wire passes through the loop in the wrong direction or the battery is reversed. Feed the wire through in the opposite direction to correct this condition after checking first to make sure that the battery is not reversed.**

SPEEDOMETER AND ODOMETER TESTS

To test the odometer accuracy, drive the car over a "measured mile." Speedometer accuracy can be checked by comparing the speedometer in question against one known to be accurate, while two cars are moving at the same speed, or by timing the car on a "measured mile."

Specifications, Part 15-5 shows the proper speedometer gears to use for various rear axle and tire size combinations.

2 COMMON ADJUSTMENTS AND REPAIRS

WINDSHIELD WIPER ADJUSTMENT

The control cable is adjusted by means of the control cable adjustment screw (Fig. 7, Part 15-4). Adjust the control cable so that the control lever on the instrument panel moves the valve control lever on the motor from off to full on. An adjustment screw is also provided in the wiper vacuum control line to regulate the length of time the wiper motor will operate after the windshield washer button is released.

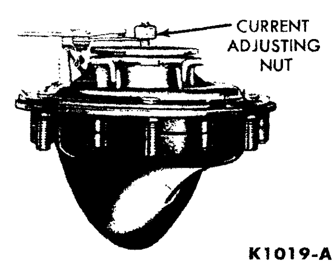

FIG. 3—Horn Adjustment

HORN ADJUSTMENT

Adjustment. Tone and current are adjusted by changing the contact tension (Fig. 3). Connect the horn as shown in Fig. 1. Turn the self locking tone-adjusting nut until the current is within the limits for the horn being adjusted. Replace the cover and recheck the current draw.

PART 15-2 LIGHTING SYSTEM AND HORNS

1 DESCRIPTION AND OPERATION

HEADLIGHTS

Four sealed-beam headlights are used. The two outboard lights have two filaments each for low beam and high beam, and are marked by a numeral "2" molded in the glass lens. Locating tabs molded in the glass allow the mounting of the No. 2 lights in the outboard headlight support frames only. The low beams are used for city driving, when meeting oncoming traffic on the highway, and for No. 2 headlight alignment.

The inboard headlights with a numeral "1" molded in the glass lens have only one filament and are used for highway driving along with the high beams of the No. 2 headlights. Locating tabs molded in the glass allow the mounting of the No. 1 lights in the inboard headlight support frames only. A conventional beam selector switch is located on the floor board near the left.

Quick disconnect terminals are provided at the left and right of the radiator support assembly. The terminals are color coded. Like colored terminals are connected together. The green wire with a black stripe supplies current to the headlight high beams. The red wire with a black stripe supplies the low beam filaments. The black wire with a yellow stripe supplies the parking lights (Fig. 1).

HORNS

The Lincoln is equipped with a pair of tuned horns controlled by a relay. The horn button closes the relay contacts, completing the circuit to the horns. One of the horns has a high-pitched tone; the other has a low-pitched tone. The horn circuit is shown in Figure 1.

2 IN-CAR ADJUSTMENTS AND REPAIRS

HEADLIGHT ALIGNMENT

All headlight adjustments should be made with a half-full fuel tank plus or minus one gallon, with a person seated in the driver's seat, the car unloaded and the trunk empty except for the spare tire and jacking equipment, and recommended pressure in all tires. Before each adjustment, bounce the car by pushing on the center of both the front and rear bumpers, to level the car.

To align the No. 1 headlights (inboard lights) by means of a wall screen, select a level portion of the shop floor. Lay out the floor and wall as shown in Fig. 2.

Establish the headlight horizontal centerline by substracting 20 inches from the actual measured height of the headlight lens center from the floor and adding this dimension (dimension "B," upper diagram Fig. 3) to the 20-inch reference line obtained by sighting over the uprights. Draw a horizontal line two inches below, and parallel to, the headlight horizontal centerline. Then draw the headlight vertical centerlines on the screen as measured on the car (dimension "A," upper diagram Fig. 3).

NO. 1 HEADLIGHT ADJUSTMENT (INNER LIGHTS)

Adjust each No. 1 headlight (inner light) beam as shown in Fig. 3. **Cover the No. 2 lights when making this adjustment.**

NO. 2 HEADLIGHT ADJUSTMENT (OUTER LIGHTS)

To align the No. 2 headlights (outer lights), a different wall chart (lower diagram Fig. 3) is used. Dimension "B" for the No. 2 lights is the same as "B" for the No. 1 lights, dimension "A" is as measured on the car. **Note that the line of adjustment of the No. 2 lights is the horizontal centerline of the No. 2 lights.** Turn the headlights to low beam and adjust each No. 2 light as shown in Fig. 3.

Each headlight is adjusted by means of two screws located under the headlight trim ring as shown in Fig. 4. Always bring each beam into final position by turning the adjusting screws clockwise so that the headlights will be held against the tension springs when the operation is completed.

Some states may not approve of the 2-inch dimension for the No. 1 headlights. Check the applicable state law, as a 3-inch dimension may be required.

3 REMOVAL AND INSTALLATION

HEADLIGHTS

1. Remove the retaining screws and headlight trim ring.
2. Loosen the retaining ring screws (Fig. 4), rotate the retaining ring counterclockwise, and remove it.
3. The headlight bulb may now be pulled forward far enough to disconnect the wiring assembly plug.
4. Plug in the new bulb, and place it in position, making sure that the locating tabs are placed in the positioning slots.
5. Install the headlight bulb re-

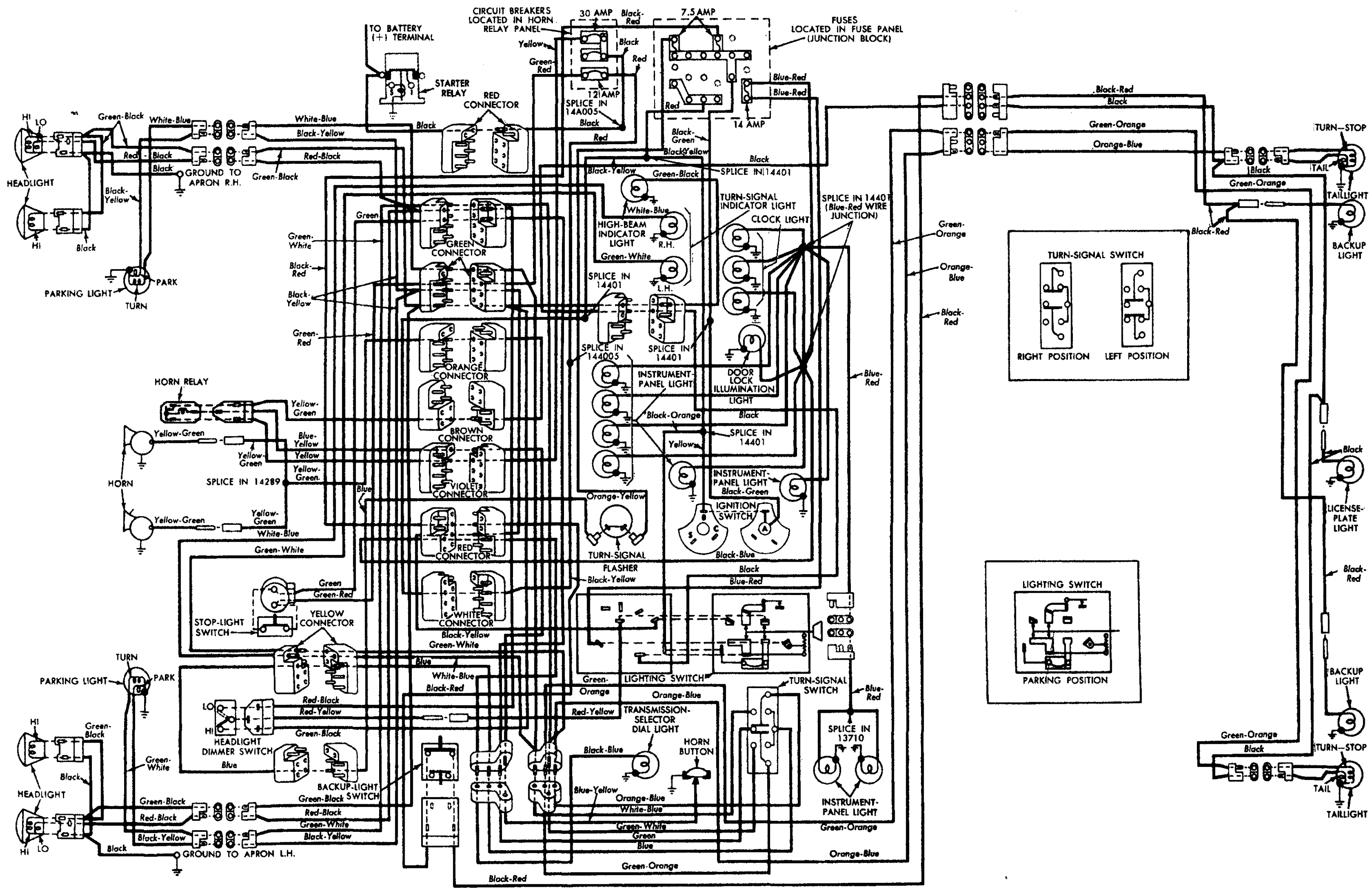

FIG. 1—Exterior Lighting, Turn Signals, Horns and Backup Lights

K1457-A

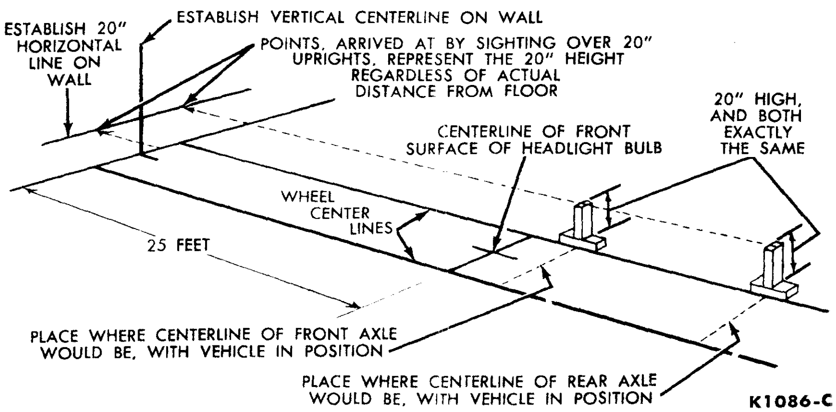

FIG. 2—Floor and Wall Layout

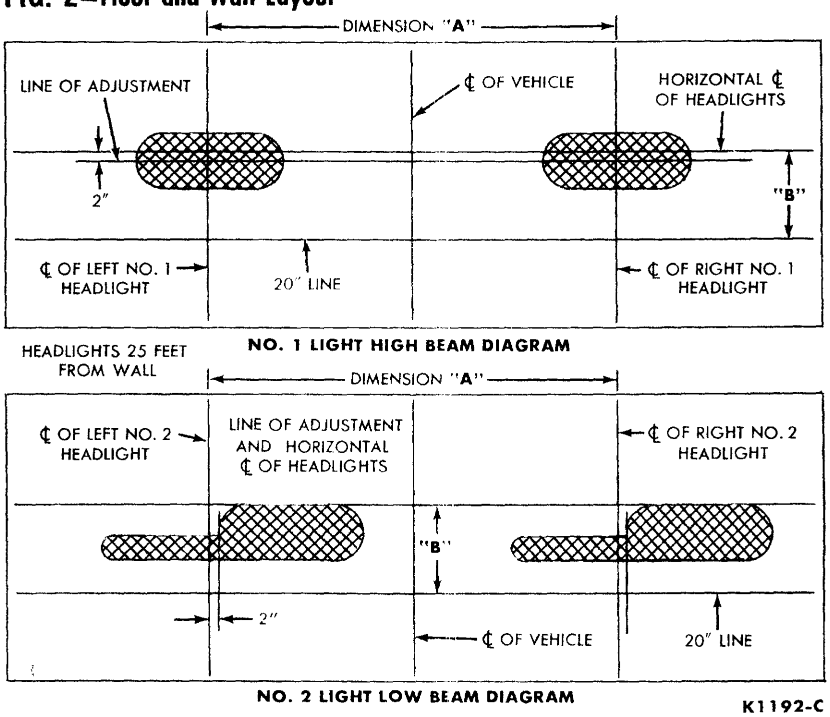

FIG. 3—Headlight Wall Screens

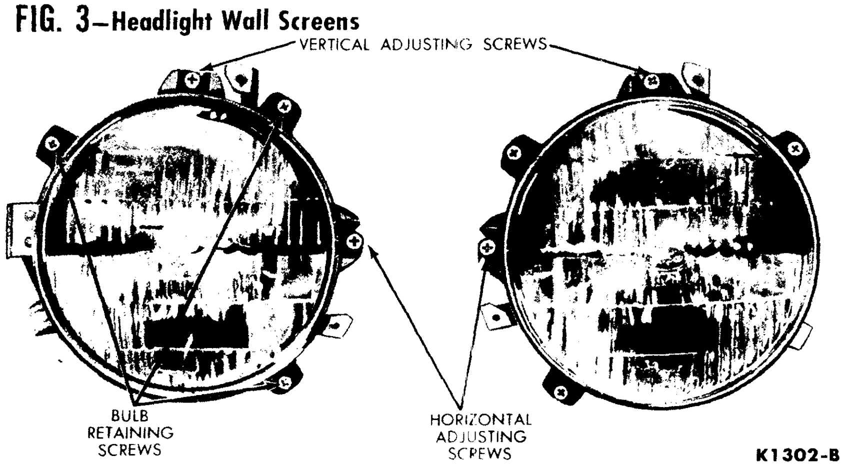

FIG. 4—Headlight Adjustment

taining ring, rotating it clockwise under the screws, and tighten the screws.

6. Place the trim ring into position, and install the retaining screws.

PARKING LIGHT

To replace the bulb in the parking light, remove the retaining screws, lens, and bulb (Fig. 5). After the bulb is replaced, install the lens and retaining screws.

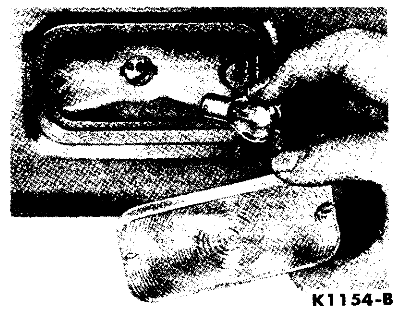

FIG. 5—Parking Light

TAIL AND STOP LIGHT

To replace the bulb, pull the luggage compartment rear liner board away from the light body and remove the bulb.

BACK-UP LIGHTS

To replace the bulb, remove the two lens retaining screws and remove the lens.

LICENSE PLATE LIGHT

The license plate light is shown disassembled in Fig. 6.

1. Disconnect the light wire from the bullet connector.
2. Remove the license plate.
3. Remove the two light bracket retaining screws and remove the light assembly.
4. Remove two lens retaining screws and remove the light shield,

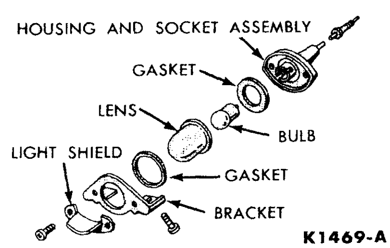

FIG. 6—Disassembled License Plate Light

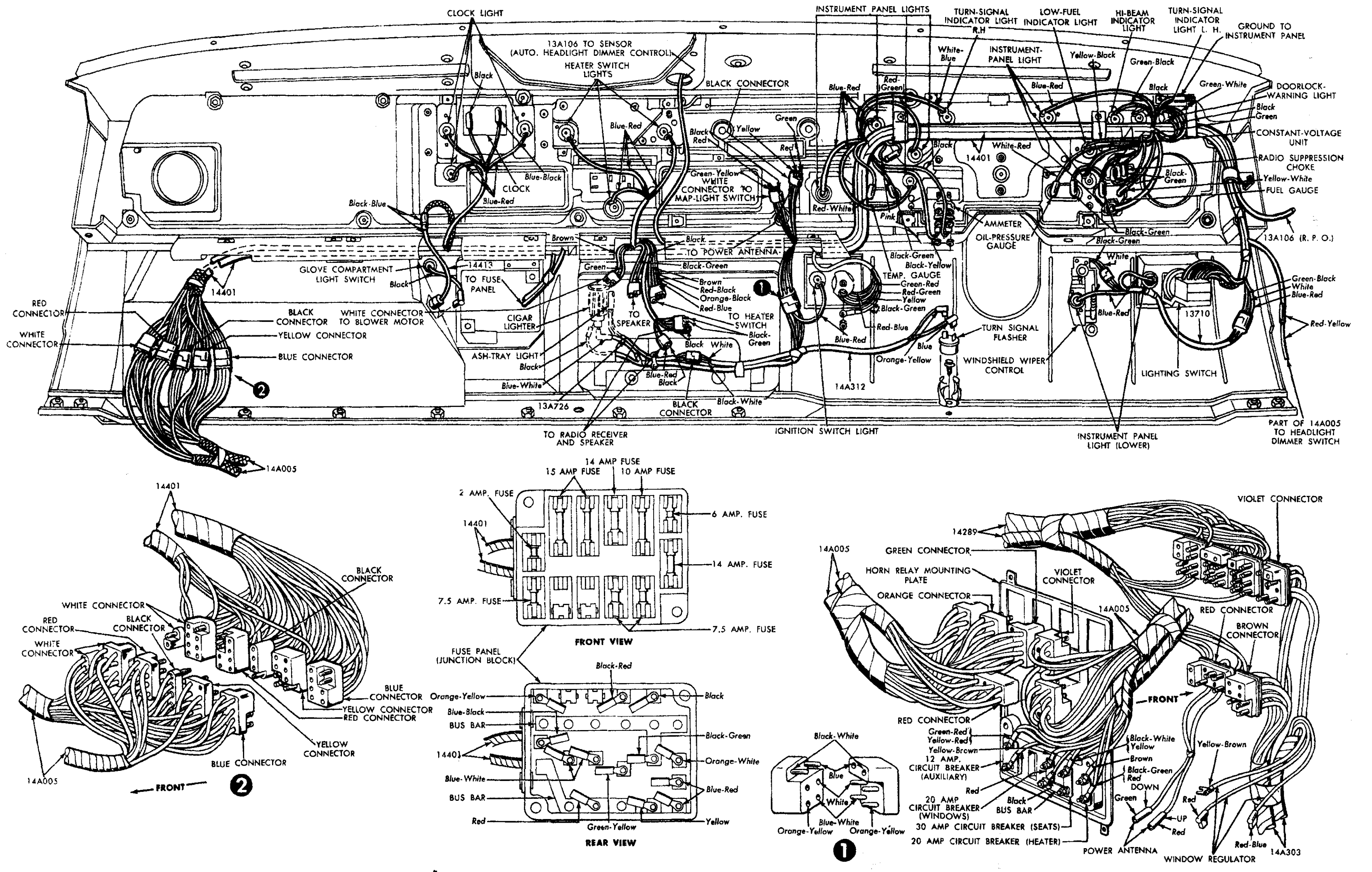

FIG. 7—Instrument Panel Lights and Wiring

K1455-A

lens and socket from the bracket.

5. Remove the bulb from the socket.

INSTRUMENT LIGHTS

The instrument panel lights and wiring are shown in Fig. 7.

1. Disconnect the battery.
2. Remove the radio control knobs and remove the radio control lock nuts and washers.
3. Remove the knobs from the heater and air conditioner controls and the heater and air conditioner blower switch.
4. Remove the 10 screws retaining the center instrument panel bezel and remove the bezel.
5. Replace the light bulb.
6. Position the center instrument panel bezel and install the 10 retaining screws.
7. Install the knobs on the heater and air conditioner controls and the heater and air conditioner blower switch.
8. Install the washers and lock nuts in the radio control parts.
9. Install the radio control knobs.
10. Connect the battery.

ASH TRAY LIGHTS

Ash tray lights are provided with the ash trays on the instrument panel and in the rear compartment. To replace the bulb, remove the ash tray.

GLOVE COMPARTMENT LIGHT

The glove compartment light is located in the upper left corner of the glove box. To replace the bulb, remove the two retaining screws and remove the bulb-type lens.

MAP LIGHT

The map light is shown in Fig. 8. To replace the bulb, remove the two lens retaining screws and remove the lens.

COURTESY LIGHTS

Courtesy lights are located on the right and left rear quarter trim panel. Remove the bezel from the trim panel to replace the bulb.

LUGGAGE COMPARTMENT LIGHT

1. Remove the screw retaining the bracket and light assembly to the rear deck lid. Remove the bracket and light assembly and the lock washer.
2. Replace the bulb.
3. Position the lock washer between the bracket and the rear deck lid and install the bracket and light assembly with the retaining screw.

LOW FUEL WARNING LIGHT

1. Remove the lower instrument panel.
2. Remove the fuel gauge, but do not remove the gauge from the dual gauge mounting plate.
3. Remove the light bulb from the instrument panel at the fuel gauge mounting area.
4. Install the new light bulb in the instrument panel.
5. Install the fuel gauge.
6. Install the lower instrument panel.

IGNITION SWITCH LIGHT

1. Disconnect the battery.
2. Turn the ignition key to the accessory position. Slightly depress the pin shown in Fig. 5, Part 15-3, turn the key counterclockwise and pull the key and lock cylinder out of the switch assembly.
3. Press in on the rear of the switch to depress the spring and rotate the swtich 1/8 turn counterclockwise (as viewed from the terminal end). Remove the switch from the lower instrument panel.
4. Remove the light and bracket assembly from the underside of the instrument panel for accessibility.
5. Replace the light bulb.
6. Position the switch to the light and bracket assembly.
7. Place the switch in the switch opening, press the switch toward the instrument panel, and rotate the switch 1/8 turn to lock it in position.
8. Turn the key in the lock cylinder to the accessory position. Place the lock and key in the ignition switch, depress the pin slightly (Fig. 5, Part 15-3), and turn the key counterclockwise. Push the lock cylinder into the switch. Turn the key to check the lock cylinder operation.
9. Connect the battery.

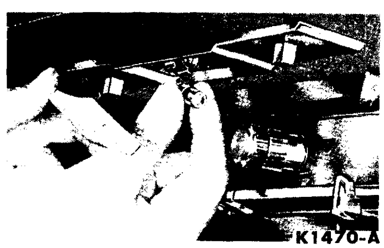

FIG. 8—Map Light

HORNS

The horns are mounted to the right front fender apron in the engine compartment. Disconnect the horn wire from the terminal. Remove the horn bracket to fender apron retaining screws and remove the horns.

To install, place the horns in position and install the retaining screws. Install the horn wire.

HORN RING

1. Disconnect the battery.
2. Remove the center steering wheel cover.
3. Remove the two retaining screws in the center of the steering wheel and the one screw retaining the three horn wires.
4. Remove the three screws under the steering wheel which retain the horn ring and remove the horn ring.
5. Position the horn ring and install the three retaining screws under the steering wheel.
6. Install the two retaining screws in the center of the steering wheel, and the one screw retaining the three horn wires.
7. Install the center steering wheel cover.
8. Connect the battery.

HORN RELAY

The horn relay is mounted on the right-hand cowl side panel.

1. Disconnect the battery ground cable from the battery.
2. Remove the six bolts retaining the stone shield to the right front fender and remove the stone shield.
3. Disconnect the wire connector from the relay.
4. Remove the three screws holding the relay mounting bracket and pull out the bracket and relay.
5. Remove the nut and bolt retaining the horn relay to the mounting bracket and remove the relay.
6. Position the relay to the mounting bracket and install the bolt and nut.
7. Position the relay and bracket assembly and install the three retaining screws.
8. Connect the wire connector to the relay.
9. Position the stone shield under the fender and install the six retaining bolts.
10. Connect the battery and check the operation of the horn.

PART 15-3 SWITCHES, CIRCUIT BREAKERS AND FUSES

1 DESCRIPTION AND OPERATION

HEADLIGHT SWITCH

A combination headlight switch, courtesy light switch and circuit breaker is used (Fig. 1). The circuit breaker protects the headlight circuit.

FUSES

The fuse panel is mounted in the left side of the glove compartment. It is accessible by removing the cover plate. The panel contains the following fuses: Instrument lights, speed control, clock, interior lights, cigar lighter, radio, turn signal, electrically operated antenna, and back-up lights. Fuse values and locations are shown in Fig. 2.

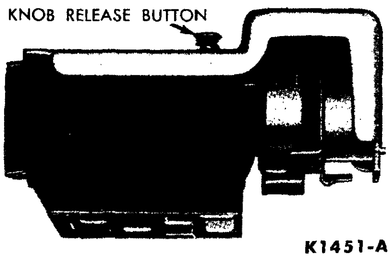

FIG. 1–Headlight Switch

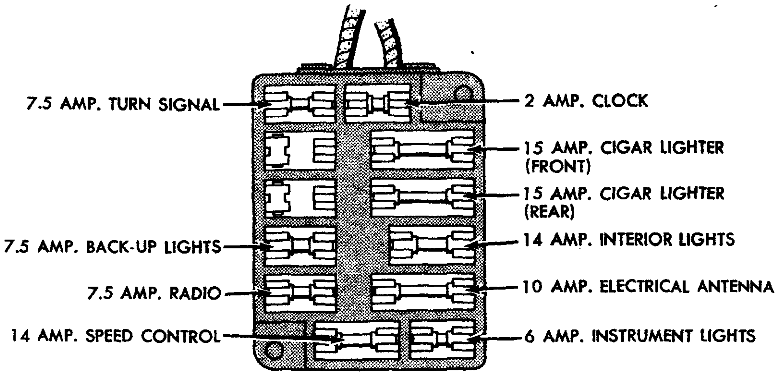

FIG. 2–Fuse Panel

2 REMOVAL AND INSTALLATION

Before removing any switch, disconnect the battery ground cable from the battery.

HEADLIGHT SWITCH

1. Remove the control knob and shaft by pressing the knob release button on the switch housing.
2. Remove the bezel screw from the switch and remove the switch from the lower instrument panel.
3. Disconnect the electrical connector from the rear of the switch and remove the switch.
4. Connect the electrical connector to the switch.
5. Position the switch in the lower instrument panel and secure with the bezel screw.
6. Install the control knob and shaft by inserting it all the way into the switch until a distinct click is heard. In some cases, it may be necessary to rotate the shaft until it engages.

HEADLIGHT BEAM SELECTOR SWITCH

Lay the floor mat back from the area of the switch and remove the mounting screws (Fig. 3). Disconnect the wire terminal block from the switch.

To install, connect the terminal block to the switch and install the switch to the floor. Replace the floor mat.

STOP LIGHT SWITCH

Disconnect the wires from the bullet connectors and unscrew the switch from the brake master cylinder (Fig. 4).

IGNITION SWITCH AND LOCK CYLINDER

1. Disconnect the negative cable from the battery.
2. Turn the ignition key to the accessory position. Slightly depress the pin shown in Fig. 5, turn the key counterclockwise, and pull the key and lock cylinder out of the switch assembly. If only the lock cylinder is to be replaced, proceed to Step 8.
3. Press in on the rear of the switch to depress the spring, and rotate the switch ⅛ turn counterclockwise (as viewed from the terminal end). Remove the switch from the lower instrument panel.
4. Remove the nut and the two leads from the accessory terminal of the switch.
5. Remove the plug connector from the switch and remove the switch.
6. Connect the plug connector to the switch and install the two leads to the accessory terminal with the retaining nut.
7. Place the switch in the switch opening, press the switch toward the instrument panel and rotate ⅛ turn to lock in position.

8. If a new lock cylinder is to be installed, insert the key in the cylinder and turn the key to the accessory position. Place the lock and key in the ignition switch, depress the pin slightly (Fig. 5), and turn the key counterclockwise. Push the lock cylinder into the switch. Turn the key to check the lock cylinder operation.

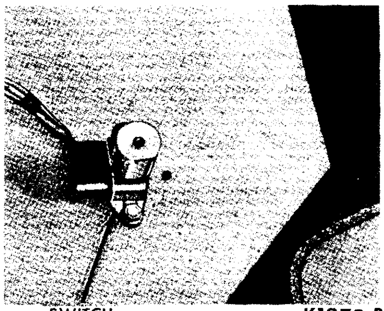

FIG. 3–Headlight Beam Selector Switch

9. Connect the battery cable and check the ignition switch operation.

MAP LIGHT SWITCH OR ANTENNA SWITCH

1. Remove two retaining screws from the trim plate and remove the plate.

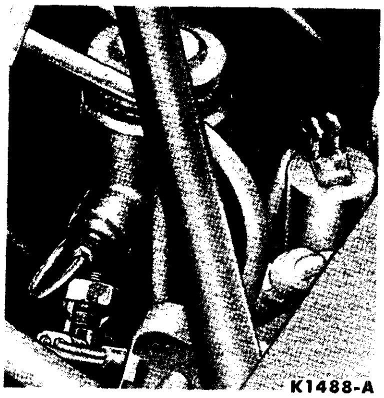

FIG. 4–Stop Light Switch

2. Disconnect the wires from the switch and remove the switch from the retaining clip.

GLOVE COMPARTMENT LIGHT SWITCH

Pull the switch from the retaining flange in the glove compartment and disconnect the wires.

FIG. 5–Ignition Switch and Lock

PART 15-4 INSTRUMENTS

1 DESCRIPTION AND OPERATION

All of the instruments are electrically operated except the speedometer. Illumination is provided by lights controlled by a rheostat on the lighting switch. A front view of the instrument panel is shown in Fig. 1.

GAUGES

The gauges and lights are shown in Fig. 7, Part 15-2. Figure 2 shows the gauge circuits. The upper portion of the instrument cluster contains the speedometer, trip odometer, turn signal indicators, and the high-beam indicator. The lower portion of the cluster contains the fuel gauge, oil pressure gauge, ammeter, and temperature gauge.

A constant voltage regulator maintains a constant voltage supply to the fuel gauge, oil pressure gauge, and temperature gauge circuits.

The constant voltage regulator (Fig. 3), maintains an average value of 5.0 volts at the gauge terminals. The regulator is temperature compensated for all expected ambient (surrounding air) temperatures.

FUEL GAUGE

The fuel gauge consists of a sending unit, located on the gas tank, and a remote register unit (fuel gauge) mounted in the instrument cluster. The remote register unit pointer is controlled by a bimetallic arm and heating coil. The sending unit is a rheostat that varies its resistance depending on the amount of fuel in the tank. The fuel gauge circuit is shown in Fig. 2.

LOW FUEL LEVEL WARNING SYSTEM

The low fuel level warning system consists of the fuel level sending unit located on the fuel tank, the warning relay, and the warning light incorporated in the fuel gauge. The warning light will light just before the fuel gauge pointer indicates empty and/or when there are approximately three gallons of fuel in the tank.

A thermistor assembly (Fig. 4), attached to the fuel sender outlet tube, is kept cool when covered by gasoline. When the fuel level drops low enough to expose the thermistor to air, the thermistor heats up. The thermistor resistance then drops and allows current to flow through a warning signal relay. The relay contacts then close to light the warning light. The low fuel level warning system circuit is shown in Fig. 2.

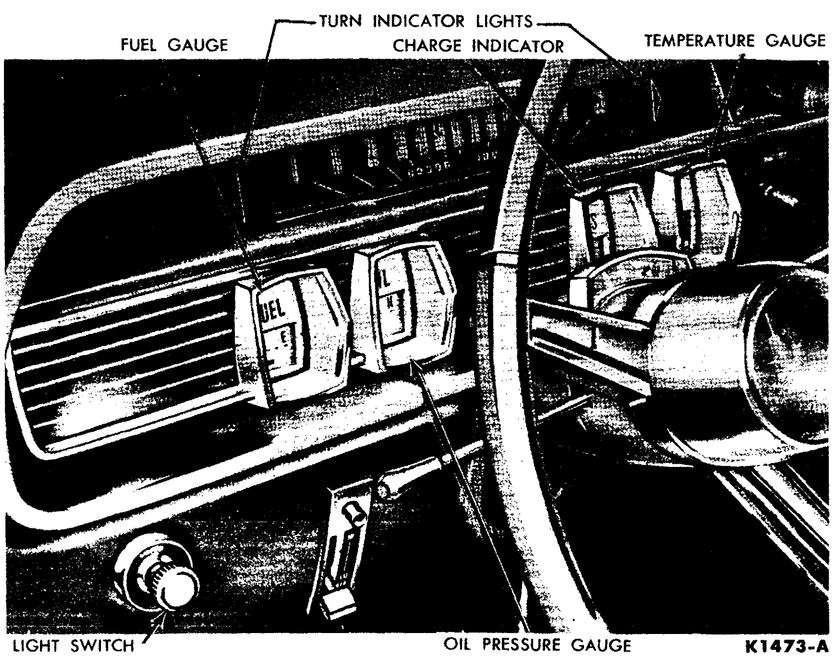

FIG. 1–Instrument Panel

TEMPERATURE GAUGE

The temperature gauge consists of a sending unit mounted in the cylinder head, and a remote register unit, (temperature gauge) mounted in the instrument cluster. The principle of operation is similar to the fuel gauge except that the resistance of the sending unit is varied by engine temperature. The temperature gauge circuit is shown in Fig. 2.

OIL PRESSURE INDICATOR GAUGE

A meter-type oil pressure gauge is used. The gauge consists of a sending unit on the engine and a remote register unit in the instrument cluster. The meter-type gauge circuit is shown in Fig. 2.

CHARGE INDICATOR GAUGE

The charge indicator used is a magnetic-loop type ammeter.

TURN INDICATOR

Fig. 1, Part 15-2 shows the turn indicator wiring diagram.

SPEEDOMETER

The speedometer is connected to the output shaft of the transmission by means of a flexible shaft, and a

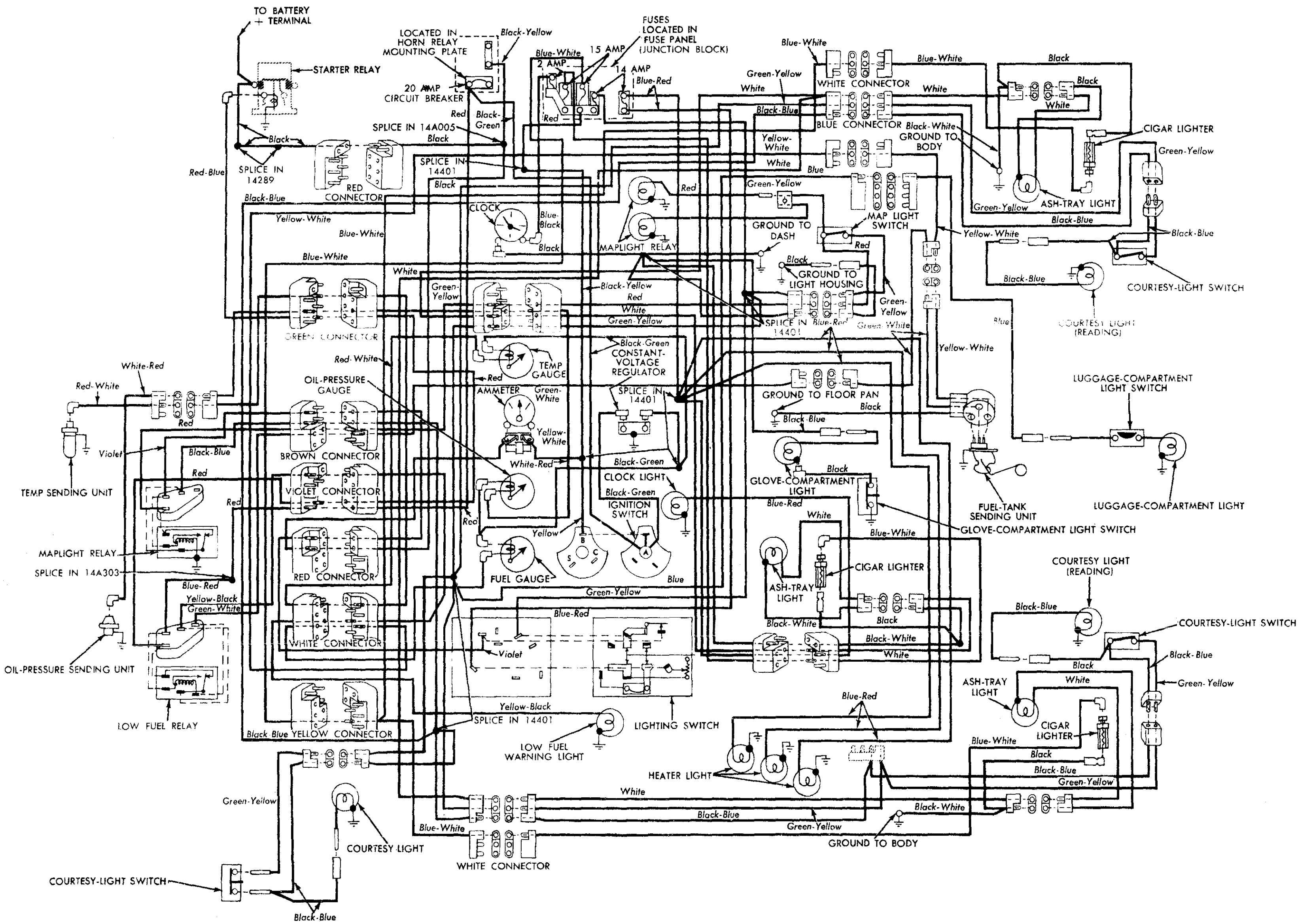

FIG. 2–Interior Lighting, Gauges, and Heater Schematic

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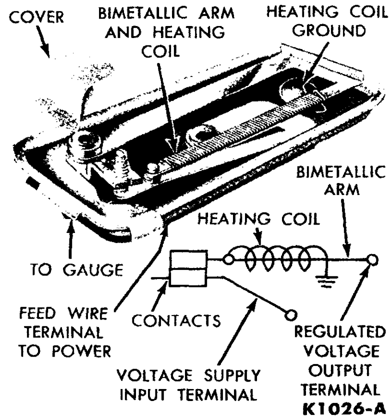

FIG. 3—Constant Voltage Regulator

drive gear located inside the transmission. The flexible shaft drives the speedometer which registers speed in miles per hour and also drives an odometer which records distance traveled in miles and tenths of a mile.

CLOCK

Adjustment of the clock is automatic. If the clock runs slow or fast, merely reset the clock to the proper time. This action adjusts the clock automatically.

The clock fuse is located on the fuse panel in the glove compartment.

WINDSHIELD WIPER

The windshield wiper motor is hydraulically operated. The hydraulic power for the motor is obtained from the power steering unit. The windshield wiper system incorporates the pressure regulator valve as part of the motor assembly (Fig. 7). The hydraulic fluid flows from the pump to the steering gear, to the windshield wiper motor, to the reservoir and back to the pump.

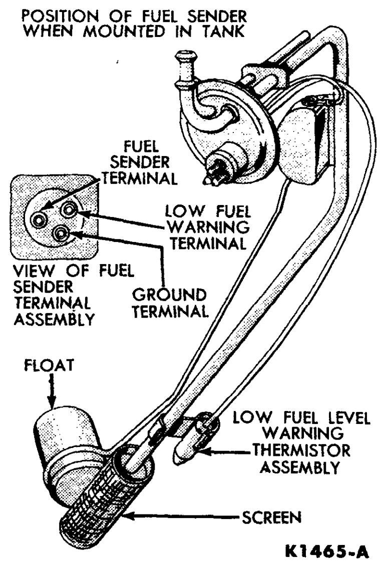

FIG. 4—Fuel Level Warning Sender Assembly

2 IN-CAR ADJUSTMENTS AND REPAIRS

WINDSHIELD WIPER BLADE ADJUSTMENT

Start the engine. Turn the windshield wipers on and then off to bring the wiper pivot shafts to their proper park position. Stop the engine. Install the wiper blades so they lie flat against the lower edge of the windshield.

3 REMOVAL AND INSTALLATION

LOWER INSTRUMENT PANEL

1. Disconnect the battery.
2. Remove the control knobs from the heater and air conditioner controls, the heater and air conditioner blower switch, and the radio controls.
3. Remove the radio control lock nuts and washers.
4. Remove the 10 screws retaining the instrument panel bezel to the instrument panel. Remove the bezel from the panel and from the car.
5. Remove the finish moulding from the upper edge of the lower instrument panel.
6. Remove the three screws retaining the trim collar at the steering column and remove the trim collar.
7. Remove the two retaining screws at the right and left lower instrument panel end plates.
8. Remove the two screws retaining the plate over the steering column and remove the plate.
9. Remove the lock cylinder from the ignition switch.
10. Remove the seven screws from the upper edge of the lower instrument panel.
11. Remove the two jam nuts and disconnect the speedometer trip reset and the clock reset control cables from the lower edge of the lower instrument panel.
12. Remove the two retaining screws and remove the hood lock release control handle and bracket from the lower instrument panel.
13. Remove the speed control head and mounting bracket from the lower instrument panel.
14. Remove the cover plate from the fuse block in the glove compartment and remove the two screws retaining the fuse block to the lower instrument panel.
15. Disconnect the glove compartment courtesy light.
16. Disconnect the rear deck lid lock release control handle.
17. Remove the ignition switch from the lower instrument panel, but do not disconnect the wires.
18. Remove the headlight switch from the lower instrument panel, but do not disconnect the wires.
19. Remove the control knob from the windshield wiper control lever.
20. Remove the two retaining nuts from the windshield wiper control bezel and remove the windshield wiper and washer control assembly from the lower instrument panel.
21. Remove the two bolts securing the lower instrument panel to the inner cowl panel at the right and left side.
22. Remove the ash receptacle and disconnect the ash tray light and cigar lighter leads.
23. Remove the lower instrument panel from the car.
24. Position the lower instrument panel in the car.
25. Install the headlight switch in the lower instrument panel.
26. Position the windshield wiper and washer control assembly in the

lower instrument panel and install the two bezel retaining nuts.

27. Install the control knob on the windshield wiper control lever.

28. Install the ignition switch on the lower instrument panel. Install the lock cylinder in the ignition switch.

29. Connect the cigar lighter and ash tray light leads and install the ash receptacle (Fig. 7, Part 15-2).

30. Install the fuse block on the lower instrument panel with the two retaining screws. Install the fuse block cover plate.

31. Connect the glove compartment courtesy light.

32. Install the rear deck lid lock release control handle.

33. Install the lower instrument panel on the center panel with seven screws at the upper edge, two screws at each end plate, and two bolts at the inner cowl panel.

34. Install the trim collar on the steering column with the three retaining screws.

35. Install the plate over the steering column with the two retaining screws.

36. Connect the speedometer trip reset and clock reset control cables to the lower instrument panel with the two jam nuts.

37. Install the hood lock release control handle and bracket on the lower instrument panel with the two retaining screws.

38. Install the speed control head and mounting bracket on the lower instrument panel.

39. Position the instrument panel bezel on the instrument panel and install the 10 retaining screws.

40. Install the finish moulding on the upper edge of the lower instrument panel.

41. Install the control knobs on the heater and air conditioner controls and the heater and air conditioner blower switch.

42. Install the washers and lock nuts on the radio control posts.

43. Install the radio control knobs.

44. Connect the battery and check the operations of all gauges, lights, and signals.

GAUGES

To replace the fuel gauge, oil pressure gauge, charge indicator gauge, and temperature gauge, it is necessary to remove the lower instrument panel.

The fuel gauge and oil pressure gauge are mounted on a single mounting plate. The charge indicator gauge and temperature gauge are also mounted on a single mounting plate.

The replacement procedure given for the fuel gauge applies to all the gauges except that only the gauge to be replaced is removed from its mounting plate. Figure 7, Part 15-2 shows the wiring connections to the various gauges.

CONSTANT VOLTAGE REGULATOR

1. Disconnect the battery.
2. Remove the two screws, retaining the left air duct grille and remove the grille.
3. Disconnect the wires from the constant voltage regulator.
4. Loosen the one regulator retaining screw and remove the regulator.
5. Position the constant voltage regulator and tighten the retaining screw.
6. Connect the wires to the regulator. Make sure that the radio suppression choke is connected to the input side of the regulator.
7. Position the air duct grille and install the two retaining screws.
8. Connect the battery and check the operation of the gauges.

FUEL GAUGE

1. Remove the lower instrument panel.
2. Disconnect the electrical connections from the fuel gauge and oil pressure gauge.
3. Remove the three retaining screws and remove the dual gauge mounting plate and gauges from the instrument panel.
4. Remove the two nuts from the terminal studs and remove the fuel gauge from the mounting plate.
5. Position the fuel gauge on the mounting plate and install the two nuts.
6. Position the dual gauge mounting plate and gauges to the instrument panel and install the three retaining screws.
7. Connect the electrical connectors to the fuel gauge and oil pressure gauge terminal studs.
8. Install the lower instrument panel.

FUEL SENDING UNIT

1. Raise the car on a hoist.
2. Drain the fuel from the tank.
3. Disconnect the wires from the sending unit.
4. Disconnect the fuel lines from the sending unit.
5. Remove any dirt that has collected around the sending unit so that it will not enter the tank.
6. Remove the sending unit and gasket from the tank.
7. Clean the sending unit mounting surface at the fuel tank.
8. Install the sending unit with a new gasket.
9. Connect the wires and the fuel lines.
10. Lower the car.
11. Fill the fuel tank with the fuel removed.
12. Check the operation of the fuel gauge, the low fuel warning light, and check for leaks.

TEMPERATURE GAUGE

To replace the temperature gauge, follow the procedure given for the fuel gauge.

TEMPERATURE SENDING UNIT

1. Disconnect the temperature sending unit wire from the sending unit.
2. Prepare the new temperature sending unit for installation by applying a small amount of water resistant sealer to the threads.
3. Remove the temperature sending unit from the cylinder head and immediately install the new temperature sending unit.
4. Connect the wire to the temperature sending unit.
5. Start the engine and check the sending unit operation.

OIL PRESSURE GAUGE

To replace the oil pressure gauge, follow the procedure given for the fuel gauge.

OIL PRESSURE SENDING UNIT

The oil pressure sending unit is mounted on top of the oil filter (Fig. 5).

1. Disconnect the oil pressure sending unit wire from the unit.
2. Remove the sending unit from the oil filter.

3. Apply conductive sealing compound to the threads of the new sending unit and install the unit to the oil filter.
4. Connect the wire to the sending unit.
5. Check the operation of the unit.

CHARGE INDICATOR GAUGE

To replace the charge indicator gauge, follow the procedure given for the fuel gauge.

TURN INDICATOR

To remove the turn indicator switch, the steering wheel must first be removed.

1. Unscrew the turn signal switch lever from the steering column.
2. Remove the switch mounting bracket screws, and remove the switch and bracket from the steering column.
3. Remove the conical tension spring and remove the switch actuating arm.
4. Disconnect the switch wires from the bullet connectors. Remove the access plate at the steering column, remove the switch to mounting bracket screws, and remove the switch and wires.

When installing the new switch, make certain that the cancelling cam on the steering wheel makes contact with the cancelling pawls on the switch. The clearance between the steering wheel hub and the steering shaft housing flange should not be more than 1/16 inch for proper switch cancelling. Reposition the steering shaft housing if necessary.

FIG. 5—Oil Pressure Sending Unit

TURN INDICATOR FLASHER

The turn indicator flasher is located at the lower edge of the instrument panel to the right of the speedometer trip reset. To replace the flasher, pull the flasher from its retaining clip and disconnect the wires from the terminals.

SPEEDOMETER

1. Disconnect the battery.
2. Remove the heater, air conditioner, and radio control knobs.
3. Remove the radio control lock nuts and washers.
4. Remove the two screws retaining the plate over the steering column and remove the plate.
5. Remove the 10 screws retaining the instrument panel bezel to the instrument panel and remove the bezel.
6. Remove the jam nut and disconnect the speedometer trip reset control cable from the lower edge of the lower instrument panel.
7. Remove the seven screws retaining the speedometer to the instrument panel. Position the speedometer out of the instrument panel, disconnect the speedometer cable, and remove the speedometer and trip reset control cable as a unit.
8. Connect the speedometer cable to the new speedometer.
9. Position the speedometer and trip reset control cable assembly in the instrument panel and install the seven speedometer retaining screws.
10. Connect the trip reset control cable to the lower instrument panel with the jam nut.
11. Position the instrument panel bezel on the instrument panel and install the 10 retaining screws.
12. Position the plate over the steering column and install the two retaining screws.
13. Install the heater and air conditioner control knobs.
14. Install the washers and lock nuts to the radio control posts.
15. Install the radio control knobs.
16. Connect the battery.

SPEEDOMETER CABLE REPLACEMENT

To replace the speedometer drive cable, disconnect the cable housing from the speedometer, and pull the cable out of the housing.

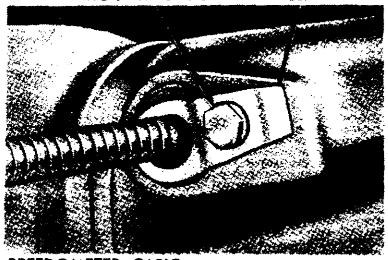

FIG. 6—Speedometer Cable Mounting

Wipe off all of the old lubricant. Lubricate the new cable with cable lubricant B5A-19581-A (do not over lubricate), insert it all the way into the housing, and twist it slightly to make sure that the squared drive is engaged in the speedometer driven gear. **If a speedometer cable is broken, it will be necessary to disconnect both ends of the cable housing in order to remove the broken sections. Tighten the mounting bolt to 20-25 foot-pounds torque (Fig. 6).**

The speedometer driven gear is held on to the speedometer cable housing by a retainer clip. When replacing the driven gear, make certain that the gear is secure by placing the gear in position before inserting the retainer clip through the gear slots.

CLOCK

1. Remove the heater, air conditioner, and radio control knobs.
2. Remove the radio control lock nuts and washers.
3. Remove the two screws retaining the plate over the steering column and remove the plate.
4. Remove the 10 screws retaining the instrument panel bezel to the instrument panel and remove the bezel.
5. Remove the jam nut and disconnect the clock reset control cable from the lower edge of the lower instrument panel.
6. Remove the four screws retaining the clock to the instrument panel. Disconnect the clock wires and remove the clock and reset control cable as a unit.
7. Transfer the reset control cable to the new clock.
8. Position the clock and cable to the instrument panel. Connect the clock wires and install the four clock retaining screws.

9. Connect the reset control cable to the lower instrument panel with the jam nut.

10. Position the instrument panel bezel to the instrument panel and install the 10 retaining screws.

11. Position the plate over the steering column and install the two retaining screws.

12. Install the heater and air conditioner control knobs.

13. Install the washers and lock nuts to the radio control posts.

14. Install the radio control knobs.

WINDSHIELD WIPER

WIPER MOTOR

1. Remove the two windshield wiper mounting bolts and slide the motor out of the mounting bracket (Fig. 7).

2. Disconnect the two hydraulic lines from the motor. Loosen the control cable set screw.

3. Remove the windshield washer vacuum hoses and remove the motor.

4. Transfer the two brass fittings to the motor, using sealing compound on the fittings.

5. Position the new motor. Position the control cable and tighten the set screw.

6. Connect the windshield washer vacuum hoses. Connect both hydraulic lines so they are snug.

7. Position the motor in the mounting bracket. Install the right-hand retaining bolt and then install the left-hand retaining bolt.

8. Tighten the hydraulic lines at the motor.

9. Start the engine and check for leaks.

10. Check the power steering fluid and add fluid if necessary.

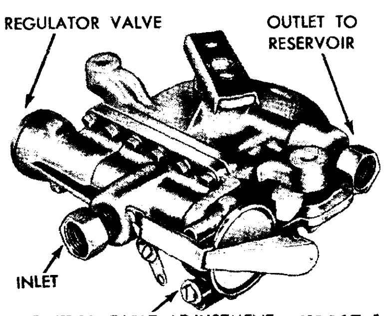

FIG. 7—Windshield Wiper Motor and Pressure Regulator

WIPER CONTROL

1. Disconnect the battery.

2. Remove the three screws retaining the trim collar to the steering column, and remove the trim collar.

3. Remove the two screws from the left end plate of the lower instrument panel.

4. Remove the finish moulding from the upper edge of the lower instrument panel.

5. Remove three screws from the top of the lower instrument panel to gain access to the wiper control assembly.

6. Remove the control knob from the windshield wiper control lever.

7. Remove the two vacuum hoses from the windshield washer control.

8. Remove the two retaining screws and remove the windshield washer control valve from the windshield wiper control assembly.

9. Remove the two retaining screws and remove the windshield wiper control from the lower instrument panel.

10. Remove the two retaining nuts and remove the bezel from the windshield wiper control.

11. Working in the engine compartment, loosen the wiper control cable set screw and remove the control cable from the wiper motor.

12. Tie a wire to the wiper control cable. Working in the passenger compartment, pull the control cable through the firewall until the wire tied to the cable is accessible. Remove the wire from the cable.

13. Tie the wire to the new control cable. From the engine compartment, pull the wire and cable through the firewall. Remove the wire from the cable.

14. Install the control cable on the wiper motor and tighten the set screw.

15. Install the windshield washer control valve on the windshield wiper control with the two retaining screws.

16. Install the windshield wiper and washer control assembly on the lower instrument panel with the two retaining screws.

17. Install the control knob on the windshield wiper control lever.

18. Install the three screws in the top of the lower instrument panel.

19. Install the two screws in the left end plate of the lower instrument panel.

20. Install the finish moulding on the upper edge of the lower instrument panel.

21. Install the trim collar on the steering column with the three retaining screws.

22. Connect the battery.

WIPER PIVOT SHAFT AND LINK

Right Pivot Shaft

1. Remove the 11 screws securing the top cowl grille and screen. Disconnect the windshield washer vacuum hoses and remove the top cowl grille and screen.

2. Remove the clip retaining the left pivot shaft link to the wiper motor. Position the link to the left.

3. Remove the clip from the right pivot. Remove the two bolts and nut retaining the right pivot and remove the pivot.

4. Position the new right pivot. Start the two retaining bolts and the nut.

5. Position the left pivot shaft link to the motor and install the retaining clip.

6. Tighten the two retaining bolts and the nut.

7. Position the screen on the cowl, and position the cowl grille. Connect the windshield washer vacuum hoses.

8. Install the 11 screws securing the grille and screen.

Left Pivot Shaft and Link

1. Remove the 11 screws securing the top cowl grille and screen. Disconnect the windshield washer vacuum hoses and remove the top cowl grille and screen.

2. Remove the clip retaining the link to the wiper motor and position the link out of the way.

3. Remove the clip from the right pivot. Remove the two bolts and nut retaining the left pivot, and remove the pivot and link assembly.

4. Position the new left pivot and link assembly. Loosen the two bolts and nut retaining the right pivot. NOTE: **It is necessary to loosen the right pivot to install the link on the pivot.** Position the link on the pivot and install the retaining clip. Tighten the two belts and nut retaining the right pivot.

5. With the left pivot and link in position, install the two retaining bolts and nut. Install the retaining clip at the motor.

6. Position the screen on the cowl, and position the cowl grille. Connect the windshield washer vacuum hoses.

7. Install the 11 screws securing the grille and screen.

PART 15-5 SPECIFICATIONS

BULB CHART

Unit	Candle Power or Wattage	Trade No.
Headlight—No. 1 (Inner)	37.5 w	4001
Headlight—No. 2 (Outer)	37.5/50 w	4002
Front Turn Signal/Parking	32/4 c.p.	1157
Rear Turn Signal & Stop/Tail	32/4 c.p.	1157
Stop/Tail Only		
License Plate	4 c.p.	1155
Back-Up Lights	21 c.p.	1141
Engine Compartment Light	15 c.p.	93
Luggage Compartment	6 c.p.	631
Dome Light	15 c.p.	1003
Instrument Panel Indicators:		
Hi Beam	2 c.p.	1895
Oil Pressure	2 c.p.	1003
Generator	2 c.p.	1895
Turn Signal	2 c.p.	1895
Parking Brake Warning	2 c.p.	1895
Illumination:		
Speedometer	2 c.p.	158
Cluster	2 c.p.	1895
Ash Receptacle/Glove Compartment	1.5 c.p.	1445
Cigarette Lighter Socket & W/S Wiper		
Heater Control	2 c.p.	158
Heater & A/C Control		
Clock	2 c.p.	158
Ignition Key & Lighting Switch		
Radio Dial	2 c.p.	1891
Courtesy and/or Map (Door Mounted)	6 c.p.	631
Automatic Transmission Control	15 c.p.	1003

INSTRUMENT VOLTAGE

Average Voltage at Fuel and Temperature Gauge Terminals	5 Volts

HORN CURRENT DRAW

All	9.0-10.0 Amperes at 12 Volts

TURN INDICATOR

Current Draw at 12 Volts	0-4 Amperes

CIRCUIT PROTECTION

Circuit	Protective Device	Location
Interior Lights & Glove Box Lights	SFE 14 Fuse	Behind Glove Box Door Plate
Clock	1AG-2 or AGA-2 Fuse	Fuse Panel in Glove Box
Cigar Lighter (Socket)	Reset Circuit Breaker	On Back of Cigar Lighter Socket
Cigar Lighter Circuit	3AG-15 or AGC-15 Fuse	Fuse Panel in Glove Box
Back-Up Lights & Windshield Washer Pump	SFE-7.5 Fuse	Fuse Panel in Glove Box
Headlights	18 Amp. Circuit Breaker	Incorporated in Lighting Switch
Auxiliary Lights (Park, Tail, Dash, Stop & Interior)		
Turn Signals	SFE 7.5 Fuse	Fuse Panel in Glove Box
Radio	SFE 7.5 Fuse	Fuse Panel in Glove Box
Rear Door Opening Warning Circuit Speed Control	SFE 14 Fuse	
Heat Blower	Circuit Breaker	Fuse Panel in Glove Box
Power Seats	30 Amp. Circuit Breaker	Fuse Panel in Glove Box
Power Windows Control Circuit	20 Amp. Circuit Breaker	
Power Windows Power Circuit	SFE 14 Fuse	Fuse Panel in Glove Box
Electric Antenna	3AG-10	Behind Glove Box Door Access Plate
Air Conditioning	Circuit Breaker	Fuse Panel in Glove Box
Automatic Headlight Dimmer	SFE 4 Fuse	At Amplifier Unit
Convertible Top Control		
Power Circuit	50 Amp. Circuit Breaker	On R.H. Cowl Side Panel
Control Circuit	10 Amp. Circuit Breaker	Fuse Panel in Glove Box
Ground Circuit		
Luggage Compartment Lock Motor	15 Amp. Circuit Breaker	On Top Control Relay Mounting Panel
Upper Back Panel Motor	15 Amp. Circuit Breaker	On Top Control Relay Mounting Panel
Instrument Panel Rheostat	SFE 6 Fuse	Fuse Panel in Glove Box

GROUP 16

PART 16-1 GENERAL VENTILATING, HEATING, AND ACCESSORIES SERVICE

1 DIAGNOSIS AND TESTING

VENTILATING AND HEATING TROUBLE DIAGNOSIS GUIDE

INSUFFICIENT OR NO HEAT	1. Burned out fuse or loose wires to the heater blower. 2. Defective motor ground. 3. Fan loose on motor shaft or motor stalled. 4. Defective heater blower switch. 5. Defective blower motor. 6. Defective thermostat. 7. Defective water control valve. 8. A kinked, clogged, or collapsed water hose. 9. Improperly connected heater hoses. 10. Plugged heater core(s). 11. Improperly installed engine thermostat. 12. Air leaks in the ventilation system.
INSUFFICIENT OR NO DEFROSTING	1. Improperly adjusted defroster air duct doors. 2. Disconnected defroster hose. 3. Binding defroster door(s). 4. Plugged or loose defroster nozzle. 5. Obstructed defroster openings at windshield.
TOO MUCH HEAT	1. Defective water control valve. 2. Malfunctioning thermostat.

AIR CONDITIONING TROUBLE DIAGNOSIS GUIDE

INSUFFICIENT OR NO COOLING	1. Inoperative magnetic clutch. 2. Inoperative blower. 3. Obstructed air passages. 4. Complete loss of charge (no bubbles in sight glass at system start up). 5. Partial loss of charge (continuous bubbles in sight glass after start up). 6. Service valves improperly set. 7. Inoperative servo. 8. Suction pressure low, discharge pressure OK. 9. Suction pressure high, discharge pressure OK. 10. Discharge pressure low, suction pressure high. 11. Compressor defective, or loose compressor belt. 12. Vacuum lines kinked, clogged, loose, or off. 13. Thermostat defective.

CONTINUED ON NEXT PAGE

AIR CONDITIONING TROUBLE DIAGNOSIS GUIDE (Continued)

INSUFFICIENT OR NO COOLING (Continued)	14. Clutch lead disconnected or broken. 15. Expansion valve inoperative, stays open or closed. 16. Plugs left in compressor under service valve.
NOISY COMPRESSOR	1. Loose, torn, or misaligned belt. 2. Loose, or slipping clutch. 3. Foreign material or damaged parts in compressor. 4. Compressor loose on bracket.
COMPRESSOR VIBRATION	1. Broken or loose mounting bracket. 2. Loose clutch. 3. Loose belt.

RADIO TROUBLE DIAGNOSIS GUIDE

NO RECEPTION	1. Burned out fuse. 2. Reversed battery polarity. 3. Defective antenna or lead. 4. Shorted speaker lead or defective speaker. Be sure that proper voltage is available at the set, then substitute the known good antenna and speaker.
NOISY OR ERRATIC RECEPTION	**NOISY RECEPTION—ENGINE NOT RUNNING** 1. Loose connections. **NOISY RECEPTION—ENGINE RUNNING** 1. Defective suppression equipment. 2. Suppression condensers not properly grounded. 3. Receiver not properly grounded to instrument panel. **NOISY RECEPTION—CAR IN MOTION** 1. Loose or broken lead-in cable. 2. Loose or defective radio antenna. 3. Defective wheel static collectors.
DISTORTED OR GARBLED SOUND	1. Voice coil rubbing on center pole piece of speaker magnet (either front or rear speaker). 2. Torn speaker cone. 3. Foreign material on cone. 4. Bent or twisted speaker mounting.
WEAK RECEPTION	1. Beyond normal reception distance from station (FM only). 2. Defective antenna. If FM reception is poor be sure that antenna is at 30-32 inch height before trying a new antenna.
NO SOUND FROM ONE SPEAKER	1. One speaker defective. 2. Wiring to dead speaker defective. Operate fader to determine speaker at fault.

ELECTRIC ANTENNA TROUBLE DIAGNOSIS GUIDE

MOTOR DOES NOT OPERATE	1. Burned out fuse. 2. Defective switch or wiring. 3. Poor ground. 4. Defective motor.
MOTOR OPERATES IN ONLY ONE DIRECTION	1. Defective switch or wiring. 2. Defective motor.
MOTOR RUNS BUT WANDS DO NOT MOVE	1. Bent or corroded wands. 2. Defective drive assembly.

SPEED CONTROL TROUBLE DIAGNOSIS GUIDE

BLOWING FUSES	1. Short or ground in the wiring circuit (Fig. 1).
NO SPEED CONTROL RESPONSE	1. Accelerator linkage is broken or disconnected. 2. Drive cable broken or disconnected. 3. Blown fuse. Fuse block is accessible through left side of glove box. 4. Loose connections or broken wires (internal or external).

CONTINUED ON NEXT PAGE

SPEED CONTROL TROUBLE DIAGNOSIS GUIDE (Continued)

CONSTANT PRESSURE ON ACCELERATOR PEDAL REGARDLESS OF SELECTOR SETTING	1. Blown fuse. 2. No current at No. 2 Terminal. 3. Control cable is improperly adjusted.	4. Inoperative motor or locked drive screw.
AUTOMATIC CONTROL DOES NOT ENGAGE WHEN THE SLIDE SWITCH IS MOVED TO LOCK	1. No current at No. 3 Terminal.	2. Brake release switch improperly adjusted.
AUTOMATIC CONTROL REMAINS ENGAGED WHEN THE BRAKE PEDAL IS DEPRESSED	1. Brake switch improperly adjusted.	2. Inoperative brake switch.
PULSATING ACCELERATOR PEDAL	1. Speedometer cable or drive cable kinked. 2. Lack of lubrication on cables.	3. Improper accelerator linkage adjustment.
CARBURETOR DOES NOT RETURN TO NORMAL IDLE	1. Improper carburetor or accelerator linkage adjustment.	
SPEEDOMETER DOES NOT REGISTER OR THE UNIT DOES NOT OPERATE	1. Speedometer drive gear in the transmission damaged. 2. Broken drive cable from the transmission to the power unit.	3. Broken speedometer cable. 4. Defective speedometer.
SPEEDOMETER NOISE	1. Cables bent or kinked. 2. Lack of cable lubrication.	3. Noisy speedometer head.

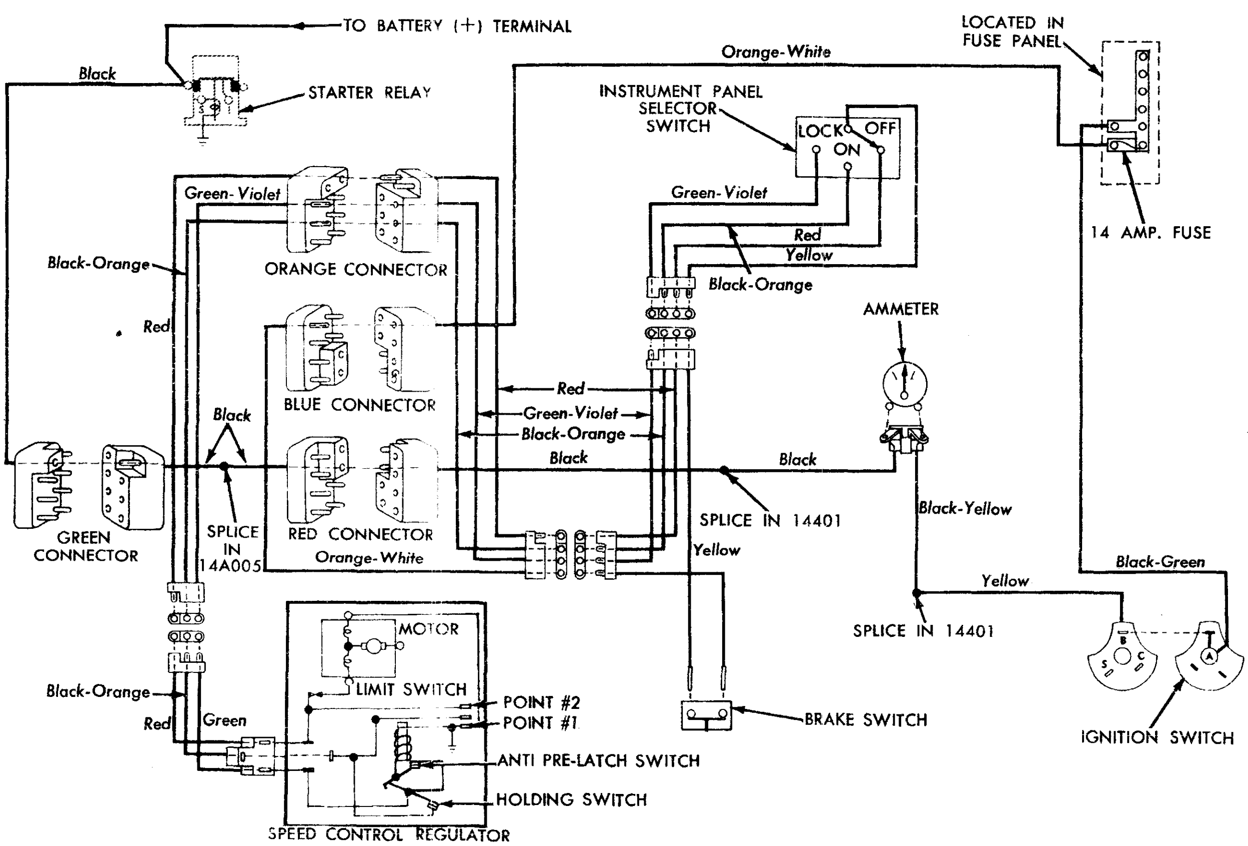

FIG. 1—Wiring Diagram

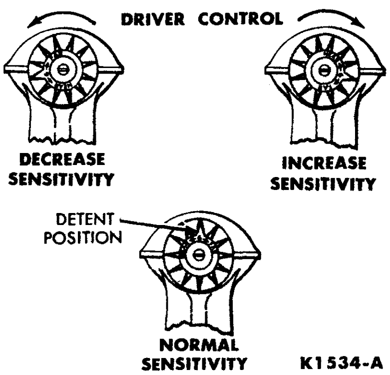

FIG. 2—Driver Control Knob

AUTOMATIC HEADLIGHT DIMMER

DIAGNOSIS TIPS

If the headlights dim at the wrong distance occasionally, the car probably has been meeting cars with badly aimed headlights.

Repeated dimming at the wrong distance may be caused by the adjustment of the sensitivity control knob (Fig. 2).

If oncoming cars are blinking before the lights are dimmed, turn the knob clockwise to increase the sensitivity and the lights will dim sooner. Turn the knob the other way, and the lights will hold on the upper beam longer.

Some perfectly normal road conditions, such as snow or fog, will cause the headlights to dim even if another car is not approaching. This is a plus factor for the driver. It is far safer to drive on low beam through rain, snow and fog.

Side lighting may cause the lights to dim. Light objects such as white picket fences, flashing traffic lights, billboards, and distant cars in hilly country may trigger the unit. This high degree of sensitivity is necessary in order for the unit to do its job properly.

Brightly-lighted areas (gas stations, intersections, or lighted streets, etc.) will dim the lights.

Snow or dirt on the windshield may block the phototube. Sometimes wiper blades in front of the unit may block its vision. This reduces sensitivity and can cause cycling. It may be necessary to lower the right-wiper blade one or two notches to assure clear vision.

If the unit doesn't switch to upper beam immediately after the approaching car passes, it may simply be out of adjustment. To correct the situation, follow the procedure for sensitivity and aim adjustment.

TESTING VENTILATING AND HEATING

Use the following procedure to check for malfunction of the heater vacuum system. The procedure will determine if there are leaks, pinched lines or lines not connected.

1. Insert a vacuum gauge in the vacuum supply line (black line) near the dash connector block (See Fig. 3).

2. Set the regulator lever at the MAX position. Set the vents-heater lever at the OFF position.

3. Start the engine and run it until at least 16 inches of vacuum is obtained. Stop the engine.

4. Record the vacuum reading. If this reading decreases steadily, there is a leak in the check valve or the vacuum system from the check valve

CHART 1—Heater Vacuum Line Operation (Regulator Lever at MAX)

Vents-Heater Lever Position	Vacuum To Line	Amount Of Vacuum In Line	Air Door Position (Doors with no vacuum applied are closed)*
R-L	Black-Blue Stripe Black-Green Stripe Black-Orange Stripe	14 Inches Mercury Minimum	Outside Air Closed Left Vent Open Right Vent Open
R	Black-Blue Stripe Black-Orange Stripe	14 Inches Mercury Minimum	Outside Air Closed Right Vent Open
L	Black-Blue Stripe Black-Green Stripe	14 Inches Mercury Minimum	Outside Air Closed Left Vent Open
OFF	Black-Blue Stripe	14 Inches Mercury Minimum	Outside Air Closed
HEAT	Black-Red Stripe Black-Brown Stripe	14 Inches Mercury Minimum	Outside Air Open Heater Water Valve Open
DE-ICE	Black-White Stripe Black-Red Stripe Black-Brown Stripe	14 Inches Mercury Minimum	Defroster Open Outside Air Open Heater Water Valve Open

*Some air is bled by the defrost-heat door in both closed positions.

to the vents-heater control (Refer to Fig. 3).

5. Move the vents-heater control lever to the positions shown in Chart 2, observe the drop in vacuum on the gauge. Repeat steps 3 and 4 between each lever movement to bring the vacuum back to 16 inches.

6. If any vacuum drop is less than indicated, check for pinched lines, plugged lines, plugged fittings, or partial cycle due to a binding door. If any vacuum drop is greater than that indicated, check for leaks, lines not connected, or defective components.

If a single vacuum actuator is malfunctioning, check the vacuum at the actuator (Chart 1). If the vacuum is within limits, the actuator is defective or the door is binding.

AIR CONDITIONING

Use the following procedure to check for malfunction of the heater-air conditioner vacuum system. The procedure will determine if there are leaks, pinched lines or lines not connected.

1. Insert a vacuum gauge in the vacuum supply line (black line) near the dash connector block (Refer to Fig. 4).

2. Set the regulator lever at the MAX position. Set the vents-heater lever at the OFF position.

3. Start the engine and run it until at least 16 inches of vacuum is obtained. Stop the engine.

4. Record the vacuum reading. If this reading decreases steadily, there is a leak in the check valve or the vacuum system from the check valve to the vents-heater control (Refer to Fig. 4).

5. Move the vents-heater control lever to the positions shown in Chart 4, observe the drop in vacuum on the gauge. Repeat steps 3 and 4 between each lever movement to bring the vacuum back to 16 inches.

CHART 2—Vacuum Drop vs. Vents-Heater Lever Position

Vents-Heater Lever Movement	Vacuum Drop Inches of Mercury
OFF to HEAT	0.75-3.0
HEAT to DE-ICE	0.25-2.5
DE-ICE to HEAT	0-1.5
HEAT to OFF	0.5-3.0
OFF to L	0.25-2.0
L to R	0.25-2.0
R to R-L	0.25-2.0

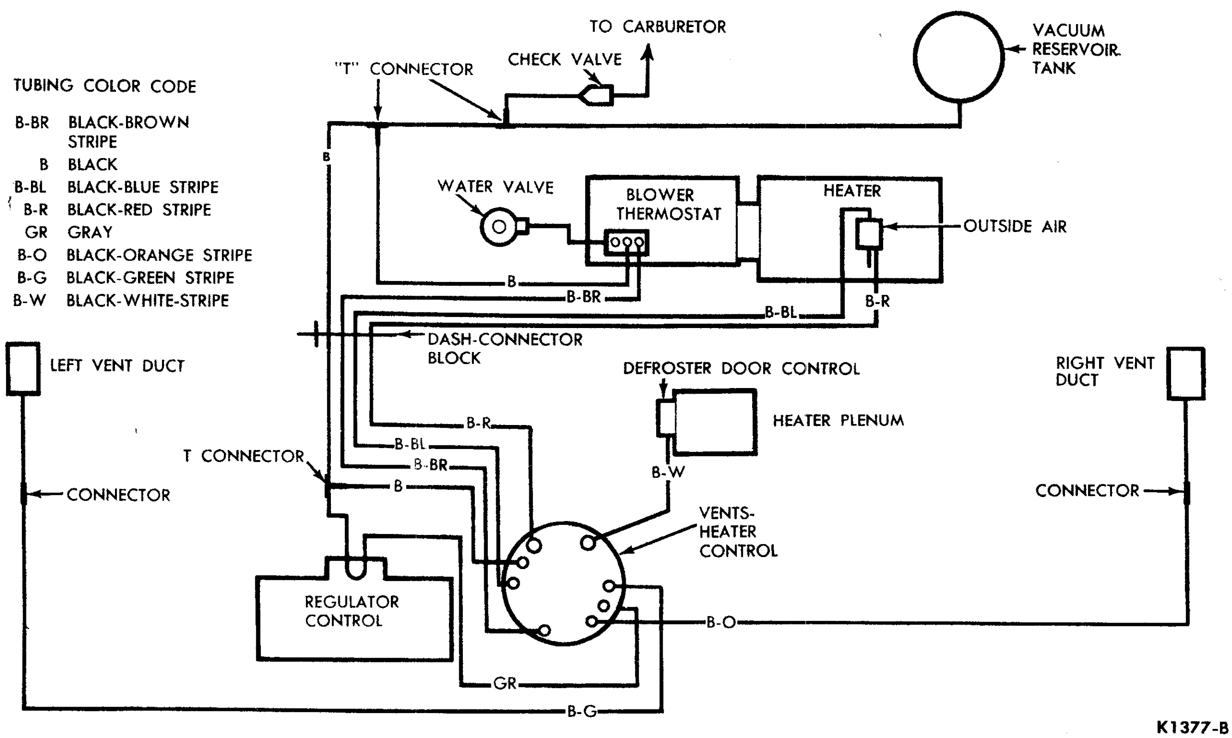

FIG. 3—Heater—Vacuum Line Connections

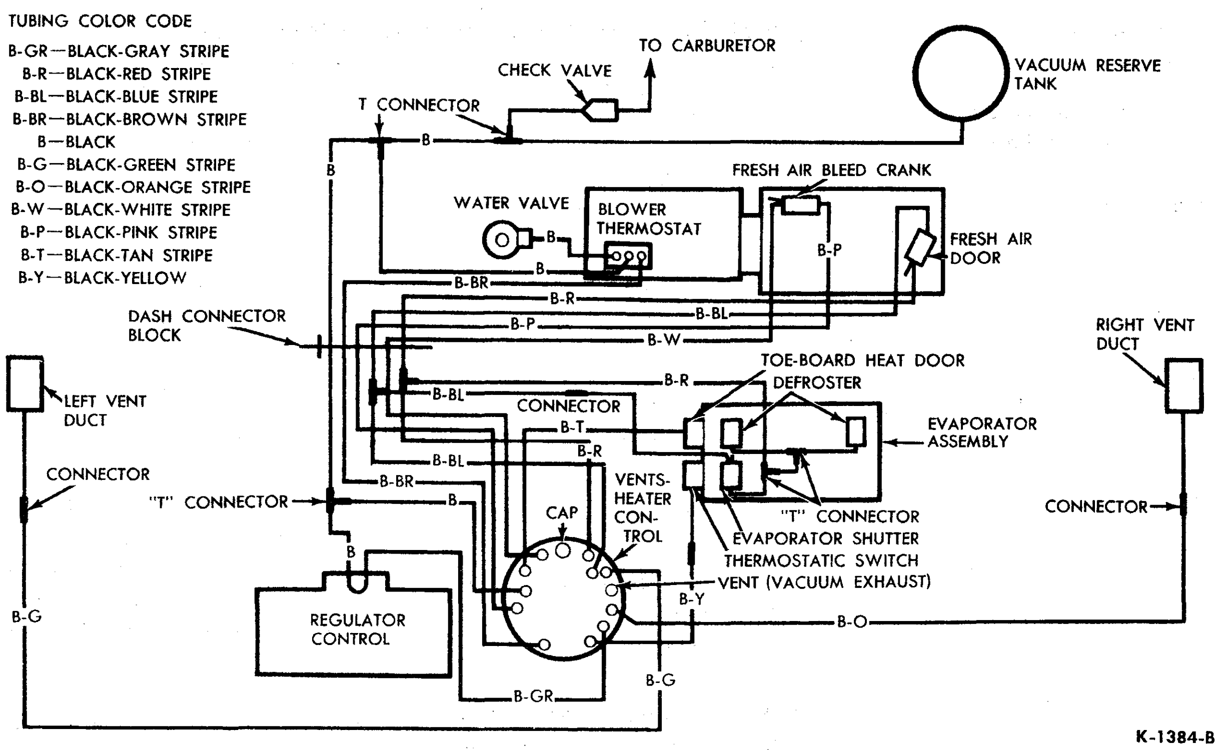

FIG. 4—Heater-Air Conditioner—Vacuum Line Connections

CHART 3—Heater-Air Conditioner Vacuum Line Installation (Regulator Lever at MAX)

A/C Vents-heater Lever Position	Vacuum To Line	Amount of Vacuum In Line	Air Door Positions (All Doors or Valves not indicated are closed)
REC	Black-Blue Stripe Black-Pink Stripe Black-Yellow Stripe	14 Inches Mercury Minimum	Outside Air Closed, Evaporator Shutters Open Outside Air Bleed Closed Thermostatic Switch Operating
FRESH	Black-Blue Stripe Black-White Stripe Black-Yellow Stripe	14 Inches Mercury Minimum	Outside Air Closed, Evaporator Shutters Open Outside Air Bleed Open Thermostatic Switch Operating
R-L	Black-Blue Stripe Black-Pink Stripe Black-Green Stripe Black-Orange Stripe	14 Inches Mercury Minimum	Outside Air Closed, Evaporator Shutters Open Outside Air Bleed Closed Left Vent Open Right Vent Open
R	Black-Blue Stripe Black-Pink Stripe Black-Orange Stripe	14 Inches Mercury Minimum	Outside Air Closed, Evaporator Shutters Open Outside Air Bleed Closed Right Vent Open
L	Black-Blue Stripe Black-Pink Stripe Black-Green Stripe	14 Inches Mercury Minimum	Outside Air Closed, Evaporator Shutters Open Outside Air Bleed Closed Left Vent Open
OFF	Black-Blue Stripe Black-Pink Stripe	14 Inches Mercury Minimum	Outside Air Closed, Evaporator Shutters Open Outside Air Bleed Closed
HEAT	Black-Brown Stripe Black-Red Stripe Black-Tan Stripe	14 Inches Mercury Minimum	Heater Water Valve Open Outside Air Open, Evaporator Shutters Closed Toe Board Heat Open
DE-ICE	Black-Brown Stripe Black-Red Stripe	14 Inches Mercury Minimum	Heater Water Valve Open Outside Air Open, Evaporator Shutters Closed

CHART 4—Vacuum Drop vs. Vents-Heater Lever Position

Vents-Heater Lever Movement	Vacuum Drop Inches of Mercury
DE-ICE to HEAT	0.25-2.5
HEAT to OFF	2.5-5.5
OFF to L	0.25-2.0
L to R	0.25-2.0
R to R-L	0.25-2.0
R-L to FRESH	0.5-3.0
FRESH to REC	0.25-2.5

6. If any vacuum drop is less than indicated, check for pinched lines, plugged lines, plugged fittings, or partial cycle due to a binding door. If any vacuum is greater than that indicated, check for leaks, lines not connected, or defective components.

If a single vacuum actuator is malfunctioning, check the vacuum at the actuator (Chart 3). If the vacuum is within limits, the actuator is defective or the door is binding.

CHECKING FOR LEAKS

Attach the manifold gauge set (Fig. 5). Leave both manifold gauge valves at the maximum clockwise position. Set both service valves at the center position. Both gauges should now show approximately 60 to 80 pounds pressure at 75° F. If very little or no pressure is indicated, leave the vacuum pump valve closed, open the Refrigerant-12 tank valve, and set the low pressure manifold gauge valve to the counterclockwise position. This opens the system to tank pressure.

Check all connections, and the compressor shaft seal for leaks, using a flame type leak detector (Fig. 6). Follow the directions with the leak detector. The smaller the flame the more sensitive it is to leaks. Therefore to insure accurate leak indication keep the flame as small as possible. The copper element must be red hot. If it is burned away, replace the element.

Hold the open end of the hose at each suspected leak point for two or three seconds. The flame will normally be almost colorless. The slightest leak will be indicated by a bright color to the flame. Be sure to check the manifold gauge set and hoses for leaks as well as the rest of the system.

If the surrounding air is permeated with refrigerant gas, the leak detector will indicate this gas all the time. Good ventilation is necessary to prevent this situation. A fan, even in a well ventilated area, is very helpful in removing small traces of refrigerant vapor.

SPEED CONTROL

PERFORMANCE CHECKS

After servicing the speed control unit, the car should be road tested for proper operation of the speed control in both the manual and automatic control positions. **The speed control unit cannot be tested with the car on a hoist or jack.**

MANUAL OPERATION

1. Set the selector dial for any desired speed.

2. With the car in motion, a resistance should be felt at the accelerator pedal when the pre-selected speed is reached.

3. Drive while holding the accelerator pedal against the back pressure. The car should maintain a constant speed at the selected setting even when traveling up or down hills.

4. Push through the accelerator resistance to increase car speed above the speed control selector setting. The resistance should continue at all speeds above the pre-set speed.

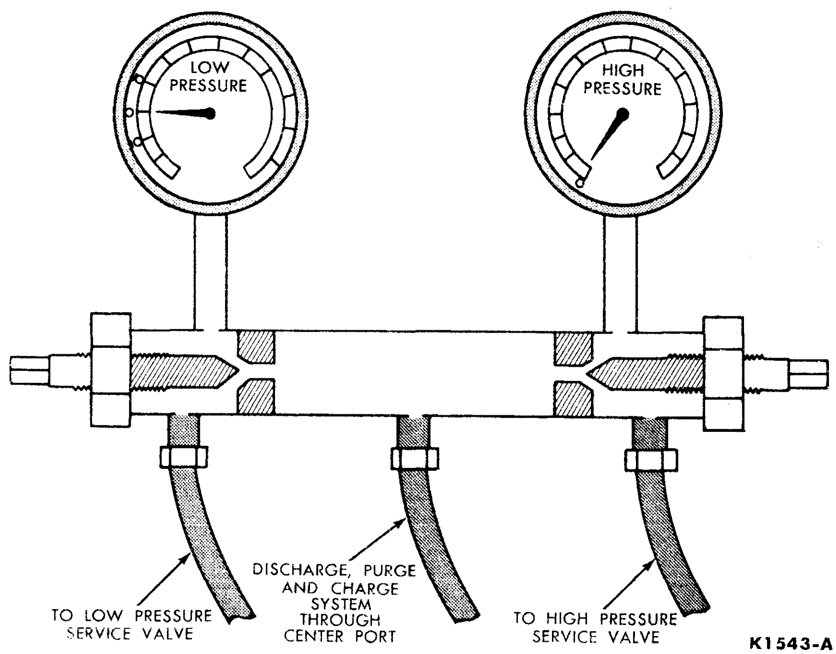

FIG. 5—Manifold Gauge Set

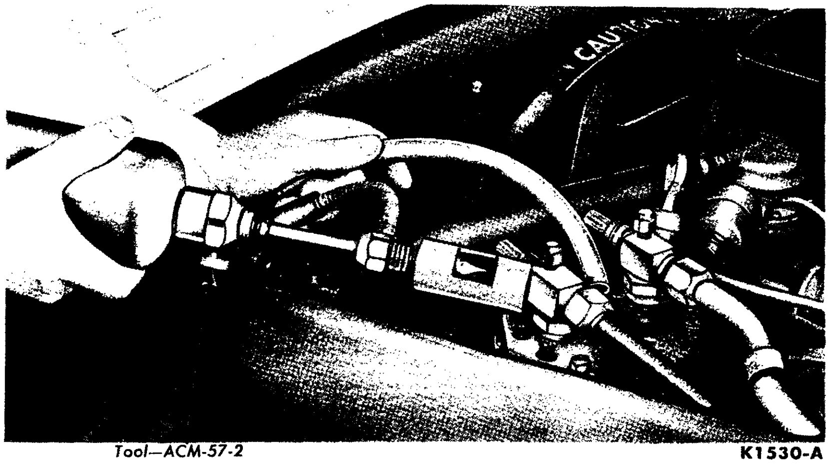

FIG. 6—Testing for Leaks

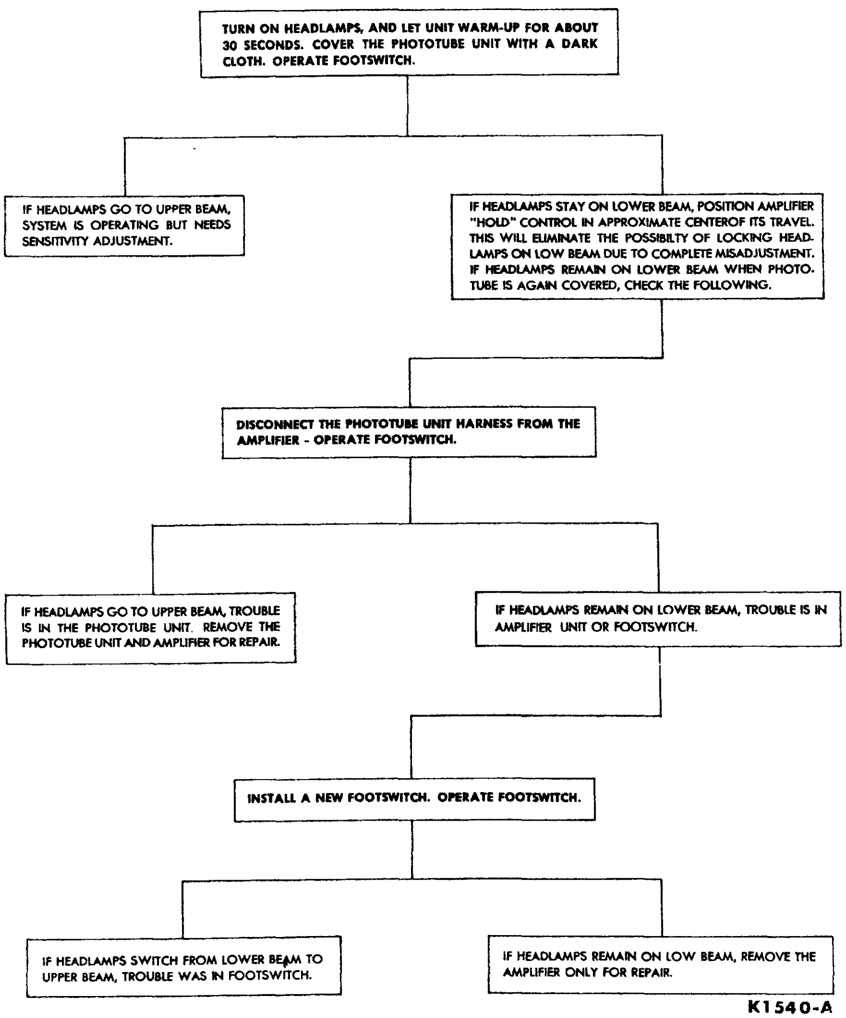

FIG. 7—Trouble Shooting—Locked on Low Beam

5. Check to see if the selected car speed can be increased or decreased at any time by turning the selector dial. The accelerator pedal must be held against the back pressure during this test.

AUTOMATIC OPERATION

Before road testing the car for automatic operation, the speed control system should be tested for cancellation when the brake pedal is depressed.

1. Turn the ignition switch to the ACC position.

2. Press the accelerator pedal to the floor. Push the slide switch to LOCK.

3. Release the slide switch, and accelerator pedal. The speed control should hold the accelerator pedal in the full throttle position.

4. Depress the brake pedal ¼-inch. The accelerator pedal should return to the normal position.

5. Road test the car and set the selector knob to any desired speed.

6. When the pre-set speed is reached, hold the accelerator pedal against the resistance and push the slide switch to LOCK. The car should now be automatically controlled and maintain the selected speed.

7. Test to see if the speed can be increased or decreased by turning the dial.

8. Again test to see if the automatic speed control cancels by lightly depressing the brake pedal or by turning the ignition switch to the OFF position. **It is not necessary to change the speed setting when re-engaging the automatic speed control. It can only be engaged when the selected speed is reached and the accelerator pedal is held against the resistance pressure when the slide switch is pushed to LOCK.**

9. Disengage the unit by moving the switch to the OFF position.

AUTOMATIC HEADLIGHT DIMMER

PRELIMINARY TEST

1. Turn the headlamps to the full ON position. (Allow about 30 seconds for the headlight dimmer to warm up.) With the car in a lighted area, the lights should be on low-beam regardless of the position of the foot switch. (If upper-beam is obtained in one position of the foot switch, check the fuse.)

2. Depress the foot switch about ⅛-inch to the detent. The lights should change to the upper-beam and then change back to the lower-beam when the foot switch is released, if the foot switch is in the Automatic position. If not, cycle the foot switch to obtain the automatic position.

3. Place a hand or a dark cloth over the phototube unit. The lights should switch to the upper-beam. Remove the cloth or hand. The lights should change back to the lower-beam. (The unit will not go to upper-beam if the phototube unit temperature is above 90° F. Therefore, check to see if the phototube is hot. If it is, allow it to cool and repeat the above checks.)

If the headlights operate as explained in steps 1, 2, and 3, the device should operate correctly with the proper aiming and sensitivity adjustments. If the lights do not operate as described in the above steps, refer to Figs. 7 and 8.

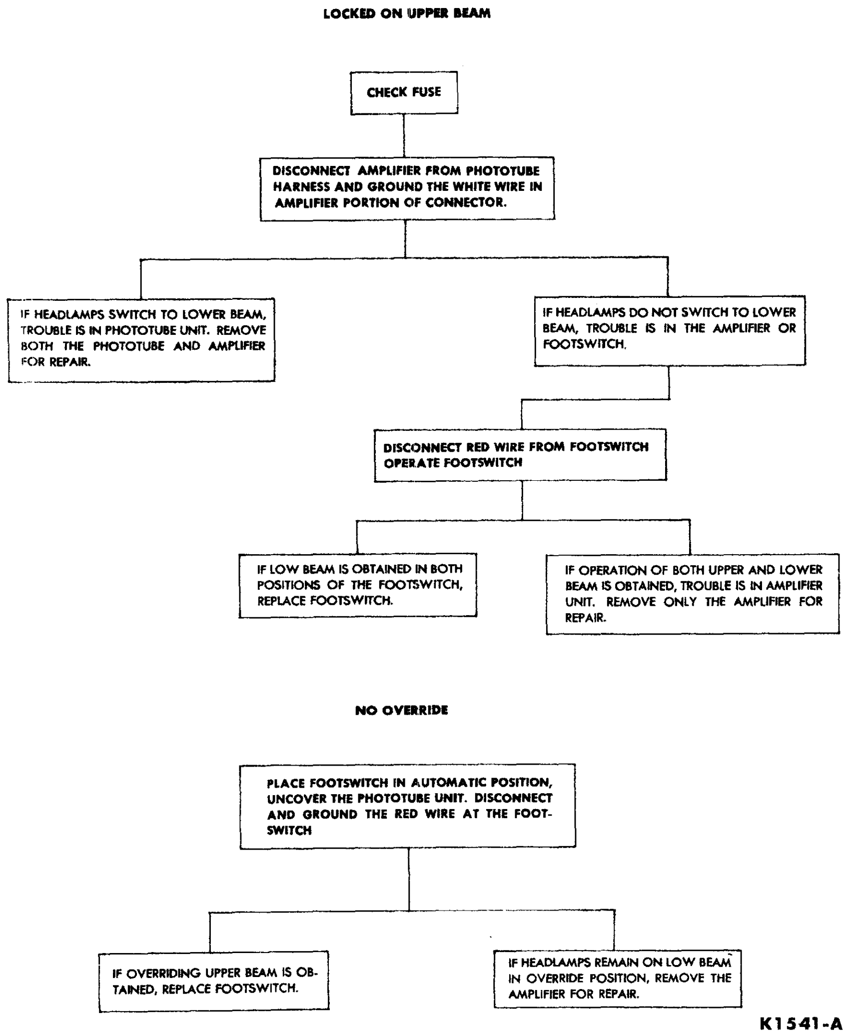

FIG. 8—Trouble Shooting—Locked on Upper Beam or No Over-Ride

2 COMMON ADJUSTMENTS AND REPAIRS (NOT APPLICABLE)

SEE IN-CAR ADJUSTMENTS AND REPAIRS (PART 16-2)

3 CLEANING AND INSPECTION

VENTILATING AND HEATING

When installing a new vents-heater valve or a regulator valve, inspect for dirt and foreign objects. Also, check to be sure the vacuum hoses are clean and not pinched or cracked. Be sure the pointer is not bent or rubbing.

Whenever the battery ground cable is removed, make certain the cable clamp and the battery terminal post are clean and dry before assembly.

AIR CONDITIONING

On a compressor clutch installation, carefully remove any burrs or dirt that may be on the compressor shaft. The shaft must be dry and brightly polished. Then install the key in the shaft.

When the compressor is disassembled, completely clean all gasket surfaces of shreds and foreign objects.

If the compressor shaft seal is being replaced, inspect the compressor internally and clean out dirt or chips as required.

See also ventilating and heating, this section.

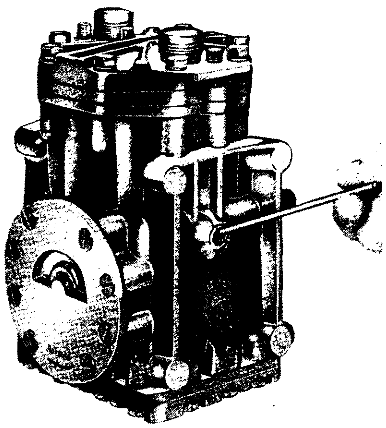

FIG. 9—Checking Compressor Oil Level

COMPRESSOR OIL LEVEL CHECK

Under normal conditions, when the air cooling system is operating satisfactorily, the compressor oil level need not be checked. There is no place for the oil to go except inside the sealed system. When the car is first started, some of the oil will be pumped into the rest of the system. After 15 minutes of operation, most of the oil is returned to the compressor crankcase.

Check the compressor oil level only if a portion of the refrigerant system is being replaced, or if there was a leak in the system and the refrigerant is being replaced.

Check the oil after the system has been charged and has been operating at an engine speed of 1500 rpm for 15 minutes in 60° F. surrounding air temperature or above. Turn off the engine, and isolate the compressor. (See In-Car Adjustments and Repairs, Part 16-2.) Remove the oil filler plug from the compressor (Fig. 9), insert a flattened ⅛-inch diameter rod (Fig. 10) in the oil filler hole until it bottoms. The rod should show ⅞-inch of oil. This is equivalent to 9 ounces of oil. It may be necessary to rotate the compressor crankshaft slightly (by hand) so that the dip rod will clear the crankshaft. If additional oil is needed in the compressor, add Suniso 5 or Capella E refrigerator compressor oil, or equivalent.

If more than ⅞-inch of oil is indicated, as might happen if a new compressor is installed and oil already in the system is pumped back to the compressor, draw out the excess oil until the proper quantity is indicated.

Replace the oil filler plug, and then evacuate and connect the compressor back into the system. Be sure to check the compressor filler opening for leaks.

CHECKING SYSTEM PRESSURES

The pressures developed on the high pressure and low pressure side of the compressor indicate whether or not the system is operating properly.

Attach the manifold gauge set (Fig. 5). It will not be necessary to attach the Refrigerant-12 tank unless refrigerant is to be added to the system. Set both manifold gauge valves at the maximum clockwise, or closed, position. Set both service valves at the center position.

Check the system pressures with the engine running at 1500 rpm, all controls set for maximum cooling, and the front of the car at least five feet from any wall.

The actual pressures indicated on the gauges will depend on the temperature of the surrounding air and the humidity. Higher air temperatures along with low humidity, will

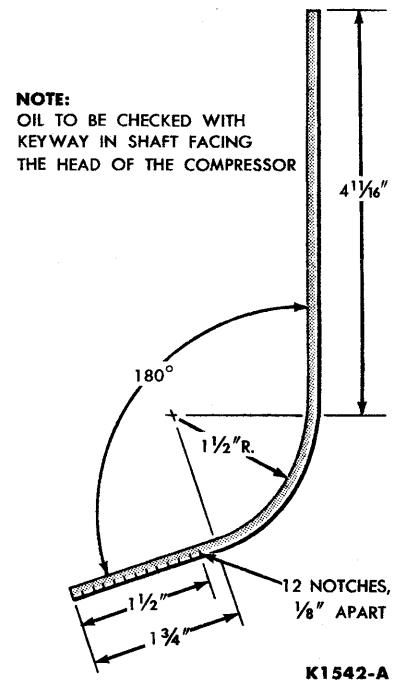

FIG. 10—Compressor Oil Level Dip Stick

give higher system pressures. The lowest figures given are for an ambient (surrounding air) temperature of 75° F., 50% relative humidity.

The low pressure gauge should indicate a pressure of from 12-50 pounds. The high pressure gauge should indicate a pressure six or seven times the low pressure, or 80-300 pounds.

At idle speed and a surrounding air temperature of 100°-110° F., the high pressure may go as high as 300 pounds or more. If it becomes necessary to operate the air conditioner under these conditions, keep the high pressure down with a fan directed at the condenser and radiator.

PART 16-2 VENTILATING AND HEATING

1 DESCRIPTION AND OPERATION

The heater control system incorporates two levers. The upper, or regulator lever, controls the heat temperature and ventilation quantity from minimum to maximum. The vents-heater lever controls the air duct doors for outside air, heated air and defrosting. A 4-position blower control switch is used to give three blower speeds for low, medium and high volumes of air for heating and defrosting. Fig. 1 shows the heater installation. Some air is bled by the defrost-heat door in both closed positions.

A wiring diagram covering both heating and air conditioning is shown in Fig. 13, Part 16-3.

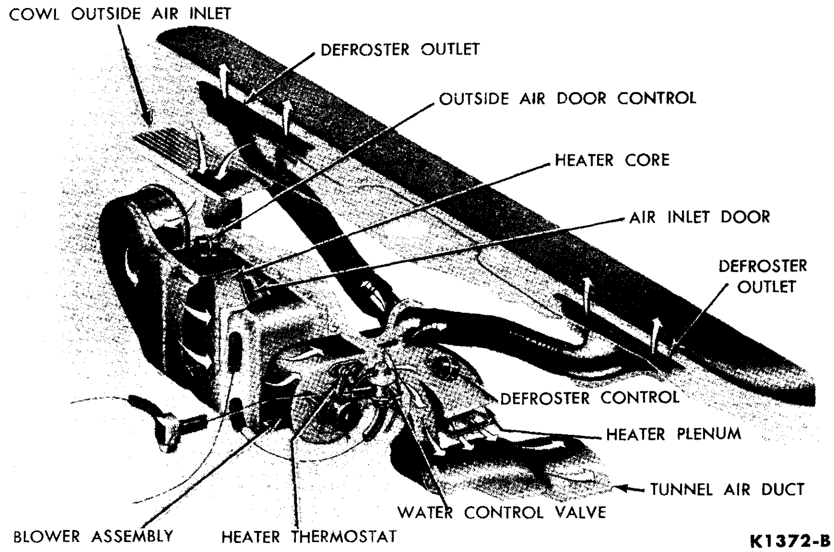

FIG. 1–Heater Installation

HEATER CORE AND WATER TEMPERATURE CONTROL

The water temperature control system consists of a thermostat and a water control valve.

The thermostat is mounted on the heater blower case and is subjected to discharged heater air. The Dole-type water control valve is mounted outside the heater blower case.

In operation, when the regulator lever on the instrument panel is moved to the right for heat, vacuum is applied to the thermostat, setting the sensing element for the desired temperature. This in turn controls the amount of vacuum directed to the water valve, thus regulating the flow of water through the heater core.

The vents-heater lever controls vacuum to the vacuum actuators to operate the various vent and heater doors.

2 IN-CAR ADJUSTMENTS AND REPAIRS

VACUUM ACTUATORS

The vacuum actuators are adjustable for proper air door operation. With no vacuum applied, adjust the right and left fresh air vent actuators and the defroster actuator so that the vent doors and defroster outlet door are closed. Make these adjustments so that the actuator return spring is preloaded for about a ⅛-inch travel of the actuator connecting link, with no vacuum applied.

Adjust the fresh air door actuator so that the door is completely closed (door arm in maximum clockwise position) when the vents-heater lever is at the OFF position (engine running).

BRACKET ADJUSTMENT

1. Loosen the two vacuum motor attaching screws or nuts.
2. Move the motor until the preload indicator is flush with the motor body. The damper must be in its normal position with no vacuum applied.
3. Tighten the two bracket attaching screws or nuts and check the operation of the motor.

3 REMOVAL AND INSTALLATION

HEATER CORE

REMOVAL

1. Start the engine and set the heater controls for maximum heat, to open the heater water valve.
2. Stop the engine and drain the coolant. Disconnect the heater core hoses.
3. Remove the front cover of the heater core housing (Fig. 2).
4. Remove the heater core mounting screws and remove the core.

INSTALLATION

1. Place the new core in position with the sponge rubber seals on each

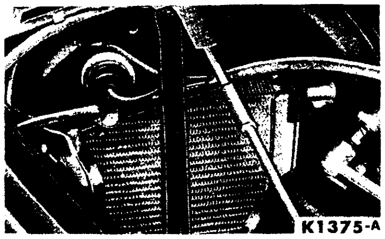

FIG. 2—Heater Core Removal

heater core inlet tube. Install the mounting screws.

2. Connect the heater core hoses. The hose from the water valve connects to the heater core lower inlet pipe.

3. Fill the cooling system. Bleed the system at the upper heater core inlet pipe.

4. Check for leaks. Then install the core housing front cover. Check the heater operation.

VENTS-HEATER VALVE

REMOVAL

1. Disconnect the battery ground cable.

2. Remove the mounting screws and control knobs, and remove the front casting and the dial.

3. Remove the plate assembly.

4. Remove the vents-heater valve and the vacuum lines.

INSTALLATION

1. Install the vacuum lines on a new vents-heater valve, and install the valve.

2. Install the plate assembly and its mounting screws.

3. Install the front casting and dial, the mounting screws, and the control knobs.

4. Connect the battery ground cable.

REGULATOR VALVE

Remove the front casting and the dial. Then remove the mounting screws and control knobs, disconnect the vacuum hoses and remove the regulator valve.

BLOWER MOTOR

The blower motor, mounted in the blower housing on the engine side of the dash, can be removed by disconnecting the motor connecting wires and ventilation tube and by removing the mounting nuts and screws. The heater blower wiring circuit is shown in Fig. 3.

BLOWER SWITCH

Disconnect the battery ground cable. Remove the front casting and dial. Remove the plate assembly. Disconnect the switch wires, and remove the switch.

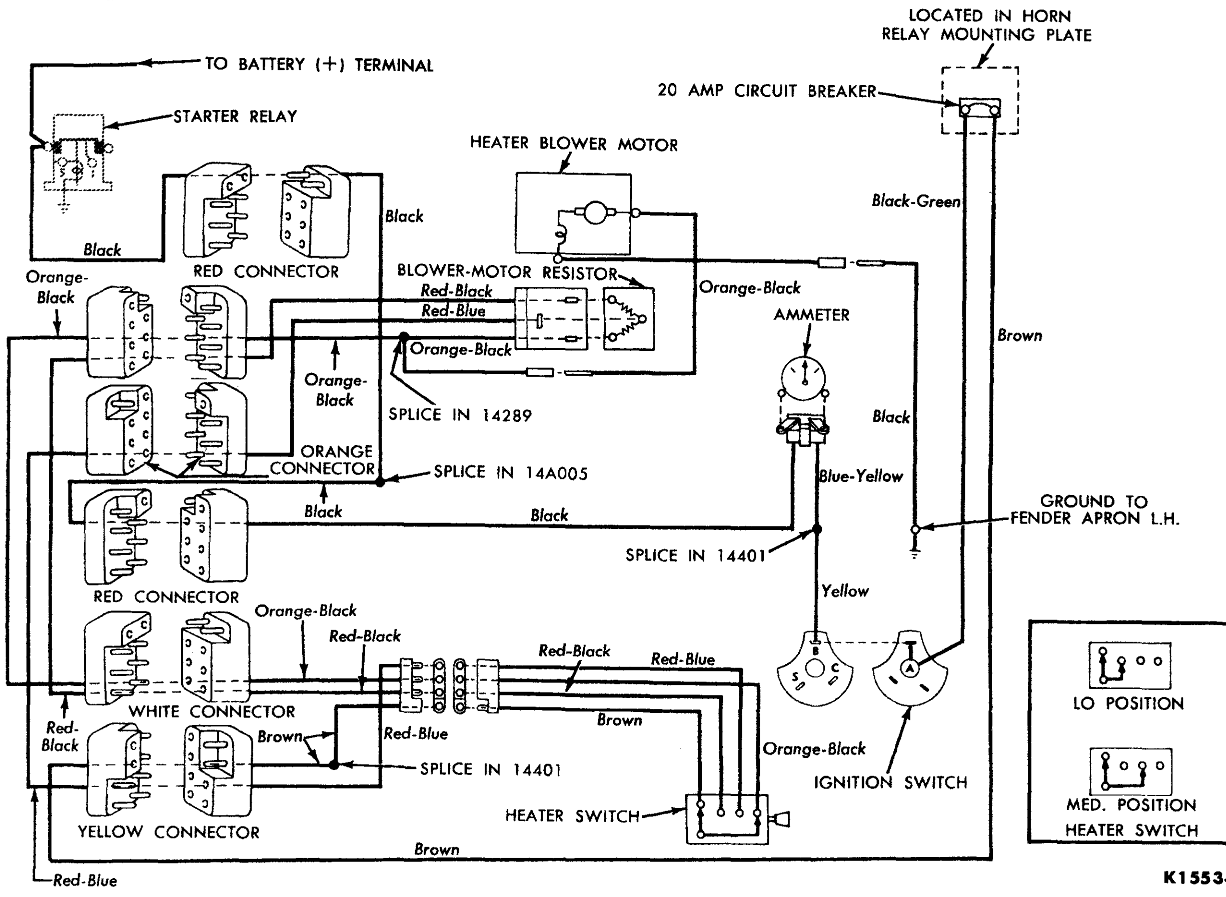

FIG. 3—Heater Blower Wiring Circuit

PART 16-3 AIR CONDITIONING

1 DESCRIPTION AND OPERATION

The combined heater-air conditioner incorporates two control levers. The regulator lever controls both heating and cooling temperature and ventilation quantity, from minimum to maximum. The vents-heater lever controls the air duct doors for fresh air, heated air, defrosting, cooled recirculated air, and cooled fresh air. The cooled fresh air is part recirculated and part fresh. A 4-position blower control switch is used to give three blower speeds for low, medium and high volumes of air for heating, defrosting, and cooling. Fig. 1 shows the heater-air conditioner installation. Some air is bled by the defrost doors and the toe-board heat door when they are in their closed positions.

A wiring diagram covering both heating and air conditioning is shown (Fig. 13) at the end of this part of the manual.

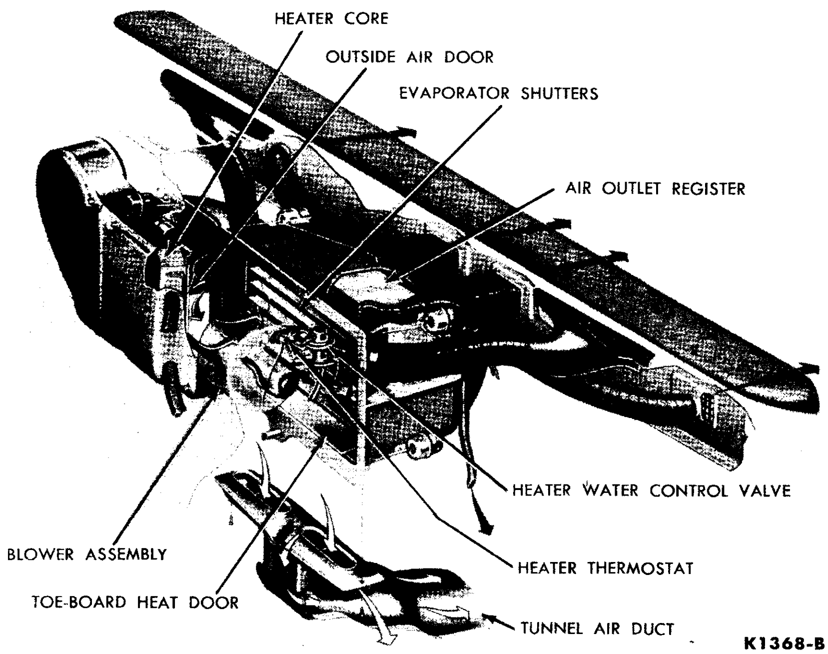

FIG. 1–Heater-Air Conditioner Installed

RECEIVER UNIT

The air cooling system stores the liquid Refrigerant-12 under pressure in a combination receiver and dehydrator. The pressure in the receiver normally varies from about 80 to 300 psi, depending on the surrounding air temperature and compressor speed. The receiver and condenser comes charged and marked with the total weight, so that any leak, indicated by a loss in weight, can be detected before assembly.

The dehydrator removes any traces of moisture that may have accumulated in the system. Even small amounts of moisture will cause an air cooling unit to malfunction. A fusible plug is screwed into the receiver. This will release the refrigerant before the refrigerant temperature exceeds 212° F.

EVAPORATOR UNIT

When the cooling system is in operation, the liquid Refrigerant-12 flows from the combination receiver and dehydrator unit through a flexible hose to the evaporator (cooling unit) where it is allowed to evaporate at a reduced pressure. The evaporator assembly is mounted on the passenger compartment side of the dash.

EXPANSION VALVE

The rate of refrigerant evaporation is controlled by an expansion valve (Fig. 2) which allows only enough refrigerant to flow into the evaporator to keep the evaporator operating efficiently, depending on its heat load.

The expansion valve consists of the valve and a temperature sensing capillary tube and bulb. The bulb is clamped to the outlet pipe of the evaporator. Thus, the valve is controlled by evaporator outlet temperature. An internal equalizer applies evaporator outlet pressure to one side of the valve diaphragm. Thus, the valve is controlled by both evaporator outlet temperature and outlet pressure.

The restricting effect of the expansion valve at the evaporator causes a low pressure on the low pressure side of the system of 12-50 psi, depending on the surrounding air temperature and compressor speed.

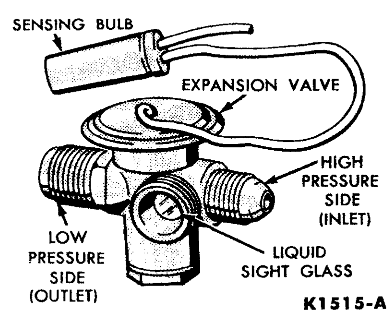

FIG. 2–Expansion Valve and Liquid Sight Glass

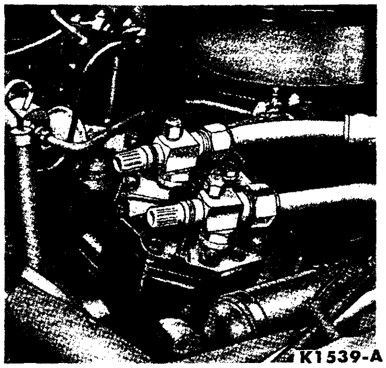

FIG. 3—Compressor Installed

LIQUID SIGHT GLASS

A liquid sight glass is mounted in the expansion valve (Fig. 2). The sight glass is used to check whether or not there is enough liquid refrigerant in the system. Foam seen in the sight glass while the compressor is operating, is an indication of loss of refrigerant. See "Diagnosis and Testing," Part 16-1.

COMPRESSOR UNIT

The evaporated refrigerant leaving the evaporator (now in the form of a gas at a pressure of 12-50 psi), is pumped by the compressor located on the engine (Fig. 3), into the top of the condenser located in front of the radiator.

The compressor maintains a pressure on its high pressure side of from 80-300 psi, depending on the surrounding air temperature and compressor speed.

As the now heated and compressed refrigerant gas flows down through the condenser, it is cooled by air passing between the sections of the condenser, and the cooled, compressed refrigerant gas condenses to liquid refrigerant which then flows into the receiver. Before the liquid refrigerant flows on to the expansion valve, it makes one more pass across the bottom of the condenser where it is further cooled.

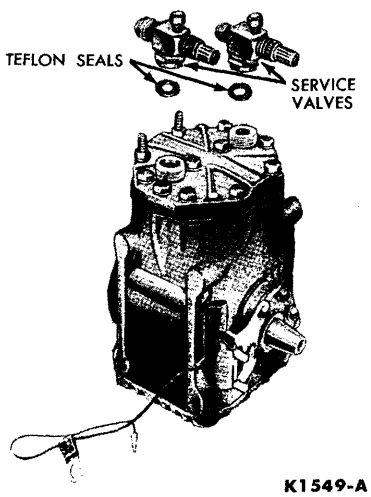

FIG. 4—Compressor Service Valves Removed

MAGNETIC CLUTCH

To control the amount of cooling that the system produces, the compressor is electrically cut in and out of operation by the use of a magnetic clutch pulley mounted on the compressor crankshaft. The magnetic clutch is controlled by a thermostatic switch which has its temperature sensing tube inserted in the fins of the evaporator core.

SERVICE VALVES

The service valves on the compressor are used to test and service the cooling system (Fig. 4). The high pressure service valve, mounted at the outlet to the compressor, allows access to the high pressure side of the system for attaching a pressure gauge, or a servicing hose.

The low pressure valve, mounted at the inlet to the compressor, allows access to the low pressure side of the system for attaching a pressure gauge, or a servicing hose.

Both service valves may be used to shut off the rest of the system from the compressor during compressor service.

THERMOSTATIC SWITCH

The thermostatic switch controls the operation of the compressor by controlling the compressor magnetic clutch. The temperature sensing tube of the switch is placed in contact with the evaporator fins.

When the temperature of the evaporator becomes too cold, the thermostatic switch opens the magnetic clutch electrical circuit, disconnecting the compressor from the engine. When the temperature of the evaporator rises to the upper limit at which the thermostatic switch is set, the thermostatic switch closes and energizes the magnetic clutch. This connects the compressor to the engine and cooling action begins again.

When the ignition switch is off, or the cooling control thermostatic switch is in the off position, the magnetic clutch is not energized, and the cooling system can not operate.

When the ignition switch is on (engine running), and the cooling control is in the cooling range, the magnetic clutch is energized, the compressor is connected to the engine, and the cooling system is in operation.

The thermostatic switch may be adjusted to maintain an average evaporator temperature of from 30°-60° F. (Fig. 5). The thermostatic switch operating differential temperature at any one setting is 6° F. The switch is controlled by the regulator control.

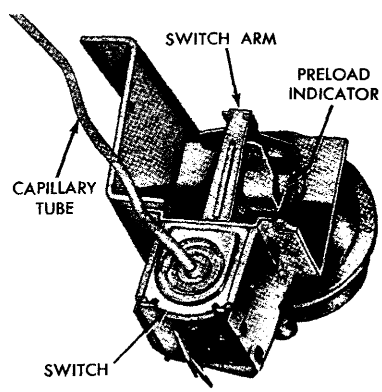

FIG. 5—Thermostatic Switch

2 IN-CAR ADJUSTMENTS AND REPAIRS

VACUUM ACTUATORS

The vacuum actuators (Fig. 2), are adjustable for proper air door operation. The single acting actuators are adjusted so that the actuator return springs are preloaded for about ⅛ inch travel of the actuator connecting links, with no vacuum applied.

Adjust the fresh air door actuator so that the door is completely closed (door arm maximum clockwise position) when the vents-heater lever is at the OFF position (engine running).

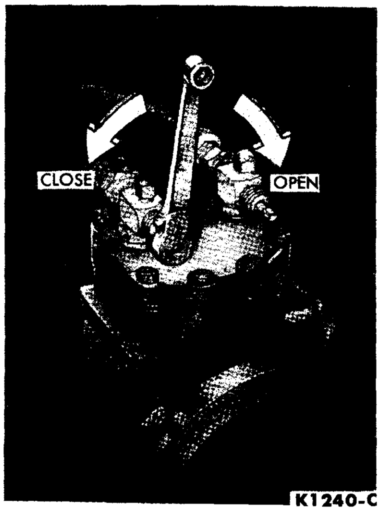

FIG. 6—Low Pressure Service Valve Gauge Port

Adjust the fresh air bleed crank so that the fresh air door is completely closed when the vents-heater lever is at the OFF position (engine running).

Adjust the evaporator shutter so that the shutter is completely open when the vents-heater control is at the REC position. Also see bracket adjustment instructions under "Ventilating and Heating."

ISOLATING THE COMPRESSOR

To isolate the compressor from the system, turn both the high and the low pressure service valves to the extreme clockwise position (Figs. 6 and 7). Loosen the cap on the high pressure service valve gauge port, and allow the gas to escape until the compressor is relieved of refrigerant pressure.

Loosen the cap a small amount only, and do not remove it until the pressure is completely relieved.

To connect the compressor back into the system, evacuate the compressor at the high pressure service valve gauge port, close the vacuum pump valve, turn both service valves to the maximum counterclockwise position, and cap the high pressure service valve gauge port and service valve stems.

DISCHARGING THE SYSTEM

Discharge the refrigerant from the system, except the compressor, before replacing any part of the system.

To discharge the system, connect the manifold gauge set to the system (Fig. 5, Part 16-1). Do not connect the manifold center connection hoses to the Refrigerant-12 tank, or vacuum pump. Place the open end of these hoses in a garage exhaust outlet. Set the high pressure manifold gauge valve at the maximum counterclockwise or open position. Open the high pressure service valve a slight amount (Fig. 7), and allow the refrigerant to discharge slowly from the system.

Do not allow the refrigerant to rush out, as the oil in the compressor will be forced out along with it.

CHARGING THE SYSTEM

The procedure for charging depends on whether a partial charge or a complete charge is being made. When a complete charge is to be made, check for leaks first (See "Diagnosis and Testing," Part 16-1), then release the pressure and evacuate the system.

EVACUATING THE SYSTEM

Attach the manifold gauge set, a tank of Refrigerant-12 and a vacuum pump to the system (Fig. 8). Make certain that the Refrigerant-12 tank valve is tightly closed. Set both service valves to the mid-position. Open both manifold valves (Fig. 8). Release any pressure in the system.

Open the vacuum pump valve and run the pump until the low pressure gauge reads at least 25 inches, and as close to 30 inches of vacuum as possible. Continue vacuum pump operation for 20 to 30 minutes to boil any moisture out of the system. Close the pump valve. Turn off the pump.

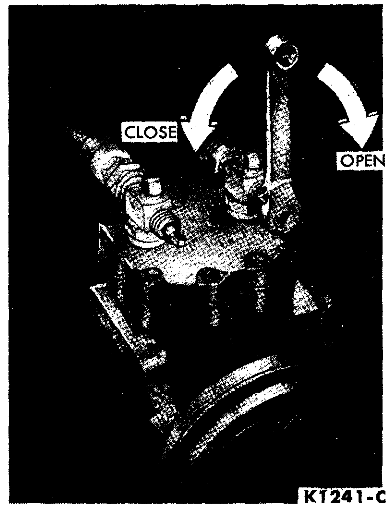

FIG. 7—High Pressure Service Valve Gauge Port

MAKING A PARTIAL CHARGE

Attach the manifold gauge set. Open both manifold valves. Close the vacuum pump valve. Open the Regfrigerant-12 tank valve. Purge the air from the high pressure hose by loosening the high pressure hose at the service valve for a few sec-

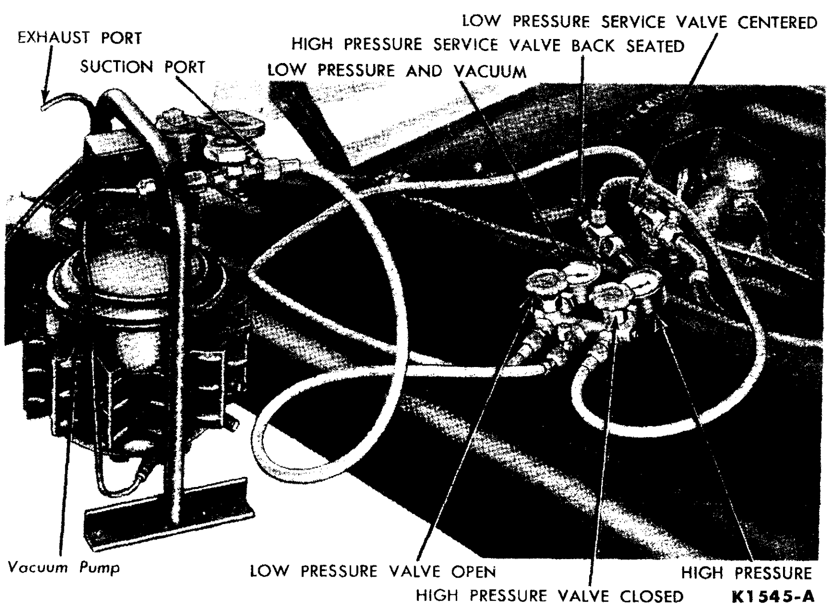

FIG. 8—Evacuating the System

onds. Tighten the connections and set the high pressure manifold gauge valve at the maximum clockwise position. Loosen the low pressure gauge hose slightly at the low pressure service valve, for a few seconds, to purge the air from the hose. Tighten the connection. Set both service valves at the center position (Fig. 9).

Run the engine at 1500 rpm with all controls at the maximum cold position. Charge the system until all foam disappears from the sight glass, then add ½-pound of Refrigerant-12. Shut the Refrigerant-12 tank valve.

It may be necessary to place the Refrigerant-12 tank in a container of hot water at about 150° F. to force the gas from the tank during charging.

Never heat the Refrigerant-12 tank with a torch. A dangerous explosion may result.

Set both service valves at the maximum counterclockwise position. Remove the gauge set, and cap the service valve gauge ports and valve stem.

MAKING A COMPLETE CHARGE

Check for leaks first (See "Diagnosis and Testing," Part 16-1), release the pressure, then evacuate the system. Leave both service valves at the mid-position and the vacuum pump valve closed. Leave the low pressure manifold gauge valve at the maximum counterclockwise or open position. Set the high pressure manifold gauge valve at the maximum clockwise or closed position. Set all controls to the maximum cold position.

Open the Refrigerant-12 tank valve. Run the engine at 1500 rpm. Charge the system until 2½-pounds of refrigerant have been weighed into it. During the charging, the high pressure may build up to an excessive value. This can be caused by an overcharge of refrigerant, or an overheated engine, in combination with high surrounding temperatures. Never allow the high pressure to exceed 240-pounds while charging. Stop the engine, determine the cause, and correct it.

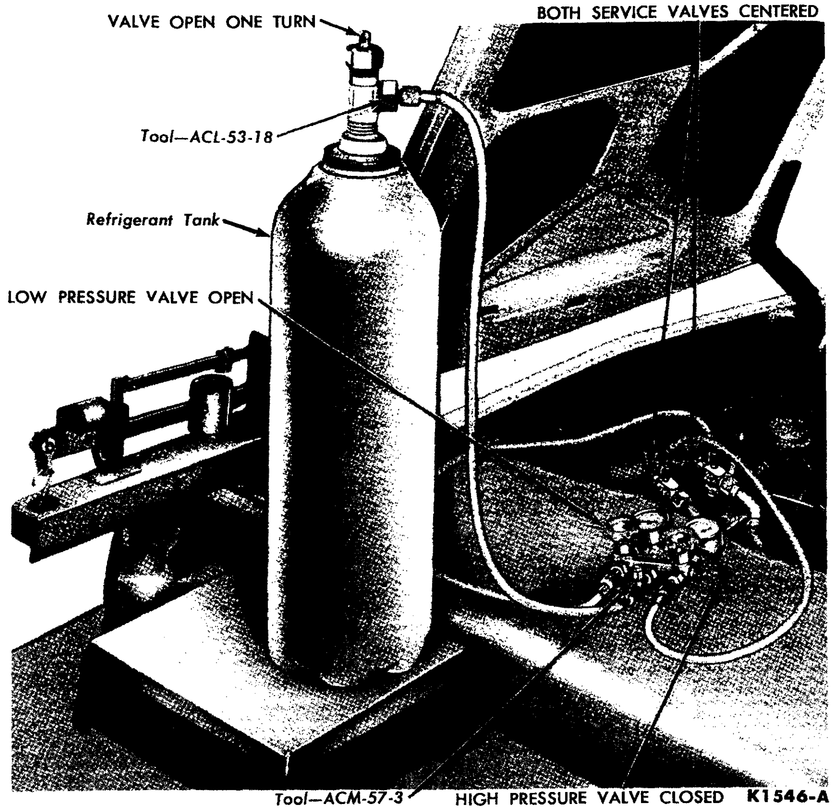

FIG. 9—Charging the Air Conditioning System

After the proper charge has been made, close the Refrigerant-12 tank valve, and check the system pressures for proper operation. Set both service valves at the maximum counterclockwise position. Remove the gauge set, and cap the service valve gauge ports and valve stems.

CHARGING FROM SMALL CONTAINERS

Refrigerant-12 is available in one pound cans. A scale is not necessary if these small containers are used instead of a tank.

Attach the hose, that would normally go to the large tank, to the special valve that is provided for the small cans. Close the valve (maximum clockwise position) and follow the procedure for leak testing, evacuating and charging the system as previously given.

For charging, attach a one pound can of Refrigerant-12 to the special valve, and open the valve. Keep the can in an upright position. When the can is empty (no frost showing), close the valve, remove the empty can, attach a new one, and open the valve again.

Allow only ½ of the third can of refrigerant to be pumped into the system by closing the valve at the can when the frost line has reached ½ way down the can. The system will then have been charged with 2½-pounds of refrigerant.

Check the system pressures, set both service valves at the maximum counterclockwise position. Remove the gauge set, and cap the service valve gauge ports and valve stems.

3 REMOVAL AND INSTALLATION

AIR CONDITIONING

SAFETY PRECAUTIONS

Refrigerant-12, which is used in the air conditioner system, is nonexplosive, noninflammable, noncorrosive, has practically no odor, and is heavier than air. Although it is classified as a safe refrigerant, certain precautions must be observed to protect the parts involved and the person who is working on the unit.

Use only Refrigerant-12.

At normal atmospheric pressures and temperatures, liquid Refrigerant-

12 evaporates so quickly that it tends to freeze anything that it contacts. For this reason, extreme care must be taken to prevent any liquid refrigerant from coming in contact with the skin and especially the eyes.

Refrigerant-12 is readily absorbed by most types of oil. It is therefore recommended that a bottle of sterile mineral oil and a quantity of weak boric acid solution be kept nearby when servicing the air conditioning system. Should any liquid refrigerant get into the eyes, use a few drops of mineral oil to wash them out, and then wash the eyes clean with the weak boric acid solution. Seek a doctor's aid immediately even though irritation may have ceased.

Always wear safety goggles when servicing any part of the refrigerating system.

The Refrigerant-12 in the system is always under pressure. Because the system is tightly sealed, heat applied to any part would cause this pressure to build up excessively.

To avoid a dangerous explosion, never weld, use a blow torch, solder, steam clean, bake body finishes, or use any excessive amount of heat on, or in the immediate area of, any part of the air cooling system or refrigerant supply tank, while they are closed to the atmosphere whether filled with refrigerant or not.

The liquid refrigerant evaporates so rapidly that the resulting refrigerant gas will displace the air surrounding the area where the refrigerant is released. To prevent possible suffocation in enclosed areas, always discharge the refrigerant from an air cooling system into the garage exhaust collector. Always maintain good ventilation surrounding the work area. **If the car is to be undercoated, make certain that the undercoating does not plug the evaporator drain tubes.**

Although Refrigerant-12 gas, under normal conditions, is non-poisonous, the discharge of refrigerant gas near an open flame can produce a very poisonous gas. This gas will also attack all bright metal surfaces. This poisonous gas is generated in small quantities when the flame-type leak detector is used. Avoid inhaling the fumes from the leak detector. **Make certain that Refrigerant-12 is both stored and installed in accordance with all state and local ordinances.**

When admitting Refrigerant-12 gas into the cooling unit, always keep the tank in an upright position. If the tank is on its side or upside down, liquid Refrigerant-12 will enter the system and damage the compressor. **In surrounding air temperatures above 90°F., prolonged engine idle will result in excessively high compressor pressures.**

EVAPORATOR

REMOVAL

1. Disconnect the battery ground cable.
2. Remove the carburetor air cleaner.
3. Discharge the refrigerant into the garage exhaust system.
4. Disconnect the refrigerant lines from the evaporator, and remove the expansion valve (Fig. 10).
5. Disconect the vacuum lines at the junction block.
6. Disconnect the wires from the thermostatic switch.
7. Remove the instrument panel insulation board (See Group 15).
8. Remove the sun visor mounting brackets.
9. Remove the corner post garnish moulding.
10. Remove the five screws retaining the upper section of the instrument panel. Carefully lift the rear end of the panel and slide it away from the windshield.
11. Disconnect the phototube unit plug from the amplifier of the automatic headlight dimmer.
12. Remove the upper panel.
13. Disconnect the right and left defroster hoses at the evaporator.
14. Disconnect the right and left register hoses at the evaporator.
15. Disconnect both center register hoses at the instrument panel.
16. Remove five screws just back of windshield.
17. Remove four vertical bolts, two at steering column, the other two at outer ends of instrument panel.
18. Pull instrument panel back to allow clearance for removal of evaporator.
19. Remove evaporator mounting screws and remove the evaporator.

INSTALLATION

1. Position the evaporator to the dash and drive the mounting screws.
2. Reposition instrument panel and install the four vertical bolts.
3. Drive the five screws which attach the instrument panel just back of the windshield.
4. Connect both center register hoses to the instrument panel.
5. Connect the right and left register hoses to the evaporator.
6. Connect the right and left defroster hoses to the evaporator.
7. Position the upper section of the instrument panel such that the phototubes unit plug can be connected to the amplifier, and make the connection.
8. Carefully slide the panel to the correct position and drive the five retaining screws.
9. Install the instrument panel insulation board (See Group 15).

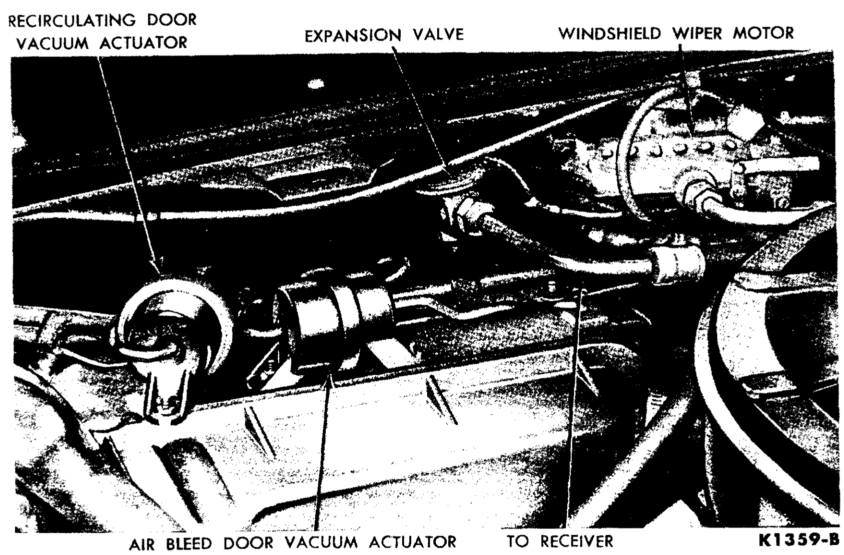

FIG. 10—Evaporator Refrigerant Line Connections

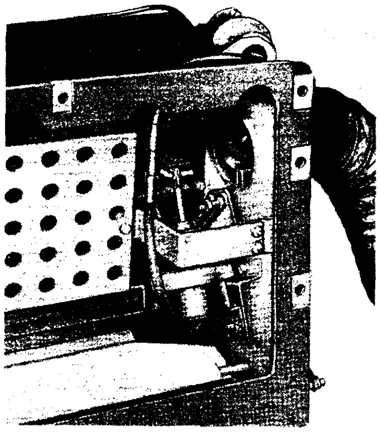
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FIG. 11—Evaporator Shutter Actuator

10. Connect the wires to the thermostatic switch.

11. Connect the vacuum lines at the junction block.

12. Install the expansion valve and connect the refrigerant lines.

13. Charge the system. (See In-Car Adjustments and Repairs.) As there will be no pressure in the system to begin with, be sure to check for leaks after charging the system.

14. Install the carburetor air cleaner.

15. Connect the battery ground cable.

16. Operate and test the air conditioner.

EVAPORATOR CORE

Remove the evaporator assembly from the car, and remove the air deflector plate. Disconnect the evaporator shutter vacuum actuator and remove the evaporator shutter. Remove the evaporator core mounting screws and remove the evaporator core.

Install the new core in the housing. Install the evaporator shutters and connect the actuator arm. Install the air deflector, and install the evaporator assembly in the car.

EVAPORATOR SHUTTER ACTUATOR

The evaporator shutter vacuum actuator is mounted inside the evaporator housing (Fig. 11). To remove and install, remove the blower housing and the access plate on the engine side of the dash panel.

COMPRESSOR

REMOVAL

1. Isolate the compressor (See In-Car Adjustments and Repairs) and disconnect the two service valves and hoses from the compressor (Fig. 4).

2. Energize the clutch and loosen and remove the clutch mounting bolt.

3. Install a ⅝-11 inch bolt in the clutch drive shaft hole. With the clutch still energized, tighten the bolt to loosen the clutch from the shaft. Disconnect the clutch wire at the bullet connector.

4. Loosen the muffler bracket attaching bolt, located below the muffler.

5. Loosen the compressor mounting bolts. Slide the compressor toward the center of the engine, remove the drive belt and the clutch, and then remove the mounting bolts and the compressor.

6. With the compressor on the work bench, remove the key from the shaft.

INSTALLATION

Before installing the compressor, see Cleaning and Inspection — Air Conditioning (Part 16-1).

1. Mount the clutch on the shaft and install the mounting screw and washer, finger-tight.

2. Place the compressor on the mounting bracket and install the four mounting bolts, finger-tight.

3. Connect the clutch wire, energize the clutch and torque the clutch mounting bolt to specifications. **If the new compressor was shipped with a bolt and washer in the end of the crankshaft, remove and discard the bolt and use a bolt with a nylon insert in it.**

4. Install and adjust the drive belt, and tighten the mounting bolts to specifications. Do not exceed torque specifications as misalignment can result.

5. Install the service valves on the compressor using new gaskets. Tighten the service valve flared nuts to specifications. **Do not over-tighten the flared nuts. The new ROTO-LOK service valves can be rotated slightly on their seat without**

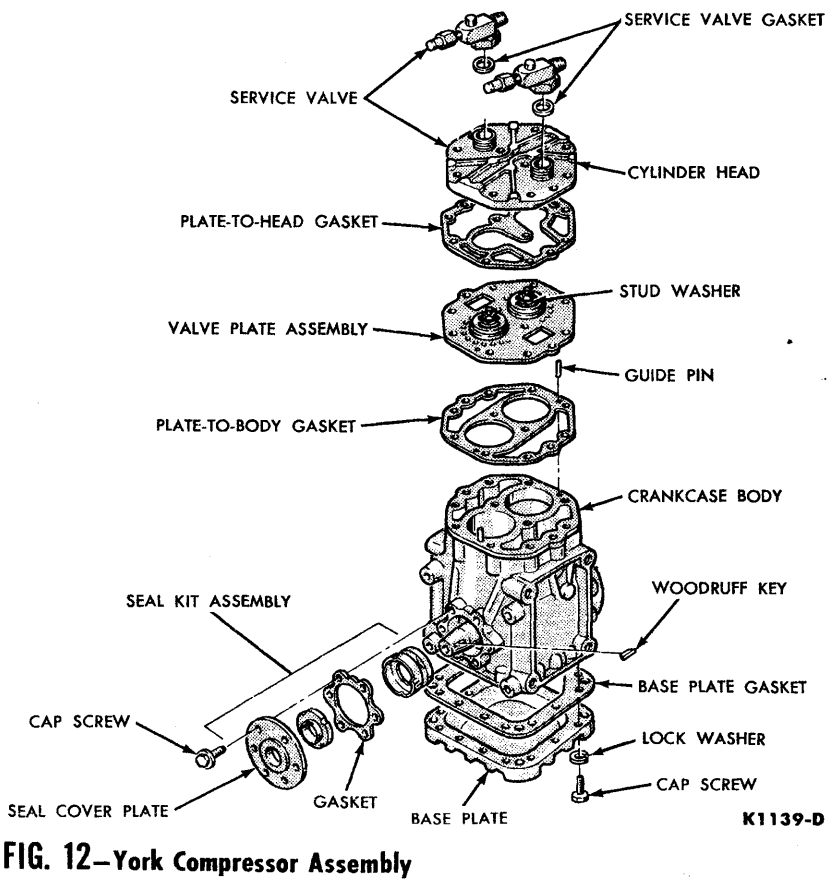

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FIG. 12—York Compressor Assembly

breaking the high pressure seal. This is not an indication of a loose valve.

6. Tighten the muffler bracket attaching bolt.

7. Leak test the compressor, then evacuate it and connect it back into the system.

8. Check the oil level in the compressor and add or remove oil if necessary. See Cleaning and Inspection, Part 16-1.

COMPRESSOR COMPONENTS

All compressor removal and installation operations, except belt replacement, can be performed only after the unit has been isolated from the rest of the system. See In-Car Adjustments and Repairs.

VALVE PLATE

Removal

1. Isolate the compressor and disconnect the service valves. Remove the twelve head bolts.

2. Remove the cylinder head and valve plate from the top of the compressor body (Fig. 12). Do not tap or hit the aluminum head with any hard tool, as damage could result.

3. Remove and discard all gaskets, and be sure to clean gasket shreds from all gasket surfaces.

4. Examine the cylinders and top of the pistons, particularly in case of valve breakage. If there are score marks, replace the compressor assembly.

5. If the cylinders and pistons are in good condition, check the valve plate and valve leaves for damage. If the valve assembly is in good condition, it can be used again. If the valve plate is damaged, install the entire replacement kit which includes the valve plate, valve leaves, and the two gaskets (Fig. 12).

6. When the valve plate assembly is re-used, wash it in clean solvent and dry in dry air.

7. Check the oil for dirt. If the system is not clean, replace the oil.

Installation

1. Starting with the valve plate gasket, assemble the parts in the order shown in Fig. 12. Insert the cylinder head bolts carefully to avoid damaging the gaskets. Before assembly, apply a film of new refrigeration oil to both sides of both gaskets.

2. Tighten all bolts finger tight, and then torque the bolts a quarter turn at a time to specifications. Do this by tightening the service valve bolts first. Then tighten the remaining bolts in a sequence so those diagonally opposite are evenly drawn to the required torque.

3. Connect the compressor into the system.

4. Check the oil level in the compressor, and add or remove oil if necessary. See Cleaning and Inspection, Part 16-1.

BELT

REMOVAL AND INSTALLATION

1. Loosen the four compressor mounting bolts, and slide the com-

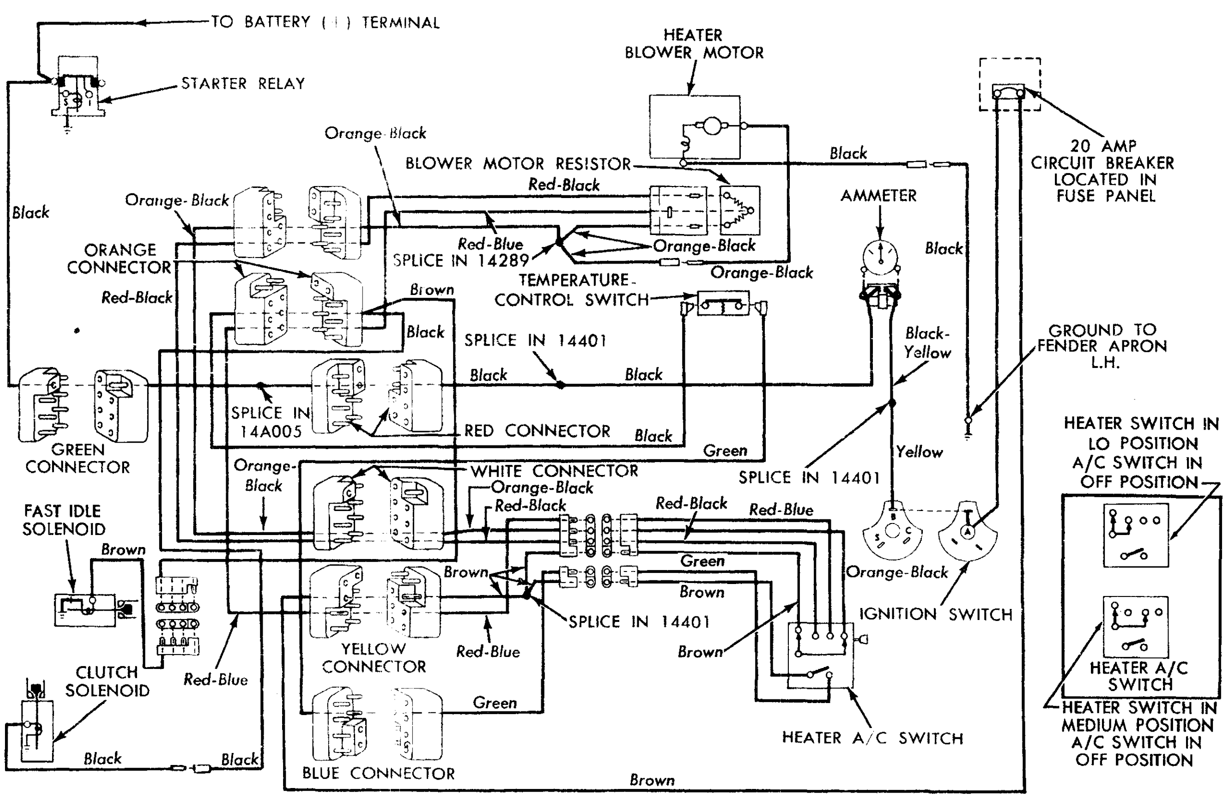

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FIG. 13—Wiring Diagram Heater and Air Conditioner

pressor toward the center of the car to remove the belt.

2. Place the new belt in position, and slide the compressor toward the outside of the car and tighten the four mounting bolts.

3. Adjust the belt tension to specifications.

CLUTCH

REMOVAL AND INSTALLATION

1. Energize the clutch and loosen and remove the clutch mounting bolts.

2. Install a 5/8-11 inch bolt in the clutch drive shaft hole. With the clutch still energized, tighten the bolt to loosen the clutch from the shaft, then remove the magnetic clutch.

3. Install the clutch, the clutch mounting bolt, and the washer.

4. Energize the clutch, and torque the bolt to specifications.

CRANKSHAFT SEAL

REMOVAL

1. Isolate the compressor, and remove from the car. See In-Car Adjustments and Repairs.

2. Remove the clutch and remove the Woodruff key.

3. Remove the seal plate bolts, and remove the plate and gasket. Do not mar the sealing surfaces, or the polished shaft surface.

4. Remove the carbon seal ring and seal housing assembly from the crankshaft. A disassembled view of the crankshaft seal assembly is included in Fig. 12.

5. Remove the base plate and inspect internal compressor for foreign particles. Clean out as required.

6. Clean all old gasket material from the seal plate and the compressor. Make certain that the shaft, the seal plate and the compressor gasket surfaces are completely clean before installing the new seal.

INSTALLATION

1. Lubricate the new shaft seal parts in clean compressor oil. Position the seal assembly on the crankshaft, with the carbon ring toward the seal plate.

2. Position the new gasket on the compressor and install the seal plate.

3. Torque the bolts to specifications.

4. Make certain that there are no burrs or dirt on the compressor shaft. Then install the key, the belt, and the clutch.

5. Install the new base plate gasket and install the base plate. Add new compressor oil to specifications. See Cleaning and Inspection, Part 16-1.

6. Install the compressor.

7. Adjust the belt tension to specifications.

HEATER CORE, REGULATOR VALVE, AND VENTS-HEATER VALVE

For removal and installation, follow the procedures given in the heater section of this manual.

BLOWER MOTOR

The blower motor is mounted in the blower housing on the engine compartment side of the dash (Fig. 1). The motor is removed by disconnecting the motor connecting wires and ventilation tube, then removing the mounting nuts and screws.

PART 16-4 RADIO

1 DESCRIPTION AND OPERATION

An AM and an AM/FM radio are available for 1964. Both radios have push button tuning as well as manual tuning. An electrically operated antenna is mounted on the right fender. The antenna switch is located under the rear edge center of the crash pad. A rear seat speaker and a front speaker are used. Figs. 1 and 3 show the radio schematic diagrams.

2 IN-CAR ADJUSTMENTS AND REPAIRS

PUSH BUTTON ADJUSTMENT

Turn the radio on. Pull out the desired push button and reduce the volume to a low value. Tune in the desired station with the manual tuning knob. The station is correctly tuned in when the clearest tone is heard. Carefully push the button in all the way, then release it.

Adjust the remaining buttons and check all the positions for repeat accuracy. Repeat the procedure for any buttons that shift from the correct tuning point.

On the AM/FM radio push one AM button all the way in before adjusting the AM buttons. Push one FM button all the way in before adjusting the FM buttons.

3 REMOVAL AND INSTALLATION

RADIO

REMOVAL

1. Disconnect the battery ground cable.
2. Remove the radio control knobs, and the heater control knobs.
3. Remove the 7 upper screws from the instrument panel reinforcement bracket. Remove the 5 upper instrument panel bezel mounting screws and remove the reinforcement bracket. Remove the 5 lower instrument panel bezel mounting screws, and remove the bezel.
4. Remove the right and left sun visors, and the right and left windshield pillar garnish mouldings.
5. Remove the retaining screws from the upper front instrument panel. Lift the panel and disconnect the photo tube lead at the quick disconnect and remove the upper panel.
6. Remove the radio support mounting bolt from the upper panel area. Remove the radio mounting plate at the face of the radio.
7. Pull the radio out of the instrument panel and disconnect the antenna lead, speaker lead and power lead and remove the radio (Fig. 4).

INSTALLATION

1. Connect the speaker lead, power lead and antenna lead to the radio and insert the radio into the instrument panel.
2. Install the upper mounting bolt to the radio through the upper instrument panel.
3. Install the mounting plate on the face of the radio and the instrument panel.
4. Connect the battery and check the operation of the radio.
5. Place the upper front instrument panel in position, connect the photo tube lead and install the panel mounting screws.
6. Install the center instrument panel bezel.
7. Install the heater and radio control knobs.
8. Install the right and left windshield pillar garnish mouldings, and the right and left sun visors.

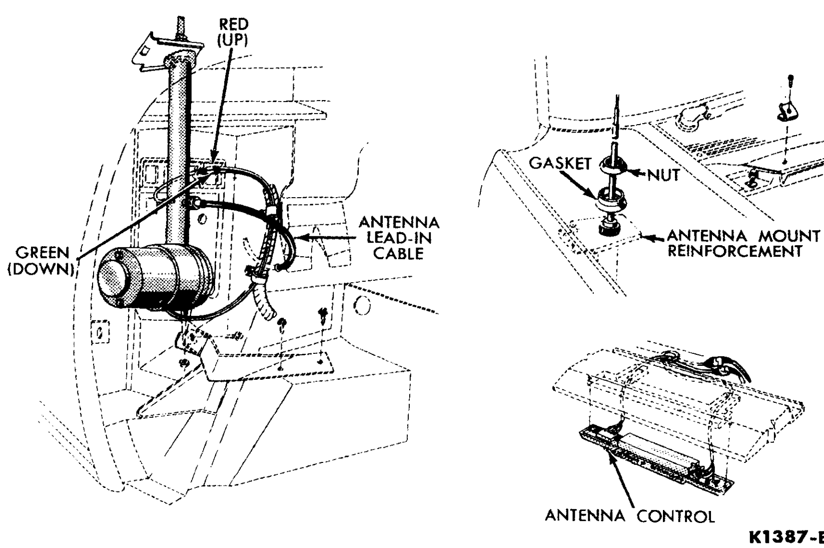
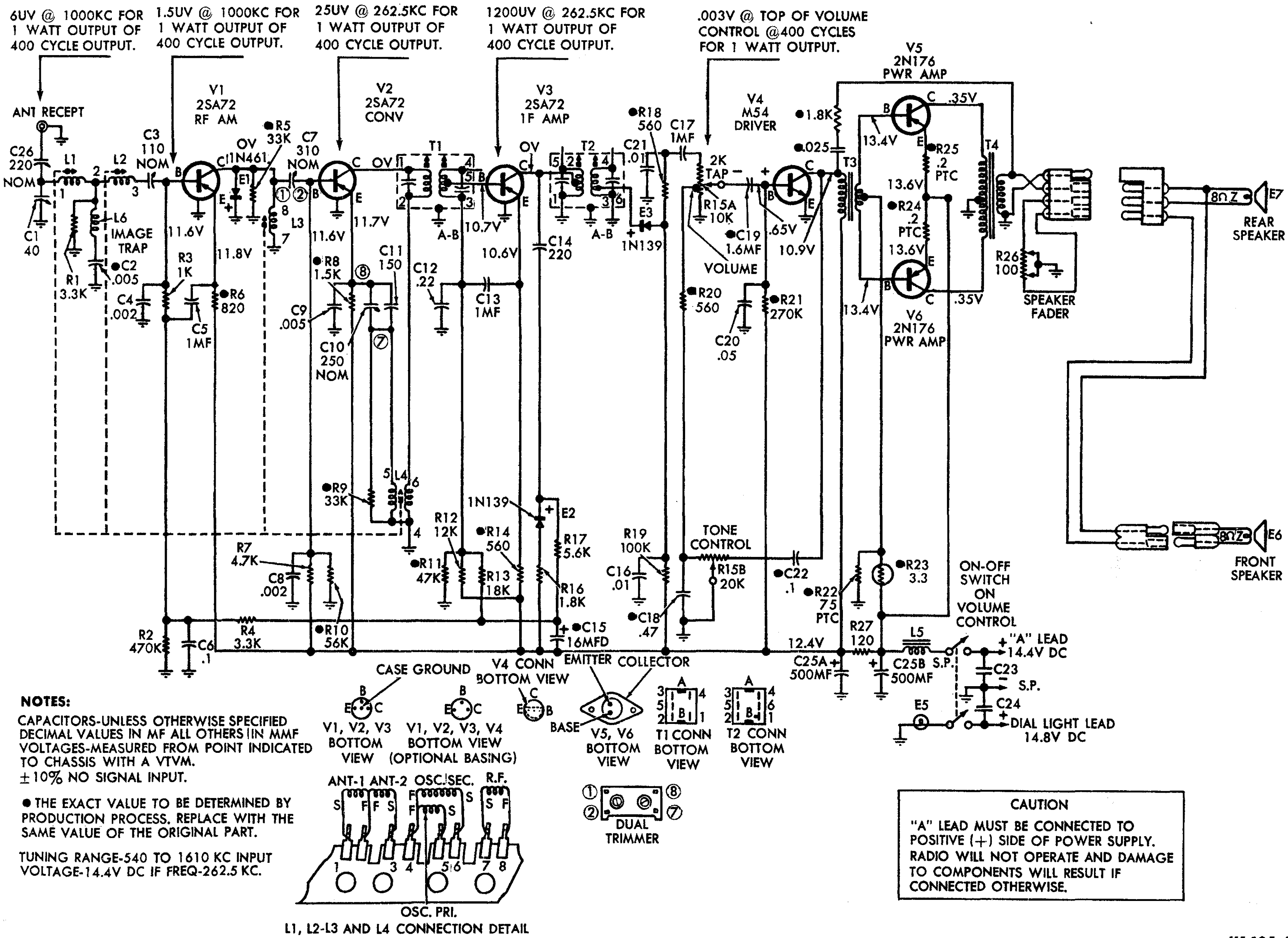


FIG. 1—Antenna Installation



NOTES:

CAPACITORS-UNLESS OTHERWISE SPECIFIED DECIMAL VALUES IN MF ALL OTHERS IN MMF VOLTAGES-MEASURED FROM POINT INDICATED TO CHASSIS WITH A VTVM. ±10% NO SIGNAL INPUT.

● THE EXACT VALUE TO BE DETERMINED BY PRODUCTION PROCESS. REPLACE WITH THE SAME VALUE OF THE ORIGINAL PART.

TUNING RANGE-540 TO 1610 KC INPUT VOLTAGE-14.4V DC IF FREQ-262.5 KC.

CAUTION

"A" LEAD MUST BE CONNECTED TO POSITIVE (+) SIDE OF POWER SUPPLY. RADIO WILL NOT OPERATE AND DAMAGE TO COMPONENTS WILL RESULT IF CONNECTED OTHERWISE.

FIG. 2—AM Radio Schematic

K1421-B

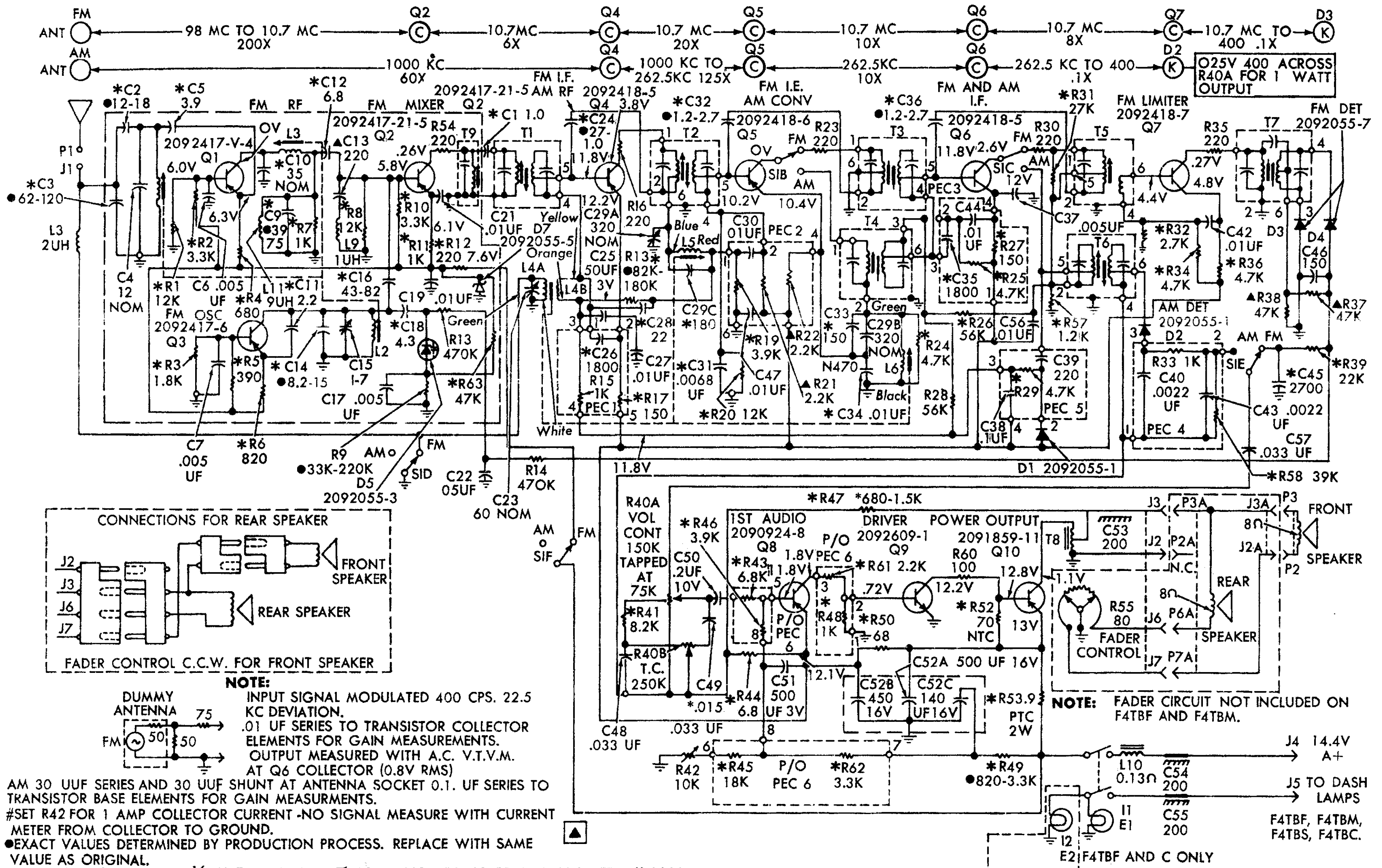


FIG. 3—AM-FM Radio Schematic

NOTE: INPUT SIGNAL MODULATED 400 CPS. 22.5 KC DEVIATION.
.01 UF SERIES TO TRANSISTOR COLLECTOR ELEMENTS FOR GAIN MEASUREMENTS.
OUTPUT MEASURED WITH A.C. V.T.V.M. AT Q6 COLLECTOR (0.8V RMS)

AM 30 UUF SERIES AND 30 UUF SHUNT AT ANTENNA SOCKET 0.1. UF SERIES TO TRANSISTOR BASE ELEMENTS FOR GAIN MEASUREMENTS.
#SET R42 FOR 1 AMP COLLECTOR CURRENT -NO SIGNAL MEASURE WITH CURRENT METER FROM COLLECTOR TO GROUND.
●EXACT VALUES DETERMINED BY PRODUCTION PROCESS. REPLACE WITH SAME VALUE AS ORIGINAL.
ALL RESISTANCE IN OHMS. ½ WATT AND ± 20% TOLERANCE UNLESS OTHERWISE STATED. K=1000. M MEGHM.
ALL CAPACITANCE IN MICROMICROFARADS. 100 VOLTS MIN. AND ± 20% TOLERANCE UNLESS OTHERWISE STATED. GMV=GUARANTEED MIN. VALVE.
FM TUNING RANGE FROM 88MC TO 108MC. AM TUNING RANGE FROM 540KC TO 1600KC.
FM I.F. FREQUENCY 10.7MC. AM I.F. FREQUENCY 262.5KC.
VOLTAGE MEASUREMENTS:
1. ALL DC VOLTAGES MEASURED WITH A 20.000 OHM/VOLT METER. NO SIGNAL INPUT.
2. ALL AC VOLTAGES MEASURED WITH AN AC V.T.V.M. AT FULL VOLUME. 1 WATT OUTPUT.
3. ALL VOLTAGES MEASURED WITH RESPECT TO CHASSIS.
4. ALL VOLTAGES MEASURED WITH + 14.1 VOLTS INPUT WITH NEGATIVE TERMINAL GROUNDED,

NO UNGROUNDED AC POWERED TEST EQUIPMENT SHOULD EVER BE USED.

∗ 10% ▲ 5%

K1423-A

ANTENNA

1. Remove the right front fender rear splash shield.

2. Disconnect the antenna lead-in from the antenna. Disconnect the antenna motor wiring connector (Fig. 1).

3. Remove the antenna to fender top retaining nut, stanchion and gasket.

4. Remove the motor support bracket retaining screws. Remove the antenna assembly through the splash shield opening.

5. TO INSTALL: Place the antenna in position and install the antenna to fender mounting gasket, stanchion and retaining nut. Install the retaining nut just tight enough to permit alignment of the motor support bracket retaining screws.

6. Tighten the motor support mounting screws; then, tighten the antenna to fender retaining nut.

7. Connect the motor wiring connector, and the antenna lead-in.

8. Test the antenna operation.

9. Install the fender splash shield.

FRONT SPEAKER

1. Remove the ten center instrument panel bezel mounting screws and the bezel.

2. Remove the right and left sun visors and the right and left windshield pillar garnish mouldings.

3. Remove the retaining screws from the upper front instrument panel. Lift the panel and disconnect the photo tube lead at the quick disconnect and remove the upper panel.

4. Remove the speaker mounting screws, disconnect the speaker lead and remove the speaker.

5. Connect the speaker lead, place the new speaker in position and install the mounting screws.

6. Check for correct speaker operation.

7. Place the upper front instrument panel in position, connect the photo tube lead and install the panel mounting screws.

8. Install the center instrument panel bezel, the right and left windshield pillar garnish mouldings, and the right and left sun visors.

REAR SEAT SPEAKER

To remove the rear seat speaker on convertible cars, first remove the rear seats, the quarter trim panel and the package tray. The speaker is then accessible for replacement. On the sedan, it is only necessary to remove the spare tire for access to the rear seat speaker.

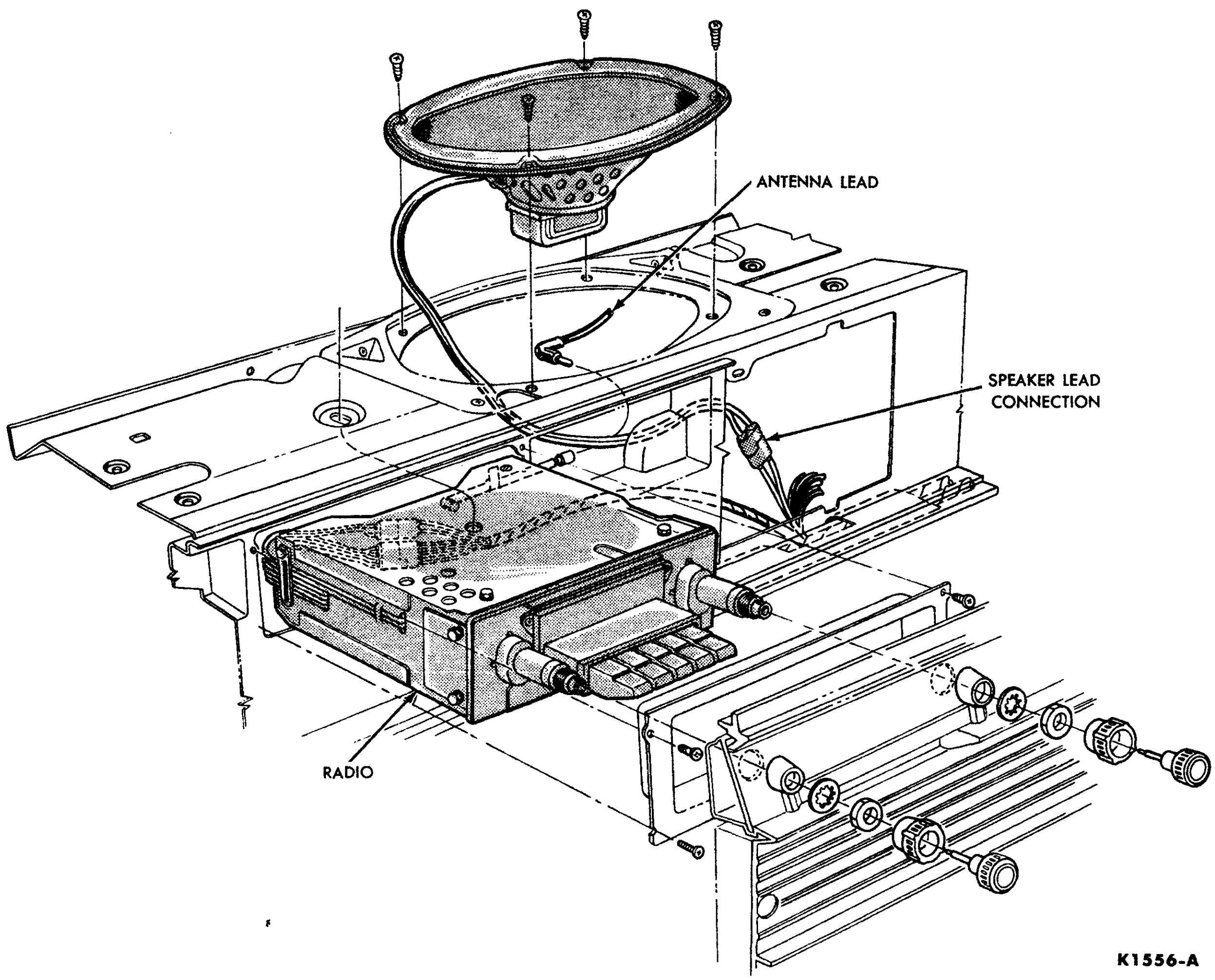


FIG. 4—Radio Receiver Installation

PART 16-5 SPEED CONTROL

1 DESCRIPTION AND OPERATION

The speed control unit is governed directly by car speed. A conventional speedometer drive cable, connected to the input shaft at the bottom of the control unit, drives a spring loaded governor in the control unit and at the same time drives a second cable which extends to the speedometer head by means of a 1:1 gear set. The spring loading of the governor is varied and controlled by turning the selector knob located on the instrument panel. For example, with the selector knob set at 50 mph the tension in the governor spring is such that when the car speed reaches 50 mph the force of rotation of the governor weights is balanced by the governor spring tension.

When the speed control unit is used as a mechanical speed reminder device, a resistance or back pressure is felt at the accelerator pedal at and above the speed selected on the selector dial.

The position of the back pressure point will vary with the road grade.

The car speed can be increased at any time by pushing the accelerator through the back pressure. Release the pressure on the accelerator pedal and the car will slow down normally.

Turn the selector dial higher or lower to increase or decrease the speed setting. **Back pressure will always be felt when selected speed is reached.**

The automatic speed control feature can be put into operation by moving the slide switch to the lock position (it will return to the ON position when released), when a pre-selected speed is reached and the accelerator pedal is held against the reaction pressure.

The speed control will now operate automatically without the need of foot pressure on the accelerator pedal. The control unit motor will advance or retract the acceleration pedal to maintain the pre-selected speed. The speed of the vehicle may be increased or decreased by turning the selector dial while the speed control is operating automatically.

The automatic feature is released by depressing the brake pedal within the first 1/4-inch of travel, moving the slide switch to the OFF position, or by turning the ignition switch to the OFF position. Any of these operations breaks the electrical circuit and the unit returns to manual control.

Inside the control unit, an activator assembly riding up and down on a shaft, moves the contact arm between motor points Nos. 1 and 2, located on the magnet assembly. Electrical contact between the point on the contact arm and either motor point activates a 12-volt reversible motor that rotates a drive screw. When the drive screw rotates, a nut on the screw moves the entire magnet assembly to the position where equilibrium is reached between the governor weights and the governor spring. When the pre-selected road speed is reached a reaction pressure is felt on the accelerator pedal.

When the car tends to go slower than the pre-selected speed, as would be the case in going up a hill, the action of the governor weights causes the contact arm to contact motor point No. 1. The motor now rotates in the opposite direction; thus, the magnet assembly moves to allow the throttle to be opened, to maintain the pre-selected speed.

When the car travels downhill, it tends to travel faster than the pre-selected speed. The resulting action of the governor weights moves the contact arm to motor point No. 2, causing the motor to rotate the drive screw and move the magnet to close the throttle.

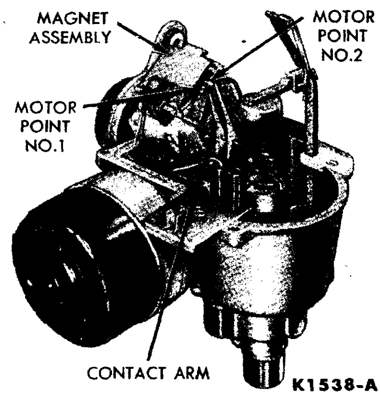


FIG. 1–Speed Control Unit–Cover Removed

2 IN-CAR ADJUSTMENTS AND REPAIRS

LINKAGE

1. Remove the cotter key from the accelerator linkage and pull the linkage from the exterior arm.
2. Start and run the engine until it operates at a slow idle.
3. Insert the gauge sleeve over the gauge bolt and hold the exterior arm securely against the gauge pin (Fig. 2).

The gauge tool is supplied in Speed Control Kits. However, if the gauge tool is not available, use a piece of 5/16-inch I.D. tubing of 1/16-inch wall thickness, two inches long.

4. Adjust the swivel on the throttle linkage until the linkage will assemble to the exterior arm.
5. Replace the linkage and cotter pin.
6. Remove the gauge sleeve.

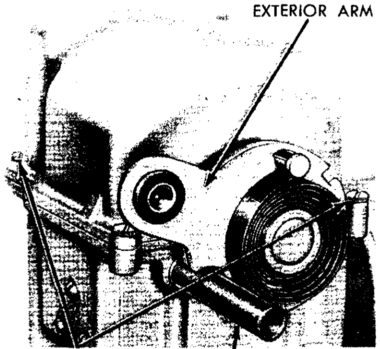


FIG. 2—Gauge Tool Installed

CONTROL CABLE

1. Rotate the selector dial toward its low setting, as far as it will turn without forcing.

2. Loosen the screw on the dust shield. This screw retains the control cable in the bottom of the dust shield.

3. After loosening the screw, pull the control cable out of the dust shield, making certain that the ferrule at the end of the cable is free in the bottom of the dust shield.

4. Reinsert the ferrule in the dust shield. Push in lightly on the control cable until it stops. **Do not force the cable beyond this position.**

5. Again check the selector dial in order to make certain it is at its low setting.

6. Again push on the control cable until it stops. While holding the cable in this position, tighten the screw on the dust shield securely.

BRAKE PEDAL RELEASE SWITCH

1. Turn the ignition switch to the ACC position, and speed control slide switch to the OFF position.

2. Place a 12-volt test lamp between terminal No. 1 and ground (Fig. 3). The test lamp should be on.

3. If the lamp is out, check for a blown fuse.

4. If the lamp fails to go on when the fuse is good, test the switch for proper operation.

5. If the switch is good, inspect the wiring for broken wires or loose connections (Fig. 3).

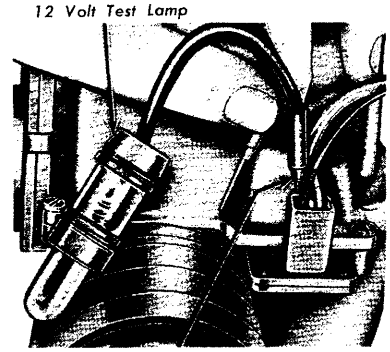


FIG. 3—Checking Brake Release Switch Adjustment

6. With the switch installed and the lamp on, depress the brake pedal to determine if the lamp goes out within the first ¼-inch of pedal travel.

7. If the lamp fails to go out during the first ¼-inch of travel, loosen the switch adjusting nuts and reposition the switch so the lamp goes out during the first ¼-inch of brake pedal travel. Tighten the adjusting nuts to specifications.

3 REMOVAL AND INSTALLATION

CONTROL UNIT

Whenever a faulty power unit is removed, the car can be driven with the speedometer operating, by removing the power unit cables from the speedometer and transmission, and by installing a standard speedometer cable and housing assembly between the transmission and speedometer.

REMOVAL

1. Disconnect the multiple electric connector at the power unit.

2. Disconnect the drive cable and the speedometer cable from the power unit.

3. Loosen the set screw at the lower end of the dust shield.

4. Remove the dust shield from the housing. Then slide the dust shield down the cable and slip the ball end of the Bowden cable out of its socket.

5. Disconnect the accelerator linkage from the exterior arm plate on the power unit.

6. Remove the two bolts securing the power unit to its mounting bracket and remove the power unit, leaving the mounting bracket attached to the fender dust shield.

INSTALLATION

1. Position the power unit on its mounting bracket and secure to the bracket with two bolts.

2. Connect the accelerator linkage to the locking arm on the power unit and adjust the linkage as described in this section of the manual (In-Car Adjustments and Repairs).

3. Install the ball end of the Bowden cable in the socket on the power unit.

4. Install the dust shield in the housing. The dust shield has bayonet type retention. Push in and turn clockwise. **Do not tighten the set screw on the end of the dust shield until the control cable is properly adjusted.**

5. Adjust the control cable as described under In-Car Adjustments and Repairs.

6. Connect the drive cable and speedometer cable to the power unit.

7. Connect the multiple electric connector at the power unit.

SELECTOR ASSEMBLY AND CABLE REMOVAL

1. Open the hood and loosen the cable retaining lock screw at the bottom of the dust shield.

2. Rotate the dust shield ¼ turn counterclockwise and remove it from the control unit.

3. Remove the dust shield from the cable.

4. From inside the car, remove the slide switch button, which will pull straight out.

5. Remove the two nuts which attach the assembly to the instrument panel.

6. Remove the selector assembly from the instrument panel.

7. Disconnect the selector wires and remove the complete assembly.

INSTALLATION

1. Position the cable through the dash, and connect the selector wires.

2. Assemble the selector assembly to the instrument panel, and assemble the two nuts which attach it.

3. Install the slide switch lever button.

4. Position the dust shield on the cable.

5. Insert the dust shield in the housing and turn the shield ¼ turn clockwise to properly retain the dust shield. **Do not tighten the set screw on the end of the dust shield until the control cable has been properly adjusted.** Adjust the control cable. (See In-Car Adjustments and Repairs.)

PART 16-6 AUTOMATIC HEADLIGHT DIMMER

1 DESCRIPTION AND OPERATION

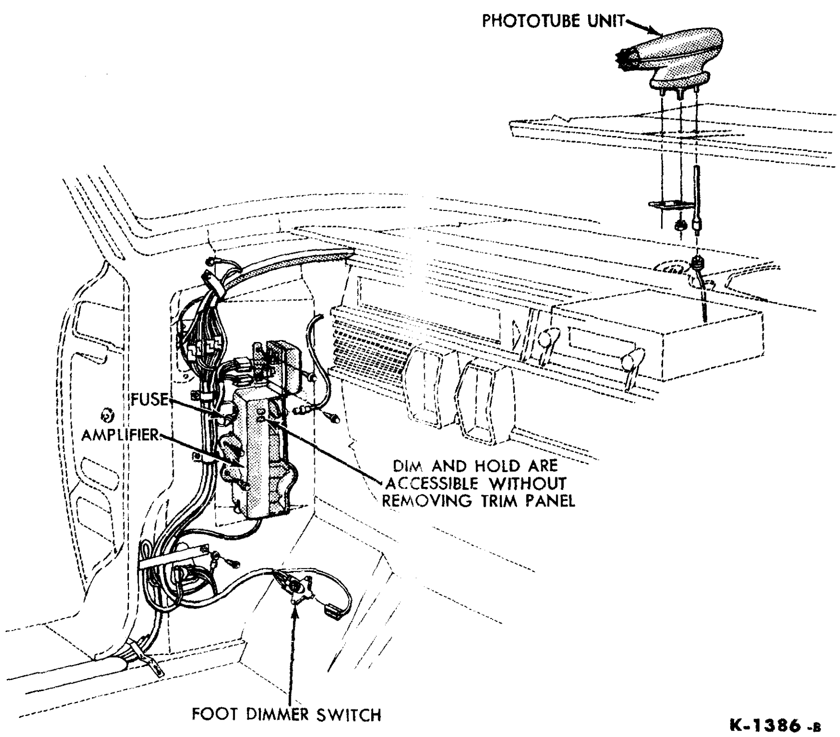


FIG. 1–Automatic Head Light Dimmer Installation

The automatic headlight dimmer, which automatically switches the headlight beam in response to light from an approaching car, consists of three individual units: a phototube unit, an amplifier unit, and a combination dimmer over-ride-type foot swtich (Fig. 1).

Headlights are automatically controlled only in one position of the foot switch. Headlights change from automatic operation to full time lower-beam when the foot switch is fully depressed. To obtain momentary highway upper-beam for signaling oncoming drivers, when using automatic control, or for checking automatic position of the foot switch, depress the foot switch about 1/8 inch to a detent.

When a car approaches within a proper distance, light from its headlights, striking the phototube unit, causes the headlights to dim or switch to lower beam. At this time, if the approaching car's headlights were on upper beam, the driver would normally switch to lower-beam, which would greatly reduce the amount of light striking the phototube unit. The automatic headlight dimmer is designed to maintain or hold its vehicle headlights on a lower beam, even with this reduction in light. When light is removed from the phototube unit, the headlights switch back to upper-beam.

A sensitivity control knob, located at the back of the phototube unit, (Fig. 2 Part 16-1), gives the driver a limited range of control over the sensitivity of the headlight dimmer. A detent position is provided in the center of the control range for normal sensitivity as adjusted at the factory. When the control is in detent position, the knob pointer should be pointing up. Rotating the knob clockwise (the word FAR moves down), increases sensitivity. In this position, the headlight dimmer will switch the headlights to lower beam when an approaching car is farther away than normal. Rotating the control counterclockwise (the word NEAR moves down), decreases the sensitivity, thus allowing an approaching car to approach nearer before switching occurs.

PHOTOTUBE UNIT

The phototube unit uses a single-stage phototube for sensing light, and is mounted on the top-center of the instrument panel upper-cover. The lens picks up light from approaching headlights and focuses it through a filter and mask onto the phototube. The phototube converts the light into an electrical signal that can be used by the amplifier unit.

AMPLIFIER UNIT

The amplifier unit supplies voltage to the phototube unit and operates the integral power relay in response to a signal from the phototube unit. The unit is located at the left hand side cowl (Fig. 1).

A heavy duty power relay, with special alloy contacts for switching the headlights between upper and lower beam, is located above the amplifier unit.

FOOT CONTROL SWITCH

The foot switch is a special dimmer over-ride type that provides either Automatic or Low-Beam control of the headlights. It also acts as an over-ride for obtaining an over-riding high-beam when in Automatic position. The over-ride section of the foot switch functions only when the switch is in Automatic position. A slight downward pressure on top of the switch to a detent provides upper-beam, regardless of light on the phototube unit. This arrangement permits signaling the approaching driver if he fails to switch to lower-beam and also provides a simple test for Automatic position of the foot switch. Street lights, encountered in the city, are usually sufficient to maintain the vehicle headlights on lower-beam; however, the upper-beam may be obtained when needed by holding foot pressure in the over-ride position.

In the lower-beam position of the foot switch, the automatic headlight dimmer is not an active part of the headlight circuit. However, it is not turned off. It continues to function as long as the headlights are turned on and is ready to provide automatic control whenever the foot switch is returned to the Automatic position.

2 IN-CAR ADJUSTMENTS AND REPAIRS

Be certain that headlights and windshield are free of snow and dirt for proper operation of the automatic headlight dimmer.

PHOTOTUBE UNIT VERTICAL AIMING PROCEDURE

The phototube unit must be accurately aimed vertically. If the unit is aimed too low, back reflections from the headlights which are being controlled, will lock the amplifier on lower-beam. However, the unit must be aimed as low as possible to provide maximum tolerance for car loading.

1. Phototube unit vertical aiming should be done with the car unloaded, trunk empty except for spare tire, gas tank at least half full, and with tires at the correct pressure.
2. Locate the car on a level floor (level within ¼ inch fore and aft of the car).
3. Rock the car sideways to equalize the springs.
4. Install the aiming device, part of the tester on the phototube unit (Fig. 2). **The three-points on the aiming device must be resting on top of the phototube unit, and the aiming device must be touching the front of the phototube unit.**
5. Observe the number stamped on the driver control knob rear face.

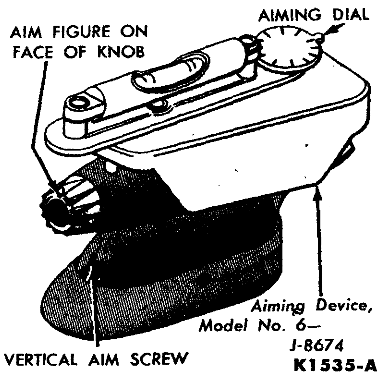


FIG. 2—Vertical Aiming Device

Adjust the aiming dial until the corresponding number is under the pointer.

6. Adjust the vertical aim screw on the phototube unit until the bubble is centered in the level.

HOLD AND DIM SENSITIVITY ADJUSTMENTS ON CAR

Hold sensitivity must be properly adjusted before adjusting Dim sensitivity. The phototube unit must be covered with a black cloth during adjustments. Adjustments should be made with the phototube unit temperature below 90°. If the car has been in the sun immediately prior to checking, allow it to cool in a covered place for approximately one hour before the adjustment is actually made.

PREPARATION FOR ADJUSTMENT

1. Set the driver control to the Detent position.
2. Install the tester lamp (Fig. 3). Cover the tester lamp and phototube with the black cloth furnished.
3. Start the engine and operate it at fast idle while making adjustments.
4. Turn the headlights on and wait at least five minutes for the amplifier unit to stabilize. Place the foot switch in the Automatic position.
5. Turn the zero corrector, on the face of the meter, until the meter pointer is on the zero set line.
6. Turn the tester intensity control counterclockwise.
7. Connect the battery leads of the tester to the battery terminals. (Red lead to the positive terminal and black lead to the negative terminal.)

HOLD SENSITIVITY ADJUSTMENT

1. Rotate the amplifier Hold completely clockwise.
2. Rotate the tester intensity control all the way clockwise.
3. Turn the dim-hold switch momentarily to the Dim position to switch the lights to lower-beam, then switch back to the Hold position. **If the lights do not switch to lower-beam, the amplifier dim control must be turned completely clockwise and then readjusted after Hold adjustment is correct.**
4. Adjust the intensity control slowly counterclockwise until the meter pointer is on the Hold sensitivity adjustment line.
5. Turn the amplifier Hold control slowly counterclockwise, just to the point where the headlights switch to upper-beam. **Do not go beyond this setting.**
6. Turn the intensity control all the way clockwise.
7. Turn the Dim-Hold switch to Dim position and back to Hold position to obtain a lower beam.
8. Slowly turn the intensity control counterclockwise just to the point where headlamps switch to upper-beam. The meter pointer should now read in the green. Hold sensitivity range on the meter scale (Fig. 3). If not, return to step 1 and repeat all steps.

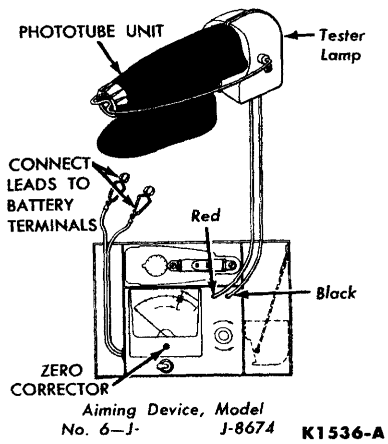


FIG. 3—Dim and Hold Sensitivity Tester

DIM SENSITIVITY ADJUSTMENT

Dim sensitivity should not be adjusted until after Hold sensitivity is properly adjusted.

1. Rotate the amplifier Dim control completely counterclockwise.
2. Rotate the tester intensity control completely counterclockwise.
3. Momentarily turn the Dim-Hold switch on the tester to Hold, then back to the Dim position to obtain upper-beam.
4. Adjust the tester intensity control until the meter pointer is at the Dim sensitivity adjustment line.
5. Slowly rotate the amplifier Dim control clockwise, just to the point where the headlights switch to lower-beam. **Do not go beyond this setting.**
6. Rotate the tester intensity control completely counterclockwise.
7. Turn the Dim-Hold switch to Hold, then back to Dim to obtain the upper beam.
8. Slowly rotate the tester intensity control clockwise just to the point where the headlamps switch to upper beam. The meter pointer should now read in the green Dim sensitivity range on the meter scale. If not, return to step 1 and repeat all steps.
9. If the adjustment is correct, turn off the headlights and disconnect the tester.
10. Remove the tester lamp from the Phototube Unit.

3 REMOVAL AND INSTALLATION

If the automatic headlight dimmer malfunctions and cannot be removed for repair immediately, manual operation of the headlights may be obtained at the foot switch, in most cases, by removing the fuse from the fuse holder. The fuse holder is located in the amplifier wiring harness, just a few inches from the amplifier unit.

Should the car have to be driven with the amplifier removed, manual operation of the foot switch may be obtained by replacing the dimmer over-ride type foot switch with a standard foot switch, and plugging the standard car wiring to it.

PHOTOTUBE

REMOVAL

1. Disconnect the negative (ground) cable from the battery.
2. Remove the screws retaining the upper section of the instrument panel.
3. Remove garnish molding from windshield pillars.
4. Carefully lift up the rear end of the panel and pull away from the windshield.
5. Disconnect the phototube unit plug from the amplifier harness. Remove the top panel and phototube unit.
6. Remove the phototube unit from the top panel.

INSTALLATION

1. Install the phototube unit on the top panel.
2. Position the top panel and phototube to permit connecting the phototube plug to the amplifier harness. Then make the connection, pushing plug down through hole in speaker mounting plate.
3. Carefully position the top panel and drive in the retaining screws.
4. Replace garnish moldings on windshield pillars.
5. Connect the negative (ground) cable to the battery.
6. Check the aim and sensitivity adjustments (See In-Car Adjustments and Repairs).

AMPLIFIER UNIT AND HARNESS

REMOVAL

1. Disconnect the negative (ground) cable from the battery.
2. Remove the left hand cowl trim panel.
3. Disconnect the amplifier wiring harness from the relay (above amplifier), from the foot switch, and from the headlight wiring harness.
4. Remove the two amplifier unit mounting screws. Lower the amplifier and disconnect the phototube to amplifier cable.

INSTALLATION

1. Connect the phototube to amplifier cable, position the amplifier, and drive in the mounting screws.
2. Connect the amplifier unit to the relay, to the foot switch, and to the headlight wiring harness.
3. Install the left hand cowl trim panel.
4. Connect the negative (ground) cable to the battery.
5. Check the Dim and Hold sensitivity adjustments (See In-Car Adjustments and Repairs). **If the car is to be driven without the automatic headlight dimmer, install a standard foot switch and connect the car headlight harness to it.**

FOOT DIMMER SWITCH

REMOVAL

1. Disconnect the negative (ground) cable from the battery. (Very important.)
2. Position the left side of the floor mat back away from the area of the switch.
3. Remove two screws attaching the switch to the floor pan. Lift the switch from the floor pan.
4. Disconnect the wiring connectors from the switch.

INSTALLATION

1. Connect the wiring connectors to the switch.
2. Position the switch on the floor pan, and drive in the two mounting screws.
3. Position the floor mat in the area of the switch.
4. Connect the negative (ground) cable to the battery. **Should installation of a standard foot switch be necessary, remove the left side cowl trim panel, and connect the car headlight wiring harness to the foot switch.**

PART 16-7 SPECIFICATIONS

BLOWER MOTOR CURRENT DRAW

At Low Speed	2-3 Amperes at 12 volts
At Medium Speed	3-4 Amperes at 12 volts
At High Speed	4-6 Amperes at 12 volts

AIR CONDITIONING COMPRESSOR

Location	Torque (ft-lbs)
Base Plate	7-11
Rear Cover Plate	7-10
Cylinder Head	14-18
Front Seal Plate	13-17
Service Valve (Rotalock)	35 Max.
Mounting Bolt	14-17
Oil Filler Plug	18-22
Clutch Mounting	15-22

Oil Level: Vertical Mount ⅞ Inch Minimum. Use Suniso #5 or Capella E.

DRIVEN BELT TENSION

Between Fan Pulley and Air Conditioner Compressor	
All Engines	New 120-150
	Used* 90-120

*Belt operated for a minimum of 10 minutes is considered a used belt.

SPEED CONTROL

BRAKE PEDAL RELEASE SWITCH	
Adjustment Nut Torque	48-60 pound-inches

RADIO

Radio Current Draw	1 ampere max. @ 12 volts
Antenna Current Draw	8 amperes @ 12 volts

GROUP 17

PART 17-1 GENERAL BODY SERVICE

COMMON ADJUSTMENTS AND REPAIRS

TYPES OF SEALER AND APPLICATION

The all-purpose sealers described as follows are for service use. The method and points of application are given under each sealer type. Also, refer to Figs. 1 through 4 for sealer application.

BODY SEALER B8A-19562-A

This fast drying, white sealer which remains semi-elastic will not run. It is easily cleaned up with a dry cloth; however, if necessary, apply a solvent. This sealer, which provides an excellent surface for paint, is used for all seam sealing jobs such as those that are found in the floor pan, wheelhouse, dash panel, rocker panel, door opening, quarter panel, or drip rail. It is also used to seal trim panel and outside moulding clip holes while windshield and back window installation is still another use.

BLACK CAULK AND SEALER B6A-19563-A

The combination black caulk and sealer is of the same composition as body sealer and is used in the same areas. The color is gloss black instead of white; however, this sealer is to be used with dark colored paints or in areas that are not visible.

BODY SEALER AB-19560-A

This sealer which is heavy bodied and is commonly known as "perma-gum" has a plastic base with an asbestos filler. It is used on spotweld holes around moulding clips or between two surfaces not properly sealed by a gasket. Apply this sealer with a putty knife.

CEMENT C2AZ-19C525-A

This cement is recommended for instrument panel safety cover and body panel plastic water shield installation. It is also useful for repair or replacement or other vinyl and rubber trim.

RUBBER CEMENT 8A-19552-B

This quick-drying, strong adhesive material is designed to hold weather-stripping on doors, bodies, deck lids, cowl ventilators, and the surrounding metal. Windows and windshields which are set in rubber can be effectively sealed against leakage by flowing cement into affected areas.

Clean all grease, dirt, and old sealer from the surfaces to be cemented. For best results, apply a medium coat of cement to both surfaces, allow it to dry until tacky, and press both surfaces firmly together.

CLEANING SOLVENT B7A-19526-A or B7A-19521-A

This general clean-up solvent cleans off new or old cement smears, wax, tars, oils, grease, caulk and sealer. When desired, it can be used to thin caulk and sealer. It is harmless to cured paint, but useful in new car pre-delivery. **It is important to prevent either of these cleaners from contacting vinyl or leather.**

SILICONE LUBRICANT C0AZ-19553-A (JELLY) AND C0AZ-19553-B (SPRAY)

This lubricant is to be used on the door window weatherstrips. It is recommended that silicone lubricant be applied to the upper weatherstrips at every regular lubrication period. Its uses makes the doors easier to close, avoids weatherstrip squeaks, retards excess weatherstrip wear from chafing between the door glass upper frame and weatherstrip, and helps to retain door window alignment by reducing friction between the glass frame and rubber weatherstrip.

BODY MAINTENANCE

Regular body maintenance preserves the car's appearance and reduces the cost of maintenance during the life of the car. The following steps are suggested as a guide for regular body maintenance.

1. Vacuum the interior thoroughly and wash the car.

2. Check all openings for water leaks, and seal where necessary.

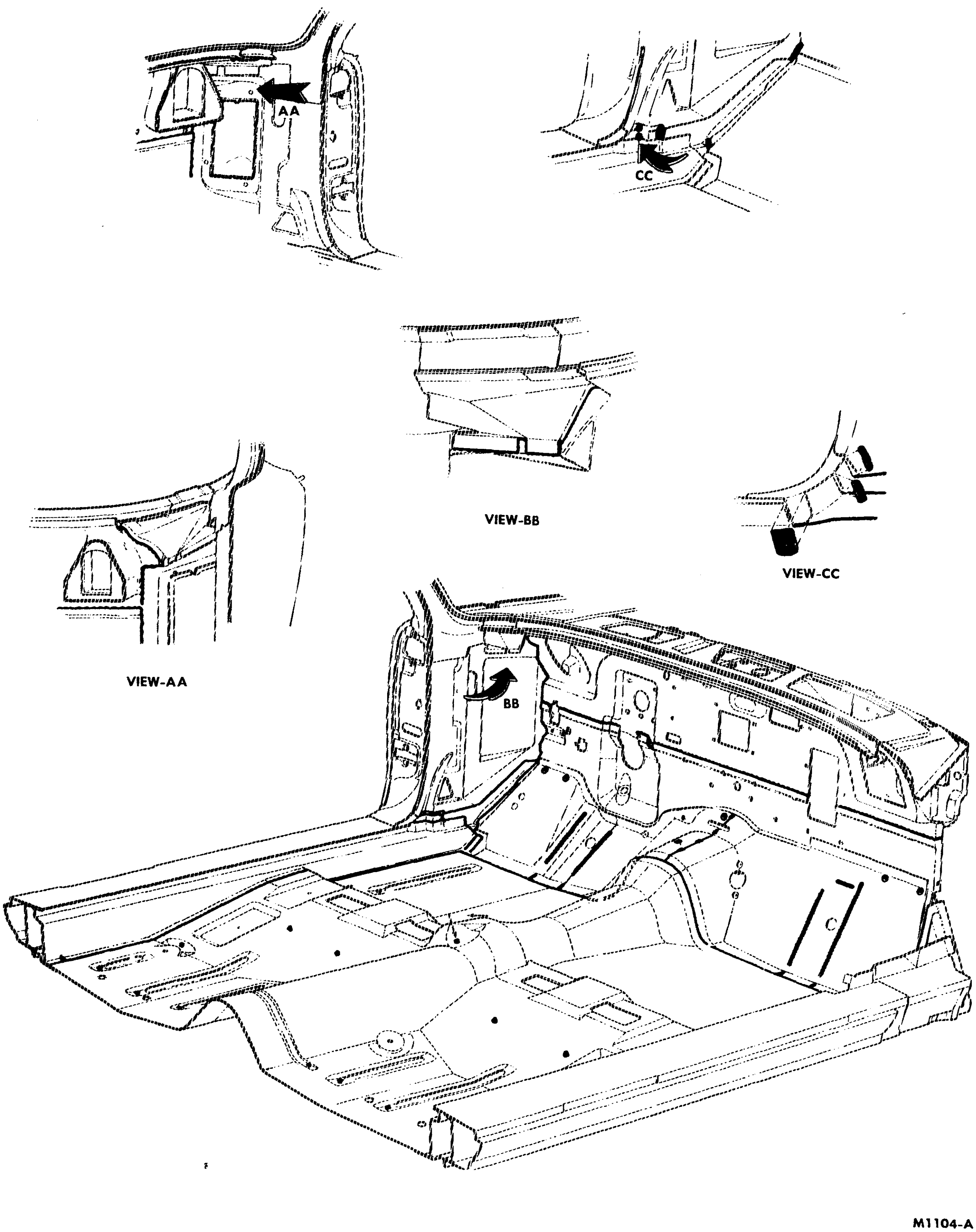


FIG. 1—Sealer Application—Front Floor Pan, Cowl Side and Dash Panel

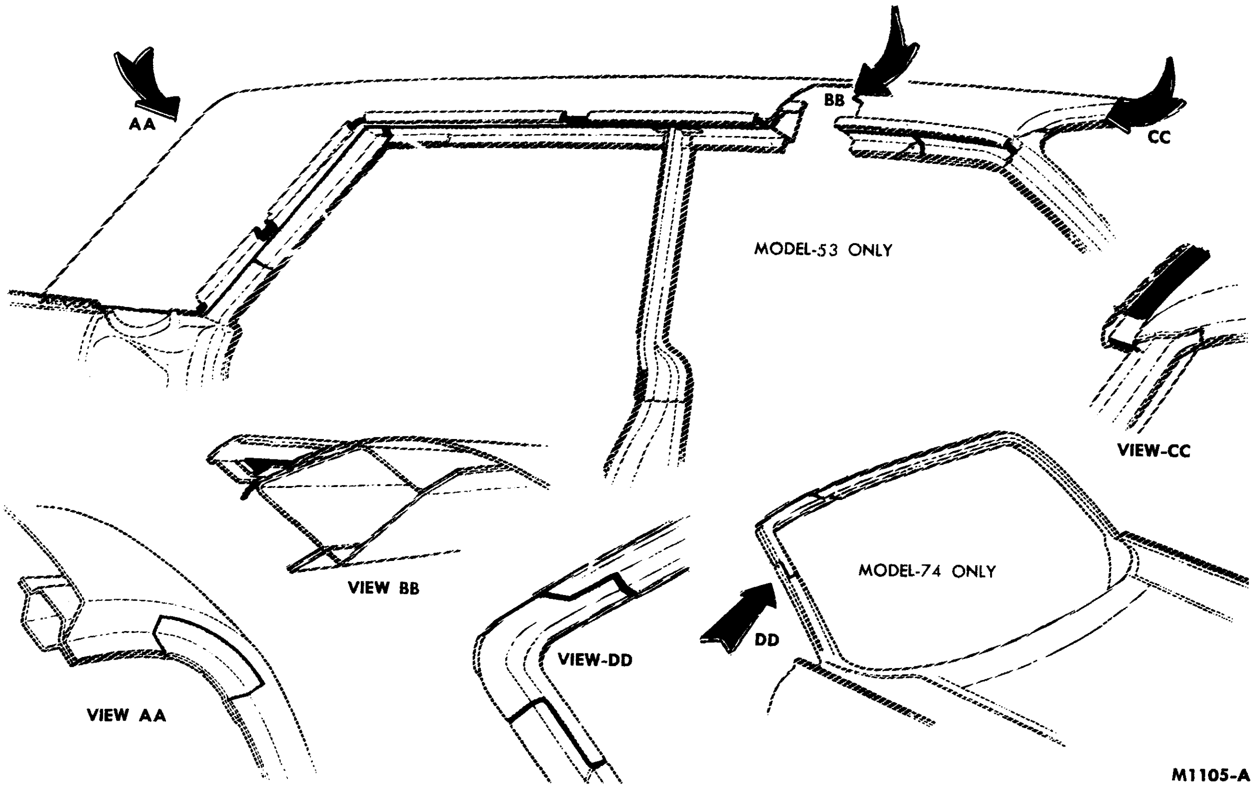


FIG. 2—Sealer Application—Roof and Upper Body

3. Cement all loose weatherstrips which are still usable.

4. Replace all door and deck lid weatherstrips which are unfit for service.

5. Apply silicone lubricant to the weatherstripping.

6. Replace all cracked, fogged, or chipped glass.

7. Align hood, doors, and deck lid if necessary.

8. Inspect windshield wiper blades and replace if necessary.

9. Tighten sill plate and garnish moulding screws.

10. Clean the seats, door trim panels, and headlining.

11. Touch-up or paint chipped or scratched areas.

12. Drain valves located on the underside of each rocker panel, quarter panel and door, should be cleared periodically.

BODY ALIGNMENT

Servicing the unitized body should not present any unusual difficulties or necessitate additional equipment other than that required for the conventional frame and body repair. The application of heat and the use of heavy-duty jacks must be carefully controlled because of the difference in the gauge of the metal in the sub-frame of a unitized body and the stress points developed in a single welded unit construction. It is possible to pull damaged areas back into alignment with the use of light-weight jacks and hydraulic equipment without heating the metal.

Rough out badly damaged areas before taking measurements for squaring up a body. If necessary, remove the glass from the damaged area to prevent damage to the glass. In severe cases, reinforcement brackets and other inner construction may have to be removed or cut to permit restoration of the outer shell and pillars without excessive strain on the parts. Straighten, install, and secure all such parts in place before attempting to align the body.

In cases of severe or sharp bends, it may be necessary to use heat. Any attempt to cold-straighten a severely bent bracket may cause ruptures of the welds and may also cause cracks in the bent part. Never heat the area more than a dull red.

CHECKING BODY FOR MISALIGNMENT

To align or square up a body, take two opposite diagonal measurements between pillars. Use a measuring tram for these measurements. Take the measurements between reference points such as crease lines or weld joints which are diagonally opposite each other on the two pillars being measured. Since all measurements should be made from the bare metal. remove all interior trim from the checking points.

In some cases, it is difficult to obtain proper body alignment when repairing a body that is damaged on both sides. In these cases, horizontal and vertical measurements can be taken from a body of the same body style. Once these basic dimensions are taken and established on the damaged body, alignment can be made by diagonal measurements taken from points on the two pillars.

Do not attempt to correct any serious misalignment with one jacking operation. This is particularly true if other sections of the body also require aligning. Align each section proportionately until the proper dimensions are obtained.

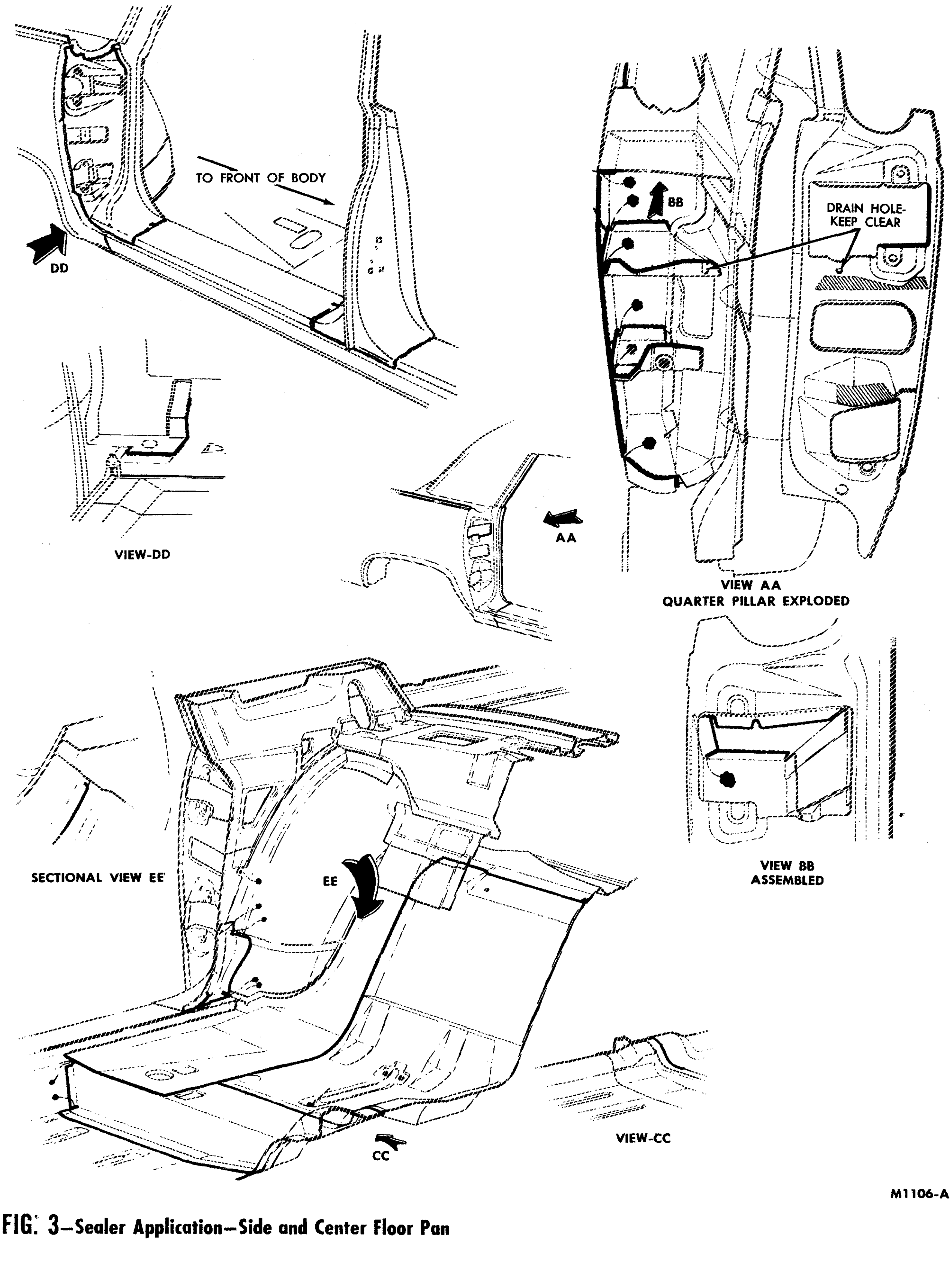


FIG. 3—Sealer Application—Side and Center Floor Pan

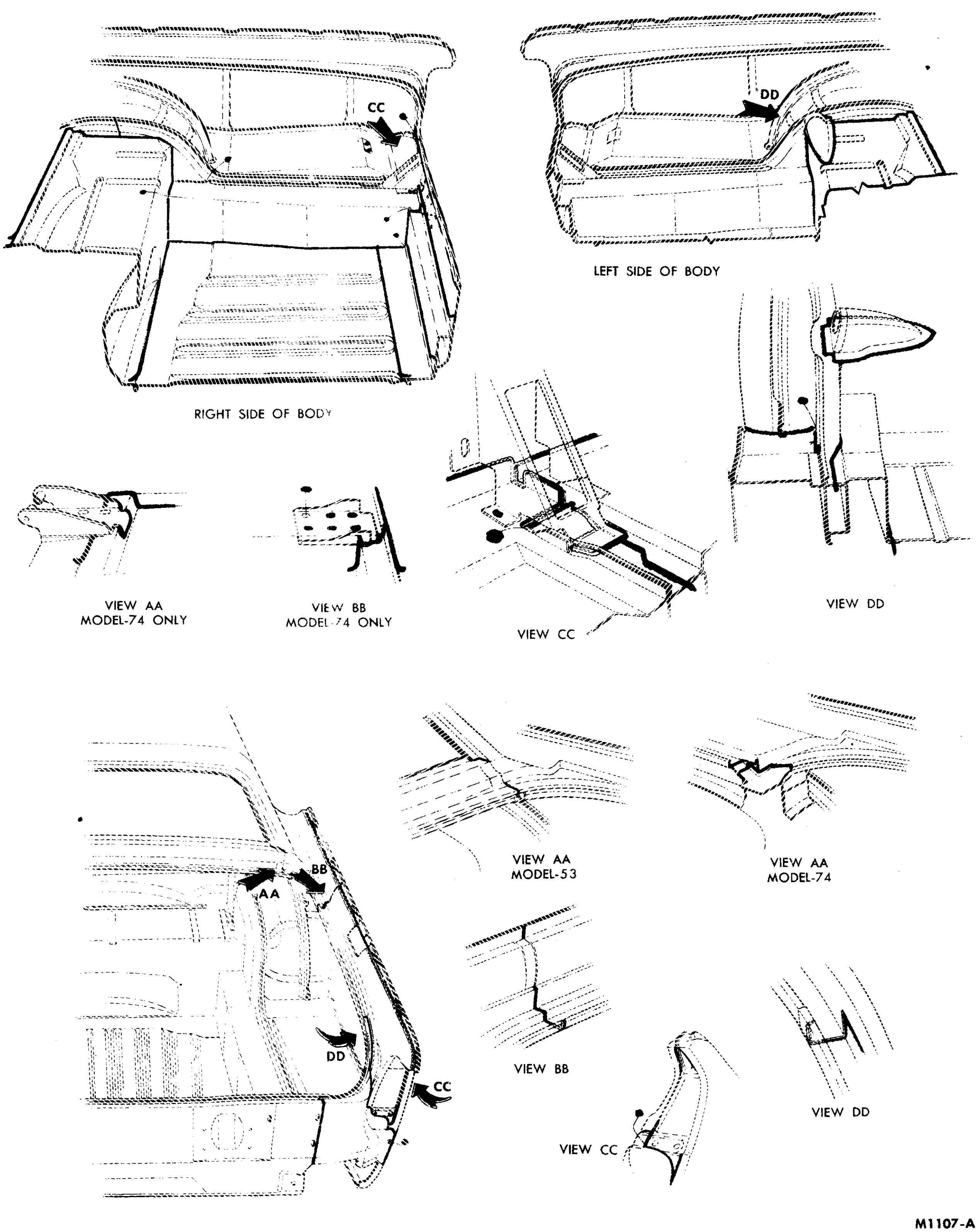


FIG. 4–Sealer Application–Rear Floor Pan and Body Rear

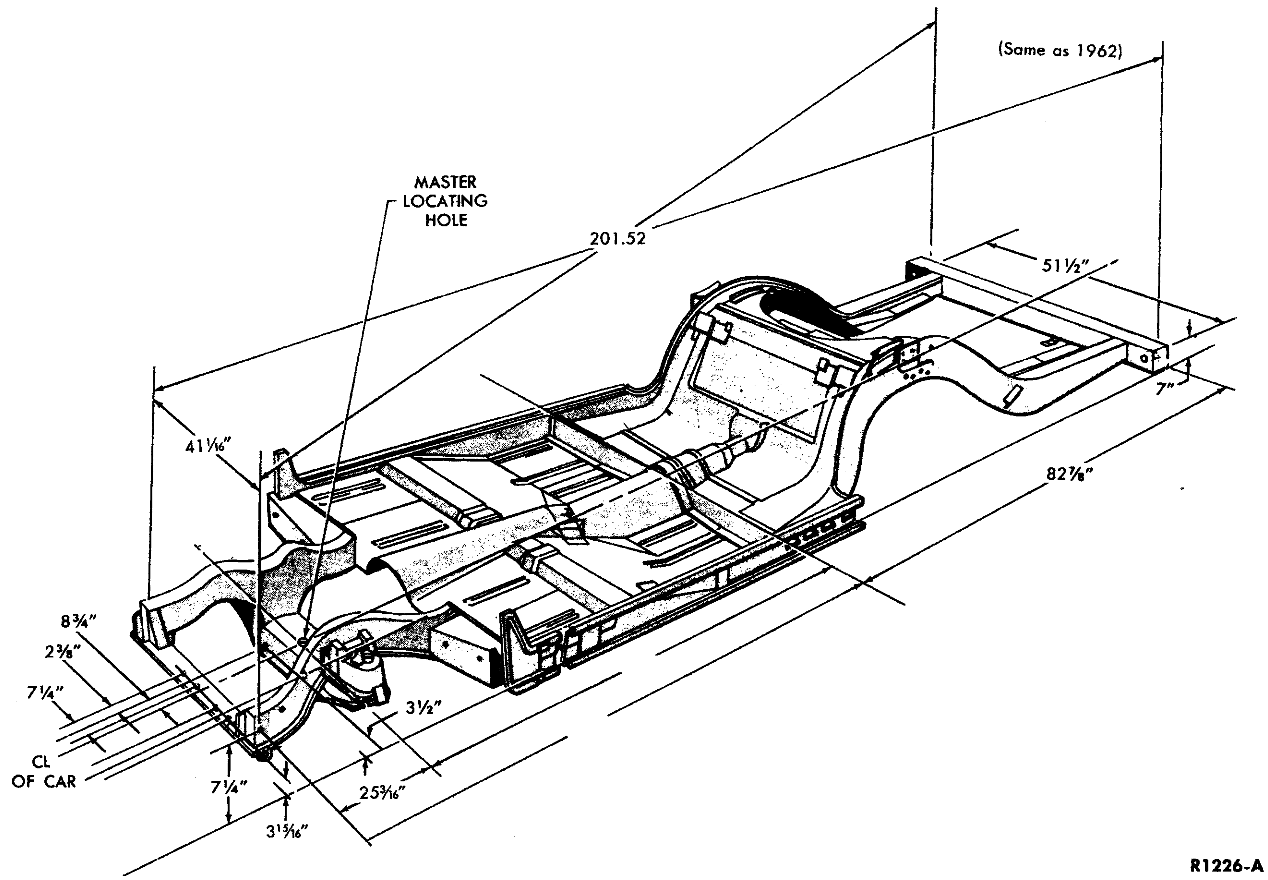


FIG. 5—Underbody Dimensions

Door openings are checked in the same manner as the body. Horizontal, vertical, and diagonal checking points are established on all four sides of the door opening that is being measured.

CHECKING UNDERBODY FOR MISALIGNMENT

The dimensions of the underbody must be restored in the repair of major body damage in order to provide correct front and rear wheel geometry. Dimensions (Fig. 5) are detailed to the center line of existing holes in the underbody assembly. Once the frame and suspension members are aligned, the balance of the repair can be performed.

PAINT DAMAGE AND REPAIR

PAINT REPAIRS ON GALVANIZED METALS

If for any reason it becomes necessary to perform paint repairs on galvanized rocker panels or any other galvanized steel surfaces, care must be exercised in preparing the bare galvanized surface to properly accept paint. The best possible paint products must be employed to insure satisfactory adhesion to the metal and to give a good color match with acceptable durability. The methods involving the use of duPont Preparakote and Ditzler Zinc Dust Primer are indicated here and it is important that either one be employed exactly as directed. No short cuts nor any inter-mixing should be attempted.

Some operators in performing rocker panel repairs prefer to grind down the entire panel thus removing the zinc coating (galvanizing) completely. This, of course, involves some paint removal on adjacent panels which somewhat complicates the repair job.

Metal Preparation for Galvanized Steel

1. Strip, sand-off or otherwise remove all paint from the affected galvanized steel panel.

2. Wire-brush or steel-wool the entire metal surface and remove all grease or oil by wiping with a clean solvent.

3. Wipe the panel using a clean cloth or sponge with Lithofoam No. 2. The work should be kept completely wet for at least three minutes and the metal should be thoroughly etched. If any bright metal remains, the treatment should be repeated.

4. Rinse the area with clean water and blow off with compressed air.

5. The dried surface must be primed immediately. Then succeeding coats and color as required must be applied according to the supplier's directions.

PAINT REFINISHING

Acrylic Enamels. Acrylic enamels exhibit better hardness, mar resistance and gloss retention in metallic colors than the ordinary enamels. Acrylic enamels also possess the property of good polishability.

Following are recommended repair procedures for acrylic enamels:

REPAIR BY POLISHING. Repair of minor dirt or fallout, sags, mars, scratches, dry spray, overspray, and orange peel can be accomplished by machine or hand polishing or by both sanding and polishing without the necessity of repainting. Repairs of this type should apply to an entire panel while spot repairs should be attempted only in isolated areas.

The suggested polish repair procedure consists of:

1. Remove the defect by oil sanding with 600 grit paper.

2. Apply a white or light colored medium grit machine polishing compound (Sno-Flake No. 16 or equivalent) to the painted surface with a brush.

3. Polish the entire panel surface using an 1850 rpm wheel and a carpet pad (approximately ⅝" nap) or lambswool pad.

4. Buff the surface with a clean lambswool pad.

Normally, acrylic enamels do not need polishing to improve their gloss; however, the foregoing procedure can be used to restore the original luster to the film after weathering, or to improve the surface smoothness of the finish on the entire car.

Repair By Repainting. Acrylic enamels can be repaired by repainting with either conventional air drying or low bake enamels, or with acrylic lacquers. When repainting metallic colors, it is recommended that acrylic lacquer be used since a better color match can be obtained; both the original finish and the repair can be polished to provide the same luster, and the air dry acrylic repair lacquer will provide better durability in service than air dry enamels.

When using any one of the three types of repair materials over acrylic enamel, it is extremely important that a thorough sanding of the original finish be accomplished using #400 grit paper. Care should be exercised to insure that all surfaces, including edges and areas adjacent to applied mouldings, are thoroughly sanded in order to provide adhesion of the repair top coat.

After sanding, proceed with the application of a primer surfacer reduced according to the supplier's recommendations to any bare metal spots that have been exposed. After the recommended air dry time, sand the primer surfacer with #400 grit paper before application of the repair material. The lacquer or enamel used should be reduced as recommended by its supplier.

PAINT DEFECTS AND REPAIR PROCEDURES

Listed here are some of the abnormal paint conditions that may be encountered. It is very important to identify the paint condition correctly so that the proper repair procedure may be followed. For each of the following paint conditions described, the recommended repair procedure will be indicated.

Blistering. Blistering is the formation of bubbles or pin points on the surface of the finished work (Figs. 6 and 7). Unless inspected by a magnifying glass, this condition is very hard to identify. In some instances, this complaint may be confused with dirt in the paint. To verify blistering, prick the suspected areas, and note whether a hole exists under the bubble. This condition is caused by rust, moisture, or oil between the coats, metal not properly cleaned, or uneven temperatures between the metal and the paint being sprayed.

Acrylic Enamel – Repair by repainting (color coat).

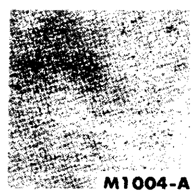


FIG. 6
Random Blisters

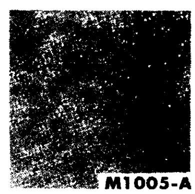


FIG. 7
Pattern Blisters

Checking. "Line checking" has the appearance of thin, straight lines criss-crossing each other (Fig. 8). These lines may be from one-half inch to four inches or longer, increasing in length as the finish ages.

Acrylic Enamels–Refinish panel. (Color coat–primer if damaged.)

Chipping and Stone Bruises. Chipping occurs when the surface of the finish coat of paint has been broken by a sharp blow, and small particles of paint have flaked off (Fig. 9). Frequently, stone bruises result in chipping (Fig. 10).

Acrylic Enamel – Refinish panel. Paint may be spotted if in isolated areas. (Prime it to bare metal.)

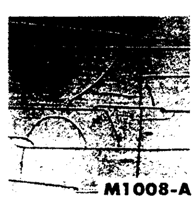


FIG. 8
Line Checking

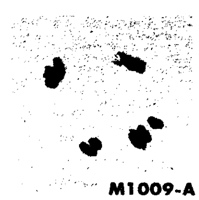


FIG. 9
Chipping

FIG. 10
Bruises

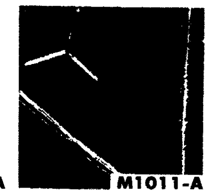


FIG. 11
Cracking

Cracking. Cracking is evidenced by the paint curling. Frequently, cracking starts at the edge of the panel (Fig. 11). This is caused by poor mixing of paint or by temperature changes during the various painting stages.

Acrylic Enamel – Refinish panel. (Prime if both color and primer cracking.)

Crow Footing. Crow footing may be described as small lines branching off from a point in all directions and giving the appearance of a crow's foot (Fig. 12). Crow footing is usually caused by spraying a second coat before the first coat is dry, by spraying an excessively thick coat, or by thinners which evaporate too fast.

Acrylic Enamel – Refinish panel. (Color coat.)

Dirt in Paint. Patches where dirt appears (Fig. 13) are sometimes confused with blistering. To verify the condition, prick the suspected areas, and note whether there is foreign material under the surface.

Acrylic Enamel–Polish repair procedure will be effective in most cases. (Color coat.)

Mildew. Mildew growth, which occurs along radial lines, (Fig. 14) is most commonly found in a very dark gray or black color.

Acrylic Enamel–Repair by polishing.

Off-Color. The term off-color is applied to adjacent areas on which the colors do not match (Fig. 15). It may also appear when making spot repairs.

FIG. 12
Crow Footing

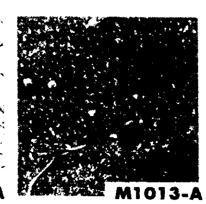


FIG. 13
Dirt in Paint

FIG. 14
Mildew

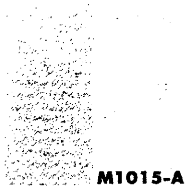


FIG. 15
Off Color

Acrylic Enamel—Refinish panel if polishing does not correct condition. (Color coat.)

Orange Peel. Orange peel is a term used to describe an uneven, mottled appearance on the paint surface (Fig. 16). This is usually caused by improper thinning of the paint.

Acrylic Enamel—Repair by polishing.

Overspray. Overspray is evidenced by a rough, dull finish in the area surrounding the paint repair (Fig. 17).

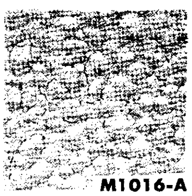


FIG. 16
Orange Peel

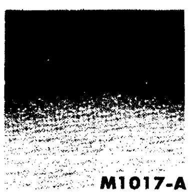


FIG. 17
Overspray

Peeling. Peeling occurs when large areas of the finish or primer coat separate from the metal or prime coat (Fig. 18). This is usually caused by wax, grease, rust, or oil under the paint. Do not confuse with orange peel.

Pits and Craters. Pits and craters may be identified by the appearance of small round depressions in the paint (Figs. 19 and 20). These may be caused by not allowing the first coat to dry sufficiently before applying the second coat or from failure to remove silicone polishes before

FIG. 18
Pecking

FIG. 19
Pits

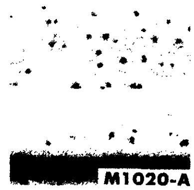


FIG. 20
Craters

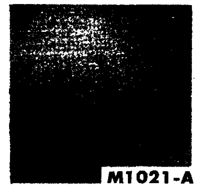


FIG. 21
Primer Shows

repainting.

Acrylic Enamel—First use polish repair procedure, refinish panel if necessary. (Color coat.)

Primer Shows. The primer will show through the finish coat as a result of an excessively thin color coat, or application of the color coat before the surface is dry (Fig. 21).

Acrylic Enamel — Refinish panel. (Color coat.)

Runs, Sags and Wrinkles. The uneven collections of paint on the finish surface are referred to as runs or sags (Fig. 22). The collections may appear in the form of tear drops or sagging lines. Usually these lines are quite soft and sometimes they may be wrinkled (Fig. 23). This is usually caused by over-application of paint or hesitation in the stroke of the gun.

Acrylic Enamel—Use polish repair procedure.

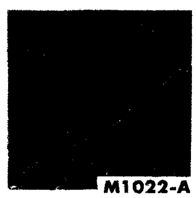


FIG. 22
Runs and Sags

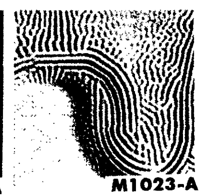


FIG. 23
Wrinkles

Scratches. Scratches are thin marks or tears that may partially or completely penetrate the surface of the finish coat of paint (Fig. 24).

Acrylic Enamel—Use polish repair procedure for shallow penetration. Refinish panels to correct conditions

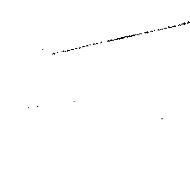


FIG. 24
Scratches

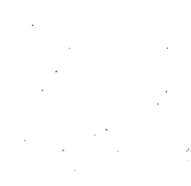


FIG. 25
Water Spotting

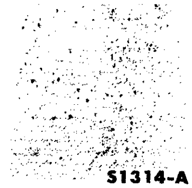


FIG. 26
Industrial Fall-Out

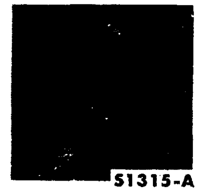


FIG. 27
Organic Fall-Out

of deep penetration.

Spot Discoloration. This is evidenced by brown spots or stains on the surface. Stains or spots can be caused by road tar, acid or alkali-bearing water from the streets.

Acrylic Enamel—Use polish repair procedure.

Water Spotting. Water spotting is evidenced by a milky pattern where water drops have fallen (Fig. 25).

Acrylic Enamel—Use polish repair procedure.

Industrial Fall-Out. Industrial fall-out is the result of particles being exhausted into the air by the various processes of heavy industry, or in areas where there is a concentration of industry.

Industrial fall-out particles appear to the eye as tiny rust-colored dots on the paint film and the surface will feel rough to the touch (Fig. 26). Some of the particles have excellent adhesion and are difficult to remove. However, the following procedure has proven effective in the removal of this fall-out:

1. Wash the car with car wash compound (C0AA-19B521-A) to remove loose dirt. Rinse well and examine painted surfaces for iron base fall-out particles. If there is a significant quantity of fall-out not removed by ordinary washing, the oxalic treatment should then be used. All cracks, ledges, grooves, etc., where fall-out has accumulated, should be cleaned by wiping or by air blow-off.

2. Dissolve six to eight ounces of oxalic acid (dry) in one gallon of warm water and add one to two tablespoonsful of a non-alkaline detergent such as car wash compound (C0AA-19B521-A). This acid detergent solution must be prepared and kept in a clean **non-metallic** container.

Apply this solution liberally to all affected surfaces of the car with a large sponge. Use a broad wiping stroke and keep the work completely wet for about 15 minutes, or until the operator can no longer feel any surface roughness or even isolated gritty particles with bare or gloved finger tips. If this is not done thoroughly, rust staining may soon redevelop. Be sure that the entire acid cleaning procedure is performed in a sheltered area so that the work will be kept as cool as possible to prevent rapid evaporation of water and consequent surface drying. **Do not work in the sun.**

3. Rinse with clear water. This must be done very thoroughly to prevent possible corrosion.

No traces of acid should be left on any surface. Bright trim parts, particularly anodized aluminum and stainless steel, may be stained by prolonged contact with the cleaning solution. Painted areas also can be spotted by prolonged exposure. It is also important to keep the oxalic acid cleaner solution from leaking to the inside of the car because some fabrics might be bleached or discolored by the solution.

If the fall-out is not completely removed or is deeply imbedded in the paint film, cleaning with the acid detergent mixture must be repeated. This may be aided by using a fine scrub brush, possibly a nylon bristle type. Make sure that the light scrubbing required does not scratch the paint. It is sometimes helpful to briskly rub the work with a mixture of equal parts of oxalic acid cleaner and FoMoCo cleaner wax polish (8A-19519-A) using a piece of heavy toweling. Again, a thorough water rinsing is extremely important.

Sometimes small black spots remain after the oxalic cleaning has removed all iron based fall-out. Such deposits might be asphaltic or they might be over-spray. These usually can be removed by rubbing vigorously with a cloth saturated with a mixture of kerosene and Actusol (about five parts of kerosene to one part of Actusol). Any residue of this solvent mixture may be readily flushed off with water.

Organic Fall-Out. Organic fall-out may result from parking cars under trees or from the air under certain atmospheric conditions (Fig. 27).

Acrylic Enamel—Refinish damaged panels. (Color coat and primer.)

INTERIOR PAINT REPAIRS

The proper matching of colors can be obtained if the below procedures are carefully followed.

1. Clean the surface to be painted with wax and silicone remover.

2. Feather-edge the damaged areas with No. 400 grit wet or dry sandpaper. (Prime all the areas of the bare metal with M-6J-12S Primer.)

3. Mix the paint according to the instructions on the can and spray several light coats. **Allow the paint to become tacky between coats.**

4. Spray the entire area sparingly with Lacquer Leveler (B7A-645-S) which will blend the repaired area with existing painted surfaces.

RATTLE ELIMINATION

Most rattles are caused by loose bolts or screws. Foreign objects such as nuts, bolts, or small pieces of body deadener in the door well, pillars, and quarter panels are often the source of rattles. Door wells can be checked by carefully striking the underside of the door with a rubber mallet. The impact made by the mallet will indicate if loose objects are in the door well.

In the event that tightening the bolts and screws, located on such assemblies as the doors, hood, and deck lid, does not eliminate the rattles, the trouble is probably caused by misalignment. If this is the case, follow the adjustment and alignment

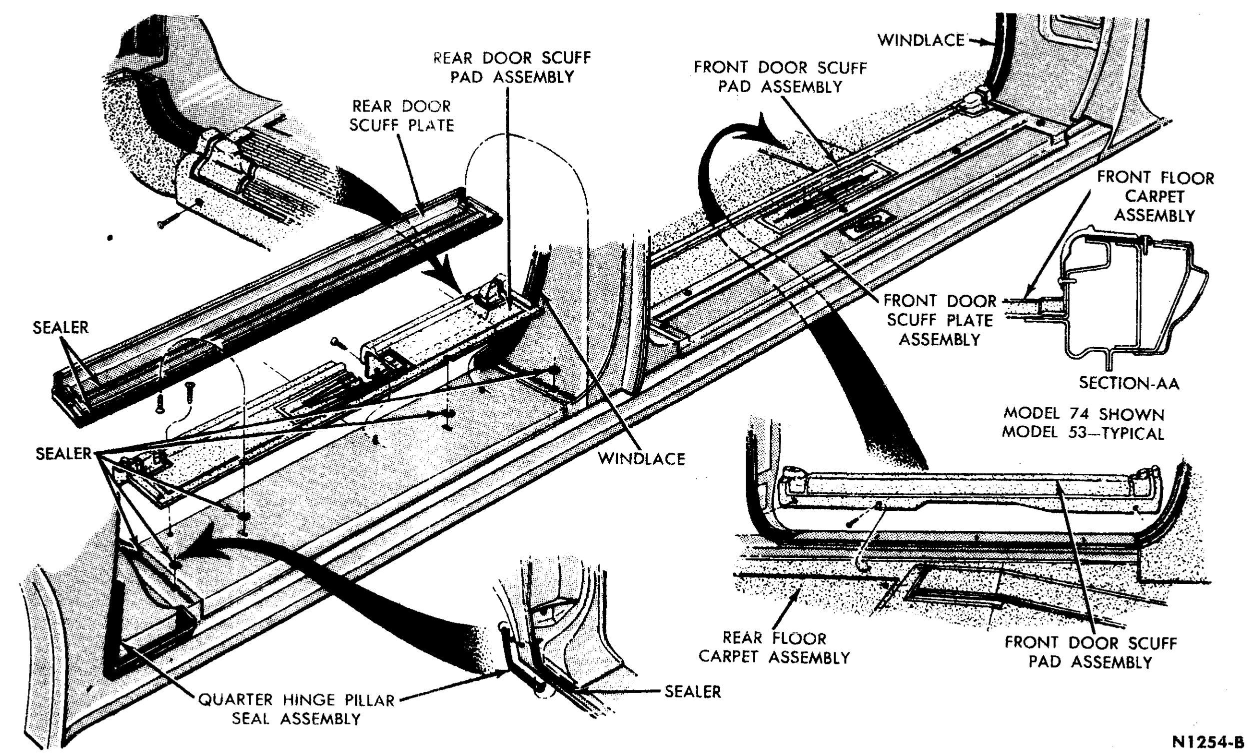


FIG. 28—Scuff Plates and Pads—Installation

procedures for these assemblies.

Rattles and squeaks are sometimes caused by weatherstripping and anti-squeak material that has slipped out of position. Apply additional cement or another adhesive and install the material in the proper location to eliminate this difficulty.

SCUFF PLATES AND PADS

For the proper method of removing or installing and sealing the scuff plates and pads, see Fig. 28.

2 CLEANING AND INSPECTION

FLOOR PAN PLUGS AND GROMMETS

Many plugs and grommets are used in the floor pan and dash panel. The floor pan plugs seal the various body access holes. If any plugs are missing or improperly installed, a dust or water leak may result. This also applies to the grommets used on the dash panel. When dust or water leaks are evident, these plugs and grommets should be checked for proper installation.

DRAIN VALVES

Drain valves located on the underside of each rocker panel, quarter panel, and door, should be cleared periodically.

DUST AND WATER LEAKS

Sealer locations should be considered when checking for dust or water leaks. It should be remembered that the forward motion of the car creates a slight vacuum within the body, particularly if a window or ventilator is partially open. Any unsealed crevice or small opening in the lower section of the body will permit air to be drawn into the body. If dust is present in the air, it will follow any path taken by the air from the point of entry into the passenger and luggage compartments. Opening the ventilator air ducts will equalize these pressures. Dust may work its way into the hollow, box-type, rocker panel which extends along the edge of the floor below the doors. Dust that accumulates in the rocker panel, may eventually work its way to the kick-up or the rear body pillar, and thus, follows the contour of the wheelhouse into the luggage compartment.

To eliminate dust leakage, determine the exact point at which the dust enters. As explained above, the point of entry is often deceptive in that the dust may enter at one point then follow the passages, formed by interior trim, to another point.

Under certain conditions, water can enter the body at any point where dirt or dust can enter. Any consideration of water leakage must take into account all points covered under dust leaks.

To determine the exact location of a dust leak, remove the following trim from the car:

1. Cowl trim panel.
2. Quarter trim panel.
3. Rear seat back and seat cushion.
4. Luggage compartment floor mats, spare wheel, and side trim panel.
5. Center pillar trim.
6. Scuff plates.

After removing the trim, the location of most leaks will be readily evident. Seal these leaks and road test the car on a dust road to make sure all leaks are sealed. The entrance of dust is usually indicated by a pointed shaft of dust or silt at the point of entrance.

After the road test, check for indications of a dust pattern around the door openings, cowl panel, lower part of the quarter panel, and in the luggage compartment.

Sometimes leaks can be located by putting bright lights under the car, with the above components removed, and checking the interior of the body joints and weld lines. The light will show through where leaks exist.

EXTERIOR CLEANING

The outside finish should be frequently washed. Never wipe the painted surfaces with a dry cloth. Dusting the finish when it is dry tends to rub the dust and dirt into the baked enamel, thus leaving a sandpaper effect on the surface. To keep the finish bright and attractive while eliminating the necessity of using polish, wash the car whenever it has accumulated a moderate amount of dirt and road salt.

The bright metal parts of the car require no special care. Periodic cleaning will preserve the beauty and life of these finishes. Wash with clear water or if the parts are very dirty use FoMoCo COAA-19B521-A compound. Using a clean, soft cloth or a sponge and water, rinse and wipe the parts dry. FoMoCo Chrome Cleaner may be used sparingly to remove rust or salt corrosion from chrome plated parts. Do not scour aluminum or chrome finished parts with steel wool or polish them with products containing abrasives. A FoMoCo polish will provide excellent protection for all bright metal parts.

INTERIOR CLEANING

Use a vacuum cleaner to remove dust and dirt from all upholstery or floor covering. Vinyl and woven plastic trim that is dusty can usually be cleaned with a damp cloth. **Do not use cleaning materials containing kerosene, naphtha, toluol, xylol 10°, lacquer thinners, cellulose acetate, butyl cellosolve, carbon tetrachloride, body polish, battery acid, anti-freeze, gasoline, motor oils or other type lubricants.**

Approved cleaners B8A-19523-A or B5A-19525-A, COAZ-19526-A or B, (soft trim cleaners) and C1AZ-19C507-A (convertible back window cleaner) are available for service. Instructions for the use of these cleaners are included on their containers.

3 HOISTING PROCEDURES

Special precautions are necessary when hoisting due to the design of the front and rear suspension and the unitized body frame construction. Failure to follow these instructions will result in unsafe hoisting and/or possible damage to the car.

DRIVE-ON HOIST

Care should be exercised while driving the car onto the hoist so that the upright flanges of the hoist do no contact the underbody of the car. Approach ramps should be built up slightly if the angle of approach is too steep.

RAIL TYPE (FREE WHEELING) AND FORK LIFT (TWIN POST) HOISTS

The rear post fork, if not adjustable for width, may require special adapters to avoid damaging the rear shock absorbers and also the forward side of the fuel tank. The front post may require special adapters in order to fully encompass the wider lower suspension arms.

FRAME CONTACT HOIST

Particular care must be exercised when raising the car on frame contact hoists. Specific underbody areas, which will sustain the weight of the car, are designated as hoisting areas. The length of the car may make it necessary to use special adapters in order to reach these safe hoisting areas. The special adapters, if necessary, are available from the various hoist manufacturers. Any deviation from the following instructions may result in damage to the underbody and/or sheet metal.

The lifting areas at the front of the car are designated by corrugated metal plates.

The lifting areas at the rear of the car are located at the edges of the underbody forward of the front edge of the rear wheel opening cover panel. The rear hoist pads or adapter arms must be positioned in this area.

JACKING INSTRUCTIONS

When jacking up the car for tire changing or any other reason, specific areas and methods must be utilized. Adherence to the following instructions will assure safe jacking and minimize the possibility of damage to the car.

FLOOR JACK

Do not attempt to raise one entire side of the car by placing a jack midway between the front and rear wheels. This procedure may result in permanent damage to the car.

Each front wheel can be raised independently by placing a floor jack under the spring seat pocket in the lower suspension arm.

Each rear wheel can be raised independently by placing a floor jack under the rear axle housing.

Do not lift both front or rear wheels by the bumpers since damage to the bumpers or fuel tank can result.

BUMPER JACK

Bumper jack locating notches are provided on the underside edge of the front and rear bumpers. The protruding end of the bumper jack hook should be positioned under these notches to assure slip-proof jacking. The transmission shift lever should be positioned in Park, the parking brake set, and the wheels blocked to prevent the car from rolling.

TOWING

Lifting and towing require the use of a towing and lifting device, other than a bumper bar and/or attaching brackets. A universal towing sling of the type pictured in Fig. 29 can be used.

When towing from the front end of the car, the large hook on the chain assembly is to be attached to the rear of the lower arm, then the chain in the hooks is to be adjusted so that the belt material will wrap around the bumper bar. The front end may be lifted as high as necessary within the limits of rear bumper clearance with the ground (Fig. 29).

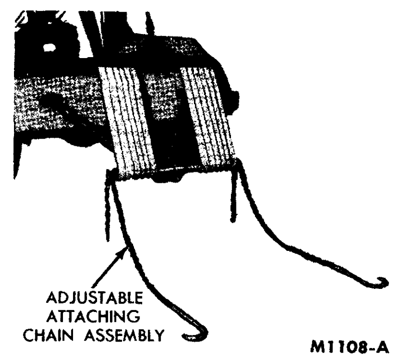


FIG. 29–Towing Sling–Typical

The car may be raised and towed from the rear end using the rear axle as attaching locations for the sling hooks. Place the chain hooks on the outer ends of the rear axle housing, between the wheels and spring seat. Place a 4 foot length of 4 inch square wood on the lifting sling and, as the car is being raised, position the length of wood so that it contacts the rear cross member and side rails at the rear of the fuel tank. This prevents damage to the fuel tank. When towing the car with the rear end raised, a locking device must be used on the steering wheel to keep the front wheels in a straight-ahead position.

PART 17-2 FRONT SHEET METAL, BUMPERS, AND EXTERIOR MOULDINGS

1 IN-CAR ADJUSTMENTS AND REPAIRS

HOOD

Adjustments can be made at the hood hinges and at the hood lock hook (Figs. 1 and 2).

The hood mounting holes in the hinges are slotted to provide fore or aft adjustment; also, to provide up or down movement at the front of the hood panel.

To maintain a flush surface between the hood and the cowl, the lock hook can be raised or lowered. Also, adjustable rubber bumpers are located at each side of the cowl panel to maintain a flush surface between the hood and fenders.

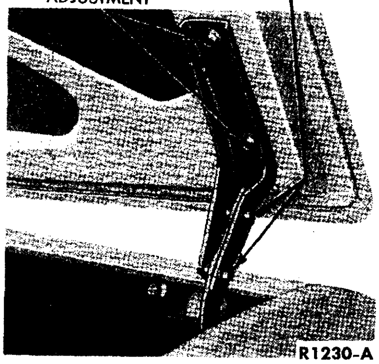


FIG. 1—Hood Hinge Adjustment

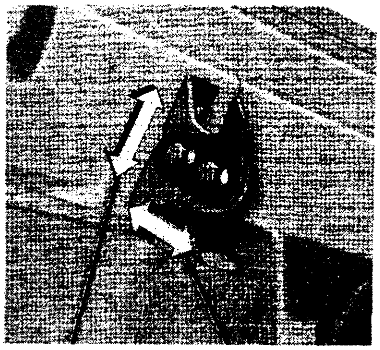


FIG. 2—Hood Lock Adjustment

2 REMOVAL AND INSTALLATION

FRONT BUMPER BAR EXTENSION

1. Remove the two extension to bumper and mounting bracket retaining cap screws (Fig. 3).
2. Remove the extension.
3. To install, align the extension on the impact bar and install the retaining cap screws.

FRONT IMPACT BAR

1. Remove the impact bar extensions.
2. Remove the lower stone shield.
3. Disconnect the parking lamp wires and remove the wires from their retaining clips.
4. Remove the four impact bar to mounting bracket bolts, nuts and washers (Fig. 3).
5. Remove the impact bar assembly.
6. To install, transfer the parking lamps and license to the new bumper; then, reverse the removal procedure.

HOOD PANEL

1. To maintain proper hood alignment, scribe a line on the hood panel around the hood hinge.
2. Remove the hinge-to-panel retaining cap screws and, with a helper, remove the hood panel.
3. To install, position the hood panel on the hinges and install the hinge-to-panel retaining cap screws. Check hood panel alignment.

HOOD HINGES

REMOVAL

1. Remove the hood panel.
2. Remove the grille assembly.
3. With Tool T64N-16A605-A, remove both hinge torsion rods.
4. Remove the hinge retaining screws and washers and remove the hinges.

INSTALLATION

1. To install, position the hinges and install the retaining screws and washers.
2. Using tool T64N-16A605-A, install the hinge torsion rods.
3. Install the grille assembly.
4. Install and align the hood panel.

HOOD LATCH-CONTROL CABLE

REMOVAL

1. Disconnect the cable from the hood latch.
2. Remove the left inside vent assembly retaining bolts and remove the vent assembly.
3. Disconnect the cable from the instrument panel bracket.
4. Remove the screws retaining the cable to the dash panel and remove the cable.

INSTALLATION

1. Transfer the retaining nut and retaining clips to the new cable.
2. Route the cable through the dash panel to the hood lock.
3. Connect the cable to the instrument panel bracket.
4. Install the retaining screws in the dash retaining clip.
5. Install the left vent assembly.
6. Connect the cable to the hood lock.

HOOD HINGE TORSION ROD

REMOVAL

1. Remove the headlamp doors

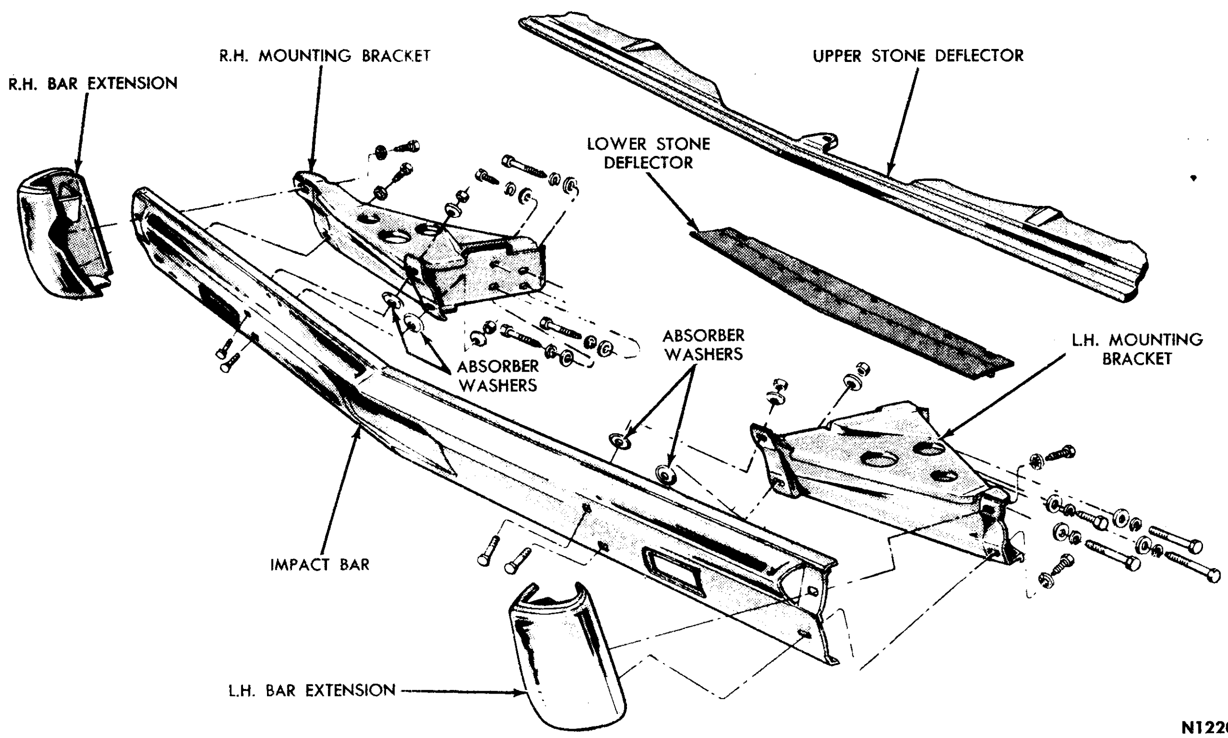


FIG. 3—Front Bumper Installation

and headlamp retaining rings.

2. Remove the lower stone deflector.

3. Remove both bumper bar extensions.

4. Remove the grille inner support bracket retaining screws.

5. Remove the rubber fender mud deflectors. Remove both grille end

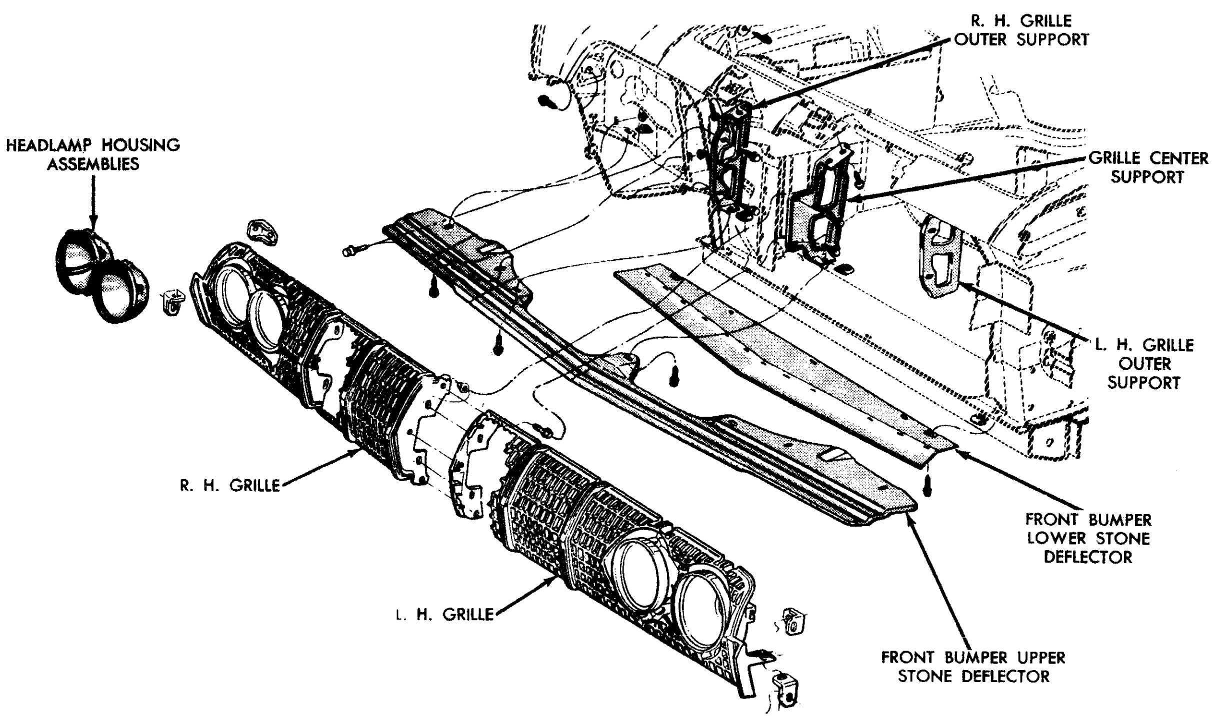


FIG. 4—Radiator Grille Installation

support bracket retaining screws and remove the grille assembly.

6. Remove the grille outer support bracket retaining screws and move the brackets toward the grille center support.

7. Prop the hood securely open.

8. Remove the torsion rods, using Tool T64N-16A605-A.

INSTALLATION

1. Using Tool T64N-16A605-A, install new torsion rods.

2. Install the grille outer support brackets.

3. Position the grille assembly and loosely install the grille end support bracket retaining screws.

4. Install the grille inner support bracket retaining screws and tighten the grille end support retaining screws.

5. Install the rubber fender mud deflectors.

6. Install the bumper impact bar extensions.

7. Install the lower stone deflector.

8. Install the headlamps, headlamp retaining rings and the headlamp doors.

COWL TOP VENTILATION GRILLE AND SCREEN

1. Remove the windshield wiper arms and blades.

2. Remove the vent grille retaining screws (Fig. 12, Part 17-3).

3. Raise the ventilation grille and disconnect the washer hoses.

4. Remove the ventilation grille and screen from the car.

5. To install, reverse the removal procedure.

RADIATOR GRILLE

REMOVAL

1. Remove the headlamp doors.

2. Remove the headlamp retaining rings and remove the headlamps.

3. Remove the lower stone deflector (Fig. 3).

4. Remove the retaining cap screws from the center support bracket of the grille assembly (Fig. 4).

5. Remove both the left and right bumper bar extension retaining cap screws and remove the extensions (Fig. 3).

6. Remove the cap screws from each grille outer support.

7. Remove one retaining cap screw from each outer lower grille support bracket (Fig. 4).

8. Remove one retaining cap screw from each outer upper grille support bracket (Fig. 4). This cap screw is near the outer headlamp and can be removed with the use of a distributor clamp nut removal wrench or similar tool.

9. Remove the grille assemblies.

INSTALLATION

1. Transfer all hardware to the new grille assemblies.

2. Place the grille assemblies on a bench and install the left-hand-to-right-hand grille retaining cap screws.

3. Position the grille assembly on the center support bracket and loosely install the grille-to-support retaining cap screws.

4. Loosely install the grille-to-outer support retaining cap screws.

5. Loosely install the grille-to-outer lower support bracket retaining cap screws.

6. Loosely install the grille-to-outer upper support bracket retaining cap screws.

7. Align the grille assembly in the grille opening.

8. Tighten the grille-to-center support retaining cap screws.

9. Tighten the grille to outer support retaining cap screws.

10. Tighten the grille - to - outer bracket retaining cap screws.

11. Install the bumper bar extensions.

12. Install the lower stone deflector.

13. Install the headlamps and retaining rings.

14. Install the headlamp doors.

REAR BUMPER

1. Working under the car, remove the nuts and bolts securing the center section of impact bar to the rear bumper mounting brackets.

2. Open the luggage compartment door and remove the lining board from the lower back panel. Disconnect the back-up lamp wires and remove the dome shaped back-up lamp housing covers.

3. Remove the bolts (model 53) or nuts (model 74) securing the center section of the bumper impact bar to the lower back panel (Fig. 5).

4. Slowly lower the bumper

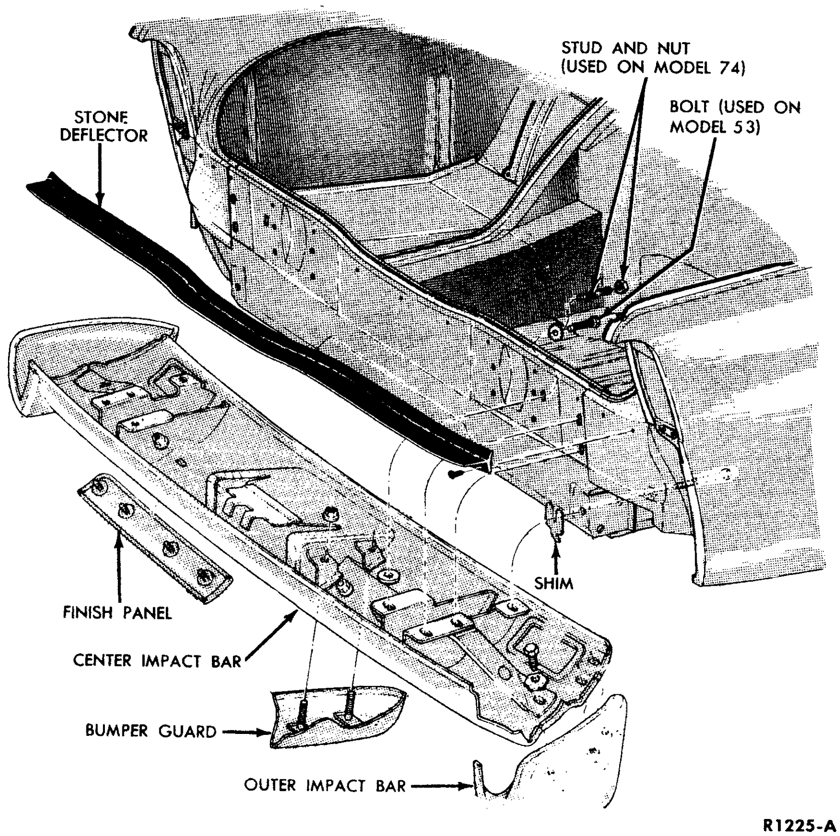
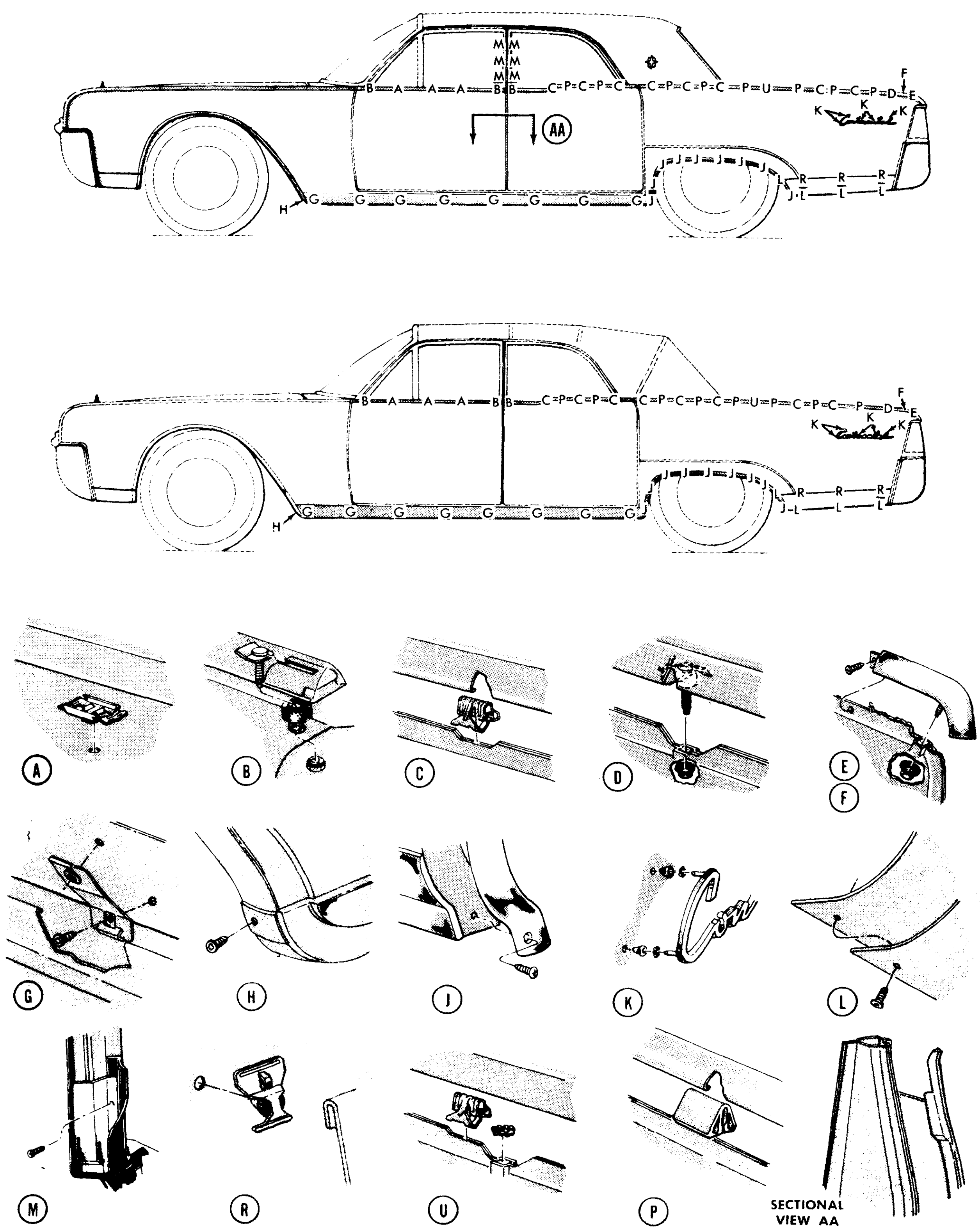


FIG. 5—Rear Bumper Installation



N1213-B

FIG. 6–Exterior Moulding Installation

assembly to gain access to the license lamp wire. Disconnect the wire.

5. The individual parts of the bumper assembly are bolted together and can be replaced as necessary (Fig. 5).

6. To install the bumper assembly, reverse the removal procedure. Adjust the position of the bumper before tightening the bolts.

EXTERIOR MOULDINGS

Figure 6 shows the various methods of retaining the body outside mouldings. Before removing any outside moulding, it should be determined by the type of moulding retainer used whether the respective door trim, quarter trim, or luggage compartment trim should be removed. Bolt-on moulding retainers may require removal of the trim panel before removing the moulding.

PART 17-3 DOORS, WINDOWS AND DECK LID

1 DIAGNOSIS AND TESTING

VACUUM DOOR LOCK

The vacuum hoses are color-coded and the corresponding color marking at the connections of each component provides easy identification for proper installation (Fig. 1).

Under no circumstances should air pressure be applied to the vacuum system as the actuator diaphragms may be damaged.

Perform all the vacuum locking system checks with the engine running.

TROUBLE DIAGNOSIS GUIDE

COMPLETE SYSTEM INOPERATIVE	1. Check for vacuum at the manifold, the check valve, and/or the reservoir. This can be accomplished by removing the hose from each component and attaching it to a vacuum gauge. (Six to eight inches of vacuum will actuate the locks.) 2. To gain access to the control valve, remove the glove compartment. 3. Check vacuum to the control valve by disconnecting the ¼-inch green supply hose at the control valve. If vacuum is not present, the hose is damaged, obstructed, or not properly installed. If vacuum is present, connect the hose to the nozzle from which it was removed.
ALL DOORS WILL NOT LOCK	1. With all doors unlocked, remove the 5/32-inch red hose and the 1/8-inch green hose from the control valve. Check for vacuum at the red hose nozzle on the control valve. If no vacuum is present, the control

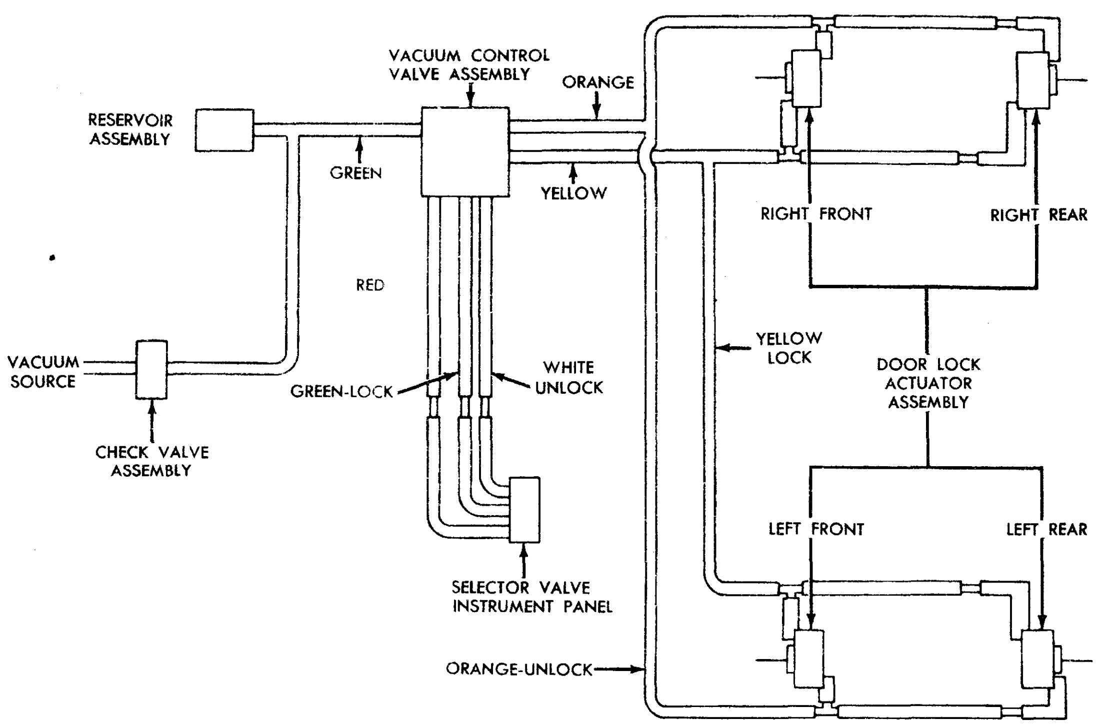


FIG. 1—Vacuum-Operated Door Locking System

R1232-A

TROUBLE DIAGNOSIS GUIDE (Continued)

ALL DOORS WILL NOT LOCK (Continued)	valve is faulty. If vacuum is present, use a jumper hose and connect the red nozzle to the green nozzle of the control valve. If the doors lock, the problem is in the selector valve or the red and/or green hoses connected to the selector valve.	2. Remove the ¼-inch green and two yellow hoses from the control valve. Connect the yellow hoses to the green hose using a jumper tube (¼-inch copper or steel tubing). If the doors lock, the control valve is faulty.
ALL DOORS WILL NOT UNLOCK	1. With all doors locked, remove the 5⁄32-inch red hose and the ⅛-inch white hose from the control valve. If no vacuum is present, the control valve is faulty. If vacuum is present, use a jumper hose and connect the red nozzle to the white nozzle of the control valve. If the doors unlock, the problem is in the selector	valve or the red and/or white hoses connected to the selector valve. 2. Remove the ¼-inch green hose and two orange hoses from the control valve. Connect the orange hoses to the green hose using a jumper tube (¼-inch copper or steel tubing). If the doors unlock, the control valve is faulty.
ONE OR MORE LOCKS ARE INOPERATIVE	1. Remove the cowl trim panel and disconnect the yellow (locking) or orange (unlocking) hose from its respective tee. If vacuum is not present at the hoses connected to the control valve when the selector valve is operated, the control valve or the hoses from the valve are faulty. 2. If a front door lock is inoperative, remove the door trim panel and access cover. Disconnect the yellow (locking) or orange (unlocking) hose from the actuator. If vacuum is present at the hoses when the selector valve is operated, the actuator or the components of the locking mechanism are faulty.	3. If a rear door is inoperative, remove the rear seat cushion and back. Disconnect the yellow (locking) or orange (unlocking) hose at the nipple located in the quarter panel. If vacuum is not present at the hoses when the selector valve is operated, the difficulty is in the hose from the tee behind the cowl trim panel or in the tee. If vacuum is present, proceed with step "D". 4. Remove the rear door trim panel and access cover. Disconnect the yellow (locking) or orange (unlocking) hose from the actuator. If vacuum is present at the hoses when the selector valve is operated, the difficulty is in the actuator or the components of the locking mechanism.

POWER WINDOWS

The front door window circuits on the sedan and convertible models are identical. The rear door window circuits on sedan models (53A) are similar in design and operation to past models. The rear door window circuit on convertible models (74A) incorporates additional switches which automatically cause the rear window to partially lower when its respective rear door is opened; also, the rear window will automatically close after its respective door is closed (Figs. 11-6 and 11-7).

A master control switch is mounted on the left front door arm rest panel. The panel consists of a single-pole, double-throw control switch for each of the windows and also a safety lock-out switch. The lock-out switch enables the driver to prevent the operation of all window switches except those on the master control panel.

A single-pole, double-throw switch is located on the arm rest on each right front, right rear and left rear door for individual passenger control of the door windows. A single-pole, double-throw switch is also mounted on the right front door arm rest for vent window control.

A reversible motor which has an integral circuit breaker (to ground) is located in each door. The main, or power feed, 20-ampere circuit breaker is located on the fuse panel.

TROUBLE DIAGNOSIS GUIDE

ONE WINDOW OPERATES IN ONE DIRECTION ONLY THROUGH EITHER SWITCH CIRCUIT	One winding in motor open or shorted. If this condition prevails, remove either switch assembly and discon-	nect the switch. Insert a probe or arcless terminal jumper between the armature slot of the "quick-disconnect" and the respective field slot of

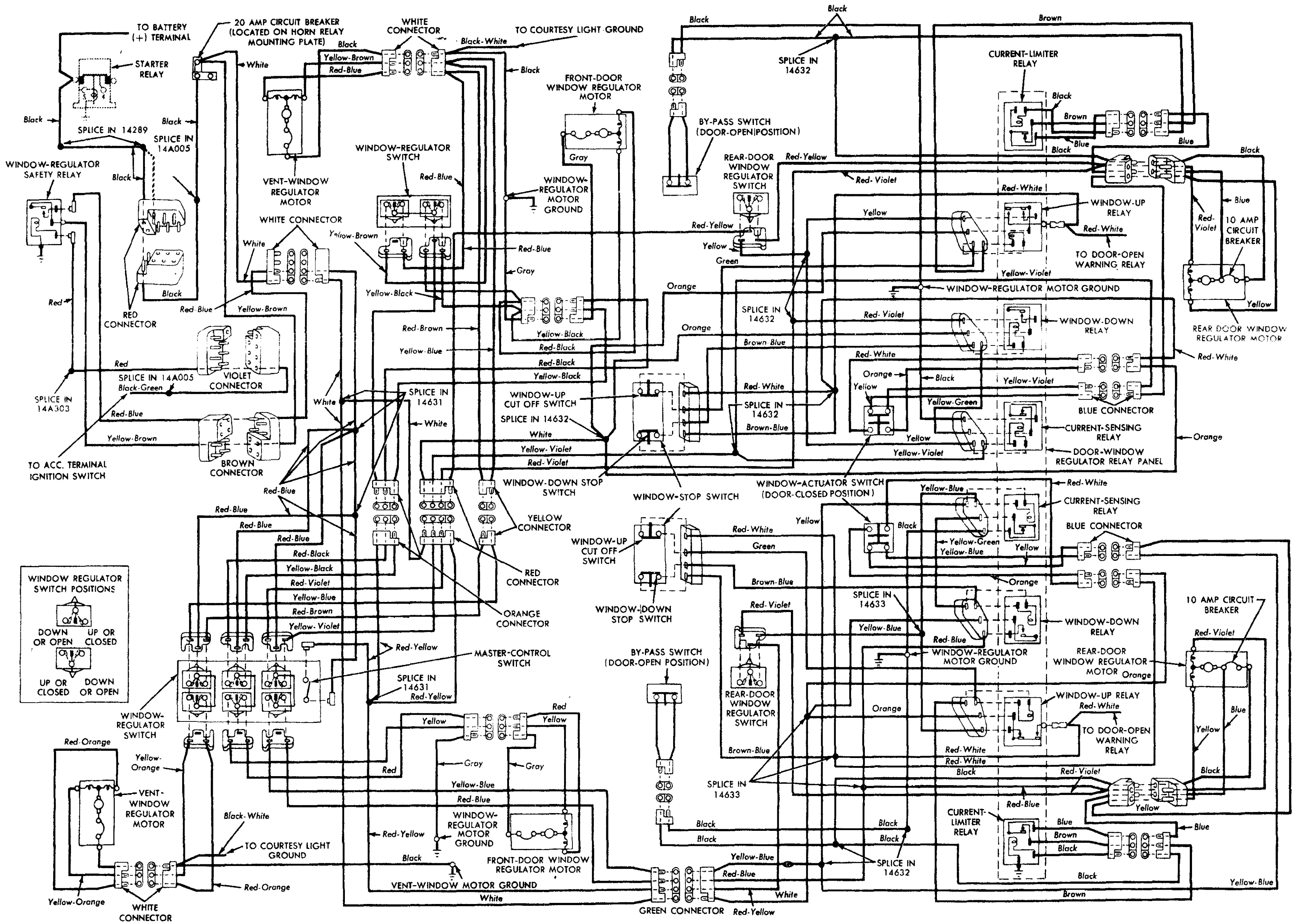


FIG. 2—Power Window Circuit

R1240-A

TROUBLE DIAGNOSIS GUIDE (Continued)

ONE WINDOW OPERATES IN ONE DIRECTION ONLY THROUGH EITHER SWITCH CIRCUIT (Continued)	the inoperative circuit; then connect the leads of the continuity test lamp beween the battery slot and the armature slot. If the window will not operate and the light does not go on, the field winding in the motor is open or the circuit wiring is open. If the test lamp lights and the circuit is inoperative, motor winding or circuit wiring is shorted.
WINDOW OPERATES IN BOTH DIRECTIONS THROUGH ONE SWITCH CIRCUIT ONLY	Defective switch or open wiring. To check this type of problem, proceed as follows: **1.** Remove the inoperative switch assembly and disconnect the switch. Substitute a known good switch and test. **2.** Insert a probe or arcless terminal jumper between the armature slot of the "quick-disconnect" and the respective field slot of the inoperative circuit; then connect the leads of the continuity test lamp between the battery slot and the armature slot. If the motor operates and the test lamp lights, the defect is in the switch or the circuit wiring is open.
ONE WINDOW WILL NOT OPERATE IN EITHER DIRECTION THROUGH EITHER SWITCH CIRCUIT	**1.** Motor armature and/or windings or circuit wiring is open or shorted. **2.** Circuit breaker is improperly grounded or defective. The following steps will help to locate the source of trouble: **a.** Remove the switch assembly and disconnect the switch. Connect the leads of a continuity test lamp between the battery slot and the armature slot of the "quick-disconnect". Connect a jumper wire between the battery slot and either field winding. If the motor will not operate and the lamp does not light, the armature in the motor is open or the armature circuit wiring is open. If the test lamp lights and the circuit is inoperative, the motor armature or armature circuit wiring is shorted or the field winding and/or wiring is open or shorted. **b.** If the continuity is indicated at the battery slot by grounding the test lamp probe, but is not indicated at any of the other slots, check the ground wire connection.
ALL WINDOWS WILL NOT OPERATE IN EITHER DIRECTION	20-ampere circuit breaker is defective. To check the continuity of this circuit and the operation of the 20-ampere circuit breaker, remove the master control switch panel assembly and disconnect the left front door window switch "quick-disconnect". Insert one probe of the test lamp in the battery slot of the "quick-disconnect" and the other probe to the ground on the car to check the continuity at the battery slot. If continuity is not indicated at this point, substitute a known good 20-ampere circuit breaker with jumper leads in the circuit and retest.

POWER VENT WINDOW

The power window schematic diaphragm should also be used as a guide during the trouble shooting procedure (Fig. 2).

TROUBLE DIAGNOSIS GUIDE

ONE WINDOW OPERATES IN ONE DIRECTION ONLY, THROUGH EITHER SWITCH CIRCUIT	One field winding in the motor has an open circuit, or is shorted. Remove the vent window switch assembly from the door arm rest. Actuate the switch, and with a voltmeter or test lamp, determine if voltage is present at the armature and field positions of the switch. Proceed with the test to the disconnect terminal at the inoperative vent motor and check for voltage at the connector. If voltage is indicated at the motor disconnect (field and armature positions), the motor assembly is defective and should be replaced.
ONE WINDOW OPERATES IN BOTH DIRECTIONS, THROUGH ONE SWITCH CIRCUIT ONLY	Defective switch or open wiring. Remove the inoperative switch assembly and disconnect the switch. Substitute a known good switch and test. If the circuit is inoperative, check for an open circuit between the disconnect at the switch and the disconnect to motor.

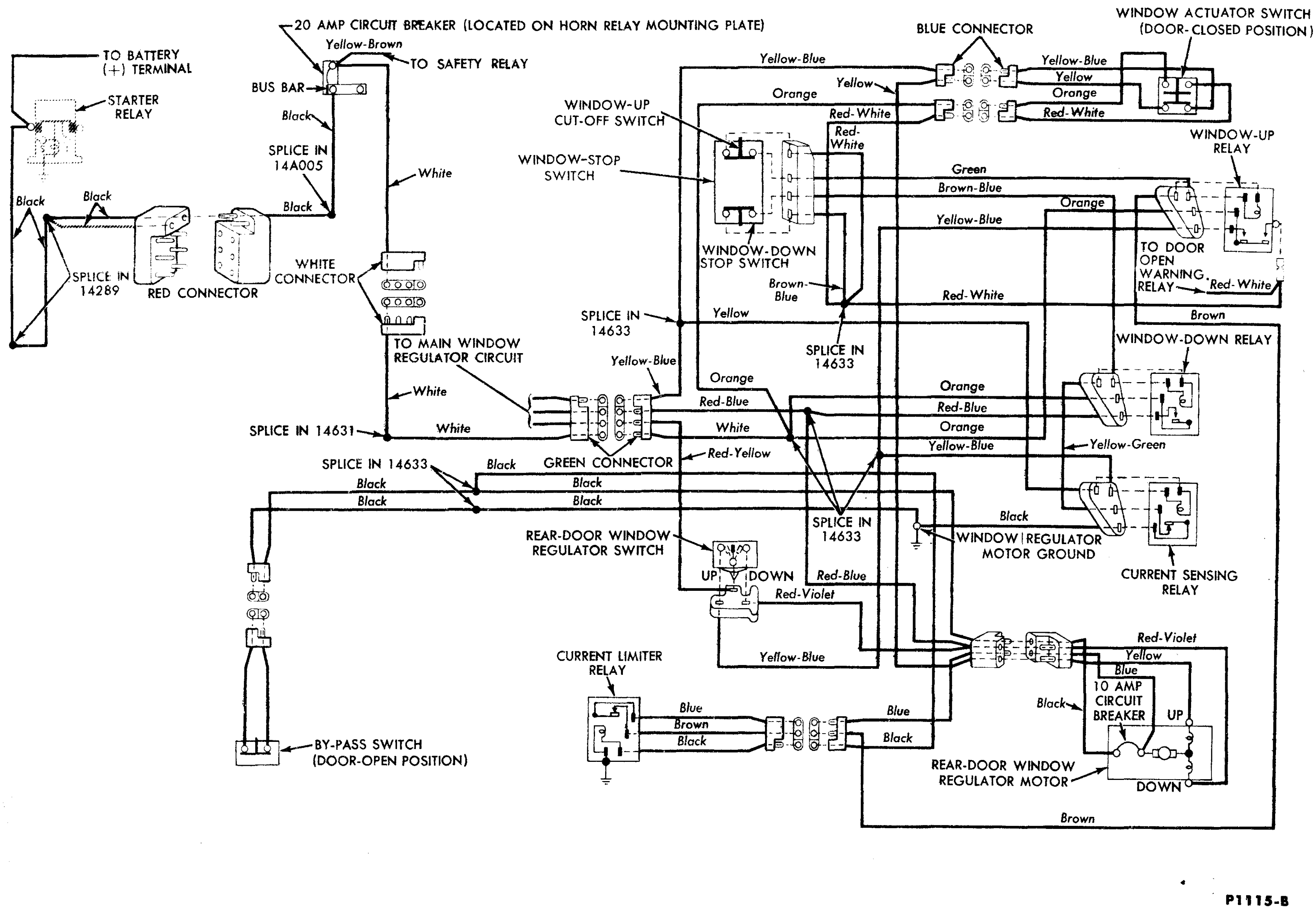


FIG. 3—Automatic Rear Door Window Circuit

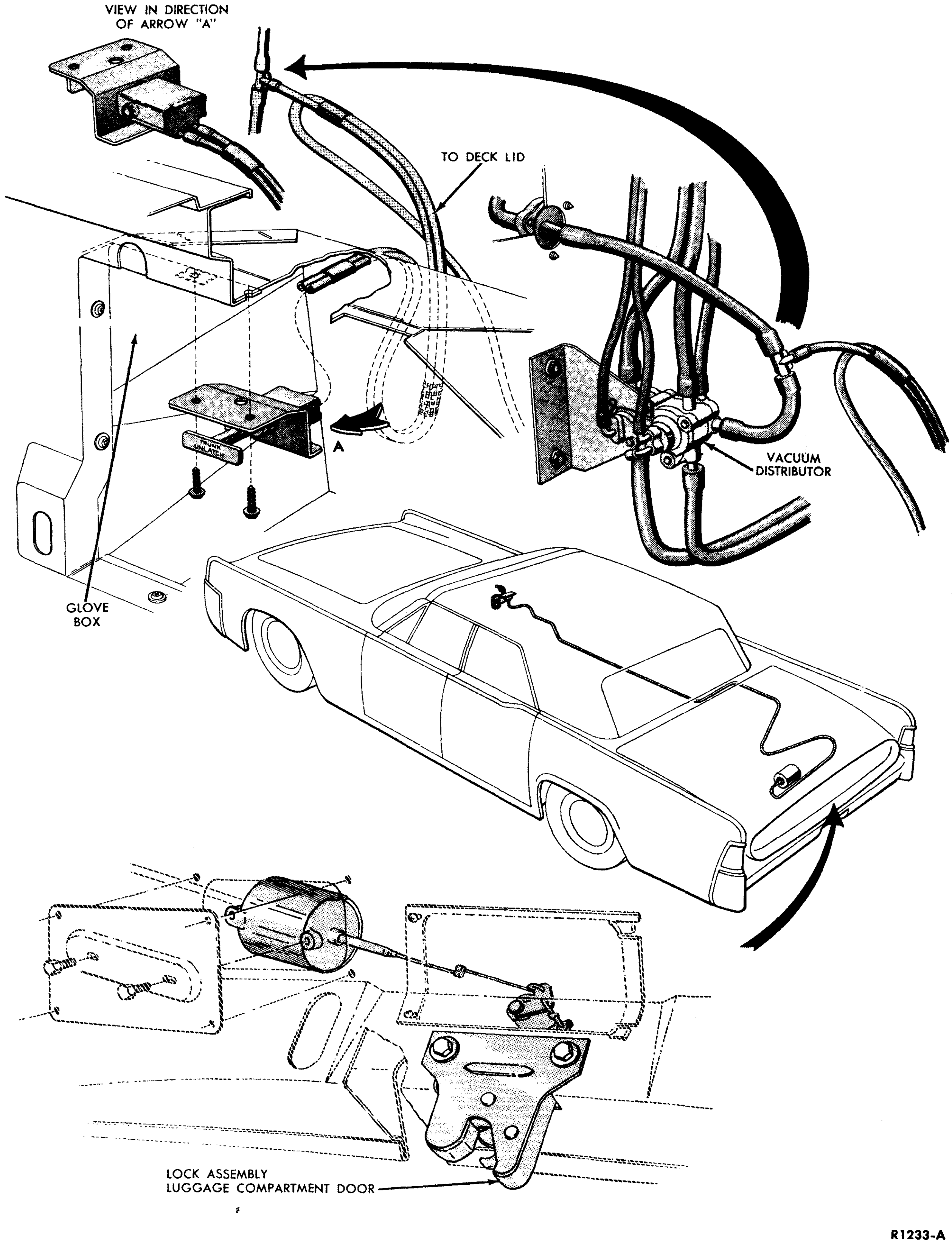


FIG. 4—Vacuum Luggage Compartment Lock

TROUBLE DIAGNOSIS GUIDE (Continued)

ONE WINDOW WILL NOT OPERATE IN EITHER DIRECTION THROUGH EITHER SWITCH	Open circuit or defective motor. Check for voltage indication at the disconnect to the inoperative vent	motor. If voltage is present, the motor is defective or the wiring leads between the disconnect and the motor are open.
BOTH WINDOWS WILL NOT OPERATE IN EITHER DIRECTION	The 20-ampere circuit breaker is defective. Remove the master control switch and check for voltage at the battery	slot of the disconnect. If voltage is not indicated at this point, substitute a known good 20-ampere circuit breaker in the circuit and retest.

AUTOMATIC REAR DOOR WINDOWS (MODEL 74A) OPERATION

WINDOW-DOWN CIRCUIT

1. When opening a rear door, the window-actuator switch is operated and the switch contacts are repositioned. This action opens the up-travel field circuit of the motor, closes the feed circuit to the control winding of the window-down relay, and closes the feed circuit to the window-up cut-off switch (Fig. 3).

2. To complete the down movement of the window, current flows through the window-actuator switch, the window-down stop switch (window travel limit switch), the down-relay windings and through the current-sensing relay contacts to ground.

3. When the down-relay contacts close, the current flows from the battery, through the down-relay contacts, the motor-down field, the motor armature and circuit breaker, and the closed bypass switch to ground. The motor is energized and the window is lowered.

4. After the window travels down approximately six inches, the window-down stop switch is actuated and its contacts are opened. This now opens the down-relay circuit, and the downward movement of the window stops.

WINDOW-UP CIRCUIT

1. When the window is lowered, the window-up cut-off switch is closed providing power to the control winding of the window-up relay. This permits current to flow through the window-actuator switch, the window-up cut-off switch, the up-relay winding, the current-limiter relay contacts, the motor circuit breaker, and the closed bypass switch to ground. The current-limiter relay contact points are closed and remain closed until the door is shut and the window is all the way up. However, the window does not go up until the door is shut because the position of the window-actuator switch (with the door open) leaves the motor up-field feed circuit open.

As soon as the up-relay contacts are closed, a lock-in circuit is established which will continue to energize the up-relay coil after the window-actuator switch contacts are repositioned upon closing the door. This lock-in circuit permits current flow through the up-relay contacts, the window-up cut-off switch, the up-relay coil windings, the current-limiter relay contacts, the motor circuit breaker, and the bypass switch to ground.

2. When the door is closed, the window-actuator switch plunger is depressed which repositions the switch contacts and completes the circuit from the battery through the window-up relay contacts, the coil windings of the current sensing relay, the window actuator switch, the up-field of the motor, the motor armature and circuit breaker, and the bypass switch to ground. The motor operates and closes the window.

The current-sensing relay contacts are in series with the window-down relay control winding to ground. When the window is being raised, the motor current flows through the current sensing relay control winding and opens the contacts, thus preventing energizing of both the up and down fields of the motor at the same time.

If the window has been lowered more than seven inches, the window-up cut-off switch is actuated and the switch contacts are open. Thus, the up-relay circuit is open and prevents the automatic up movement of the window until the door is closed.

3. Approximately ¼ inch before the window reaches the closed position, it actuates the current-limiter relay bypass switch. The bypass switch circuit is provided to prevent the current-limiter relay from cutting out if the window motor requires above normal operating current before it reaches the full up position.

4. With the bypass switch circuit open, the motor current-limiter relay coil carries the full motor current. As soon as the window reaches its upward limit, the motor stalls and the stall current is sufficient to open the current-limiter relay contacts. This opens the ground circuit of the up-relay coil windings and the complete up circuit becomes inactive.

If the conventional power windows are operating properly and the automatic system is inoperative, the motor, manual switch, bypass switch and 20-ampere circuit breaker are not defective.

If both systems are inoperative, the conventional circuit should be checked first as the systems have common motor 10- and 20-ampere circuit breakers.

Following is a trouble diagnosis guide.

TROUBLE DIAGNOSIS GUIDE

WINDOW WILL NOT GO DOWN	1. 10- or 20-ampere circuit breaker. 2. Window actuator switch. 3. Window-down relay.	4. Window-down stop switch. 5. Motor-down field winding. 6. Current-sensing relay. 7. Open circuit in wiring.

TROUBLE DIAGNOSIS GUIDE (Continued)

WINDOW CONTINUES ALL THE WAY DOWN	1. Broken spring on the stop switch actuator lever.	2. Window-down stop switch. 3. Down relay.
WINDOW WILL NOT RETURN TO UP POSITION	1. 10- or 20-ampere circuit breaker. 2. Window-up relay.	3. Motor up-field winding. 4. Window-up cut-off switch. 5. Window-actuator switch.
WINDOW CLOSES—MOTOR CONTINUES TO OPERATE	1. Current-limiter relay.	2. Bypass switch. (Improper adjustment or shorted contacts.)
WINDOW MOVES UP ONLY A SHORT DISTANCE AFTER DOOR IS CLOSED	1. Bypass switch.	2. Stalled motor due to tight window channels.

VACUUM CONTROLLED LUGGAGE COMPARTMENT DOOR LOCK

The vacuum source for this system is obtained from the vacuum door lock system through a tee connection at the distributor supply line. The system is used to unlock the luggage compartment door from the interior of the car (Fig. 4).

The principal components of the system are a control valve assembly and a door lock actuator assembly. The control valve, through which the vacuum is routed, is located in the glove compartment. The actuator, located in the luggage compartment, is a vacuum motor consisting of a diaphragm with a rod attached to operate the door mechanism.

Minor malfunctions, such as leaking or disconnected hoses, are usually detected very easily by listening for air leaks, and can be corrected without excessive checking. **Under no circumstances should air pressure be applied to the system as serious damage to the actuator diaphragm will result. If the system is inoperative, the sequence for determining the malfunction should start at the vacuum source while the engine is running. The procedure is as follows:**

1. Listen for obvious air leaks.

2. Check the vacuum control valve in the glove box by disconnecting the hose from the left hand nozzle of the valve and touching a finger to the end of the hose. If vacuum is not present, the difficulty is at the source from the vacuum door lock system. If vacuum is present, connect the hose to the valve nozzle.

3. Disconnect the hose from the right hand nozzle of the control valve in the glove compartment. Touch a finger to the end of the nozzle and operate the valve. If vacuum is not present, the difficulty is in the control valve. Connect the hose if vacuum is present.

4. Unlock the luggage compartment door with a key. Disconnect the hose at the actuator. With someone operating the control valve in the glove compartment, touch a finger to the end of the hose. If vacuum is not present, the difficulty is in the hose from the control valve to the actuator. If, however, vacuum is present, the difficulty is in the actuator assembly,

2 IN-CAR ADJUSTMENTS AND REPAIRS

WINDOW BYPASS SWITCH

1. Lower the window to the down position.

2. Disconnect the negative (ground) cable from the battery.

3. Remove the trim panel from the door.

4. Mark the position of the window-up stop bracket.

5. Remove the window-up stop and bypass switch from the door as an assembly.

6. Adjust the switch so that the threaded portion of the switch is flush with the lower surface of the window stop bracket. **The threaded part must not protrude beyond the bracket.**

7. Install the window stop and switch in the door.

8. Connect the switch lead wires. Be sure that the wires are routed through the three retaining clips.

9. Connect the battery ground cable and check the operation of the window.

10. Install the door trim panel.

WINDOWS

FRONT DOOR AND VENT

(Refer to Figs. 5 and 6).

1. Remove the door trim panel.

2. For the vent window, loosen the adjusting screws at points "A".

3. Adjust the vent assembly forward or backward and up or down, as required, to obtain approximately a 5/32-inch parallel clearance between the windshield outside, side moulding and the forward edge of the vent window frame, as shown in Sectional View "AA" of Fig. 5.

4. Temporarily tighten the adjusting screws at points "A".

5. Loosen the jam nut at point "B."

6. Tilt the vent assembly toward the inside or outside of the body by rotating the adjusting screw at point "B" clockwise or counterclockwise, as required. This adjustment is provided to obtain alignment with the windshield outside, side moulding and proper sealing between the roof rail weatherstrip and top edges of the vent window frame.

7. Cycle the glass and channel assembly to the down position.

8. Loosen the jam nut at point "C". Adjust the vent window glass forward or backward at point "C", as required, so that the glass run is parallel to the front edge of the glass and channel assembly.

9. Cycle the glass assembly up and down to determine whether or not a binding condition exists between the glass and channel assembly and the vent window run assembly.

10. Adjust the lower portion of the vent window run toward the inside or outside of the body, as necessary, by rotating the adjusting screw at point "C" clockwise or counterclockwise. After adjustment, temporarily tighten the jam nuts at points "B" and "C".

11. For the glass and channel assembly, cycle the glass to the up position and loosen the screw and washer at point "D".

12. Adjust the glass lockside run and retainer assembly forward or backward to obtain proper clearance between the front edges of the glass and channel and the run assembly of the vent window glass division bar. With the glass assembly in the down position, readjust the run and retainer assembly forward or backward at point "D" to obtain proper clearance between the front edge of the glass and channel assembly and the run assembly portion of the vent window assembly.

13. Tilt the run and retainer toward the inside or outside of the body, as necessary, at point "D" to obtain proper alignment between the top edges of the glass and channel assembly and the outside belt weatherstrip assembly. After adjustment, tighten the screw and washer at point "D".

14. With the glass and channel assembly in the down position, tilt the lockside run and retainer assembly toward the inside or outside of the body at point "E" to obtain parallel alignment between the rear edge of the glass and channel assembly and the lockside run and retainer assembly. After adjustment, temporarily tighten the screw and washer assembly at point "E". To obtain the proper alignment or seal between the top edge of the glass and channel assembly and the roof rail weatherstrip, readjust the front and rear glass run assemblies at points "C" and "E" simultaneously toward the inside or outside of the body, as required, with the glass and channel assembly in the up position. After adjustment, tighten the jam nuts at points "B" and "C". Tighten the screw and washer assemblies at points "A" and "E".

15. To obtain parallel alignment between the top edge of the glass and channel assembly and the bottom edge of the roof rail weatherstrip, loosen the equalizer arm bracket retaining screws at points "F". Move the equalizer arm bracket up or down, as required, then tighten the screw and washer assemblies at points "F". The glass and channel assembly must be in the up position for this adjustment.

16. To align the upper stop assemblies with the stop brackets on the window channel, loosen the screws at points "G" and move the stop assemblies in or out, as required, then tighten screws "G".

17. To provide a flush condition between the top edge of the glass and channel assembly and the top edge of the vent window frame, loosen the upper stop retaining screw and washer assemblies at points "H". Adjust the upper stops up or down, as necessary. Tighten the screw and washer assemblies at points "H".

18. To provide a flush condition between the top edge of the glass and channel assembly and the door outer panel at the belt line, loosen the lower stop retaining screw and washer assemblies at point "J" and adjust the lower stop assembly up or down, as required. After adjustment, tighten the screw and washer assembly at point "J".

19. Tighten the screw and washer assembly at point "J" after all adjustments have been completed. The window mechanism must be adjusted to operate with a current draw not to exceed 20 amperes at 12 volts when the windows are individually operated.

REAR DOOR WINDOW

1. To obtain the proper tension between the front and rear guide assemblies and the window assembly, rotate the adjusting screws at points "A" and "B" clockwise or counterclockwise as required. The window must be in the up position. After adjustment, temporarily tighten the jam nuts at points "A" and "B".

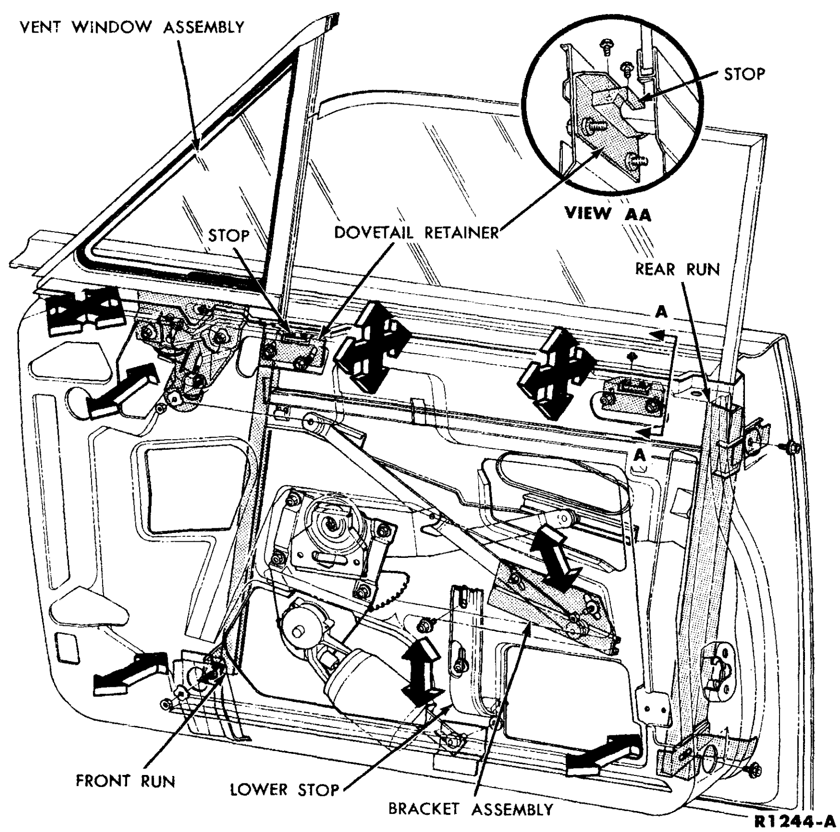


FIG. 5—Front Door Window Adjustment

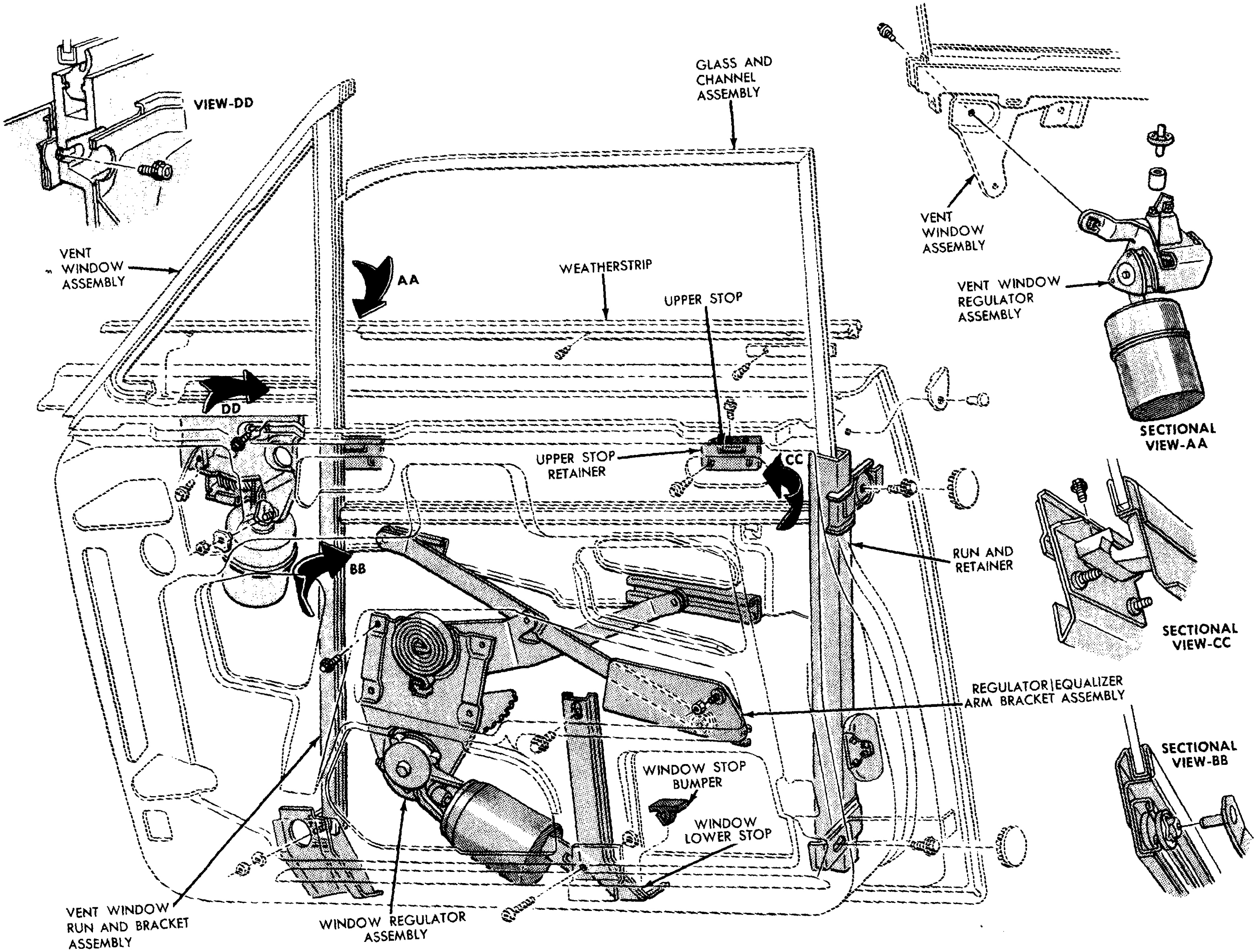


FIG. 6—Front Door Window Mechanism

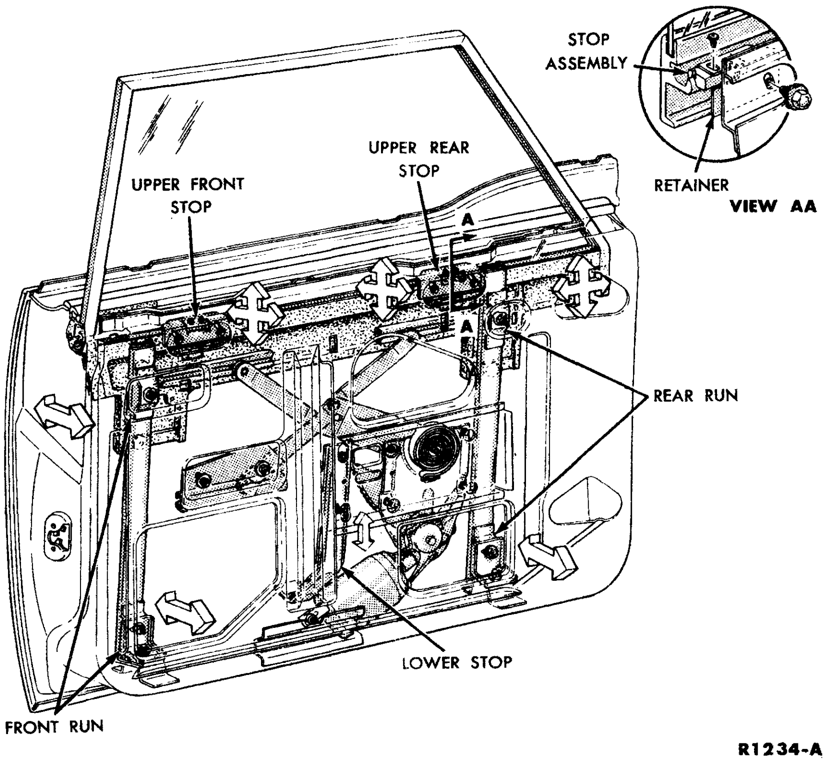


FIG. 7—Rear Door Window Adjustment

2. To obtain proper clearance between the front edge of the window assembly and the rear edge of the center pillar for Model 53, or between the front edge of the rear window and rear edge of the front window on Model 74, proceed as follows with the window in the up position. Adjust the front run forward or backward at point "A". After adjustment, temporarily tighten the jam nut at point "A".

3. To obtain a parallel alignment between the top edge of the window and the bottom edge of the roof edge rail weatherstrip, tilt the equalizer arm bracket assembly up or down at points "C", as required. Vertical alignment is also obtained between the front edge of the rear door window and the rear edge of the center pillar for Model 53, or between the front edge of the rear door window and the rear edge of the front window for Model 74 in the same manner. After adjustment, tighten the nuts at points "C" securely. The window must be in the up position for these adjustments.

4. To obtain the proper alignment between the top and rear edge of the window and the roof side rail weatherstrip, adjust the front and rear run assemblies toward the inside or outside of the body at points "D" and "E", as necessary. After adjustment, tighten the screw and washer assemblies at points "D" and "E" and tighten the nuts at points "C".

5. Adjust the upper stops up or down as necessary to control window upward travel by loosening the screws at points "G". After adjustment, tighten the screws at points "G".

6. The dovetail is adjusted toward the inside or outside of the body and the dovetail retainer up or down to align with striker at points "F".

7. To obtain a flush condition between the top edge of the window and the door outer panel at the beltline, adjust the lower stop up or down at point "H", as required. After adjustment, tighten the screw at point "H".

The window mechanism must be adjusted to operate with a current draw not to exceed 12 amperes.

FRONT AND REAR DOOR HINGES

When adjusting the door for correct alignment, remove the door lock striker plate to permit the door to hang free on its hinges. When properly adjusted, the door should be centered in the door opening.

If the contour of the door does not require correction, the door can be aligned by adjustments provided at the door hinges. The front doors can be adjusted fore or aft and up or down at the door end of the hinges by loosening the cap screws which are threaded into floating-type tapping plates. The door can be adjusted in or out at the front body pillar end of the hinges by loosening the cap screws and moving the door to the proper position (Fig. 9).

The rear doors can be adjusted up or down and in or out at the door end of the hinges by loosening the cap screws which are threaded into floating-type tapping plates. To adjust the rear doors fore or aft, it is necessary to remove the door trim panel to gain access to the door end of the hinges (Fig. 10). **When adjusting the doors, loosen the capscrews just enough to maintain a slight drag.**

DOOR LOCK STRIKER ADJUSTMENT

The striker pin can be adjusted laterally, vertically and fore and aft. Loosen the striker retaining screws and move the assembly in the required direction. Then, tighten the retainer screws and check alignment.

To get the proper striker pin-to-door lock clearance shown in Fig. 11, add or remove shims between the striker plate and body pillar.

3 REMOVAL AND INSTALLATION

WINDSHIELD

REMOVAL

1. Remove the sun visor assemblies.

2. Remove the windshield inside side mouldings.

3. Remove the front upper body pillar weatherstrips (Model 74).

4. Remove the front upper body pillar weatherstrip retainers.

5. Remove the roof drip side front mouldings (Figs. 12 and 13).

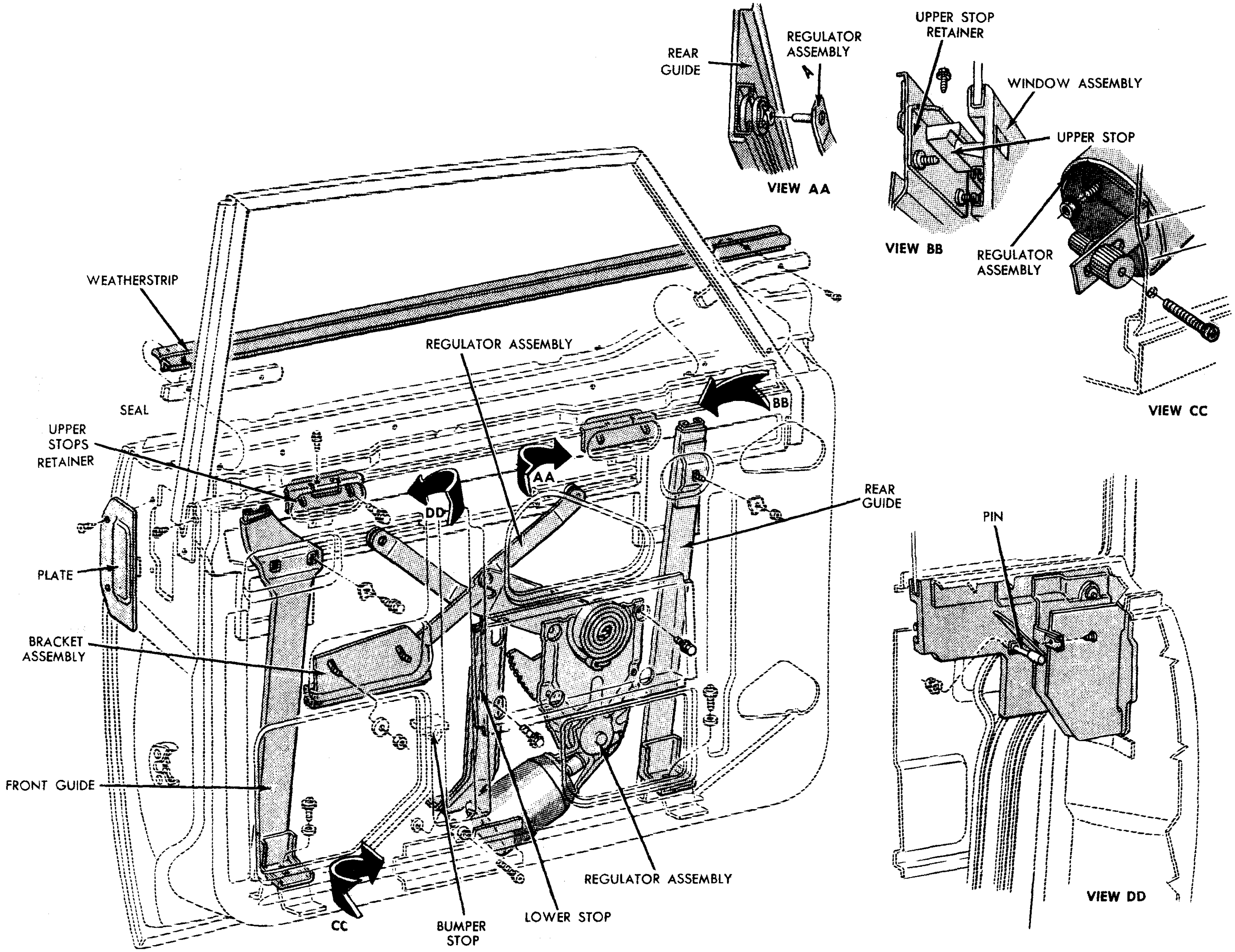


FIG. 8—Rear Door Window Mechanism

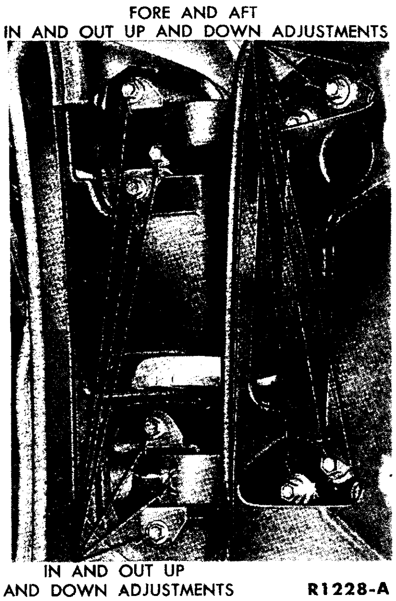


FIG. 9—Front Door Hinge Adjustments

6. Remove the windshield outside upper corner mouldings (Fig. 12).

7. Remove the windshield outside side mouldings (Figs. 12 and 13).

8. Remove the windshield outside top moulding.

9. Remove the windshield inside top moulding and visor retaining screws.

10. Remove the windshield inside side mouldings.

11. Remove the instrument panel front upper finish panel.

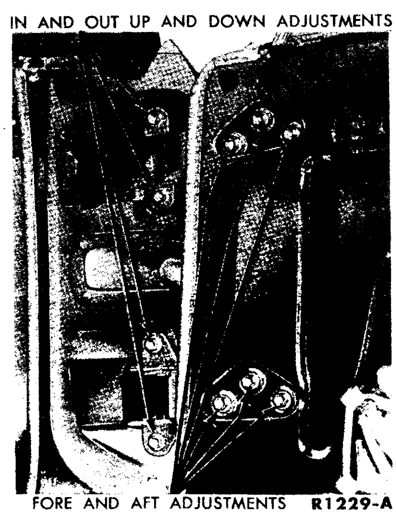


FIG. 10—Rear Door Hinge Adjustments

12. Remove the wiper blade and arm assemblies.

13. Remove the cowl top grille assembly and disconnect the windshield washer hoses.

14. With a helper, push the windshield, weatherstrip and outside lower moulding assembly out of the windshield opening and place on a bench.

15. Remove the outside lower moulding from the weatherstrip and remove the weatherstrip from the glass.

16. Clean old sealer from the weatherstrip and from the windshield opening.

INSTALLATION

1. Apply sealer to the glass groove of the weatherstrip.

2. Position the weatherstrip on the glass, install the lower moulding in the weatherstrip and install a 1/8-inch sash cord around the outer perimeter of the weatherstrip in its body flange groove (Fig. 14).

3. Apply sealer to the windshield opening pinchweld flange.

4. Apply lubricant (liquid soap or Ru-Glyde) to the weatherstrip where it contacts the pinchweld flange.

5. With the aid of a helper, carefully position the windshield in the opening.

6. Pull the inside lip of the weatherstrip over the flange by pulling the sash cord. Pull the sash cord in the same general plane as the glass. Pull the sash cord to the bottom corner of one side and then pull the other sash cord to the bottom of the other side. **Do not pull one sash cord all the way around the perimeter of the glass.** While pulling the sash cord, gently bump the outside of the windshield with a soft rubber mallet.

7. Install the cowl top grille and connect the windshield washer hoses.

8. Install the wiper blade and arm assemblies.

9. Install the instrument panel front finish panel.

10. Install the windshield inside side mouldings.

11. Install the inside top moulding and sun visor retainers.

12. Install the windshield outside side mouldings, outside top moulding and the outside upper corner mouldings.

13. Install the roof drip side front mouldings, front upper body pillar weatherstrip retainers and front upper body pillar weatherstrips.

14. Install the sun visors.

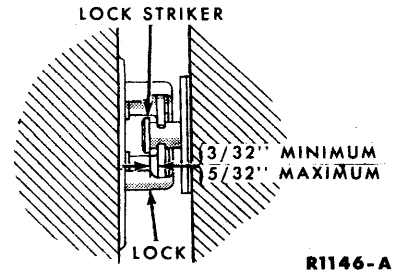


FIG. 11—Lock Striker Adjustment

15. Transfer the inside rear view miror (if removed) to the new glass.

16. Clean the windshield glass, weatherstrip and mouldings.

INSIDE REAR VIEW MIRROR

REMOVAL

1. Clean both the inside and outside surfaces of the windshield in the area of the mirror mounting bracket. Inspect the windshield for stone chips and scratches.

2. Using welding putty or wet rags, insulate all chips or scratches within 12 inches of the mirror mounting bracket.

3. Apply heat to the bracket mounting area from outside the windshield with a standard 250-watt infrared bulb (heat lamp). Hold the lamp approximately four inches from the windshield while rotating it in a small circle.

4. The mirror mounting bracket can be pulled off the windshield glass in approximately eight to ten minutes, using the mirror as a handle.

5. Slowly remove the heat lamp. **Do not remove the insulating materials until the windshield has cooled to room temperature.**

6. Remove the mirror and arm from the bracket.

INSTALLATION

1. Locate and mark with a wax pencil the bracket location on the outside surface of the windshield (Fig. 15).

2. Use a good grade of "ethyl alcohol" to thoroughly clean the inside glass surfare bracket mounting area and mounting bracket face. It is important that the mounting surfaces are properly cleaned before the resin is applied.

3. To mix the resin pour the entire contents of the small catalyst bottle into the large epoxy bottle (Fig. 15).

4. Properly stir the contents for

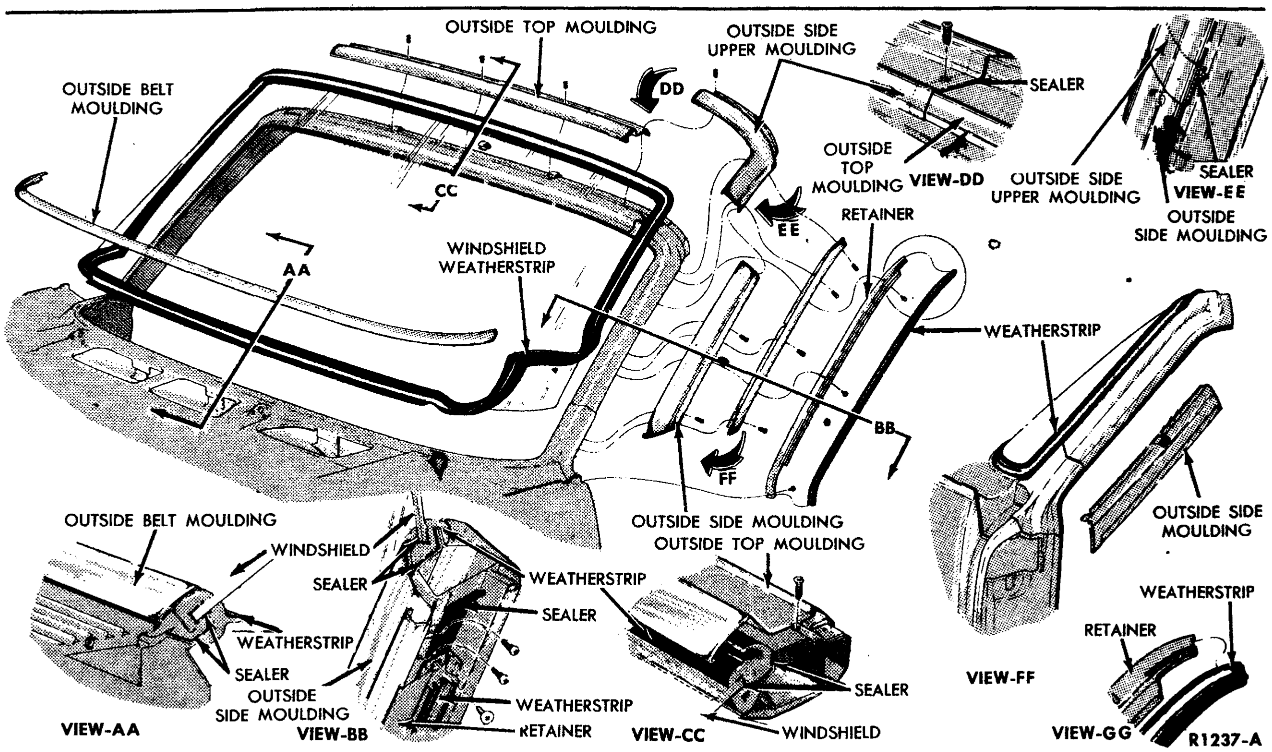


FIG. 12—Windshield and Exterior Mouldings—Model 74

three to five minutes to mix the catalyst and epoxy into resin form. **To guarantee the correct mixing ratio and resulting bond strength, it is mandatory that the entire contents of both bottles are properly mixed together. Under no circumstances should only a portion of the epoxy or catalyst be used.**

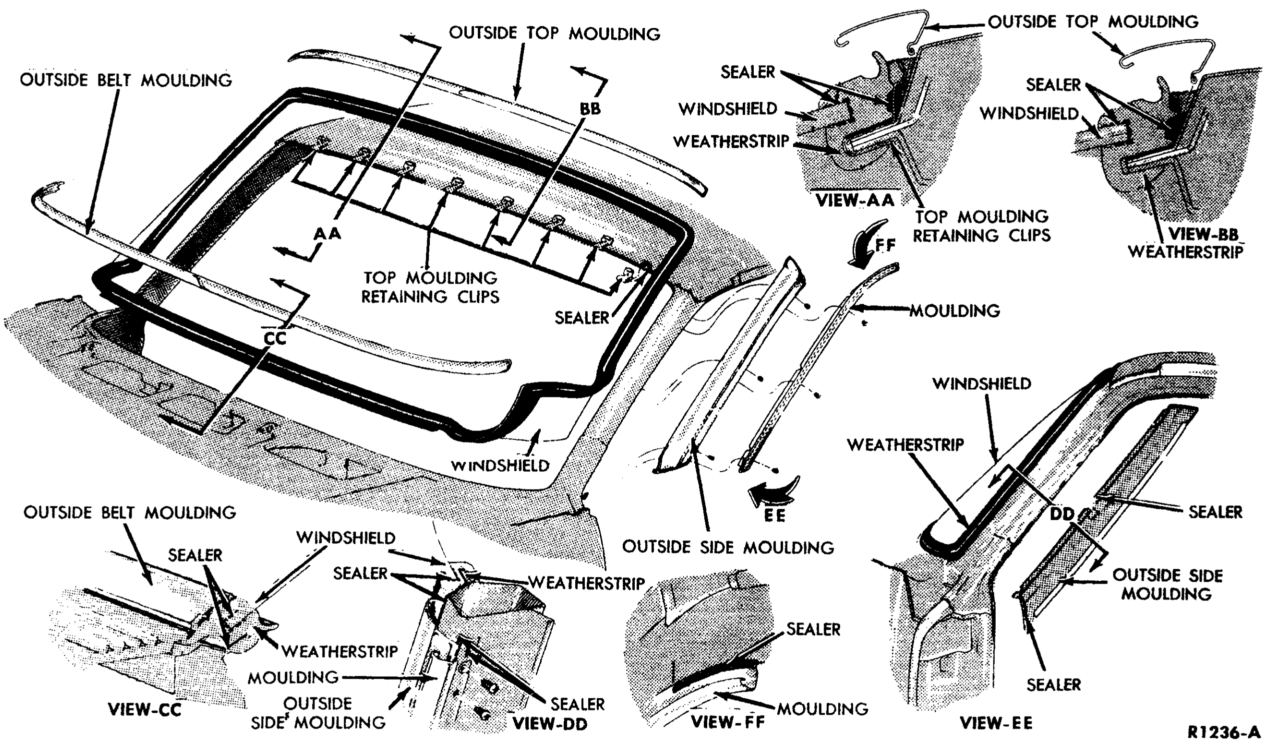


FIG. 13—Windshield and Exterior Mouldings—Model 53

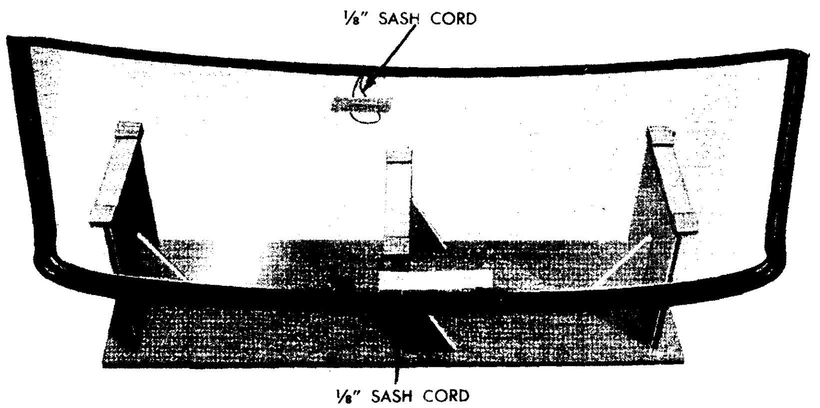


FIG. 14–Windshield Prepared for Installation

5. Apply the mixed resin to the bracket mounting surface. Level off the resin film as smoothly as possible.

6. Place the mounting bracket surface upward in a vise or in a small mound of permagum or any suitable holding material that will support the mounting bracket as shown in Fig. 15. Hold a standard 250-watt infrared lamp about five to six inches from the mounting surface of the bracket for two and one-half minutes (Fig. 15).

7. Allow the bracket to cool for one minute. With light hand pressure, apply the mounting surface of the bracket to the desired inside area of the windshield.

8. Secure the bracket to the windshield using a piece of tape about five inches long located just under the knob of the bracket (Fig. 15). Apply another piece of tape in the vertical direction to firmly hold the mounting bracket in place on the windshield.

9. When the temperatures are above 67° F., the mirror and arm should not be mounted for eight hours, to allow the resin to properly adhere the bracket to the glass. However, the car may be used with the bracket taped in place one hour after installation.

When the temperatures are below 67° F., the mirror and arm should not be mounted to the bracket for 16 hours, but the car can be used two hours after the bracket has been taped in place.

10. After the bracket has had time to adhere to the glass, remove the tape and install the mirror and arm to the bracket.

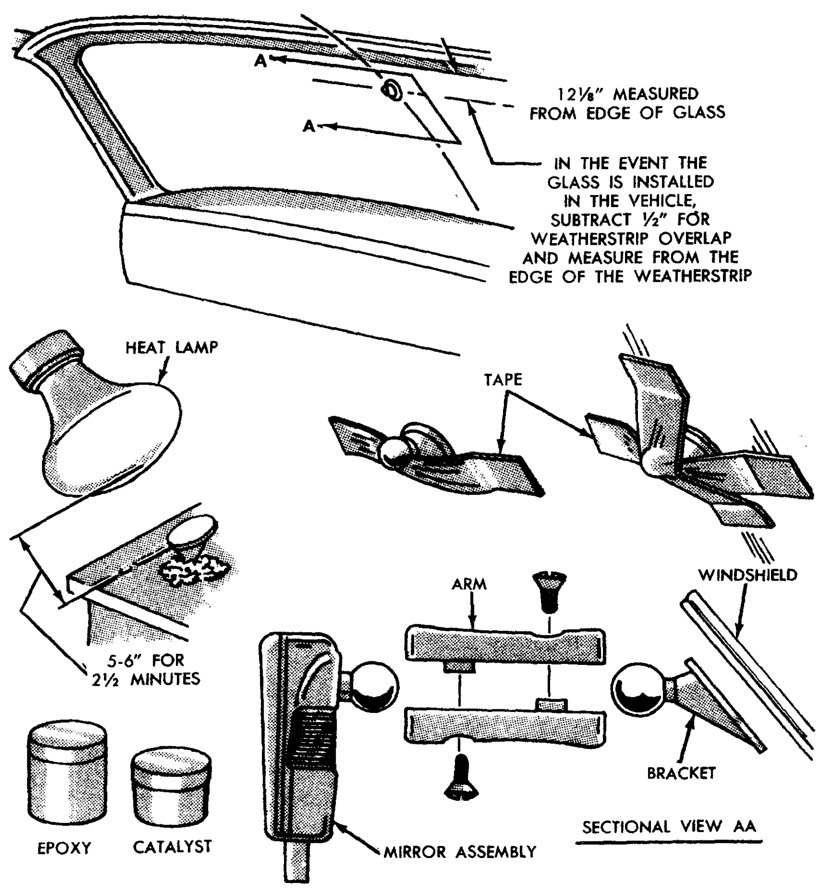


FIG. 15–Bonded Windshield Rear View Mirror Installation

FRONT DOOR LOCK

REMOVAL

1. Remove the door trim panel and water shield.
2. Remove the window rear run access covers from the door outer edge.
3. Remove the rear run retaining screws and remove the rear run from the door.
4. Disconnect the door lock remote control rod (remote control link) from the door lock assembly.
5. Disconnect the outside door handle button-to-lock rod (door lock actuating rod) from the lock assembly (Fig. 16).
6. Remove the door lock vacuum control retaining screws and disconnect the vacuum control rod from the lock assembly.
7. Disconnect the lock cylinder-to-lock assembly rod from the lock assembly.
8. Remove the lock assembly re-

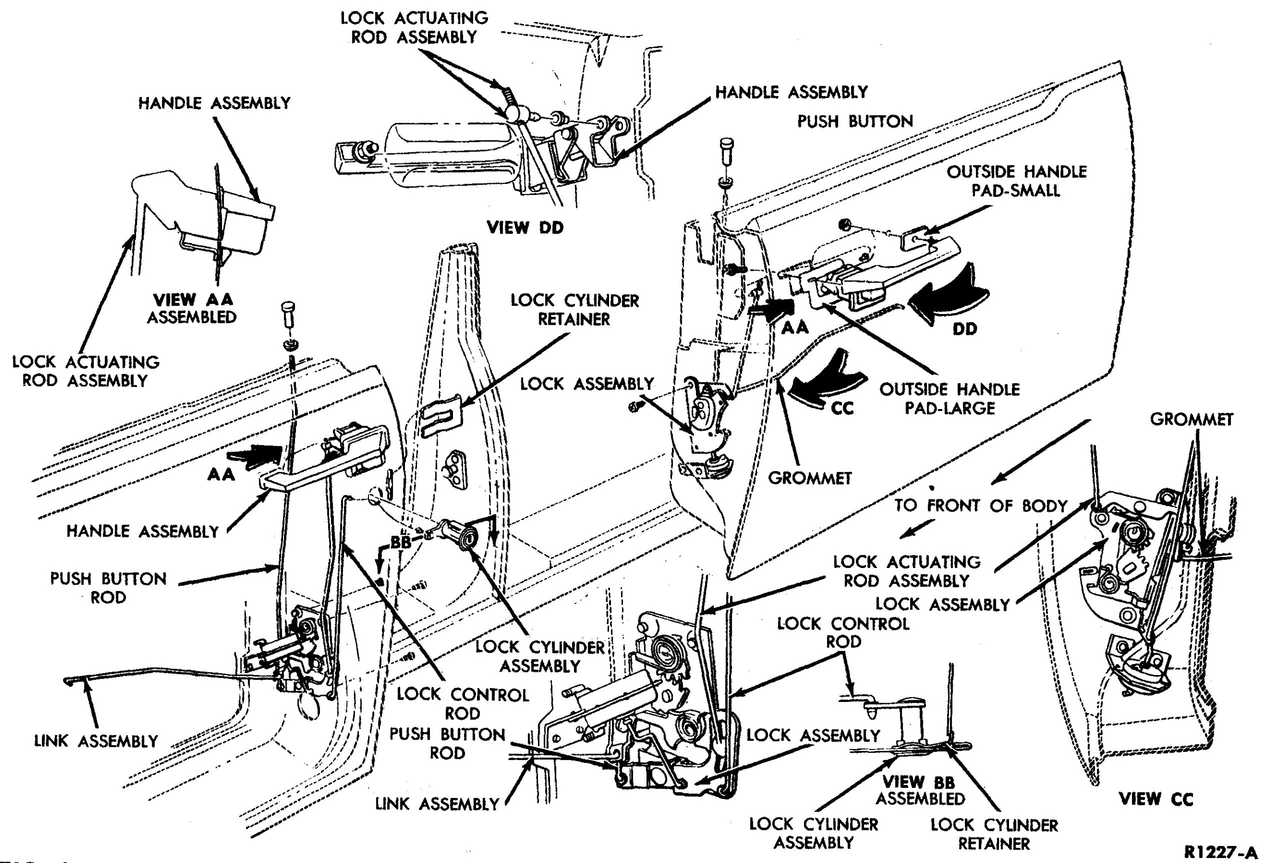


FIG. 16—Door Handles and Locks

taining screws and remove the lock assembly and push button rod.

INSTALLATION

1. Transfer the push button rod and plastic retainers to the new lock assembly.
2. Position the lock assembly in the door and install the retaining screws.
3. Connect the lock cylinder-to-lock assembly rod to the lock assembly.
4. Connect the outside door handle push button-to-lock rod to the lock assembly.
5. Connect the lock control-to-lock cylinder rod to the lock assembly.
6. Connect the remote control rod to the lock assembly.
7. Connect the vacuum control rod to the lock assembly and install the vacuum control retaining screws.
8. Position the door glass rear run in the door. Install the retaining screws and adjust the run assembly.
9. Install the rear run access cover.
10. Install the door trim panel and handles.

VENT WINDOW MOTOR

1. Remove the door trim panel and water shield.
2. Disconnect the leads from the vent window motor.
3. Remove the vent window motor and bracket to door panel retaining screws (Fig. 6).
4. Remove the vent window motor and bracket from the door area.
5. To install the motor, reverse the removal procedure.

FRONT DOOR WINDOW

REMOVAL

1. Remove the trim panel and water shield.
2. Remove the window upper stops.
3. Remove rear run access covers.
4. Remove the window rear run retaining bolts and position the run in the bottom of the door.
5. Remove the retainers that secure the window channel rollers to the regulator arms and remove the rollers.
6. Lift the window out through the window opening.

INSTALLATION

1. Slide the rollers on the window lower channel guides.
2. Position the window in the door opening; then, align the rollers with the regulator arm pivots.
3. Press the pivots into the rollers until the retainers snap into the grooves.
4. Position the rear window run, install the window stops, and adjust the run as necessary. Install the rear run access covers.
5. Replace the water shield and trim panel.

WINDOW REGULATOR MOTOR

1. Remove the trim panel and water shield.
2. With the window in the up position, remove the motor bracket retaining screw and remove the nuts attaching the motor to the regulator. Disconnect the wiring, and remove the motor and coupling.
3. To install, reverse the removal procedure.

VENT WINDOW FRAME

1. Remove the trim panel and water shield.
2. Remove the vent window motor.
3. Loosen the vent window weatherstrip from the front of the vent window assembly.
4. Remove the lower stop bumper.
5. Remove the vent window assembly upper attaching screw.
6. Remove the lock nut from the vent window assembly adjusting screw.
7. Remove the lower adjusting screw and lock nut from the bottom of the division bar.
8. With the door window down, remove the vent window assembly from the door and the front run.
9. Remove the vent window glass lower pivot bushing assembly.
10. Remove the vent window glass and frame from the vent window assembly.
11. Remove the vent window glass from the vent window frame.
12. To install, reverse the removal procedure.

FRONT DOOR WINDOW REGULATOR

REMOVAL

1. Remove the door trim panel and water shield.
2. Disconnect the regulator arms from the lower glass channel.
3. Position the glass assembly to the top of its opening and prop it in place.
4. Disconnect the motor wiring connector, remove the wire retaining clip, and remove the motor bracket retaining screw.
5. Remove the four regulator retaining screws. Remove the regulator and motor assembly from the door.
6. Hold the regulator assembly in a vise and remove the motor assembly.

INSTALLATION

1. Preload the replacement regulator assembly to the correct position. Hold the regulator in a vise and install the motor on the regulator.
2. Transfer the glass channel rollers to the new regulator.
3. Position the regulator and motor assembly in the door. Install the regulator retaining screws and the motor bracket retaining screw.
4. Connect the regulator arms (and rollers) to the lower glass channel (Fig. 6).
5. Connect the motor lead wires and install the wiring retaining clips.
6. Install the water shield and door trim panel.

FRONT DOOR VENT WINDOW FRAME AND DIVISION BAR

1. Remove the door trim panel and water shield.
2. Remove the vent window motor.
3. Remove the retaining screw from the front of the door weatherstrip and remove the weatherstrip from the vent frame assembly.
4. Remove the two lock nuts and screw retaining the vent assembly to the door.
5. Tilt the vent assembly in the door and remove the front run; then, remove the vent assembly.
6. Remove the two vent window lower bushing retaining screws and remove the bushing.
7. Remove the vent glass and frame from the vent assembly.
8. Remove the vent window weatherstrip from the vent window frame and division bar.
9. To install, reverse the removal procedure.

REAR DOOR OUTSIDE HANDLE

1. Remove the trim panel and water shield.
2. Raise the window to its closed position.
3. Remove the screw and nut that secures the handle to the door panel.
4. Position the handle away from the door and disconnect the handle-to-lock rod. Remove the handle and pads.
5. To install, connect the lock rod at the handle; then, position the door handle and pads on the door. Install the attaching screw and nut. Check the pushbutton for proper clearance between the release pin and the release lever arm on the door lock assembly.
6. Install the water shield and trim panel.

REAR DOOR LOCK

1. Remove the trim panel and water shield.
2. Disconnect the remote control rod at the door lock.
3. Remove the screws securing the door lock vacuum control to the door and disconnect the control rod from the door lock.
4. Disconnect the door outside handle rod at the handle.
5. Disconnect the door lock warning light switch lead wires.
6. Remove the screws securing the door lock to the door and remove the lock assembly and rods.
7. Transfer the push button rod, door handle rod and the warning light switch to the new lock assembly.
8. To install the lock assembly, reverse the removal procedure.

REAR WINDOW REGULATOR MOTOR

1. Remove the trim panel and water shield.
2. Remove the nuts securing the motor to the regulator and the motor-to-door bracket screw. Disconnect the wiring and remove the motor.
3. To install, reverse the removal procedure.

REAR DOOR WINDOW

1. Remove the door trim panel and water shield.
2. Remove the window upper stops.
3. Remove the window lower stop.
4. Disconnect the regulator arms from the lower window channel and lower the window to the bottom of the door.
5. Remove the door window outer belt weatherstrip and stabilizer assemblies.
6. On the convertible door window remove the rear door window control switch trigger pin from the lower window frame.
7. Remove the rear window assembly from the door (Fig. 8).
8. Remove the upper frame from the glass and remove the glass from the lower glass channel.
9. To install reverse the removal procedure.

REAR DOOR WINDOW REGULATOR

1. Remove the door trim and water shield.
2. Disconnect the regulator arms from the lower window channel and prop the window IN THE UP POSITION.
3. Disconnect the motor wiring connector, remove the wiring retaining clip and remove the motor bracket retaining screw.
4. Remove the four regulator retaining bolts and remove the regulator and motor assembly from the door. **The regulator arms must be in the down position.**

5. Hold the regulator in a vise and remove the motor assembly.

6. Preload the replacement regulator to the correct position. Hold the regulator in a vise and install the motor assembly on the regulator.

7. To install, reverse the removal procedure.

REMOTE CONTROL

1. Remove the door trim panel and water shield.

2. Remove three remote control mounting screws, disconnect the remote control rod and remove the remote control from the door.

3. To install, reverse the removal procedure.

REAR DOOR HINGES—UPPER AND LOWER

1. Remove the trim panel and water shield.

2. Remove the courtesy light switch and bracket.

3. Remove three cap screws securing the lower hinge to the door.

4. Remove three cap screws securing the top hinge to the door.

5. Position the door off the hinge and place it on a low bench or box by the car. **It is not necessary to remove the wire harness from the door for hinge replacement.**

6. To remove the lower hinge, remove two cap screws and one nut securing the lower hinge to the body and remove the hinge.

7. To remove the top hinge, remove the two cap screws securing the top hinge to the body and remove the hinge.

8. To install, reverse the removal procedure.

BACK WINDOW AND/OR WEATHERSTRIP

REMOVAL

1. Remove the two back window outside mouldings and the two outside lower mouldings (Fig. 17).

2. Remove the back window left side garnish moulding.

3. Remove the back window right side garnish moulding.

4. Remove the back window lower garnish moulding.

5. Free up the inside lip of the weatherstrip.

6. With a helper, remove the window and weatherstrip as an assembly.

7. Remove the weatherstrip from the glass.

8. Clean the weatherstrip thoroughly and inspect it for cracks or tears. Replace the weatherstrip if necessary.

9. Remove all old sealer from the window opening pinchweld flanges.

INSTALLATION

1. Apply an even bead of sealer in the weatherstrip window opening groove.

2. Position the weatherstrip on the glass. Place masking tape at intervals to retain the weatherstrip to the glass.

3. Clean off any excess sealer from the inside of the glass and weatherstrip.

4. Place two lengths of 1/8-inch sash cord in the body flange groove of the weatherstrip so that the cord ends overlap each other approximately 12 inches at the upper and lower center of the glass. Tape the cord ends temporarily to the inside of the glass.

5. Apply an even bead of sealer all the way around the edge of the body opening pinchweld flange (Fig. 17). Position the moulding retainers as shown in Fig. 17.

6. With a helper, place the window assembly in the window opening.

7. Pull the inner lip of the weatherstrip over the pinchweld flange. This is accomplished by pulling the

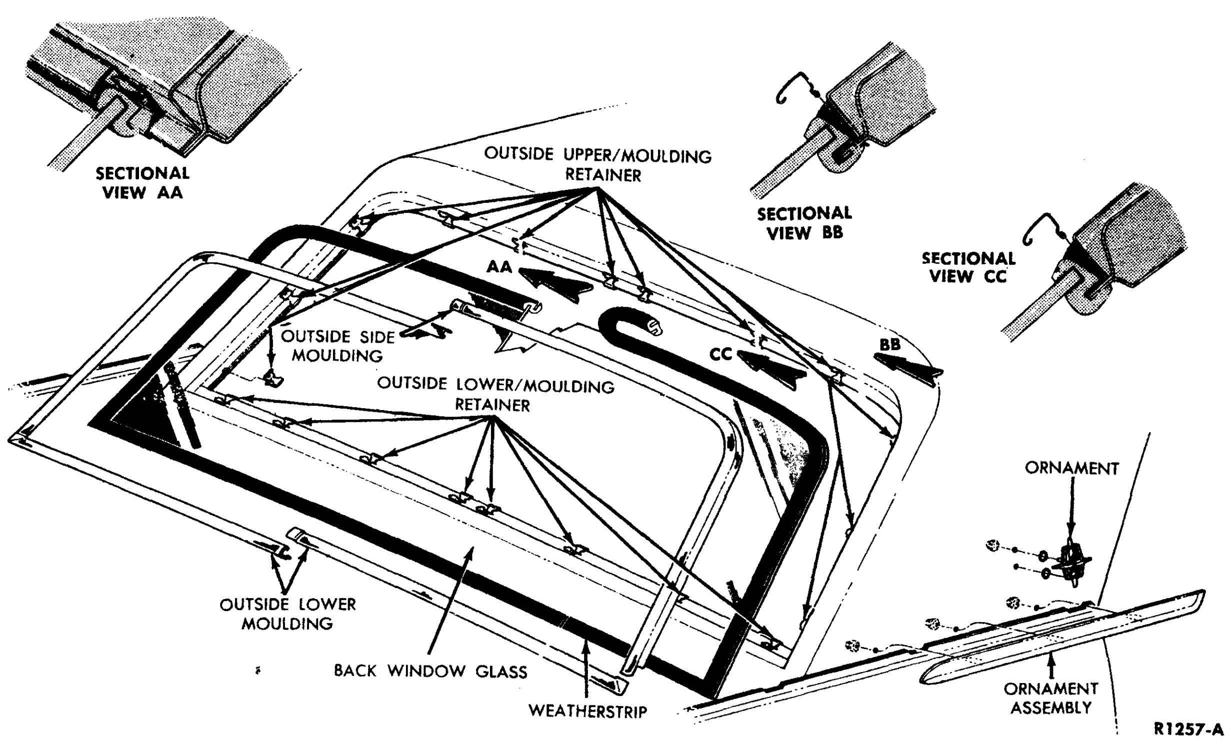


FIG. 17—Back Window and Exterior Mouldings

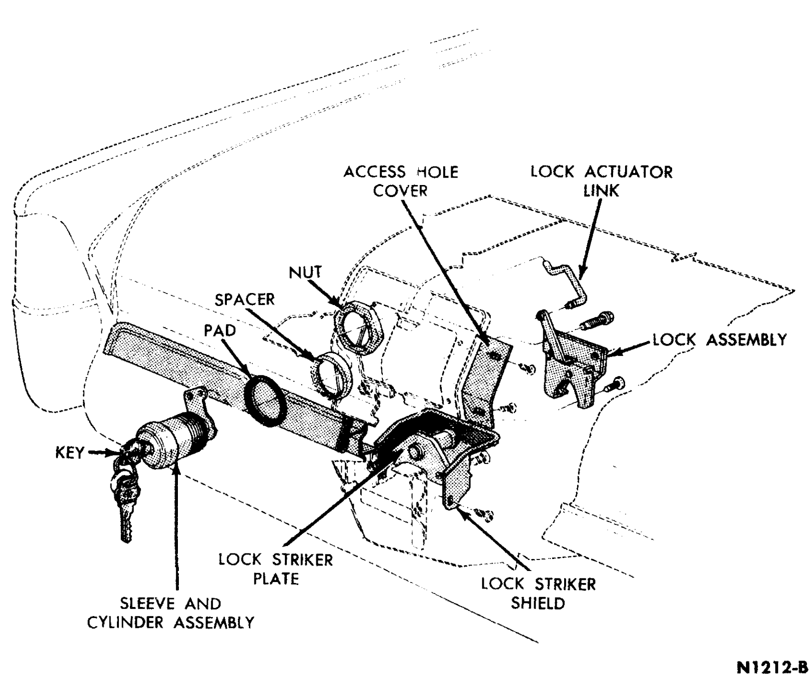


FIG. 18—Luggage Compartment Lock Mechanism

two bottom sash cords out to the corners of the glass and then pulling out the two top cords the remaining way around the glass while a helper applies pressure from the outside.

8. Remove the strips of tape that temporarily held the weatherstrip in place.

9. Install the inside garnish mouldings.

10. Install the outside and lower mouldings.

11. Clean the glass and mouldings and test for water leaks.

LUGGAGE COMPARTMENT

LOCK CYLINDER

1. Open the luggage compartment door.

2. Remove two screws and remove the door lock access cover plate (Fig. 18).

3. Disconnect the latch rod from the lock cylinder shaft.

4. Remove the lock cylinder retaining nut and spacer from the lock cylinder housing.

5. Pull the lock cylinder and pad from the door.

6. Insert the key in the lock cylinder. Depress the plunger retaining the lock cylinder in the housing and remove the lock cylinder.

7. To install, reverse the removal procedure and check the operation of the lock.

DOOR—MODEL 53

1. Lay a protective covering over the upper back panel and quarter panels.

2. Disconnect the lamp wiring.

3. Remove the four cap screws which secure the hinges to the door and remove the door.

4. To install, position the door on the hinges. Install the four cap screws just tight enough to permit the door to be shifted, if necessary, for proper alignment; then, tighten the cap screws. Connect the lamp wire.

HINGES—MODEL 53

1. Prop the luggage compartment door open.

2. Loosen the torsion rod tension bolts until all tension is relieved from the torsion rods (Fig. 19).

3. Remove the torsion rods from the hinge.

4. Remove three cap screws and remove the hinge from the car. **For the left hand hinge removal, the left quarter wheelhouse trim cover assembly has to be removed.**

5. To install, reverse the removal procedure.

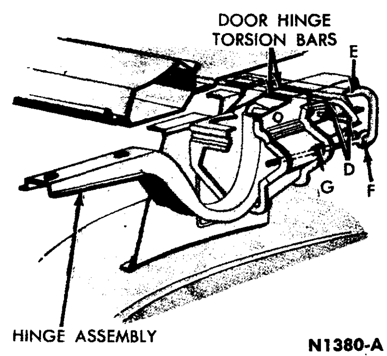


FIG. 19—Luggage Compartment Door Hinge Torsion Rods

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TRIM, SEATS, AND CONVERTIBLE TOP

GROUP 18

PART 18-1 INTERIOR TRIM

1 REMOVAL AND INSTALLATION

DOOR TRIM PANEL

Basically all door panels are retained in the same manner. In view of this, one removal and installation procedure will cover all models.

1. Remove the trim panel front support cover (front only).
2. Remove the door pull handle.
3. Remove the door lock control knob.
4. Remove the inside door handle upper half.
5. Remove the door arm rest window regulator switch plate housing and disconnect the electrical wires.
6. Remove the inside door handle lower half.
7. Remove the trim panel retaining screws.
8. Lift the trim panel away from the door, disconnect the courtesy

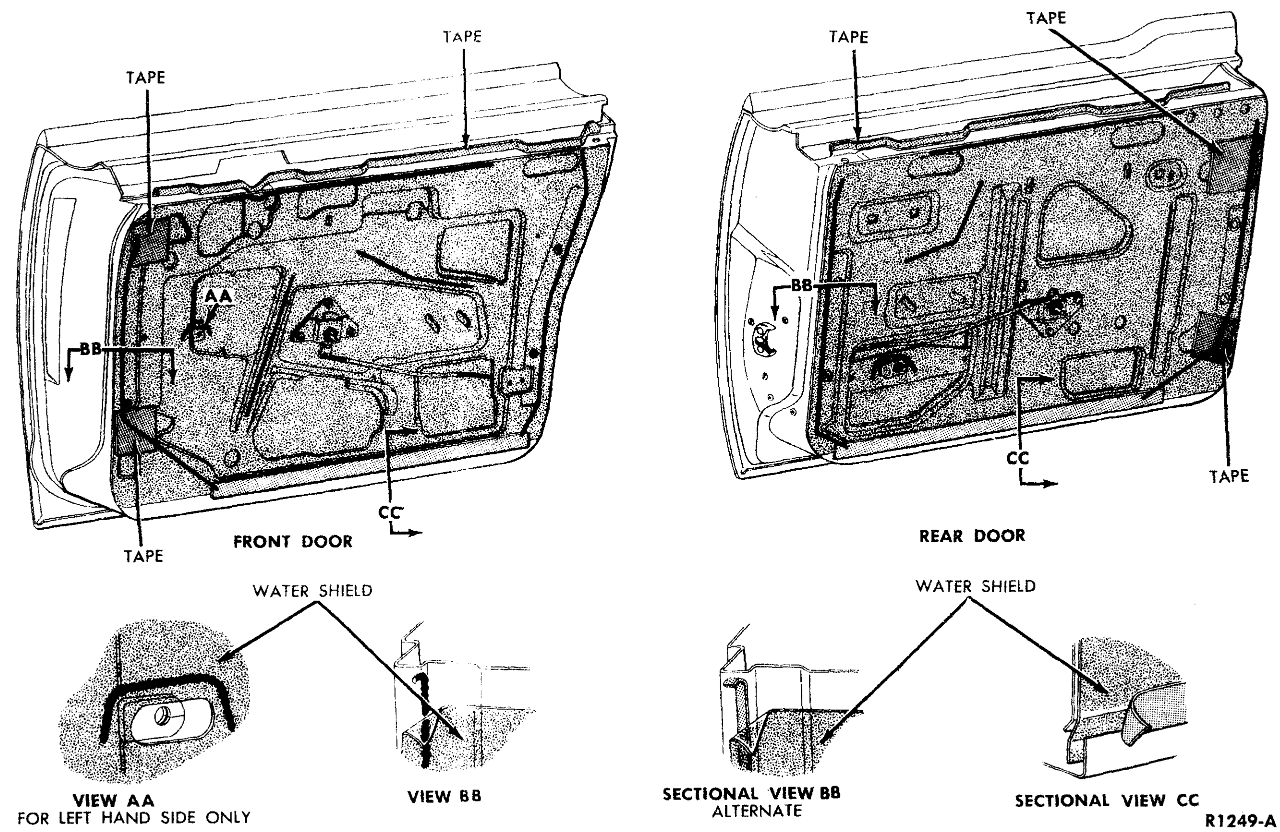

FIG. 1—Door Water Shields

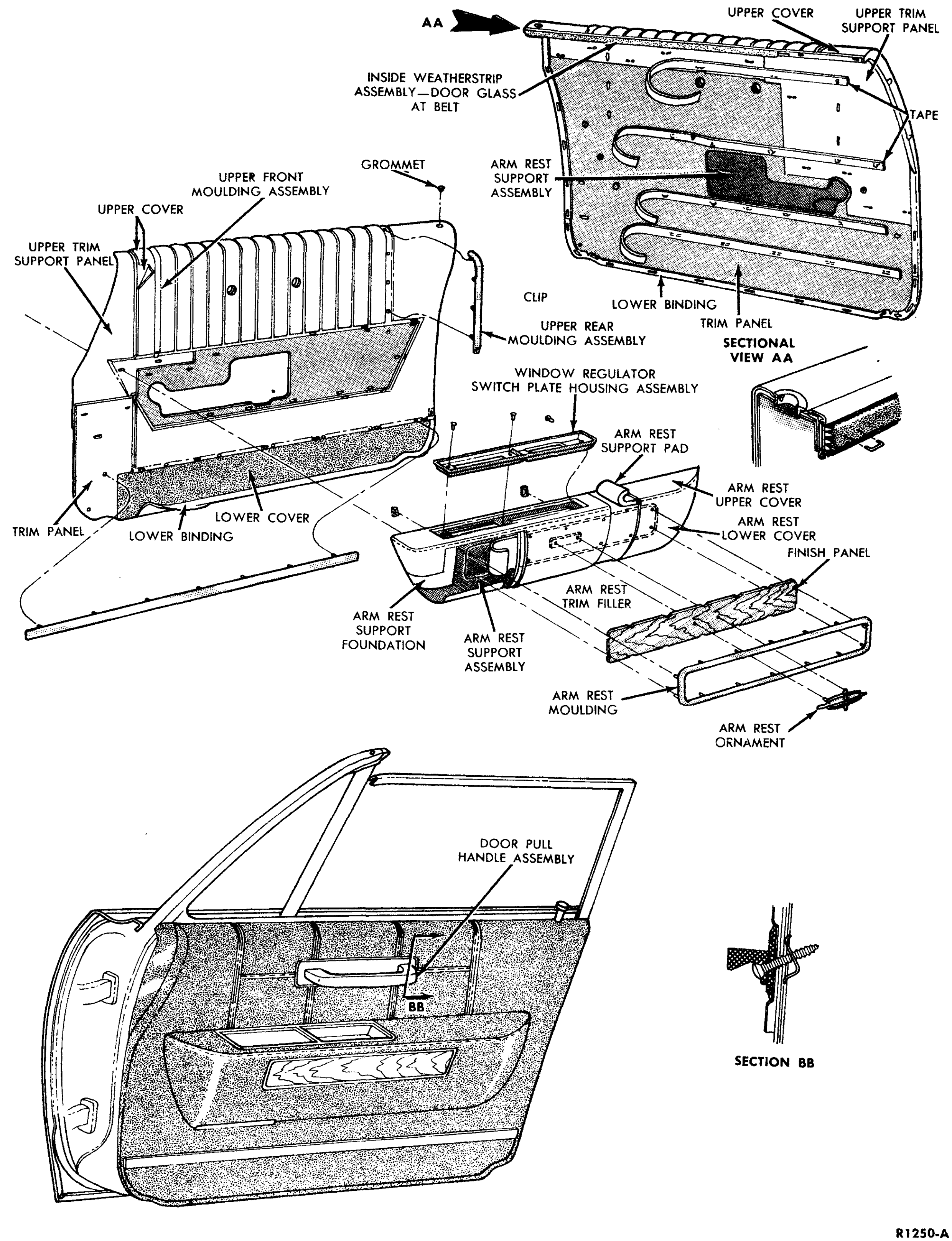

FIG. 2–Door Trim Panel

lamp wire and carefully position the water shield away from the inner panel (Figs. 1 and 2).

9. To install, reverse the removal procedure.

HEADLINING

REMOVAL

1. Open the doors and cover the seats.
2. Remove the sun visors and bracket assemblies.
3. Remove the windshield upper garnish moulding.
4. Remove the windshield side garnish mouldings.
5. Remove the coat hangers and roof inside front moulding.
6. Remove the roof inside rear moulding.
7. Remove the back window side and upper garnish mouldings.
8. Remove the quarter belt rear mouldings.
9. Remove the roof side quarter lamp assemblies.
10. Starting at the rear, remove the headlining from the retainer strips.
11. Remove the headlining bows from the header and remove from the car (Fig. 3).
12. Remove the protruding and loose staples from the retainer strips. Flatten the remaining staples in the retainer strips.

INSTALLATION

1. Transfer the roof bows from the old headlining to the new. **Be sure number 1 bow from the old headlining goes into the new headlining at the number 1 listing; number 2 bow goes into the number 2 listing, etc.**
2. Starting at the rear, position the new headlining in the car, and insert the roof bows into the header.
3. Smooth out the wrinkles and center the headlining at the windshield.
4. Staple the headlining to the retainer strip at the windshield.
5. Center the headlining at the rear window and staple the headlining to the retainer strip at the back window.
6. Smooth out the wrinkles, and staple the headlining to the roof panel side retainer strips.
7. Trim the headlining edges approximately ¼ inch below the retainer strips.
8. Cut openings in the headlining for the roof side quarter lamp assemblies and install the lamps.
9. Install the quarter belt rear mouldings, back window garnish mouldings and the roof side inside rear mouldings.
10. Install the windshield upper garnish moulding, the windshield side garnish mouldings, sun visor and bracket assemblies, roof inside front mouldings and the coat hangers.
11. Steam the headlining. **If the car is equipped with a vinyl headlining, it is necessary to steam the headlining on the fabric-covered side.**
12. Remove the covers and close the doors.

INSTRUMENT PANEL PAD

1. Open the doors and cover the seats.
2. Disconnect the battery cable.
3. Remove the radio control knobs and radio retaining nuts.

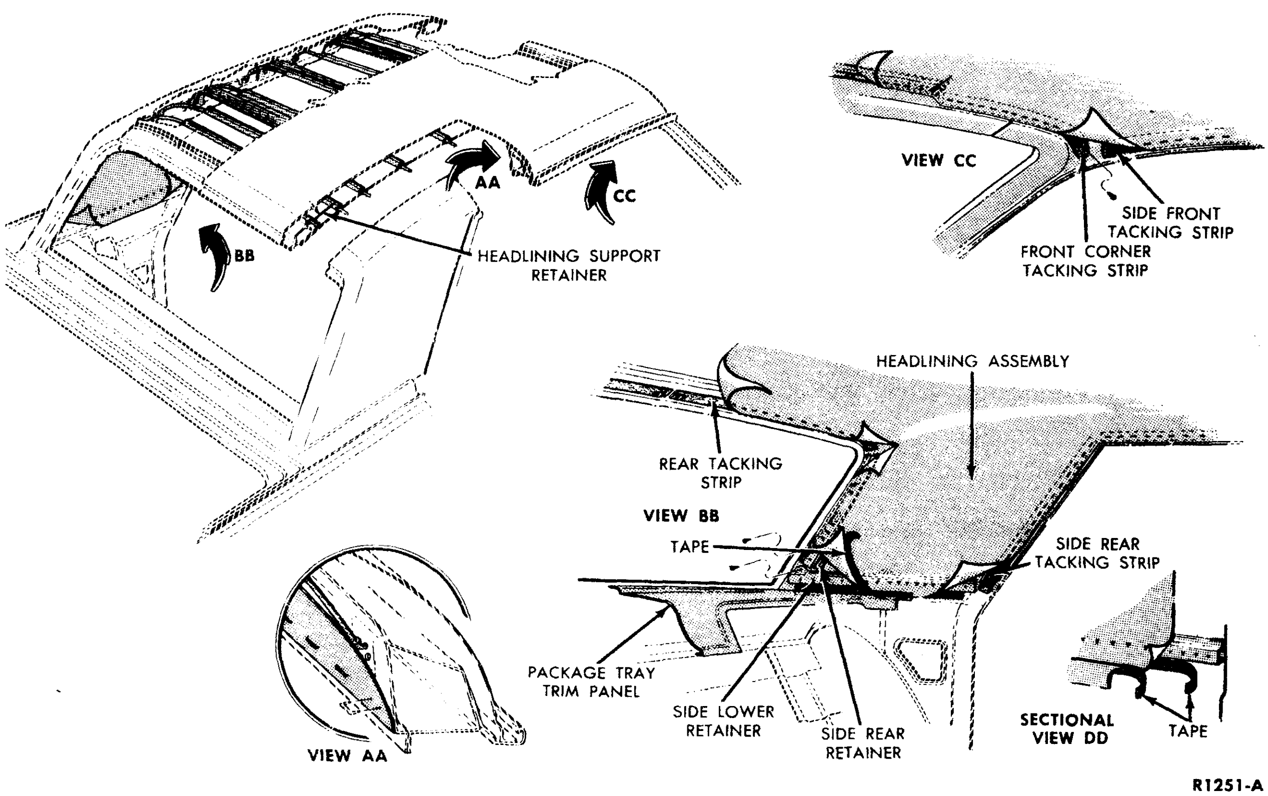

FIG. 3—Headlining Installation

4. Remove the heater control knobs.

5. Remove the steering column upper collar at the instrument panel.

6. Remove the instrument panel cluster bezel assembly.

7. Remove the sun visor and bracket assemblies.

8. Remove the windshield side garnish mouldings.

9. Remove the instrument panel front upper finish panel.

10. Remove the cowl side kick pads.

11. Remove the clock adjustment shaft lock nut at the lower instrument panel.

12. Remove the hood control cable from the lower instrument panel.

13. Remove the instrument panel to cowl side panel retaining screws.

14. Remove the instrument cluster assembly to instrument panel retaining nuts, position the cluster assembly away from the instrument panel, disconnect the cables, hoses, and wires from the cluster assembly, and remove the cluster assembly.

15. Remove the instrument panel pad retaining screws and remove the pad (Fig. 4).

16. To install, reverse the removal procedure.

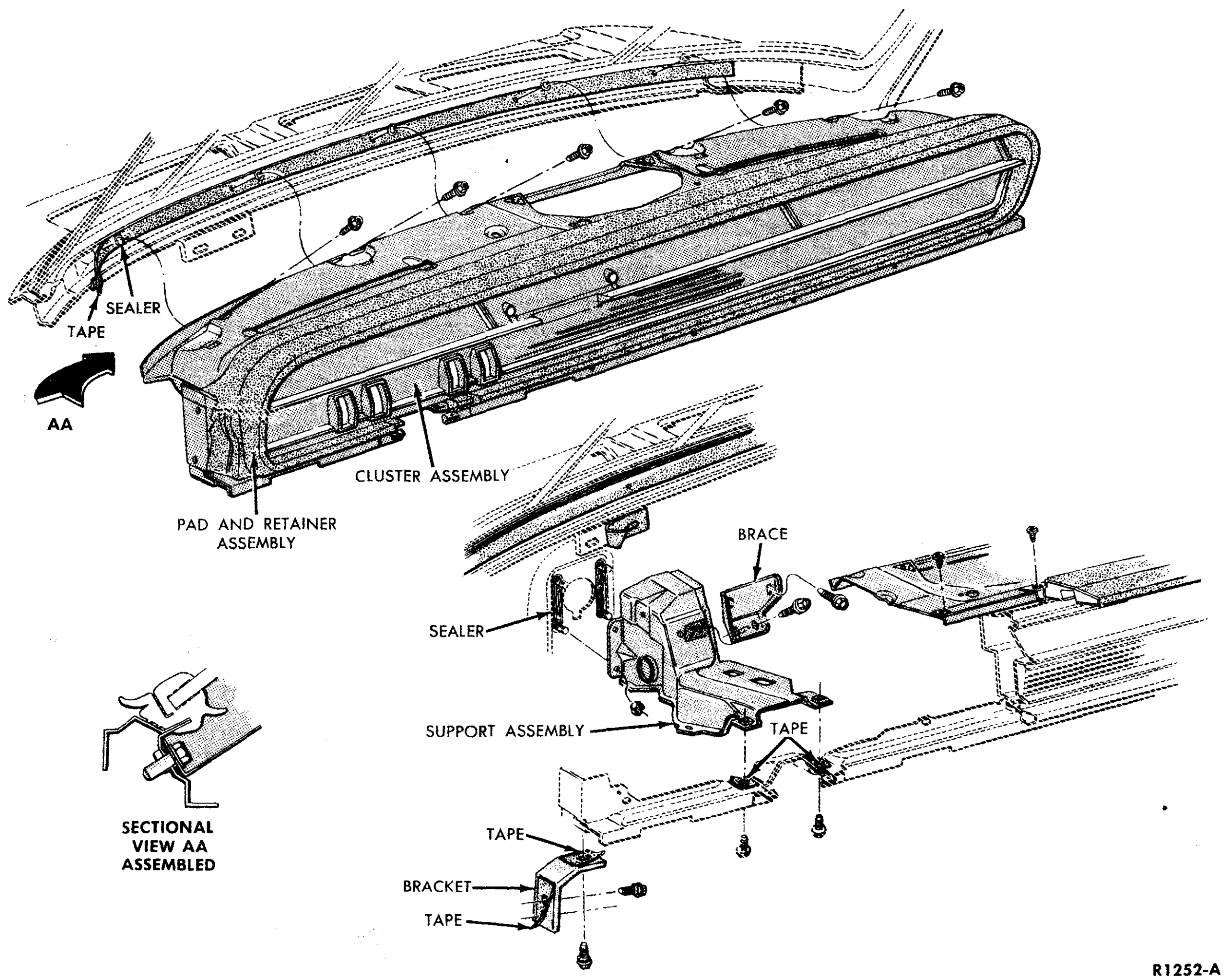

FIG. 4–Instrument Panel Pad Installation

PART 18-2 SEATS

1 POWER SEAT

DESCRIPTION

The six-way power seat provides horizontal, vertical, and tilting adjustments. The seat is driven by a single motor through a transmission and six flexible drive cables encased in housings (Fig. 1).

The control switches are mounted on the left seat side shield. The forward switch controls the vertical movement, or tilt, of the front portion of the seat. The rear switch controls the vertical movement, or tilt of the rear portion of the seat. The center switch controls both horizontal and vertical movement of the seat. These switches control the operation of three solenoids through relays with the exception of horizontal movement, which is controlled directly by switch (Fig. 2).

The solenoids engage the transmission gears, transmitting driving power to the respective driven mechanisms of the seat through drive cables. The forward solenoid operates the rear vertical seat drive assemblies. The center solenoid operates the front vertical drive assemblies. The horizontal seat screw jacks are operated by the rear solenoid.

Both the control and power circuits are protected by a common 20-ampere circuit breaker mounted on the starting motor relay.

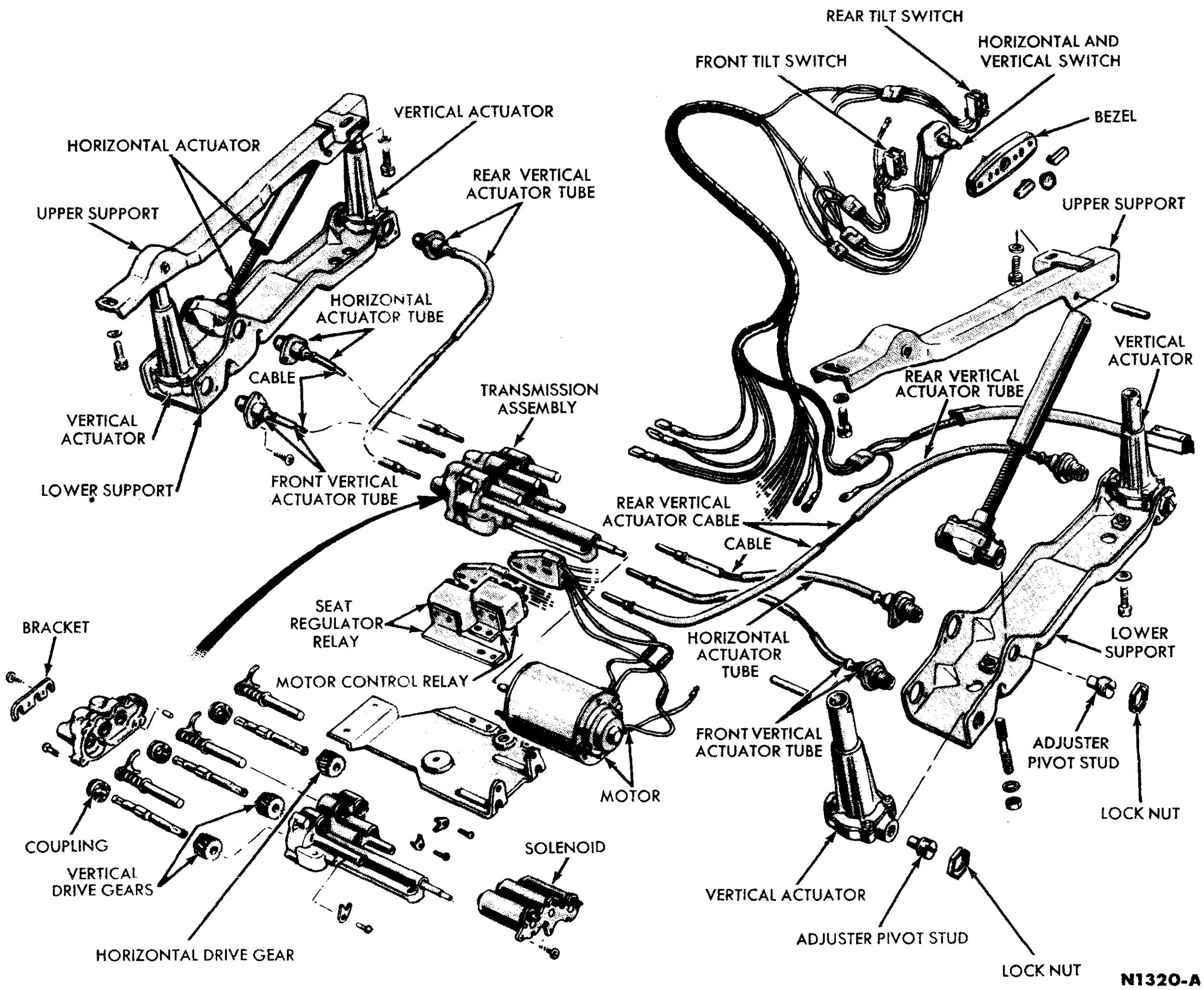

FIG. 1–Six-Way Power Seat–Disassembled

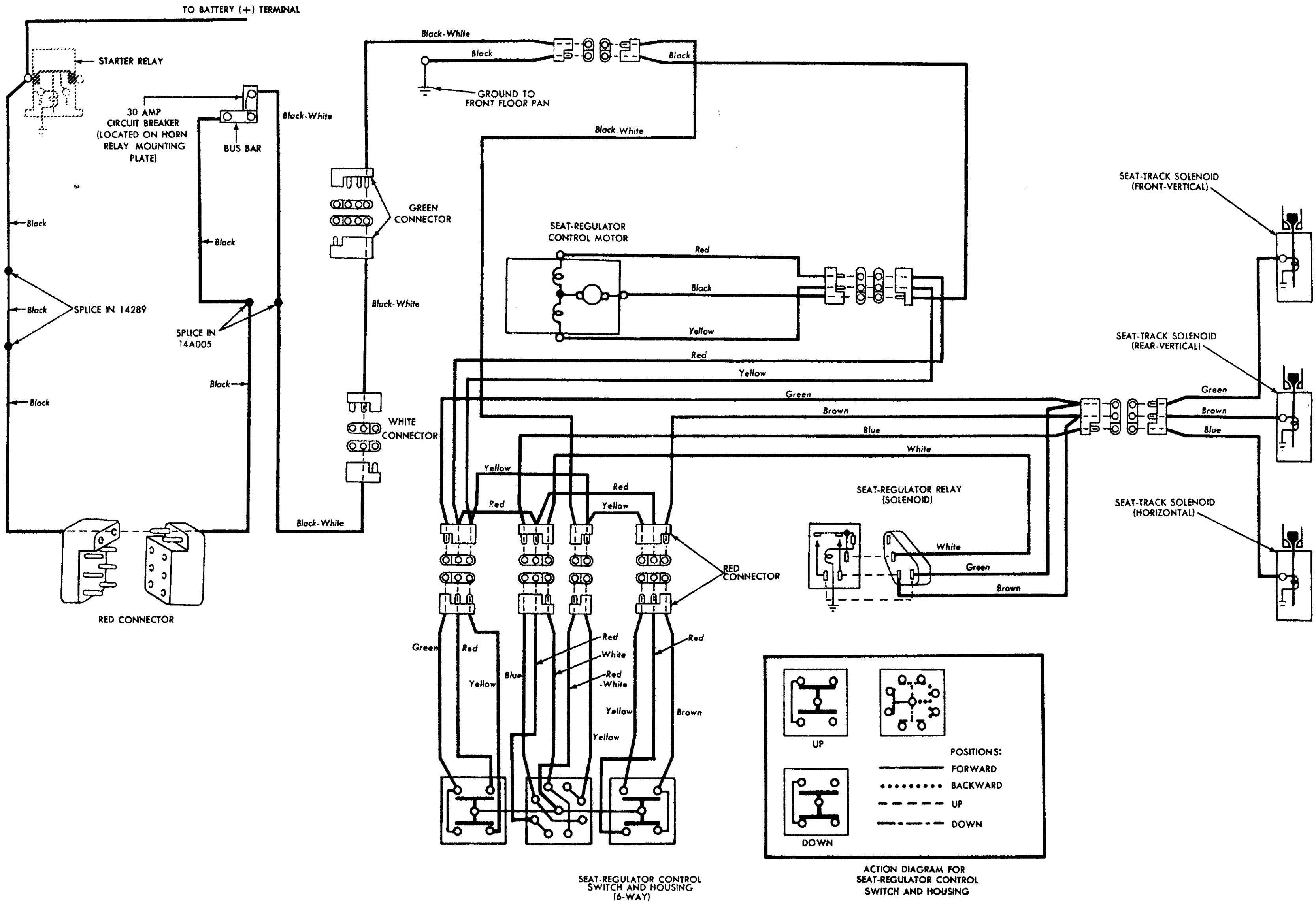

FIG. 2—Six-Way Power Seat Circuit

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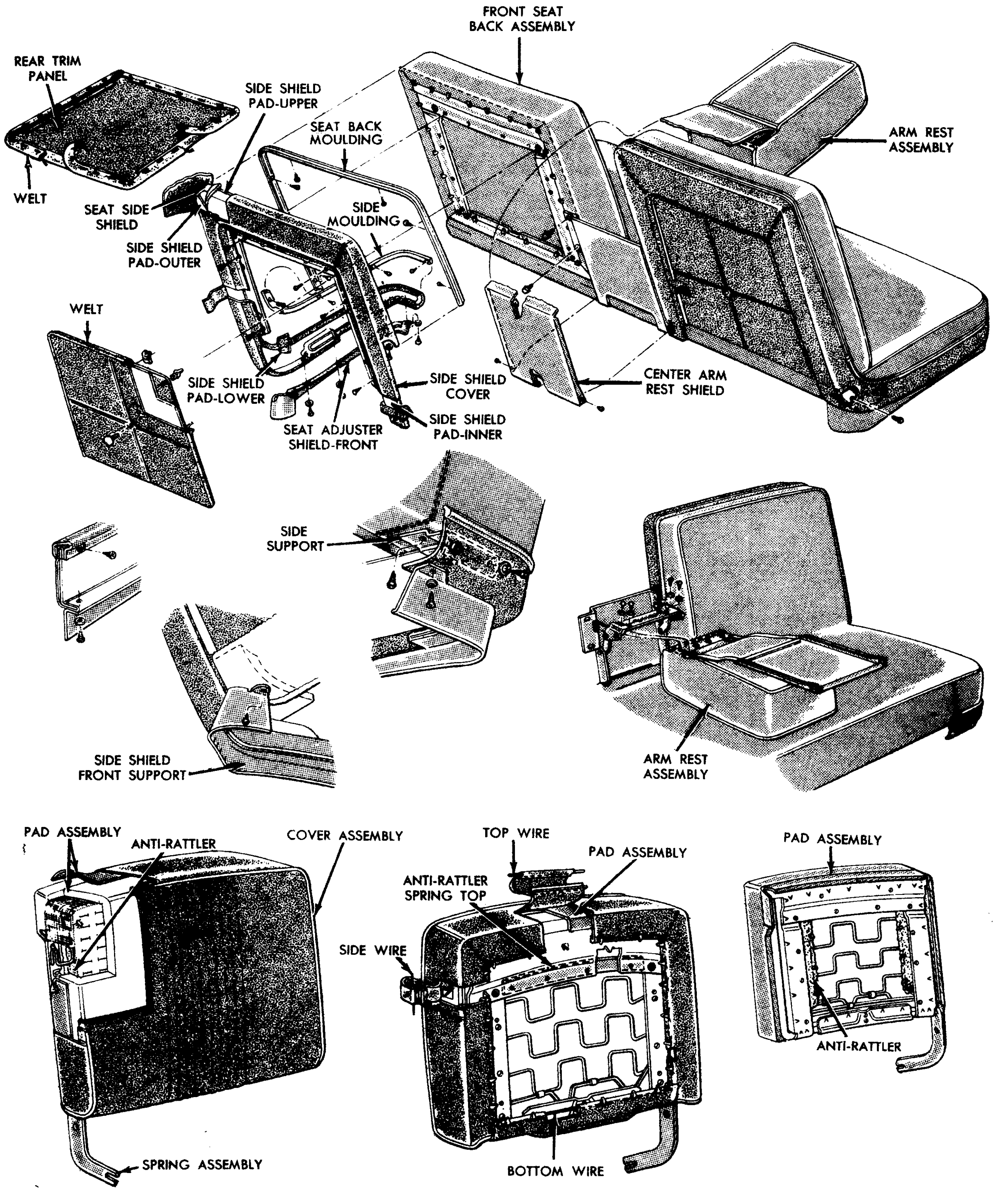

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FIG. 3—Front Seat Back Assembly and Installation

TROUBLE DIAGNOSIS GUIDE

MOTOR OPERATES, BUT THERE IS NO SEAT MOVEMENT	1. Defective shaft or coupling between motor and transmission. 2. Solenoid not engaging transmission. 3. Solenoid relay not energizing the solenoid.
MOTOR DOES NOT OPERATE	1. Defective (20-ampere) circuit breaker. 2. Defective motor relay. 3. Defective seat control switch. 4. Broken wire or loose connection. 5. Defective motor.
SEAT WILL NOT MOVE IN ONE DIRECTION	1. Appropriate solenoid not operating. 2. Transmission binding. 3. Seat control switch inoperative. 4. Broken flexible drive shaft. 5. Broken or binding mechanical drive system. 6. Broken, worn or loose connection.

REMOVAL AND INSTALLATION

SEAT REMOVAL

1. Disconnect the ground cable from the battery.
2. Remove the nut and washer from the front end of each seat actuator.
3. Remove the cap screw and lock washer from the rear of each seat actuator.
4. Remove the nut and washer that secures the motor mounting bracket to the floor pan.
5. Disconnect the main harness from the wire leading to the 20-ampere circuit breaker (Fig. 1).
6. With a helper, lift the seat and regulator from the car.
7. Remove the four cap screws and washers that secure the seat to the actuators.

MOTOR

1. Disconnect the motor leads from the four connectors (Fig. 1).
2. Remove the two nuts and lock washers that secure the motor to the mounting bracket.
3. Slide the motor out of the shaft coupling and off the mounting bracket.
4. Slide the motor shaft into the coupling and the studs into the mounting bracket.
5. Secure the motor to the mounting bracket with two lock washers and nuts.
6. Connect the motor leads to their respective connectors.

RELAY

1. Disconnect the connector from the seat regulator relay and from the motor control relay (Fig. 1).
2. Remove the two sheet metal

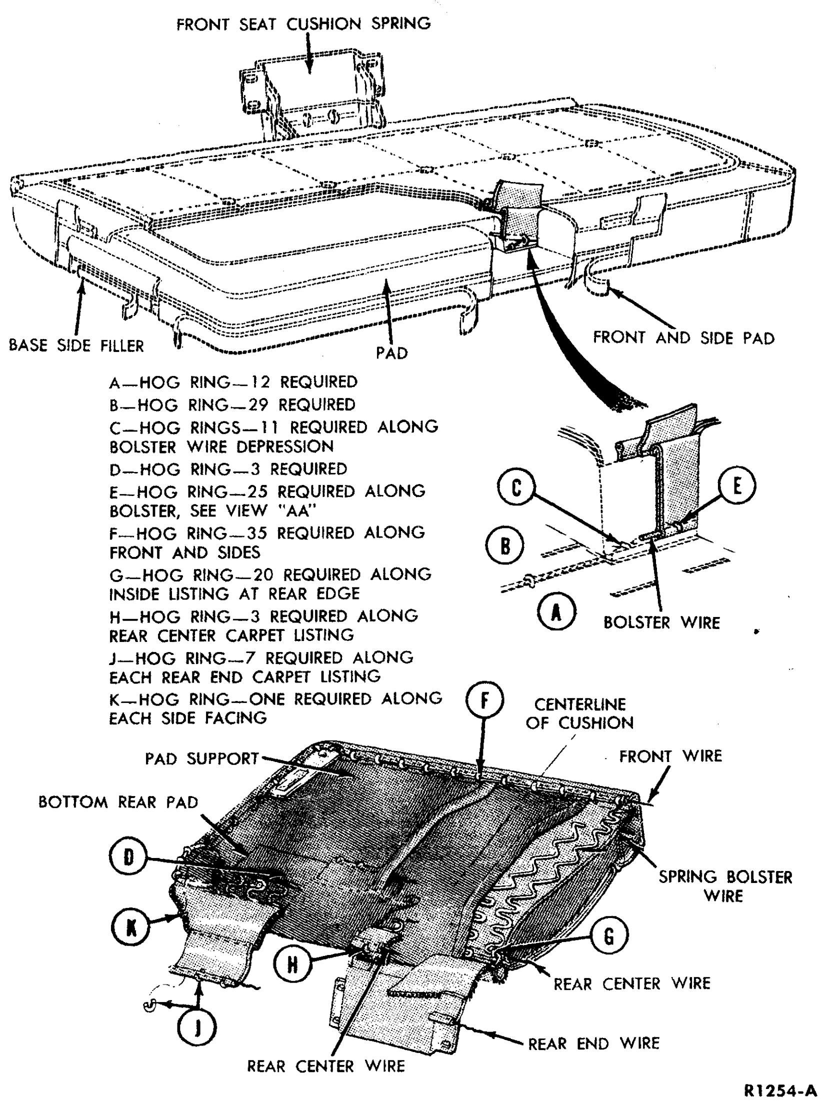

FIG. 4–Front Seat Cushion Assembly

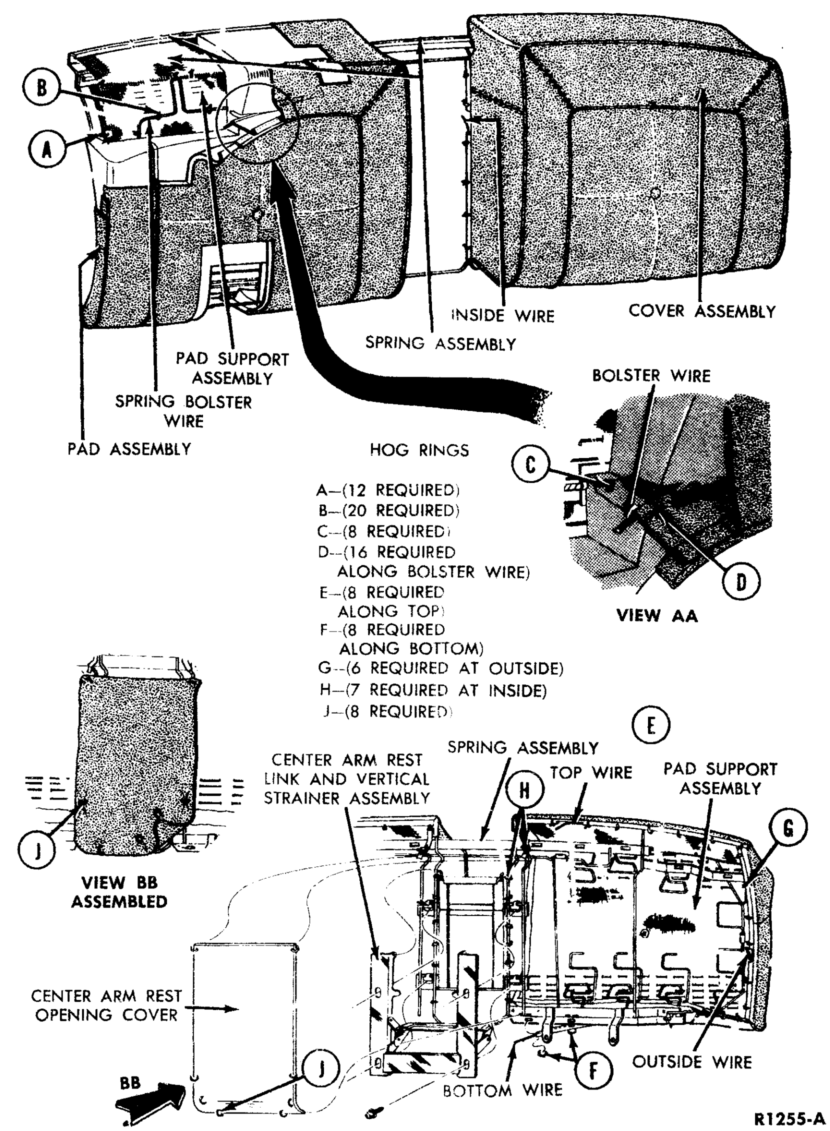

FIG. 5—Rear Seat Back Assembly

screws that secure both relays to the mounting bracket and remove the relays.

3. Secure both relays to the mounting bracket with two sheet metal screws. Make sure that the motor control relay (four-prong connector) is toward the driver's side of the seat.

4. Connect each connector to its respective relay.

TRANSMISSION

1. Disconnect the three leads from the three solenoids on the transmission (Fig. 1).

2. Remove the cable housing retainer from each end of the transmission. Separate the six cables and housings from the transmission.

3. Remove the two cap screws and lock washers that secure the transmission to the mounting bracket. Separate the transmission from the mounting bracket.

4. Secure the transmission to the mounting bracket with two lock washers and cap screws.

5. Slip the six cables and housings into their respective ports. Install the two cable housing retainers.

6. Connect the first lead to the front solenoid, the second lead to the center solenoid and the third lead to the rear solenoid.

SEAT INSTALLATION

1. Secure the seat to the regulator with four attaching screws.

2. With a helper, carefully position the seat and regulator in the car.

3. Secure the motor mounting bracket to the floor pan with a nut and washer.

4. Secure each seat actuator (regulator) to the floor pan with a cap screw, two washers and a nut.

5. Connect the main harness to the harness leading to the 20-ampere circuit breaker (Fig. 1).

6. Connect the ground lead to the battery.

7. Check the operation of the seat to make certain that it moves in all directions.

FRONT SEAT BACK

1. Open the door and install a cover.

2. Position the front seat to the top rear of its travel, and remove the seat track to seat cushion retaining screws.

3. Disconnect the seat wiring retaining clips and the wiring.

4. Remove the front seat assembly and place on a clean bench or working surface.

5. Remove the front seat back cover panel and retaining clips.

6. Remove the front seat cushion side shield assembly and the shield support bracket.

7. Remove the seat back to center arm rest frame retaining screws (Fig. 3).

8. Remove six hog rings retaining the seat cushion cover to the seat cushion frame.

9. Remove the seat back to seat cushion outer retaining screw and remove the seat back assembly.

10. Remove the seat back cover or pad and transfer the listing wires to the new cover.

11. To install the cover or pad reverse the removal procedure.

FRONT SEAT CUSHION

1. Open the door and install a cover.

2. Position the front seat to the top rear of its travel, and remove the seat track to seat cushion retaining screws.

3. Disconnect the seat wiring retaining clips and the wiring.

4. Remove the front seat assembly and place on a clean bench or working surface.

5. Remove the left and right front seat back cover panels and retaining clips.

6. Remove the left and right front seat cushion side shield assemblies and the shield support brackets.

7. Remove the right and left seat backs to center arm rest frame retaining screws (Fig. 3).

8. Remove 10 hog rings retaining the seat cushion cover to the right and left seat cushion frame.

9. Remove the right and left seat back to seat cushion outer retaining screws and remove the seat back assemblies.

10. Remove hog rings retaining the carpet portion of the seat cushion cover to the center arm rest frame.

11. Remove the center arm rest back panel to seat cushion frame retaining screws.

12. Remove the center arm rest to seat cushion frame retaining screws and remove the arm rest assembly.

13. Remove the seat cushion cover or pad from the cushion frame (Fig. 4).

14. To install the cover or pad, reverse the removal procedure.

2 REAR SEAT

REMOVAL AND INSTALLATION

REAR SEAT CUSHION COVER OR SEAT BACK COVER

1. Remove the seat cushion or back and place on a clean bench.

2. If working on the seat back, remove the center arm rest assembly.

3. If working on the seat cushion, remove the heelboard cover.

4. Remove the seat cushion or back cover and/or pad, and transfer the listing wires to the new cover (Figs. 5 and 6).

5. To install the cover or pad, reverse the removal procedure.

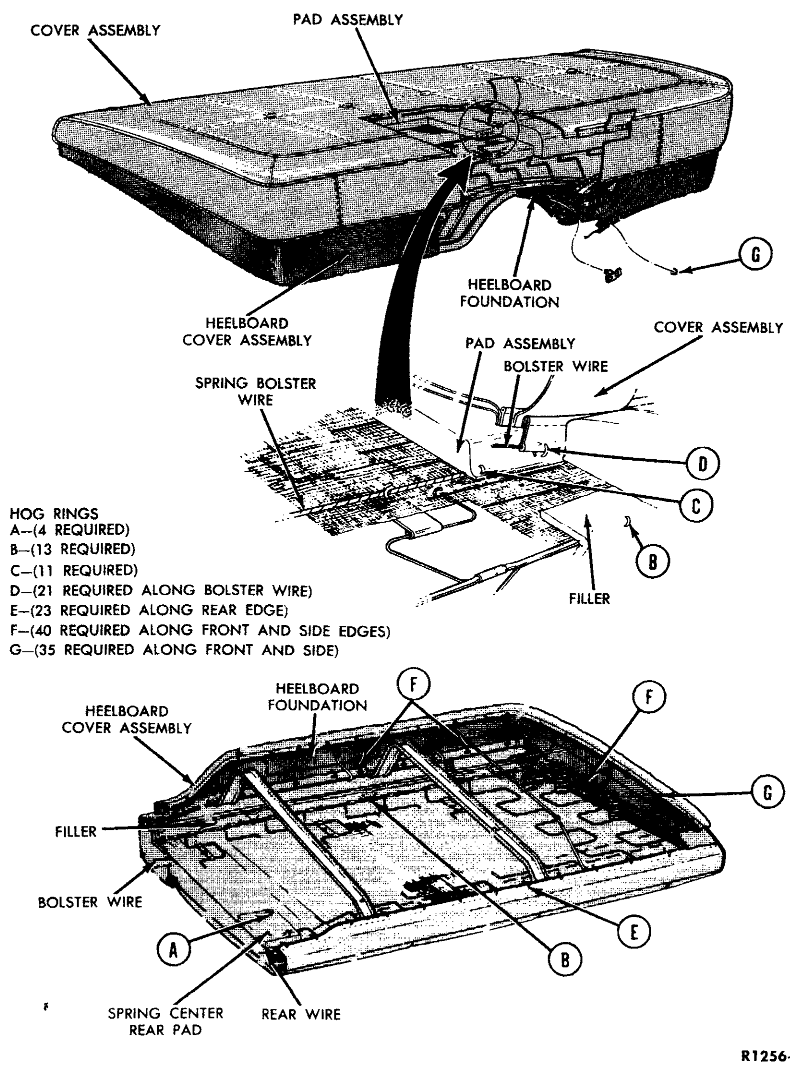

FIG. 6—Rear Seat Cushion Assembly

PART 18-3 CONVERTIBLE TOP

1 DESCRIPTION AND OPERATION

The convertible features automatic lowering of the top assembly into the luggage compartment. The deck lid completely conceals the top when it is in the retracted position. The operation of the top is accomplished by electrically powered mechanical and hydraulic linkage.

The top operation is divided into two cycles; the retract cycle in which the top unlocks and lowers into the luggage compartment, and the erect cycle in which the top is raised from the stacked position and locks to the windshield header.

The car should be stopped and all side windows lowered before the top is operated. The ignition switch must me in the ACC or ON position, preferably with the engine running. The transmission selector lever must be in either the N or P position, then, actuate the top control switch.

To retract (lower the top), unfasten the rear window at the zipper and roll it up. Use the straps with the snap buttons provided to hold it in position. Push the top control switch down and hold it until the deck lid has fully opened. Then, make sure that nothing is stored in the luggage compartment that could interfere with the top as it is lowered. Hold the top control switch down again until the top retract cycle is completed.

To erect (raise the top), push the top control switch up to open the deck lid and raise the top assembly into position. After the deck lid closes and locks, release the top control switch.

The top can be stopped at any time in either cycle (retract or erect) simply by releasing the top control switch. When the top control switch is released, the solenoid valves, which are connected to the hydraulic pressure lines, close and prevent further movement of the top assembly until the circuit is reactivated by moving the top control switch. Do not attempt to manually force the top or the deck lid either up or down.

ELECTRICAL SYSTEM

The electrical system includes four reversible motors; the top lock motor, that drives two hook locking rods that lock and unlock the top to the windshield header; the upper back panel motor that drives the upper back panel by a small transmission; the deck lock motor that locks and unlocks the deck lid through flexible drive cables; and the top-deck motor that drives a hydraulic pump which supplies hydraulic fluid pressure to open and close the deck lid and the top assembly.

There are 11 relays; the top con-

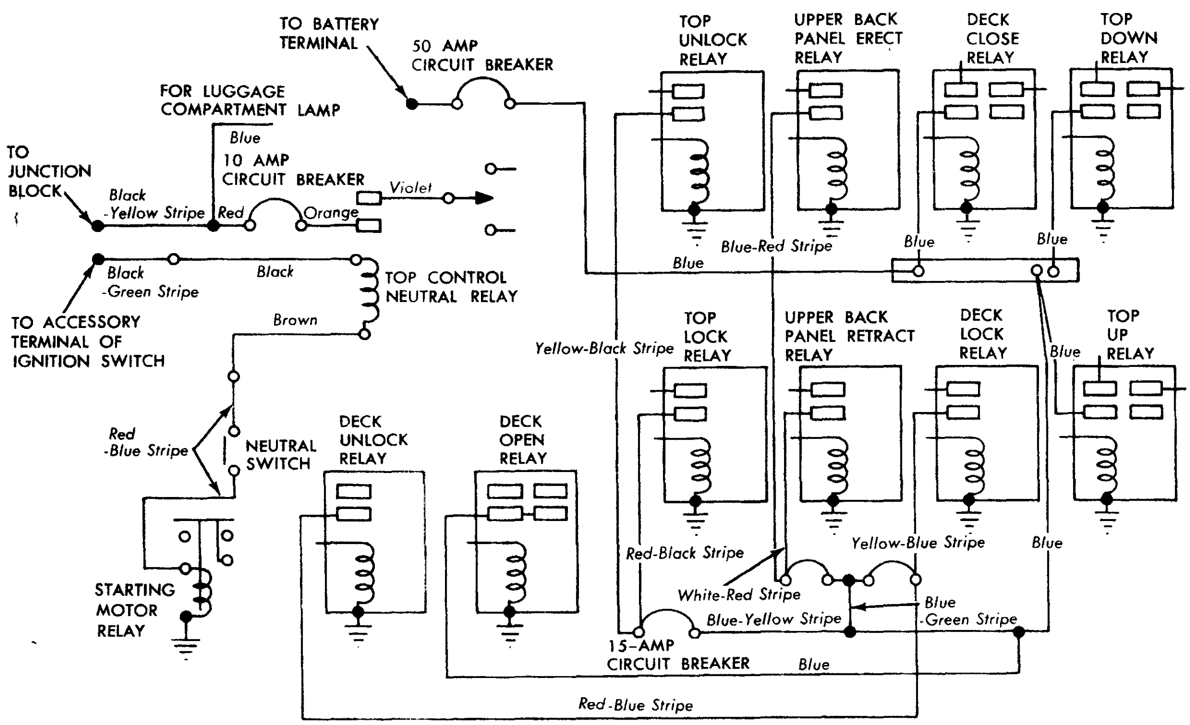

FIG. 1–Control and Power Feed Circuits

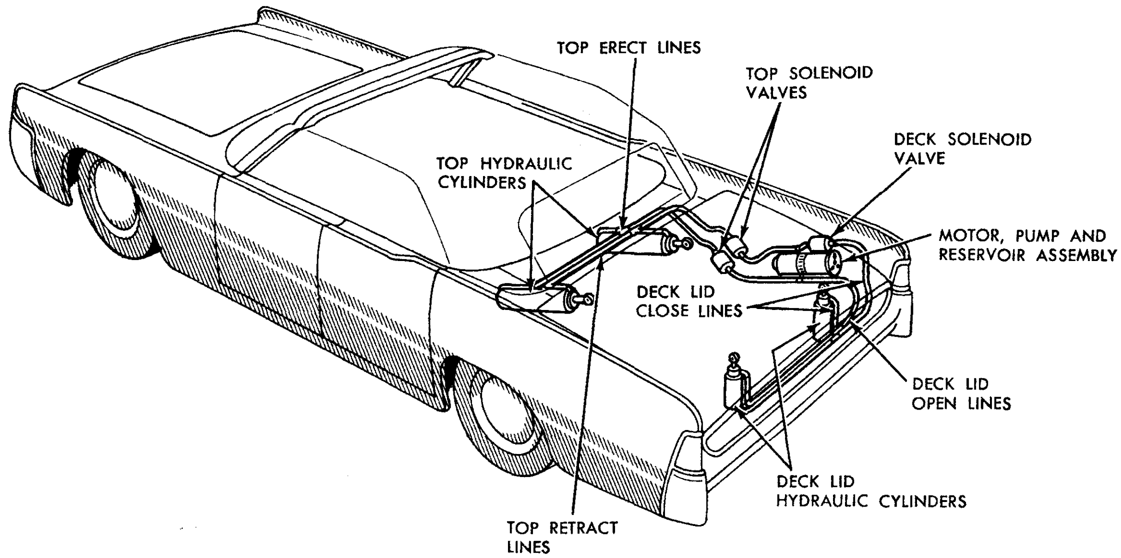

FIG. 2—Hydraulic System

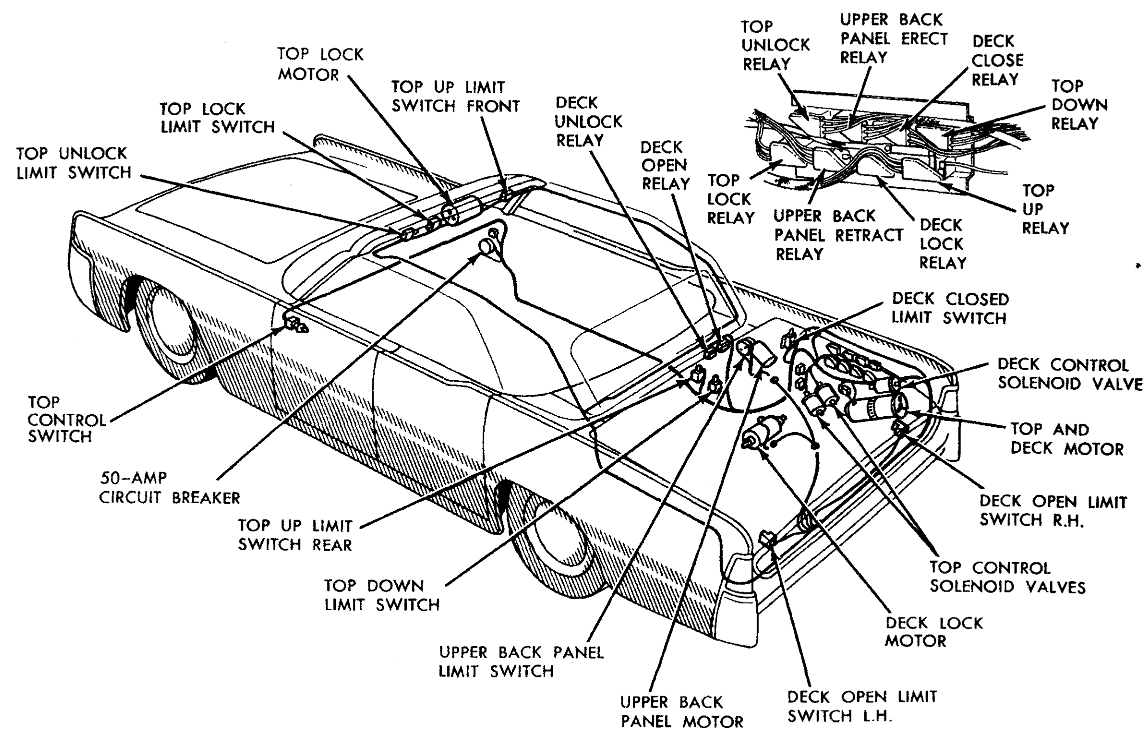

FIG. 3—Parts Location

trol neutral relay is used as a safety device in the control circuit. This relay is located on the horn relay mounting plate located behind the right cowl panel. The control circuit cannot be energized until the top control neutral relay contacts are closed. The circuit is complete only when the neutral switch is closed. The circuit is closed when the transmission selector lever is in P or N and the ignition switch is in the ACC or ON position. The control circuit to the top control switch is identical for both the top retract cycle and top erect cycle. Current flows from the ignition switch, through the top control neutral relay, the transmission neutral switch, and the starter motor relay to ground. The top control neutral relay is energized, closing the relay contacts, and current flows from the 10-ampere circuit breaker through the top control switch.

The remaining 10 relays are used to energize the motors and the three solenoids (Fig. 1).

The electrical system is protected by five circuit breakers; a 50-ampere circuit breaker in the power circuit, a 10-ampere circuit breaker in the top control circuit, and three individual 15-ampere circuit breakers, one for each motor feed circuit. The 50-ampere circuit breaker is located on the wiring and circuit breaker assembly and the 10-ampere circuit breaker is located in the fuse box.

HYDRAULIC SYSTEM

The deck lid and convertible top assembly are each operated by two hydraulic cylinders, receiving pressure from one electrically powered

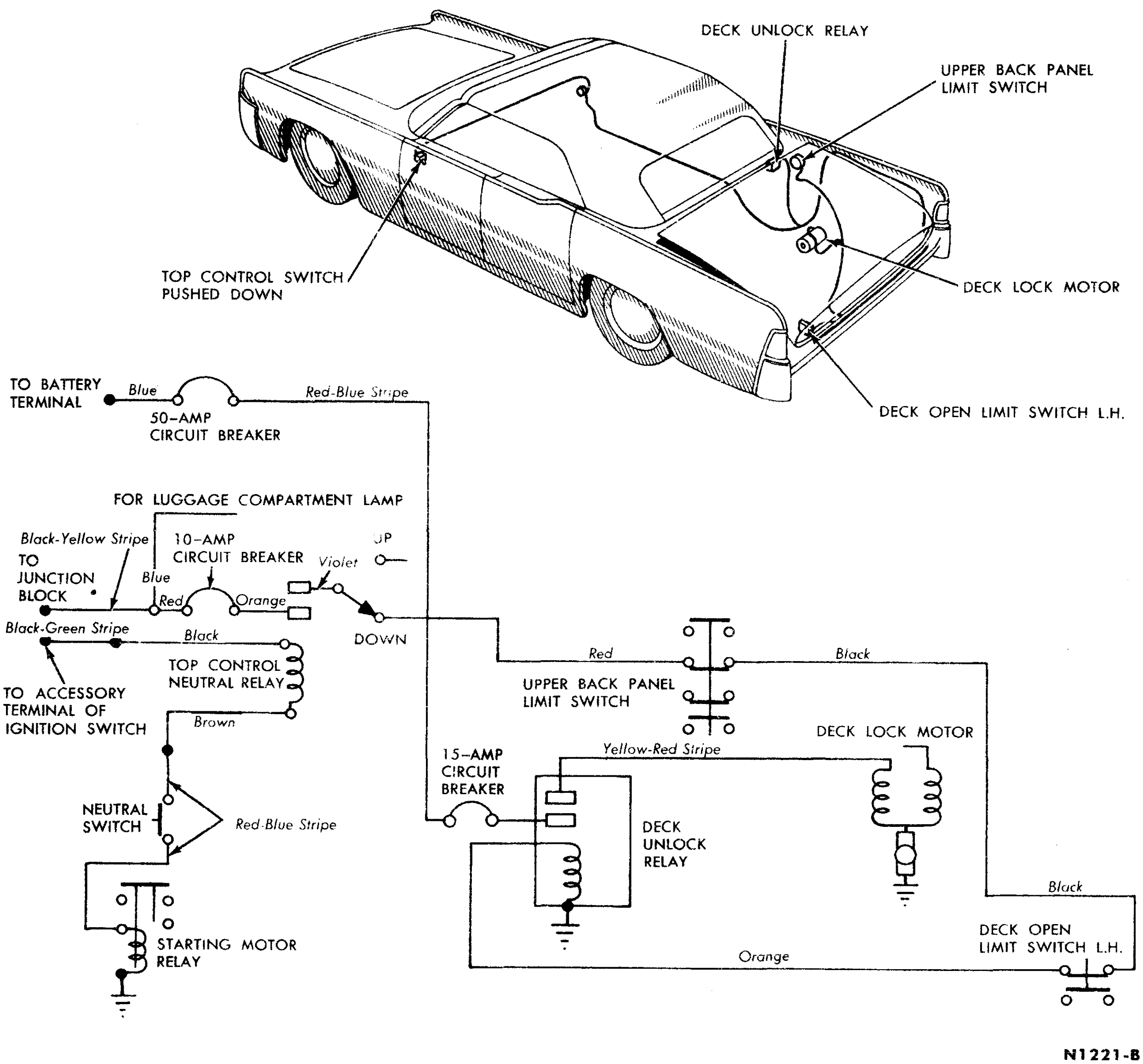

FIG. 4—Deck Lid Unlock—Top Retract Cycle

reversible motor and pump. The hydraulic fluid pressure is controlled by three electrically activated solenoid valves, two for the top assembly, and one for the deck lid (Fig. 2).

ELECTRICAL COMPONENTS

The location and proper nomenclature for each electrical component is illustrated in Fig. 3. The function of these components is explained in detail with the circuits of each phase of the retract and erect cycle in Figs. 4 through 15.

TOP RETRACT CYCLE DECK LID UNLOCK

With the top control switch in the top down position (Fig. 4), current flows from the top control switch, through the upper back panel limit switch, the left hand deck open limit switch (usually called deck open limit switch L.H.), and the deck unlock relay coil to ground. The deck unlock relay coil is energized, closing the relay contacts which complete the power circuit from the 50-ampere circuit breaker, through the 15-ampere circuit breaker to the deck lock motor. The motor is energized and the deck lid is unlocked.

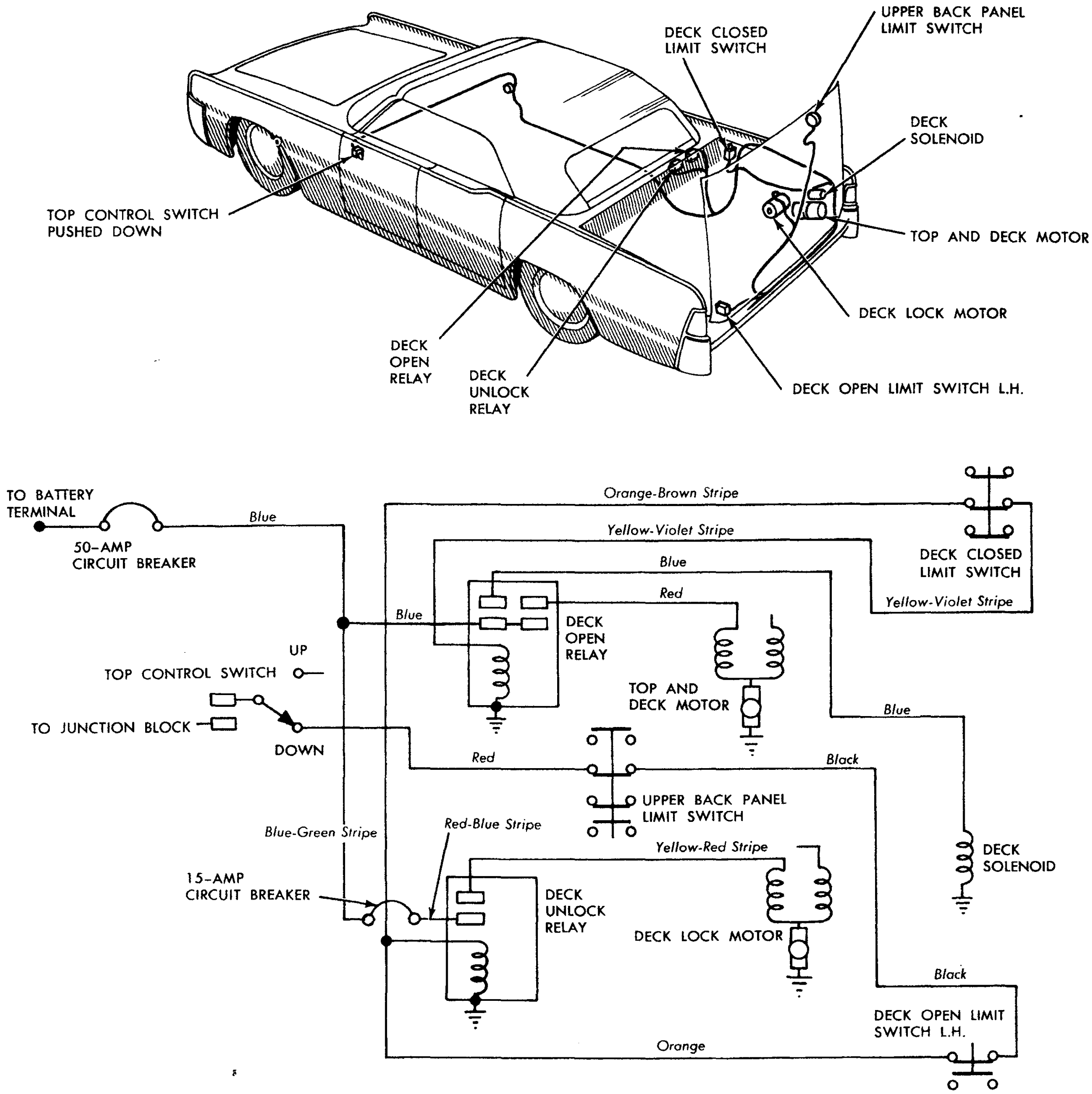

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FIG. 5—Deck Lid Open—Top Retract Cycle

DECK LID OPEN

As soon as the deck lid is unlocked, the deck lock limit switch contacts are repositioned (Fig. 5). The current now flows from the top control switch through the back panel retract limit switch, through the deck open limit switch L.H., through the deck lock limit switch and the deck open relay coil to ground. This closes the deck open relay multiple contacts which complete the power circuits from the 50-ampere circuit breaker to the top-deck motor and the deck solenoid valve.

The deck solenoid valve is energized and the proper hydraulic lines are opened to the deck control cylinders. At the same time the top-deck motor is energized and the deck lid is opened. The deck locks continue to operate until the deck is completely open.

UPPER BACK PANEL ERECT

When the deck lid is completely open, the plunger of the deck open limit switch L.H. is depressed and the switch contacts are repositioned (Fig. 6). The current now flows from the top control switch, through the deck open limit switch L.H., the upper back panel relay contacts close and the power circuit is completed through the 15-ampere circuit breaker to the upper back panel motor. The motor is energized and the upper back panel is erected.

TOP UNLOCK

As soon as the upper back panel is in the erect position, the upper back panel limit switch is actuated and the switch contacts are repositioned (Fig. 7). The current now flows from the top control switch, through the top unlock limit switch, the upper back panel limit switch and the top unlock relay coil to ground. The relay contacts close and complete the power circuit through the 15-

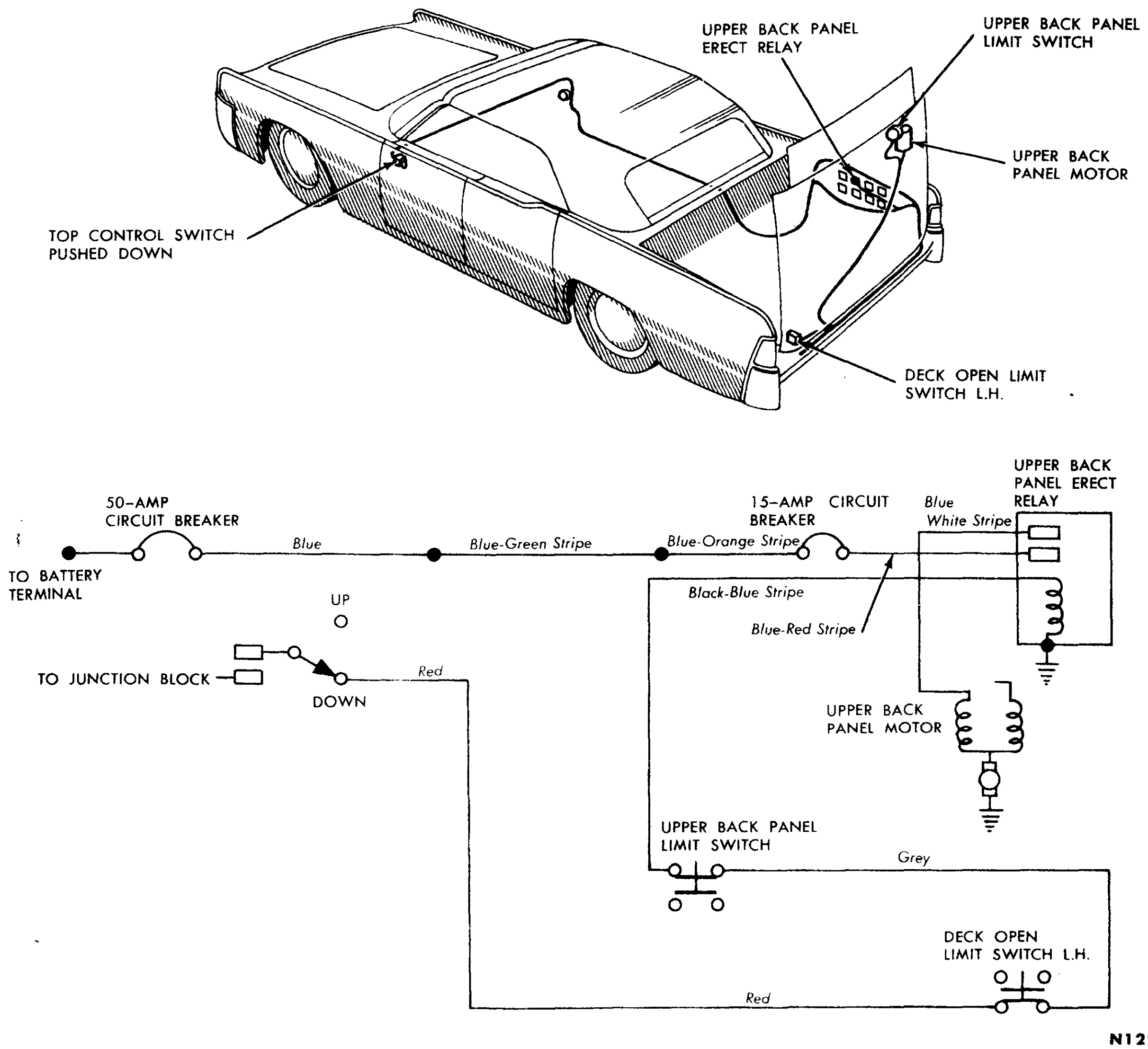


FIG. 6—Upper Back Panel Erect—Top Retract Cycle

ampere circuit breaker to the top lock motor. The motor is energized and the top is unlocked.

TOP RETRACT

When the top is unlocked, the top unlock limit switch is actuated and the switch contacts are repositioned (Fig. 8). The current now flows from the top unlock limit switch, through the top down limit switch, and the top down relay coil to ground. This closes the relay multiple contacts and completes the power circuits to the top-deck motor. The two top solenoid valves are energized and the proper hydraulic lines are opened to the control cylinders. At the same time the top-deck motor is energized and the top is lowered into the luggage compartment.

DECK LID CLOSE AND LOCK

When the top is stowed in the luggage compartment, the top down limit switch is actuated and the switch contacts are repositioned (Fig. 9). The current now flows from the top control switch, through the top down limit switch, the deck closed limit switch, and the deck close relay coil to ground. The relay contacts are closed and the power circuit is complete to the top-deck motor and the deck control solenoid valve.

The deck control solenoid is energized and hydraulic lines are opened to the deck control cylinders. The top-deck motor is also energized and the deck lid is closed. This action is interrupted when the deck lid depresses the plunger on the deck closed limit switch.

At the same time the deck lid is closing, the deck lock motor is energized. This is accomplished by the current flowing from the top down limit switch through the deck lock relay to ground. This closes the re-

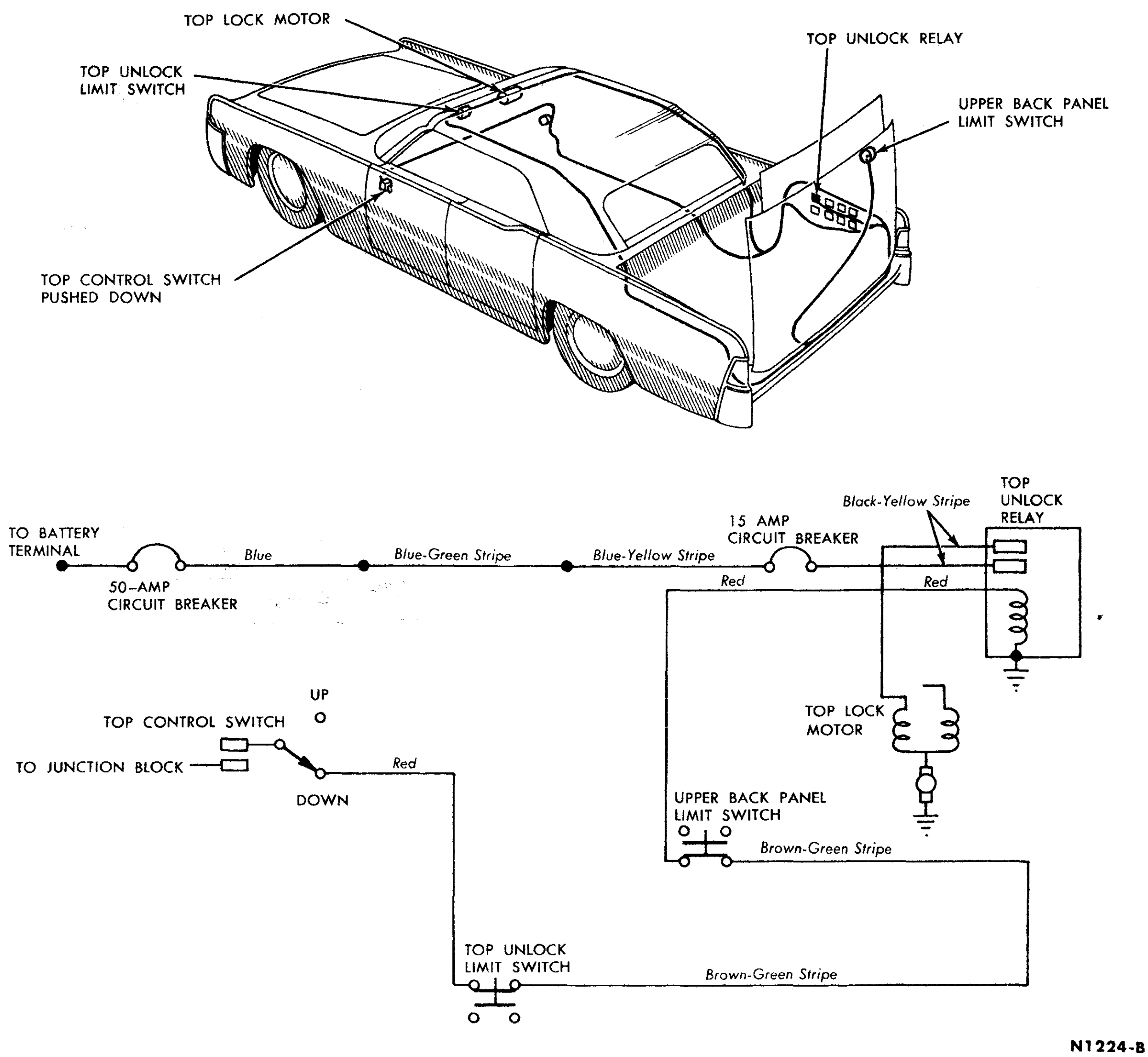


FIG. 7—Top Unlock—Top Retract Cycle

lay contacts and completes the power circuit to the deck lock motor. The deck lock motor is energized until the top control switch is released.

TOP ERECT CYCLE

DECK LID UNLOCK

With the top control switch in the top up position, current flows from the top control switch, through the top down limit switch, the right hand deck open limit switch and the deck unlock relay coil to ground (Fig. 10). The relay is energized, the contacts are closed, and the power circuit is completed to the deck lock motor. The motor is energized and the luggage compartment is unlocked.

DECK LID OPEN

As soon as the deck lid is unlocked, the deck closed limit switch contacts are repositioned (Fig. 11). Now the current flows from the deck open limit switch R.H., through the deck closed limit switch, and the deck open relay to ground. The relay multiple contacts close and the power circuits to the deck solenoid valve and the top-deck motor are completed. The deck solenoid valve is energized and the hydraulic lines are opened to the deck hydraulic control cylinders. The top-deck motor is energized and the deck lid is opened. The deck lock motors continue to run until the deck is completely open.

TOP ERECT

When the deck lid is completely opened, the deck open limit switch R.H. plunger is depressed and the switch contacts are repositioned (Fig.

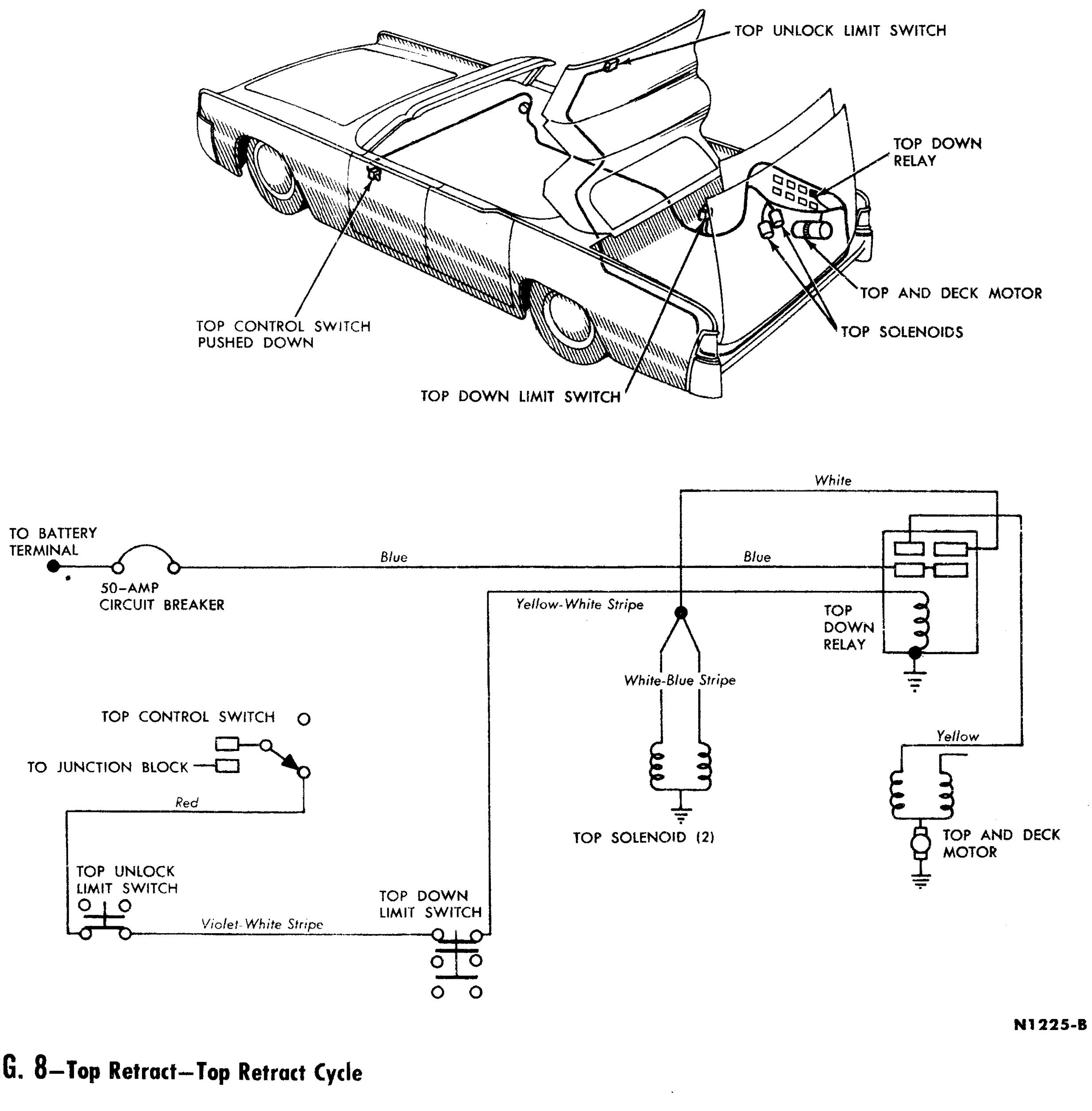


FIG. 8—Top Retract—Top Retract Cycle

12). The current now flows from the top control switch, through the top up limit switch, the deck open limit switch R.H., and the top up relay to ground. The relay multiple contacts are closed and the power circuits are completed to the top-deck motor and the two top control solenoid valves. The two top control solenoid valves when energized open the hydraulic lines to the top hydraulic control cylinders; at the same time the top-deck motor is energized and the top is erected.

TOP LOCK

As the top approaches the full up position, and the package tray seats in position, the top up limit switch rear is depressed, opening the circuit to the top up relay (Fig. 13). This stops the top motor and pump assembly. At the same time the top comes in contact with the windshield header, the contacts of the top up limit switch front are closed. The current now flows from the top control switch, through the top up limit switch front upper back panel limit switch, and the top lock relay to ground. The relay contacts close and the power circuit is completed to the top lock motor. The motor is energized and the top is locked into position. The lock motor remains energized until the upper back panel is retracted.

UPPER BACK PANEL RETRACT

During the top locking action, the top lock limit switch is actuated and the switch contacts are closed (Fig. 14). This permits the current to flow from the top control switch, through the top lock limit switch, the upper

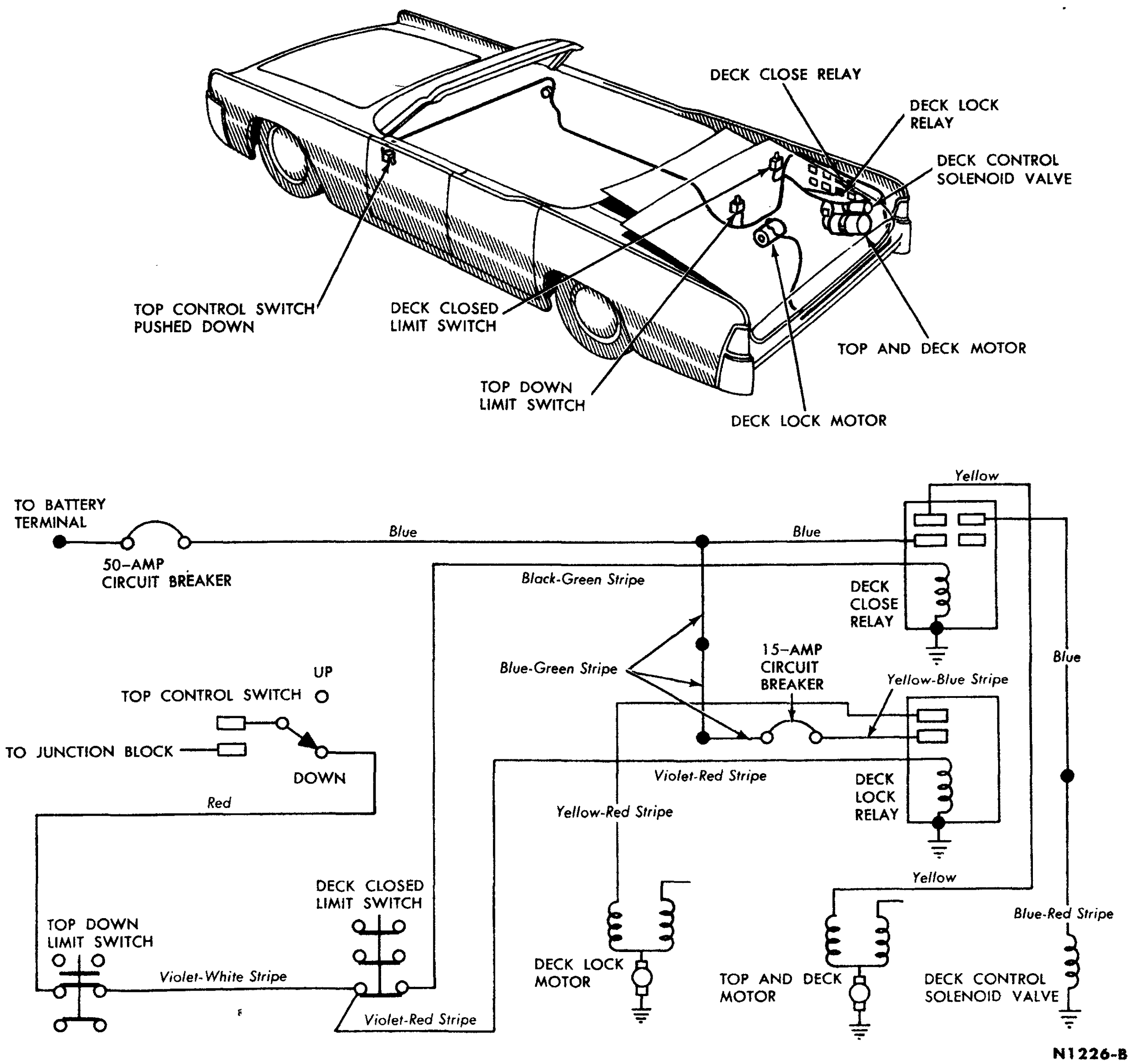


FIG. 9–Deck Lid Close and Lock–Top Retract Cycle

back panel limit switch, and the upper back panel retract relay to ground. The relay contacts close, completing the power circuit to the upper back panel motor, and the upper back panel is retracted. The top lock motor remains energized until the upper back panel is fully retracted.

DECK LID CLOSE AND LOCK

As soon as the upper back panel is retracted, the upper back panel limit switch is actuated and the switch contacts are repositioned (Fig. 15). This stops the top lock motor and the upper back panel motor. The current now flows from the top control switch, through the upper back panel limit switch, the deck closed limit switch, and the deck close relay to ground. The deck close relay multiple contacts close and the power circuits are complete to the deck control solenoid valve and the top-deck motor. The deck control solenoid valve and the top-deck motor are energized, closing the deck lid. Current also flows through the upper back panel limit switch, through the deck lock relay to ground. The relay is energized, closing the circuit to the deck lock motor. As the deck lid reaches the

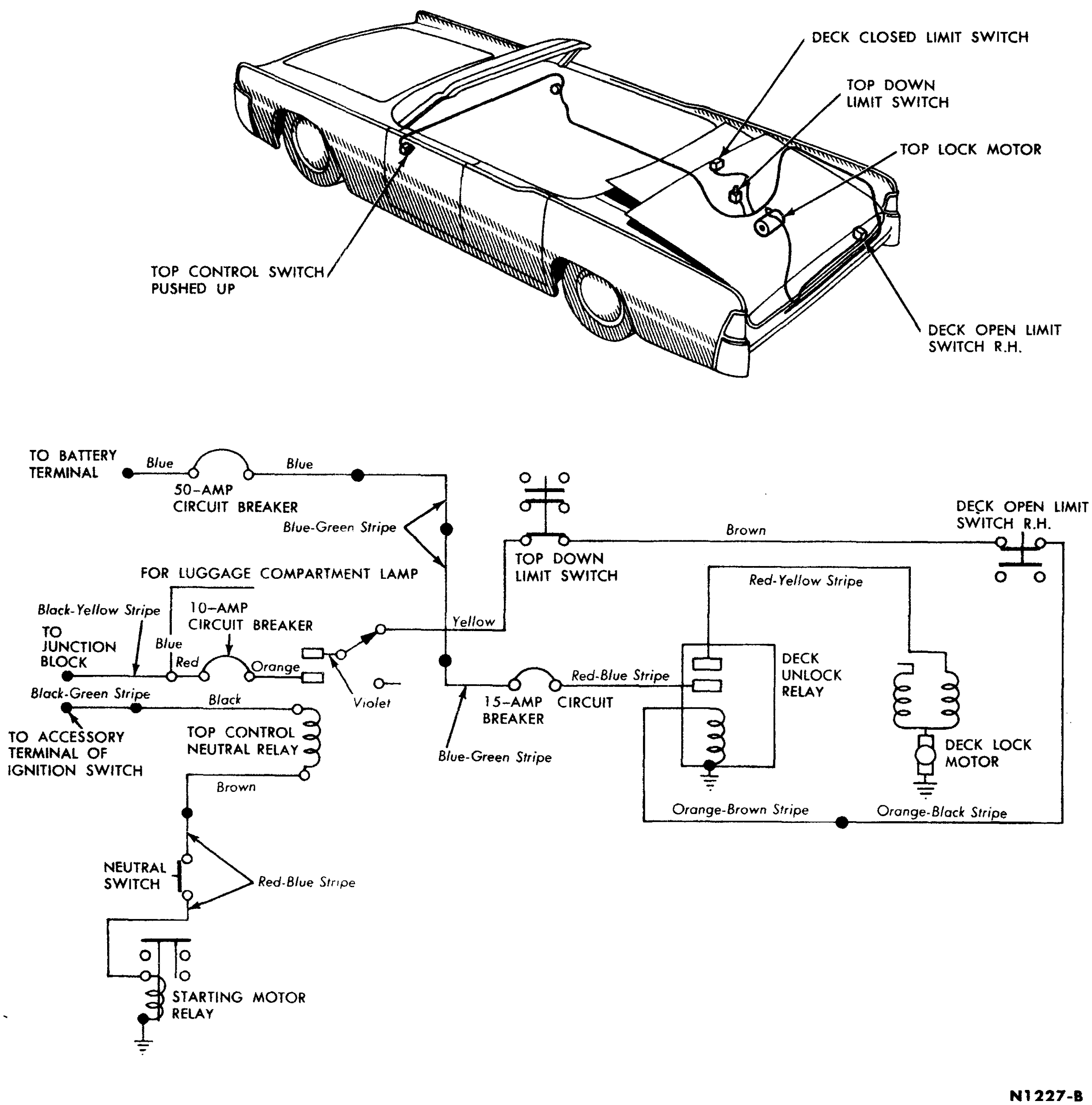


FIG. 10—Deck Lid Unlock—Top Erect Cycle

closed position, the deck closed limit switch is depressed and the deck close circuit is broken. The deck lock circuit will continue to be energized, and the locks will ratchet until the top control switch is released.

2 DIAGNOSIS AND TESTING

To properly accomplish diagnosis and testing, the convertible top operating principles and sequence of operations should be thoroughly understood. There should also be an adequate power supply from the battery.

The most common operational failures will be due to maladjusted switches in the control circuit. The power circuits can be individually operated by energizing the correct

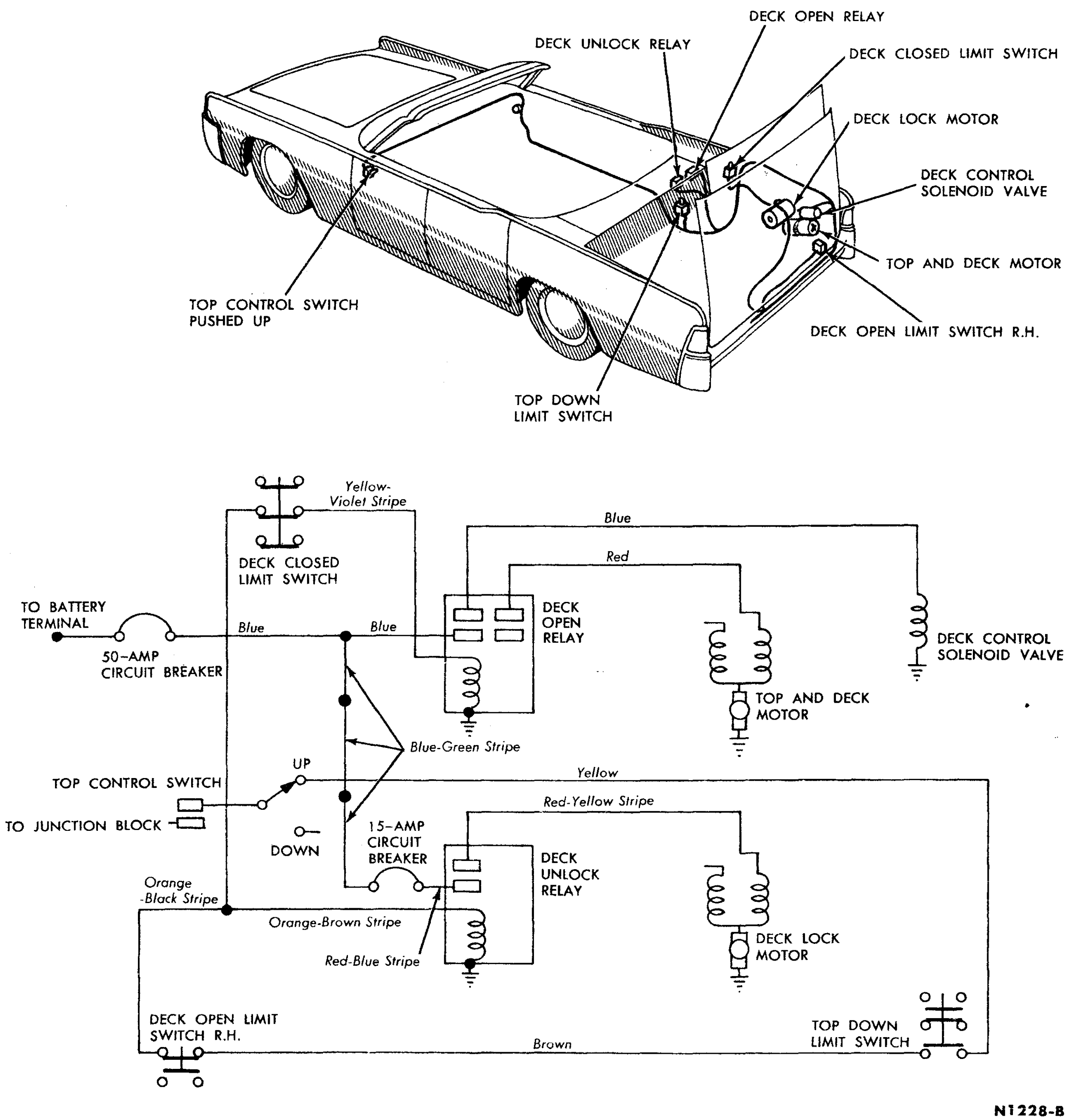


FIG. 11—Deck Lid Open—Top Erect Cycle

power relay by means of a jumper wire. The following cautions must be observed:

1. Do not use an external power source. Extensive damage to electrical components could occur if an external power source is used.

2. When an individual component is cycled by means of a jumper wire, that component must be returned to its original position in the top cycle before proceeding. If this is not done, damage to the top, deck, and/or back panels could occur.

This method is applicable since it permits bypassing various limit switches and operating the motors directly. If bypassing a control circuit operates the motor, a continuity check should be made on the components of that particular control circuit. However, before this is attempted, the motor relay feed (power circuit) circuit breaker (50-ampere) must be checked and it must be ascertained that the motor is not jammed or stalled.

If bypassing the control circuit is not effective and no mechanical failure is evident, a failed relay, a failed motor, or an open circuit in the motor feed circuit is indicated. The relay can be bypassed to test the motor.

If at any point during the operation of the top, a motor continues to run after a cycle has been completed, and releasing the top control switch does not stop the motor, there is a probability of a stuck relay. Disconnect the battery to stop the motor, then replace the applicable relay.

Before proceeding, the main power source circuit breaker, the top control neutral relay, and the top control switch should be tested, as they control the complete top circuit. If no voltage is available at the top control neutral relay, the control circuit 10-ampere circuit breaker or the neutral switch is at fault. **Don't overlook the hydraulic system. This system must be operating properly in order to obtain proper operation of the top.**

Sluggish operation of the top or deck lid assemblies is often accompanied by a loud and irregular pump

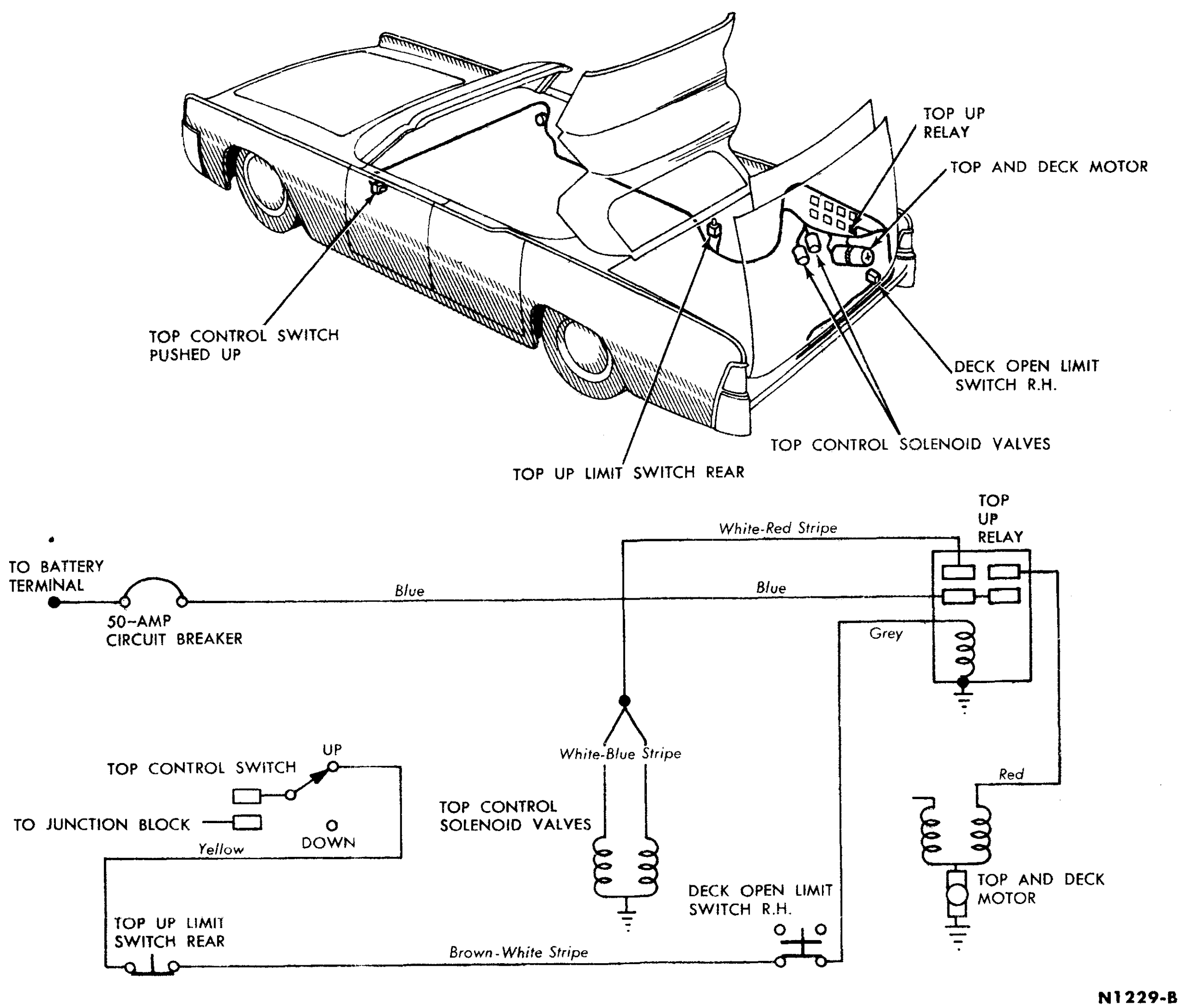


FIG. 12–Top Erect–Top Erect Cycle

noise. Very frequently this is caused by a low hydraulic fluid level. When this condition exists, cycle the top and then check the pump reservoir for proper fluid level. The fluid level should be within ¼ inch of the filler plug hole with the deck lid and top in the raised position.

EMERGENCY PROCEDURES

MANUALLY UNLOCKING TOP

If the top unlocking mechanism becomes inoperative, and the top will not unlock at the header, it may be necessary to manually unlock the top by removing the No. 1 bow access cover and manually turning the motor coupling to unlock the top.

MANUALLY OPENING DECK LID

There are two methods of opening the deck lid. With a jumper wire the deck unlock relay plug and deck open relay plug can be activated. If this procedure does not work, the deck lid can be unlocked and opened mechanically.

Opening Deck Lid With Jumper Wire.

1. Remove the rear seat cushion and seat back. This will allow access to the deck unlock relay and deck open relay.

2. Fabricate a jumper wire (12 gauge), that has a sufficient capacity to conduct 50 amperes of current (Fig. 16).

3. Remove the multiple plug from the deck unlock relay. This is the relay that is closest to the centerline of the car.

4. Energize the deck unlock motor directly through the multiple plug with the jumper wire. If the motor does not operate, it will be necessary to mechanically unlock the deck lid. (See "Mechanically Opening and Raising the Deck Lid" in this section).

5. After the deck lid is unlocked, actuate the top control switch to

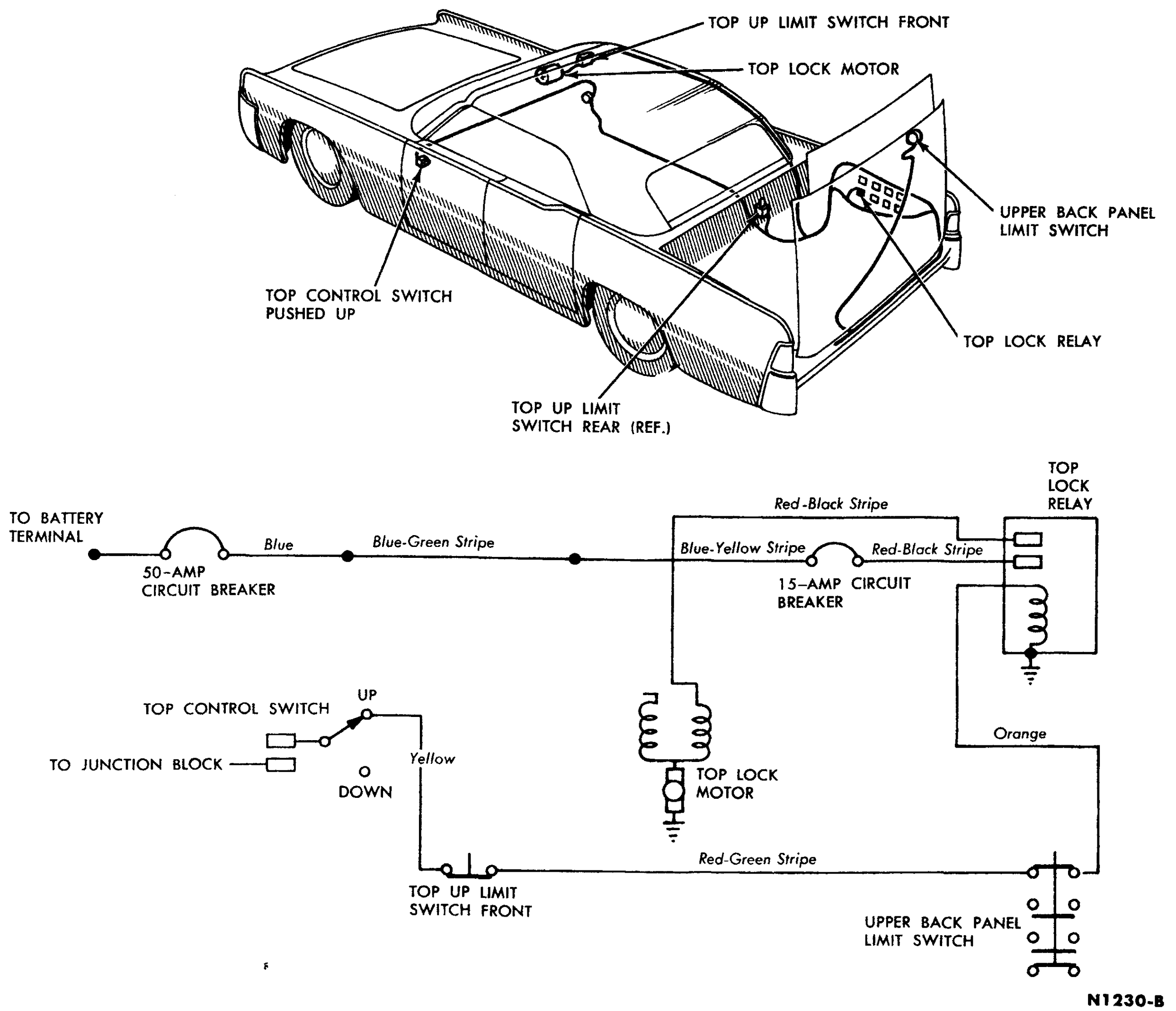


FIG. 13—Top Lock—Top Erect Cycle

determine if the deck lid will open in the normal manner.

6. If the deck lid will not open by operating the top control switch, remove the multiple plug from the deck open relay.

7. Energize the top-deck motor and pump directly through the multiple plug with the jumper wire. If the top-deck motor does not operate, it will be necessary to mechanically open the deck lid.

Mechanically Opening and Raising the Deck Lid

1. Raise the car.

2. From the underside of each rear wheel house, remove each deck lid lock nut retaining screw.

3. From behind the rear seat cushion, disconnect the deck lid unlock relay to prevent damage to the lock nut assembly.

4. Lift the forward edge of the deck lid approximately one inch, then actuate the top control switch to complete the opening of the deck lid. If the deck lid hydraulic cylinders fail to operate, the deck lid can be manually opened an follows:

a. Unlock the deck lid with the top control switch or with the above procedure.

b. From underneath the rear cross member, remove the deck lid hydraulic cylinder attaching screws (both sides).

c. Manually lift the deck lid from the body opening. If the deck lock nuts have been released here from the wheel housings, the nut and housing portion of the locks will remain attached to the deck lid lock screws.

ADJUSTMENTS

LIMIT SWITCHES

Accurate adjustment of all the limit switches is very important to assure smooth operation and to maintain continuity of the deck lid cycles. When checking a switch, it should first be checked for proper function and then adjusted as outlined in the following procedures. A pair of insulated test leads, a jumper wire, and a self-powered DC test light are essential tools for testing and adjusting switches. **A self-powered test light should be used to check the electrical components. Do not**

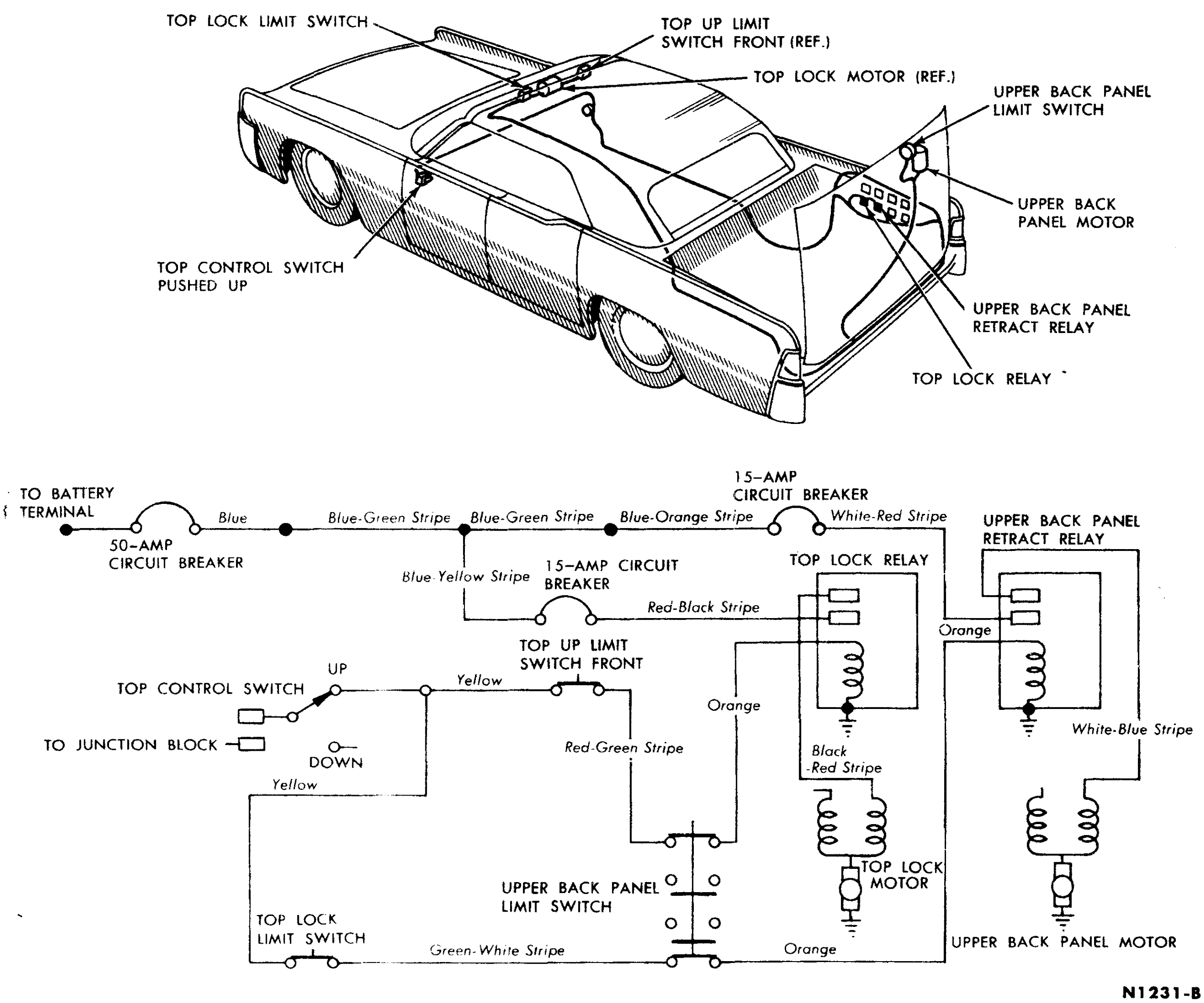


FIG. 14–Upper Back Panel Retract–Top Erect Cycle

use the car battery for the power source, because the jumping of a switch will cause the cycle to continue and possibly the cycle will go out of phase.

Figs. 17 through 24 illustrate the correct adjustment of the limit switches.

TROUBLE DIAGNOSIS

Before a systematic trouble shooting procedure is attempted a trouble free source of current should be established at the top control switch and the service side of the 50-ampere circuit breaker (Fig. 3).

POWER SUPPLY CHECK PROCEDURE

1. Check from the blue wire terminal of the 50-ampere circuit breaker to ground, using a simple test lamp, a voltmeter or other appropriate test equipment, to determine that an adequate voltage supply is available at this point.

2. Check for full functioning of the neutral switch and top-control neutral relay by placing the transmission selector lever in neutral and starting the engine. If any malfunction in this (starting) circuit is evident, check the circuit and make repairs.

3. With the starter circuit functioning properly, turn the ignition switch to the ON or ACC position and check for an adequate voltage supply at the violet wire terminal of the top control switch. Use the same equipment as in step 1.

4. If difficulties are encountered in the deck unlock and/or deck lid open phases of the top retract (top erect) cycle, when the deck lid is subsequently open for access, check the voltage supply at the bus bar on the relay panel located on the inside

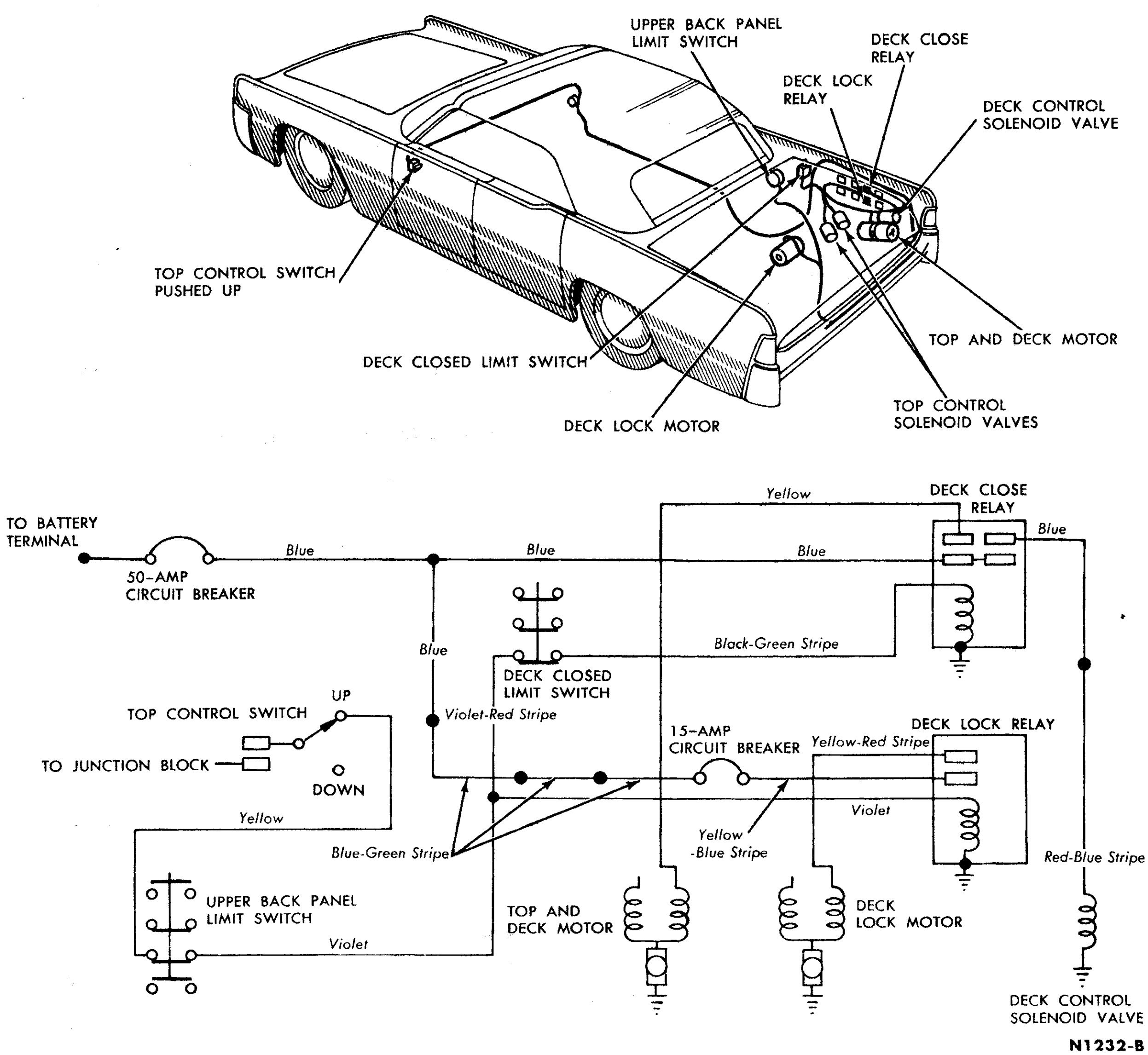


FIG. 15—Deck Lid Close and Lock—Top Erect Cycle

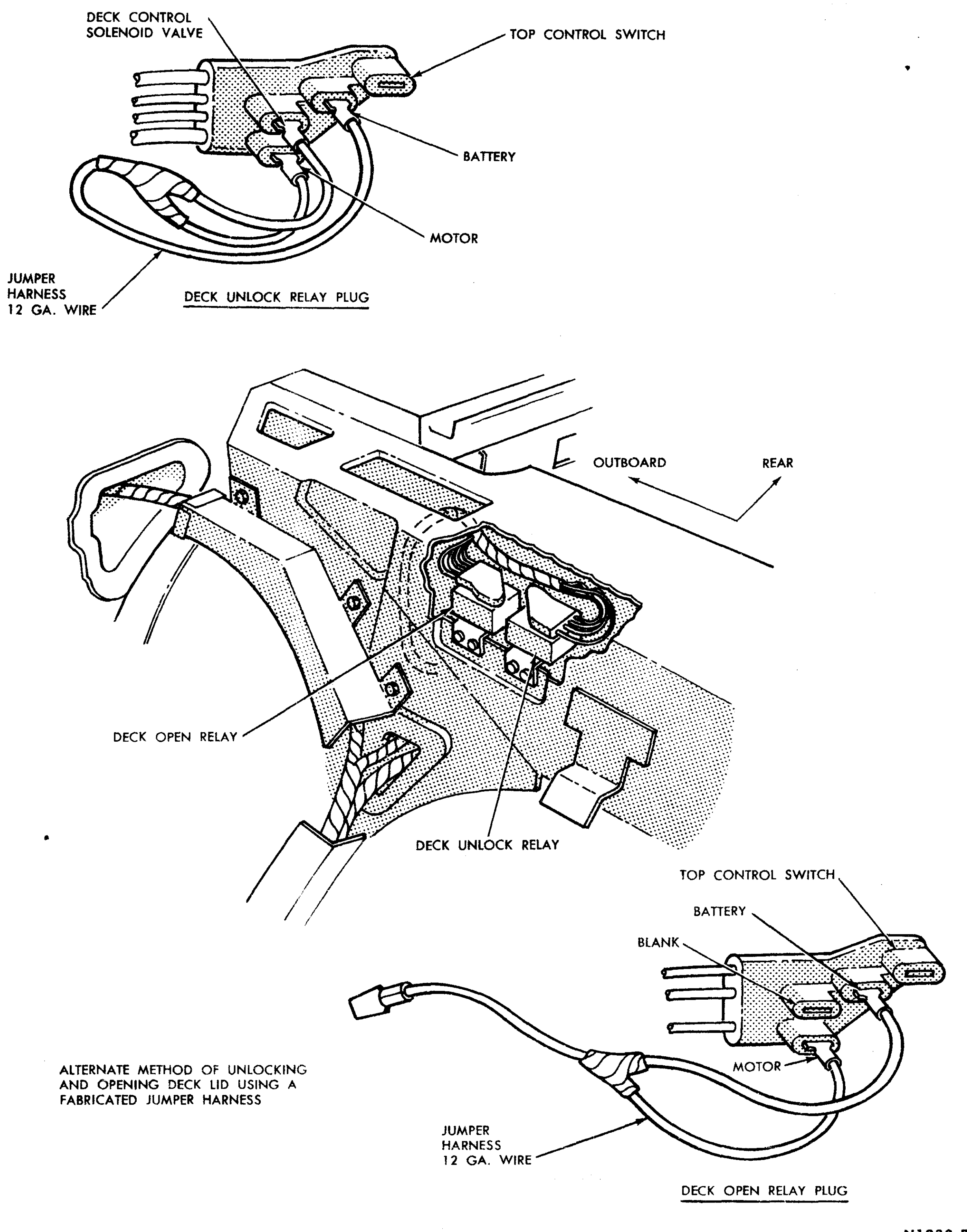


FIG. 16—Opening Deck Lid With Jumper Wire

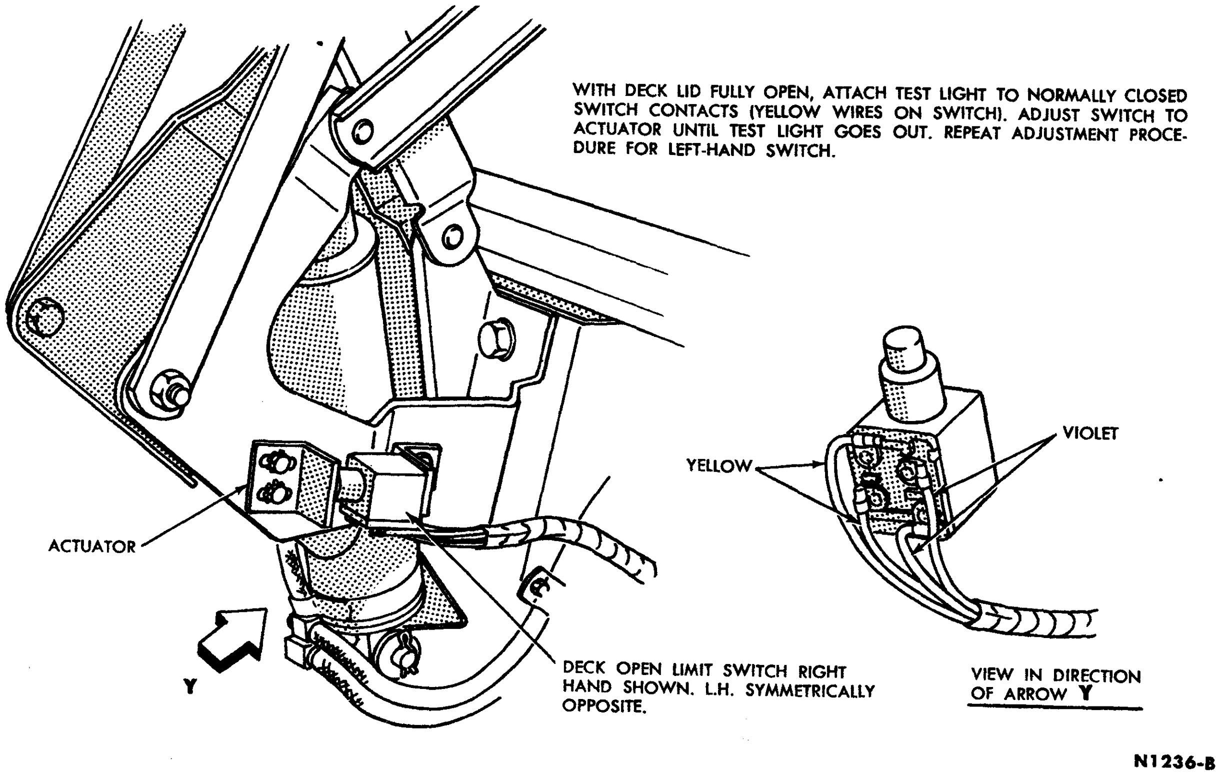


FIG. 17—Deck Open Limit Switches Adjustment

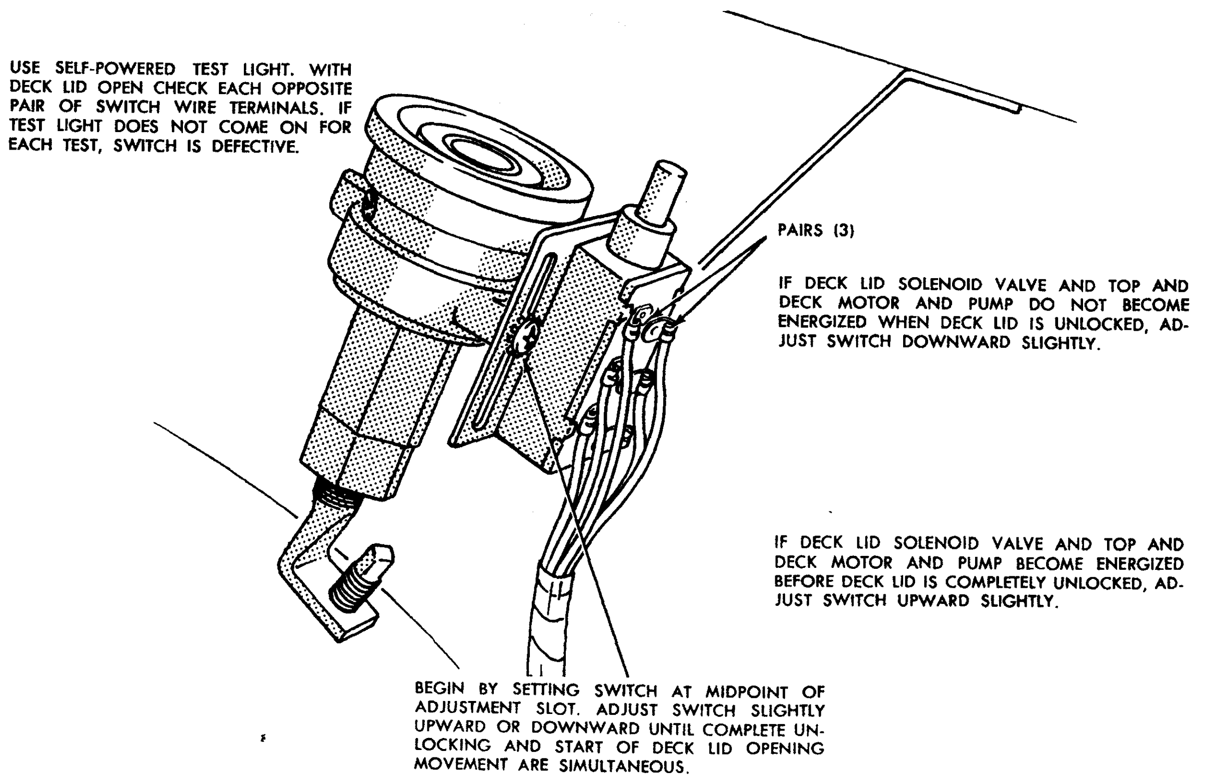


FIG. 18—Deck Close Limit Switch Adjustment

of the right rear quarter panel. Use the same equipment as in step 1. Also check the voltage supply at the service side of the three 15-ampere circuit breakers located in the same area.

5. The trouble shooting chart following assumes an adequate voltage supply, for system operation purposes, at the top control switch, bus bar, and through the 15-ampere circuit breakers.

6. When using a self-powered test light for checking the limit switches, disconnect the switch from the circuit.

TOP RETRACT CYCLE

All checks and tests detailed in the top retract cycle Trouble Diagnosis Guide are to be performed with the top control switch pressed down (retract position). In the event of a stop in the cycle, release the control switch to avoid burning out a motor. If jamming is suspected, do not reactivate control switch for over five seconds at one time until the condition is cleared.

TROUBLE DIAGNOSIS GUIDE — TOP RETRACT CYCLE — DECK LID UNLOCK (FIG. 4)

Malfunction	Probable Cause	Corrective Action
1 NO UNLOCKING ACTION—DECK UNLOCK RELAY NOT FUNCTIONING (NO AUDIBLE CLICK).	(a) Deck unlock relay defective.	(a) Move top control switch to up (erect) position; listen for ratcheting of deck lid locks. Move top control switch to down position intermittently and listen for click of deck unlock relay (behind rear seat back cushion). If no click, remove cushion and check for voltage at orange-brown wire terminal. If terminal is hot, relay is defective. Replace deck unlock relay.
	(b) No voltage at relay orange-brown terminal.	(b) Bypass relay by means of a jumper from relay terminals as shown in Fig. 16 to activate deck lock motor.

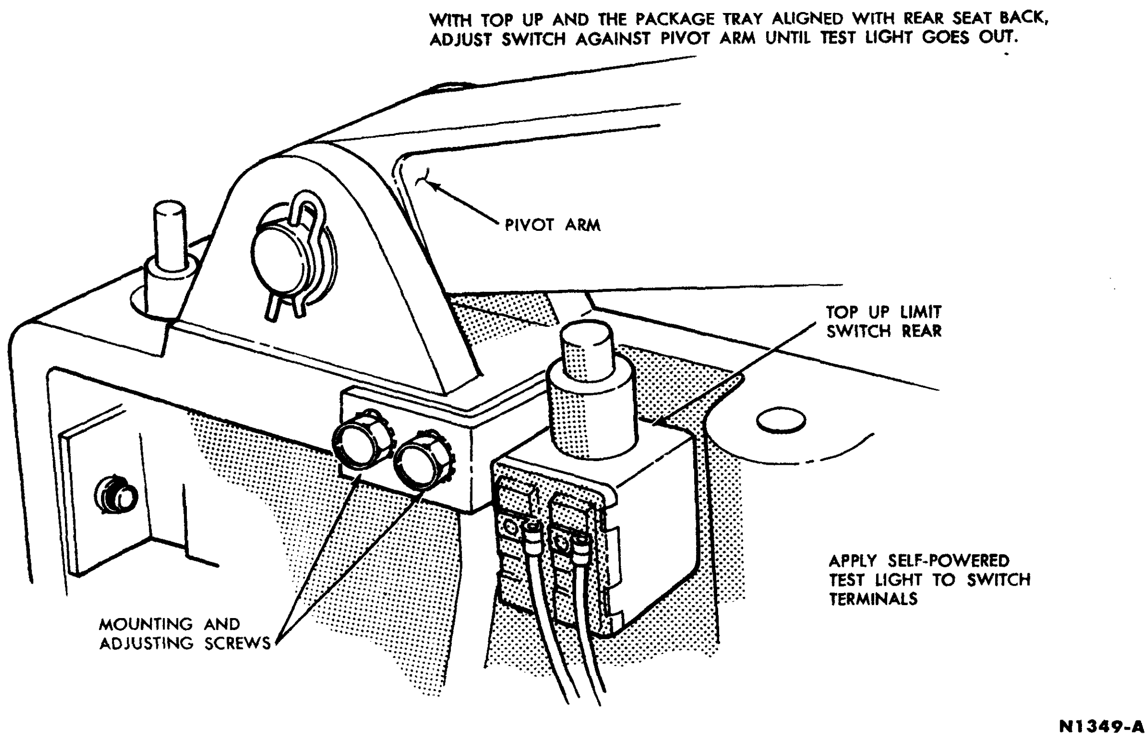


FIG. 19—Top Up Rear Limit Switch Adjustment

TROUBLE DIAGNOSIS GUIDES—TOP RETRACT CYCLE—DECK LID UNLOCK (FIG. 4) (Continued)

Malfunction	Probable Cause	Corrective Action
2 NO UNLOCKING ACTION—DECK UNLOCK RELAY FUNCTIONING (AUDIBLE CLICK).	(a) Maladjusted deck closed limit switch.	(a) A maladjusted deck closed limit switch will allow the top-deck motor and pump to operate and apply pressure to the deck lift cylinders and cause lock screws to bind. Release top control switch and unlock deck lid as outlined in 1 (b). If this fails, deck lid will have to be unlocked mechanically. See 3 (a) in "Deck Lid Open." See Fig. 18 for deck closed limit switch adjustment.
	(b) Defective deck lock motor circuit or motor. **Circuit and motor are inaccessible until deck is open.**	(b) If jumper is not effective in activating deck lock motor, the deck lid will have to be unlocked

LOOSEN SWITCH RETAINING NUTS (A) AND SWITCH ADJUSTMENT SCREWS (B & C). OPERATE THE UPPER BACK PANEL TO THE DESIRED ERECT POSITION. ROTATE THE INNER ADJUSTING RING (D) UNTIL THE NORMALLY CLOSED SWITCH CONTACTS OPEN (CHECK WITH SELF-POWERED TEST LIGHT, GREY TO BLACK-BLUE WIRE TERMINALS) LIGHT GOES OUT. TIGHTEN ADJUSTING SCREW (B).

NOTE: RED TO BROWN-GREEN WIRE CONTACTS ARE CLOSED AT THIS POINT.

RETRACT UPPER BACK PANEL UNTIL RUBBER STOPS HAVE BEEN COMPRESSED 30 TO 60% OF NORMAL. ROTATE THE OUTER ADJUSTMENT RING (E) UNTIL TEST LIGHT APPLIED AT GREEN-WHITE TO RED-WHITE WIRE TERMINALS GOES OUT. CHECK ORANGE TO RED-GREEN WIRE TERMINALS FOR OPEN CONTACTS. TIGHTEN ADJUSTING SCREW (C).

NOTE: BLACK TO RED WIRE AND VIOLET TO YELLOW WIRE CONTACTS ARE CLOSED AT THIS POINT.

AFTER BOTH ADJUSTMENTS HAVE BEEN ACCOMPLISHED, TIGHTEN SWITCH RETAINING NUTS (A).

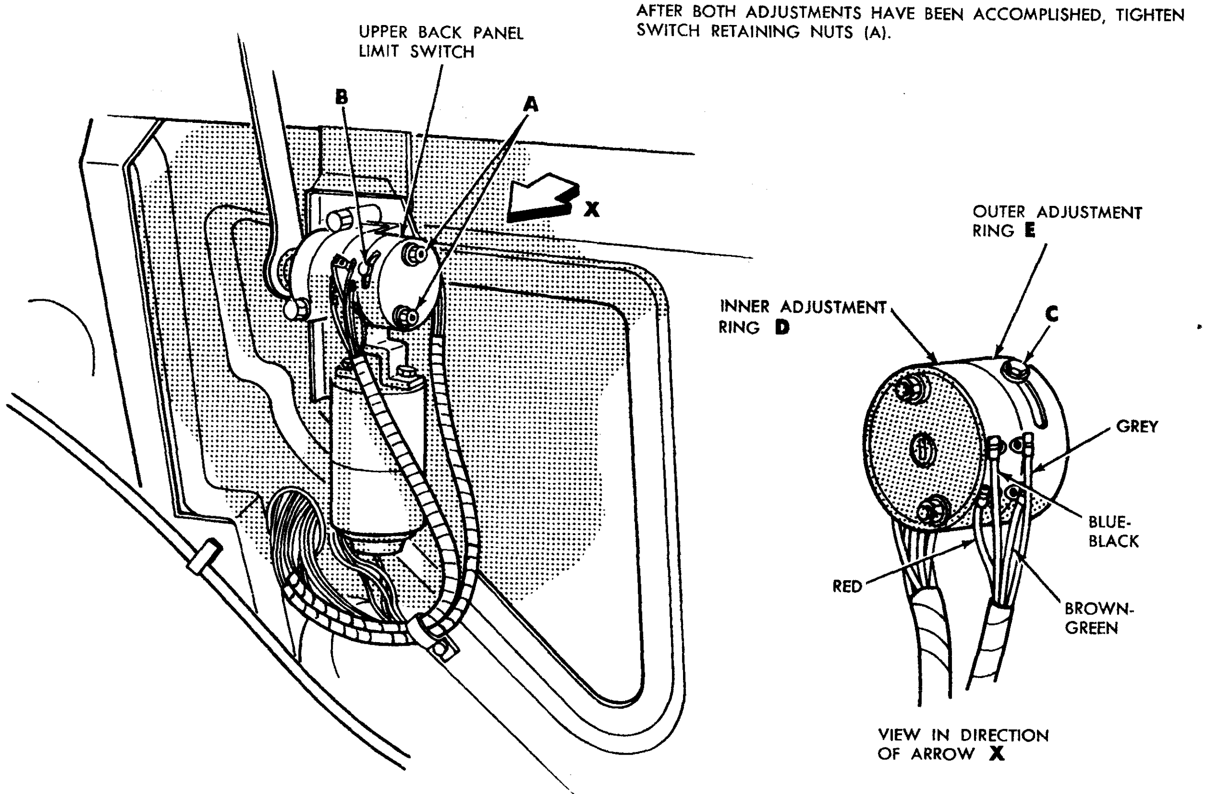
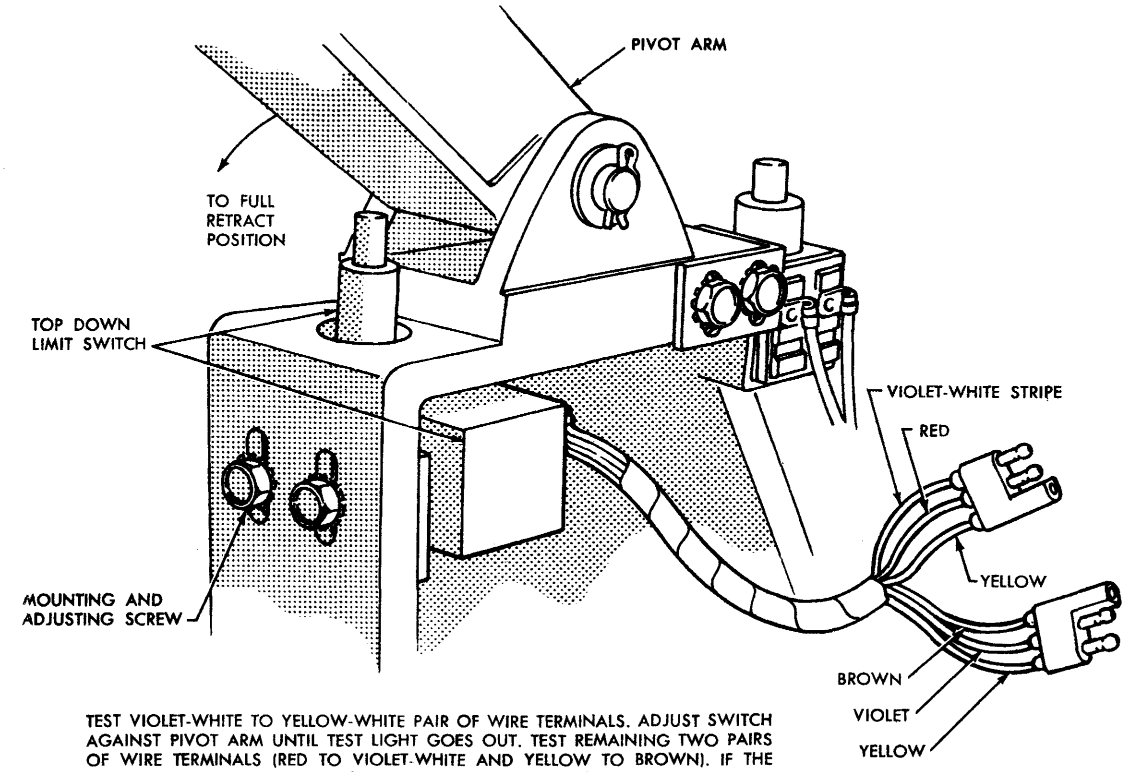


FIG. 20—Upper Back Panel Limit Switch Adjustment

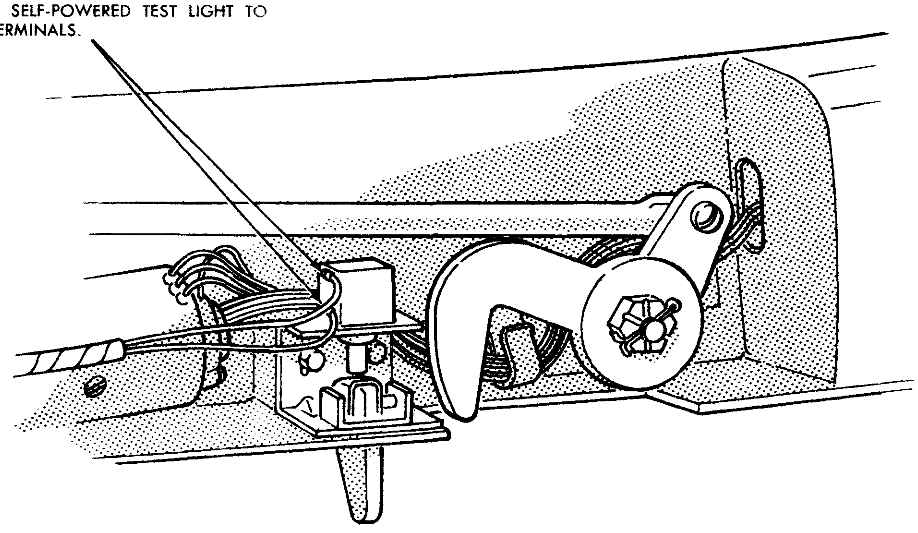


TEST VIOLET-WHITE TO YELLOW-WHITE PAIR OF WIRE TERMINALS. ADJUST SWITCH AGAINST PIVOT ARM UNTIL TEST LIGHT GOES OUT. TEST REMAINING TWO PAIRS OF WIRE TERMINALS (RED TO VIOLET-WHITE AND YELLOW TO BROWN). IF THE TEST LIGHT DOES NOT COME ON, THE SWITCH IS DEFECTIVE.

FIG. 21–Top Down Limit Switch Adjustment N1353-A

RAISE THE TOP UNTIL THE NO. 1 BOW RESTS FIRMLY ON THE WINDSHIELD HEADER AND THE LOCK HOOKS ARE ALIGNED WITH THE HOOK POCKETS. ADJUST THE SWITCH FORWARD UNTIL TEST LIGHT COMES ON.

ATTACH SELF-POWERED TEST LIGHT TO WIRE TERMINALS.



N1354-A

FIG. 22–Top Up Front Limit Switch Adjustment

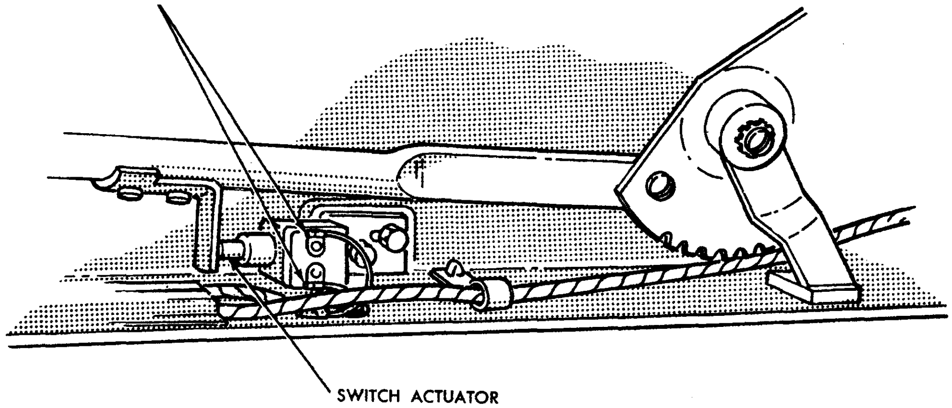


FIG. 23—Top Lock Limit Switch Adjustment

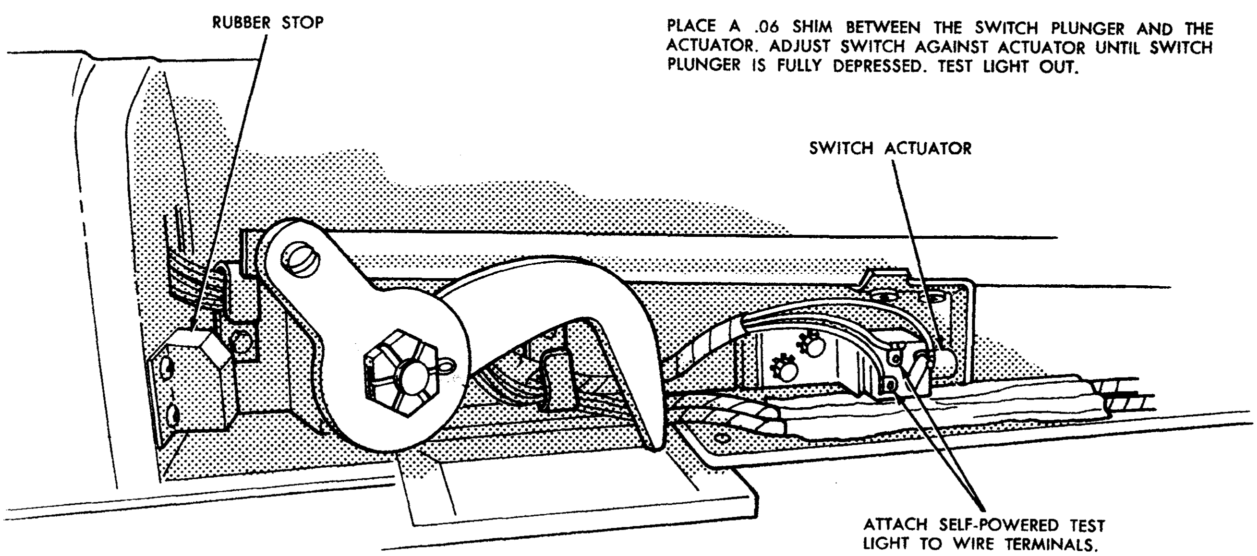


FIG. 24—Top Unlock Limit Switch Adjustment

TROUBLE DIAGNOSIS GUIDE — TOP RETRACT CYCLE — DECK LID UNLOCK (FIG. 4) (Continued)

Malfunction	Probable Cause	Corrective Action
2 NO UNLOCKING ACTION—DECK UNLOCK RELAY FUNCTIONING (AUDIBLE CLICK). (Continued)		mechanically to gain access to deck lock motor and complete circuit.
3 NO UNLOCKING ACTION—DECK LOCK MOTOR RUNNING	(a) Broken flexible shaft or loose lock nuts, one or both sides.	(a) Unlock deck lid mechanically.
4 UNLOCKING ACTION—DECK LID JUMPS OFF LOCKS	(a) Maladjusted deck closed limit switch allows top-deck motor and pump to operate early in phase and apply pressure to deck lid hydraulic cylinders before locks are clear.	(a) When deck lid has been opened, adjust deck closed limit switch. (Fig. 18.)

TROUBLE DIAGNOSIS GUIDE — TOP RETRACT CYCLE — DECK LID OPEN (FIG. 5)

1 NO DECK OPENING ACTION—DECK OPEN RELAY NOT FUNCTIONING	(a) Defective deck open relay (cycling stops as soon as deck lid locks clear).	(a) Check for voltage at yellow-violet wire terminal of deck open relay. If terminal is hot, relay is defective. Replace deck open relay. See Fig. 16.
	(b) Defective circuit. Top control switch through upper back panel limit switch, deck open limit switch L.H. and deck closed limit switch to yellow-violet wire terminal on deck open relay.	(b) If yellow-violet wire terminal of deck open relay is dead, use a jumper to bypass the deck open relay and activate the top and deck motor and pump the deck control solenoid to raise the deck lid. See Fig. 16. See also malfunction 3 (b), (c) and (d).
	(c) Defective upper back panel limit switch.	(c) With deck open for access, RELEASE TOP CONTROL SWITCH, using a self-powered test light check for open circuit between red wire terminal and black wire terminal of the eight-terminal group. If light does not come on, the switch should be adjusted before deciding it is defective. Replace defective upper back panel limit switch. At this time check violet to yellow wire terminals of the eight-terminal group and grey to black-blue wire terminal of four-terminal group.
	(d) Defective deck open limit switch L.H. **Deck lid must not be fully open to avoid repositioning of switch terminals.**	(d) TOP CONTROL SWITCH RELEASED. Using a self-powered test light, check for open circuit between yellow wire terminals of switch. If test light fails to come on, switch is defective. Also check yellow wire terminals of deck open limit switch R.H. Replace deck open limit switch(es) found defective.

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TROUBLE DIAGNOSIS GUIDE — TOP RETRACT CYCLE — DECK LID OPEN (FIG. 5) (Continued)

Malfunction	Probable Cause	Corrective Action
1 NO DECK OPENING ACTION— DECK OPEN RELAY NOT FUNCTIONING (Continued).	(e) Defective deck closed limit switch. **Deck lid open for access.**	(e) TOP CONTROL SWITCH RELEASED. Using a self-powered test light, check for open circuit between yellow wires, red wires, and white wires of switch. If test light fails to come on for any check, switch is defective. Replace deck closed limit switch.
2 NO DECK OPENING ACTION— DECK OPEN, RELAY NOT FUNCTIONING. DECK BUMPS UP AND DOWN ON LOCKS	(a) Maladjusted deck closed limit switch.	(a) Raise the deck lid manually until deck motor and pump become energized. After deck lid is open, adjust deck closed limit switch. See Fig. 18.
3 NO DECK OPENING ACTION— FUNCTIONING DECK OPEN RELAY	(a) Defective power circuit to top-deck motor and pump or deck control solenoid.	(a) A defective power circuit or defective motor or solenoid will prevent deck opening regardless of relay function and will be evident when relay jumper is applied. See 1 (b). Deck lid must be opened mechanically to gain access for repairs.
	(b) Defective deck lock motor circuit or motor.	(b) TOP CONTROL SWITCH RELEASED. If deck lock motor is not functioning, check power circuit for voltage at motor red-yellow wire terminal. Deck lid should be open, sufficient for access, only to avoid repositioning of deck open limit switch L.H. If no voltage, repair the circuit. If terminal is hot, motor is defective. Replace deck lock motor.
	(c) Broken deck lock flexible shaft(s).	(c) TOP CONTROL SWITCH RELEASED. Unlock deck lid mechanically. With deck lid open check deck lid lock shafts and lock nuts. If shaft(s) are broken, replace shafts. Otherwise, tighten lock nuts.
	(d) Faulty deck control solenoid valve or top-deck motor and pump assembly power circuits.	(d) Open deck lid mechanically. Check solenoid and motor circuits. Repair faulty circuit (Fig. 5).
	(e) Faulty deck control solenoid valve.	(e) TOP CONTROL SWITCH RELEASED. Open deck lid mechanically, sufficient for access. If circuit checks out hot at blue-red terminal on valve and the top-deck motor and pump operates when top control switch is momentarily depressed, but there is no action at deck opening cylinders, the solenoid valve is defective. Replace valve.

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TROUBLE DIAGNOSIS GUIDE—TOP RETRACT CYCLE—DECK LID OPEN (FIG. 5) (Continued)

Malfunction	Probable Cause	Corrective Action
3 NO DECK OPENING ACTION—FUNCTIONING DECK OPEN RELAY (Continued).	(f) Faulty top-deck motor and pump assembly.	(f) TOP CONTROL SWITCH RELEASED. Open deck lid mechanically, sufficient for access. If circuit checks hot at red wire terminal of motor and pump assembly, and motor does not operate when top control switch is momentarily depressed, motor is defective. Replace top-deck motor and pump assembly.

TROUBLE DIAGNOSIS GUIDE — TOP RETRACT CYCLE — UPPER BACK PANEL ERECT (FIG. 6)

1 DECK OPEN—NO UPPER BACK PANEL ACTION—UPPER BACK PANEL ERECT RELAY NOT FUNCTIONING (NO AUDIBLE CLICK)	(a) Defective upper back panel erect relay.	(a) Depress top control switch intermittently while listening for click. If no click, check for voltage at black-blue wire terminal on relay. If terminal is hot, relay is defective. Replace upper back panel relay.
	(b) Defective deck open limit switch L.H. to upper back panel erect relay circuit.	(b) Check out circuit from black-blue terminal on upper back panel erect relay connector, through upper back panel limit switch, to violet wire terminal on deck open limit switch L.H. repair circuit. See 1 (d).
	(c) Defective deck open limit switch L.H.	(c) Loosen switch actuator, press switch plunger all the way in and check between violet wire terminals on switch with self-powered test light. If light does not come on, switch is defective. Also check violet wire terminal(s) of deck open limit switch L.H. Replace defective deck open limit switch(es).
	(d) Defective upper back panel limit switch. **If defective circuits are found at this switch after switch terminals have been repositioned by erection of upper back panel, check red-green to orange and red-white to green-white wire terminals of 8-terminal group and red to brown-green wire terminals of 4-terminal group.**	(d) If circuit check performed in 1 (b) showed open circuit at black-blue to grey terminals of upper back panel limit switch, adjust the four-terminal section of switch. If adjustment does not close circuit, switch is defective. Replace upper back panel limit switch.
	(e) Defective power circuit to upper back panel erect relay.	(e) Check between ground and blue-white wire terminal on upper back panel motor. If terminal is dead, circuit is open. Repair circuit.

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TROUBLE DIAGNOSIS GUIDE—TOP RETRACT CYCLE—TOP UNLOCK (FIG. 7)

Malfunction	Probable Cause	Corrective Action
1 UPPER BACK PANEL ERECT—NO TOP UNLOCK ACTION. TOP UNLOCK RELAY NOT FUNCTIONING (NO AUDIBLE CLICK)	(a) Faulty top unlock relay.	(a) Depress top control switch intermittently and listen for relay click. If no click, bypass relay with jumper. If top lock motor is activated, check for voltage at red wire terminal on relay. If terminal is hot, relay is defective. Replace top unlock relay. If red wire terminal is dead, proceed as in 1 (b), (c), and (e). If top lock motor is not activated by jumping the relay connector, proceed as in 1 (d) in "Top Retract."
	(b) Defective top unlock limit switch to top unlock relay circuit.	(b) Check out circuit from red wire terminal on top unlock relay, through upper back panel limit switch, to brown-green wire terminal on top unlock limit switch. Repair circuit. See 1 (d) in "Top Retract."
	(c) Defective top unlock limit switch.	(c) Check between yellow wire terminal and brown wire terminal on top unlock limit switch with self-powered test light. Manually reposition switch and check yellow to white wire terminals. If light fails to come on either way, switch is defective. Replace top unlock limit switch.
	(d) Defective power circuit to top unlock motor.	(d) Check between ground and black-yellow wire terminal on motor. If terminal is dead, circuit is open. Repair circuit.
	(e) Defective upper back panel limit switch. **If defective circuits are found at this switch after switch terminals have been repositioned by erection of upper back panel, check switch adjustments before switch is considered defective.**	(e) If circuit chcek performed in 1 (b) showed open circuit at red to brown-green terminals of upper back panel limit switch, adjust the four-terminal section of the switch. If adjustment does not close the circuit, the switch is defective. Replace upper back panel limit switch.
	(f) Defective top lock motor.	(f) If yellow-black terminal wire is hot at motor case, motor is defective. Replace top lock motor.

TROUBLE DIAGNOSIS GUIDE—TOP RETRACT CYCLE—TOP RETRACT (FIG. 8)

1 TOP RETRACT—NO TOP ACTION—TOP DOWN RELAY NOT FUNCTIONING. (NO AUDIBLE CLICK)	(a) Defective top down relay.	(a) Depress top control switch intermittently and listen for relay click. If no click, bypass relay with jumper to activate top-deck motor and pump. Check for current at yellow-white wire terminal on relay. If terminal is hot, relay is defective. Replace

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TROUBLE DIAGNOSIS GUIDE — TOP RETRACT CYCLE — TOP RETRACT (FIG. 8) (Continued)

Malfunction	Probable Cause	Corrective Action
1 TOP RETRACT—NO TOP ACTION—TOP DOWN RELAY NOT FUNCTIONING. (NO AUDIBLE CLICK) (Continued)	(a) Continued	top down relay. If yellow-white wire terminal is dead, proceed as in 2 (b), (c), and (d).
	(b) Defective top unlock limit switch to top down relay circuit.	(b) Check circuit from yellow-white wire terminal on top down relay, through top down limit switch to white wire terminal on top unlock limit switch. Repair circuit. See 2 (c) and (d).
	(c) Defective top unlock limit switch. See top unlock phase.	(c) Check switch adjustment with the top unlock switch fully depressed. Check between white wire terminal and yellow wire terminal on top unlock switch with self-powered light. If light fails to come on, switch is defective. Replace top unlock limit switch.
	(d) Defective top down limit switch.	(d) Check between yellow-white wire terminal and violet-white wire terminal on top down limit switch with self-powered test lamp. If lamp fails to come on, switch is defective. Replace top down limit switch.
2 NO TOP RETRACT ACTION—TOP DOWN RELAY FUNCTIONING (AUDIBLE CLICK). TOP-DECK MOTOR AND PUMP ASSEMBLY OPERATING	(a) Defective top control solenoid valves.	(a) Check for voltage at the white-blue wire at the top control solenoid valves. If wire is hot, solenoid valve is defective. If wire is dead, check power circuit and repair.
3 NO TOP RETRACT ACION—TOP DOWN RELAY FUNCTIONING (AUDIBLE CLICK). TOP-DECK MOTOR AND PUMP ASSEMBLY NOT OPERATING	(a) Defective top-deck motor and pump assembly or power circuit.	(a) Check voltage at the yellow wire at top motor and pump assembly. If wire is hot, motor is defective. If wire is dead, check power circuit and repair.

TROUBLE DIAGNOSIS GUIDE — TOP RETRACT CYCLE — DECK LID CLOSE AND LOCK (FIG. 9)

1 NO DECK CLOSE ACTION—DECK CLOSE RELAY NOT FUNCTIONING	(a) Defective deck close relay.	(a) Check for voltage at black-green wire terminal on relay. If terminal is hot, relay is defective. Replace deck close relay. If black-green wire terminal is dead, proceed as in malfunction 1 (b) below.
	(b) Defective deck close relay to top down limit switch circuit.	(b) Check out circuit from black-green wire terminal on deck close relay through deck closed limit switch to violet-white wire terminal on top down limit switch. Repair circuit. See malfunction 2 (c) on following page.

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TROUBLE DIAGNOSIS GUIDE — TOP RETRACT CYCLE — DECK LID CLOSE AND LOCK (FIG. 9) (Continued)

Malfunction	Probable Cause	Corrective Action
1 NO DECK CLOSE ACTION—DECK CLOSE RELAY NOT FUNCTIONING (Continued)	(c) Defective top down limit switch. See top retracting phase. (d) Defective deck closed limit switch.	(c) Check between violet-white wire terminal and red wire terminal on top down limit switch with self-powered test light. If light fails to come on, switch is defective. Replace top down limit switch. (d) Check between red wire terminals on deck closed limit switch with self-powered test light. If light fails to come on, switch is defective. Replace deck closed limit switch.
2 NO DECK CLOSE ACTION—DECK CLOSE RELAY FUNCTIONING—TOP AND DECK MOTOR AND PUMP ASSEMBLY IS OPERATING	(a) Defective deck control solenoid valve.	(a) Check for voltage at deck control solenoid valve lead. If wire is hot, solenoid valve is defective. If wire is dead check power circuit and repair.
3 NO DECK CLOSE ACTION—DECK CLOSE RELAY FUNCTIONING. TOP-DECK MOTOR AND PUMP NOT OPERATING	(a) Defective top-deck motor and pump assembly or power circuit.	(a) Check voltage at the yellow wire at top-deck motor and pump assembly. If wire is hot, motor is defective. If wire is dead, check power circuit and repair.
4 NO DECK LOCK ACTION DECK LOCK MECHANISM NOT FUNCTIONING WHEN DECK LID STARTS TO CLOSE	(a) Defective deck lock relay. **Deck lock relay is activated simultaneously with deck close relay.**	(a) Check for voltage at the violet-red wire terminal of relay. If wire is hot, deck lock relay is defective. If wire terminal is dead, check for break in violet-red wire to violet-white wire circuit to the deck closed limit switch. Repair circuit.
5 NO DECK LOCK ACTION DECK LOCK RELAY FUNCTIONING	(a) Open power circuit to deck lock motor or defective deck lock motor.	(a) When deck lid starts to close, observe deck lock mechanism. If deck lock mechanism is not functioning disconnect the motor leads at the motor. Use a jumper between motor yellow-red lead and yellow-blue wire receptacle of deck lock relay connector. If motor operates, power circuit (yellow wire) is open. Repair circuit. If motor does not operate, motor is defective. Replace deck lock motor. Release top control switch.

TOP ERECT CYCLE

The top erect cycle utilizes the same motors as the top retract cycle. These motors, however, operate in the reverse direction of that for the retract cycle in the upper back panel retract, top erect, and top lock phases. The circuits, switches, and/or switch positions differ in the various phases. **All checks and tests detailed in the Top Erect Cycle Diagnosis Guide are to be performed with the top control switch pushed up (erect position).**

In the event of a stop in the cycle, release the control switch to avoid burning out a motor. If jamming is suspected, do not reactivate the control switch for over five seconds at one time until the condition is cleared.

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TROUBLE DIAGNOSIS GUIDE — TOP ERECT CYCLE — DECK LID UNLOCK (FIG. 10)

Malfunction	Probable Cause	Corrective Action
1 NO UNLOCKING ACTION—DECK UNLOCK RELAY NOT FUNCTIONING (NO AUDIBLE CLICK)	(a) Deck unlock relay defective.	(a) Move top control switch to down (retract) position. Listen for ratcheting of deck lid locks. Move top control switch to up (erect) position intermittently and listen for click of deck unlock relay (behind rear seat back cushion). If no click, remove cushion and check for voltage at orange-brown wire terminal. If terminal is hot, relay is defective. Replace deck unload relay.
	(b) No voltage at relay orange-brown terminal. Also see 1 (b) "Deck Lid Open."	(b) Bypass deck unlock relay by means of a jumper at connector terminals, as shown in Fig. 10, to activate deck lock motor.
2 NO UNLOCKING ACTION—DECK UNLOCK RELAY FUNCTIONING (AUDIBLE CLICK)	(a) Maladjusted deck closed limit switch.	(a) A maladjusted deck closed limit switch will allow the top-deck motor and pump to operate and apply pressure to the deck lift cylinders and cause lock screws to bind. Release top control switch and unlock deck lid as outlined in 1 (b). If this fails, deck lid will have to be unlocked mechanically. See 3 (a), "Deck Lid Open." See Fig. 18 for deck closed limit switch adjustment.
	(b) Defective deck lock motor circuit or motor. **Circuit and motor are inaccessible until deck is open.**	(b) If jumper is not effective in activating deck lock motor, the deck lid will have to be unlocked mechanically to gain access to deck lock motor and complete circuit. See 2 (a), "Deck Lid Open."
3 NO UNLOCKING ACTION—DECK LOCK MOTOR RUNNING	(a) Broken flexible shaft or loose lock nuts, one or both sides.	(a) Unlock deck lid mechanically.
4 UNLOCKING ACTION—DECK LID JUMPS OFF LOCKS	(a) Maladjusted deck closed limit switch allows top-deck motor and pump to operate early in phase and apply pressure to deck lid hydraulic cylinders before locks are clear.	(a) When deck lid has been opened, adjust deck closed limit switch. See Fig. 18.

TROUBLE DIAGNOSIS GUIDE — TOP ERECT CYCLE — DECK LID OPEN (FIG. 11)

1 NO DECK OPENING ACTION—DECK OPEN RELAY NOT FUNCTIONING	(a) Defective deck open relay (cycling stops as soon as deck lid locks clear).	(a) Check for voltage at yellow-violet wire terminal of deck open relay. If terminal is hot, relay is defective. Replace deck open relay. See Fig. 16.

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TROUBLE DIAGNOSIS GUIDE — TOP ERECT CYCLE — DECK LID OPEN (FIG. 11) (Continued)

Malfunction	Probable Cause	Corrective Action
1 NO DECK OPENING ACTION—DECK OPEN RELAY NOT FUNCTIONING (Continued)	**(b)** Defective circuit. Top control switch through the top down limit switch, the deck open limit switch R.H., and the deck closed limit switch to the yellow-violet wire terminal on the deck open relay (Fig. 11).	**(b)** If yellow-violet wire terminal of deck open relay is dead, use a jumper to bypass the deck open relay and activate the top-deck motor and pump and deck control solenoid to raise the deck lid (Fig. 16). See in "Deck Lid Unlock." 4 (b), (c) and (d).
	(c) Defect in top down limit switch.	**(c)** With deck lid open for access only, use a self-powered test lamp to check brown to yellow wire terminals of top down limit switch. Light should come on. Also check red to violet-white pair of wire terminals. Light should come on. If light does not come on in either case, switch is defective. Replace top down limit switch.
	(d) Defective deck open limit switch R.H. **Deck lid must not be fully open to avoid repositioning of switch terminals.**	**(d)** TOP CONTROL SWITCH RELEASED. Using a self-powered test light, check for open circuit between yellow wire terminals of switch. If test light fails to come on, switch is defective. Also check yellow wire terminals of deck open limit switch R.H. (Replace deck open limit switch (es) found defective.
	(e) Defective deck closed limit switch. **Deck lid open for access.**	**(e)** TOP CONTROL SWITCH RELEASED. Using a self-powered test light, check for open circuit between yellow wires, red wires, and white wires of switch. If test fails to come on for any check, switch is defective. Replace deck closed limit switch.
2 NO DECK OPENING ACTION—DECK OPEN RELAY NOT FUNCTIONING. DECK BUMPS UP AND DOWN ON LOCKS	**(a)** Maladjusted deck closed limit switch.	**(a)** Raise deck lid manually until deck motor and pump become energized. After deck lid is open, adjust deck closed limit switch (Fig. 18).
3 NO DECK OPENING ACTION—DECK OPEN RELAY FUNCTIONING	**(a)** Defective power circuit to top-deck motor and pump or deck control solenoid.	**(a)** A defective power circuit or defective motor or solenoid will prevent deck opening regardless of relay function and will be evident when relay jumper is applied. See 1 (b), "Deck Lid Open—Top Retract Cycle." Deck lid must be opened mechanically to gain access for repairs.
	(b) Defective deck lock motor circuit or motor.	**(b)** TOP CONTROL SWITCH RELEASED. If deck lock motor is not functioning, check power circuit for voltage at motor red-yellow wire terminal. Deck lid should be open sufficient for

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TROUBLE DIAGNOSIS GUIDE — TOP ERECT CYCLE — DECK LID OPEN (FIG. 11) (Continued)

Malfunction	Probable Cause	Corrective Action
3 NO DECK OPENING ACTION—DECK OPEN RELAY FUNCTIONING (Continued)	(b) Continued	access only to avoid repositioning of deck open limit switch L.H. If no voltage, repair the circuit. See 1 (b). If terminal is hot, motor is defective. Replace deck lock motor.
	(c) Broken deck lock flexible shaft(s).	(c) TOP CONTROL SWITCH RELEASED. With deck lid open check deck lid lock shafts and lock nuts. If shaft(s) are broken, replace shafts. Otherwise tighten lock nuts.
	(d) Faulty deck control solenoid valve or top-deck motor and pump assembly power circuits.	(d) Open deck lid mechanically. Check solenoid and motor circuits. Repair faulty circuit (Fig. 5).
	(e) Faulty deck control solenoid valve.	(e) TOP CONTROL SWITCH RELEASED. Open deck lid mechanically, sufficient for access. If circuit checks out hot at blue-red terminal on valve and the top-deck motor and pump operate when top control switch is momentarily pushed up, but there is no action at deck opening cylinders, the solenoid valve is defective. Replace valve.
	(f) Faulty top deck motor and pump assembly.	(f) TOP CONTROL SWITCH RELEASED. Open deck lid mechanically, sufficient for access. If circuit checks hot at red wire terminal of motor and pump assembly and motor does not operate when top control switch is momentarily pushed up, motor is defective. Replace top-deck motor and pump assembly.
4 NO TOP ERECTING ACTION—TOP UP RELAY NOT FUNCTIONING (NO AUDIBLE CLICK)	(a) Defective top up relay.	(a) Push top control switch up intermittently while listening for click of relay. If no click, check for voltage at green wire terminal on relay. If terminal is hot, relay is defective. Replace top up relay. If green wire terminal is dead proceed as in 4 (b).
	(b) Defective circuit from top control switch, through top up limit switch rear, deck open limit switch R.H. to top up relay.	(b) TOP CONTROL SWITCH RELEASED. Check out circuit and switches using a self-powered test light (Fig. 12). See 4 (c) and (d).
	(c) Defective top up limit switch.	(c) TOP CONTROL SWITCH RELEASED. Check between terminals of switch. If light fails to come on, switch is defective. Replace top up limit switch.

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TROUBLE DIAGNOSIS GUIDE – TOP ERECT CYCLE – DECK LID OPEN (FIG. 11) (Continued)

Malfunction	Probable Cause	Corrective Action
4 NO TOP ERECTING ACTION—TOP UP RELAY NOT FUNCTIONING (NO AUDIBLE CLICK) (Continued)	(d) Defective deck open limit switch R.H.	(d) TOP CONTROL SWITCH RELEASED. Check between violet wire terminals of switch. If light fails to come on, switch is defective. Replace deck open limit switch. See 1 (c), "Upper Back Panel Erect–Top Retract Cycle."
5 NO TOP ERECT ACTION—TOP UP RELAY FUNCTIONING	(a) Defective top and deck motor and pump assembly.	(a) Disconnect the 2-wire connector on motor leads. Jumper from each motor lead in turn to bus bar on relay panel. If motor is not activated, it is defective. Replace top-deck motor and pump assembly.
	(b) Defective top-deck motor power circuit.	(b) If motor will operate, connect leads disconnected in 5 (a) above and push top control switch up. If motor still does not operate, the motor power circuit is defective. Repair defective circuit (red wire) or (yellow wire).
	(c) Defective top control solenoid valves power circuits.	(c) Disconnect solenoid valve leads, and with ordinary test lamp, check for voltage from lead terminal to ground. If either or both leads are defective, check and repair wire circuit (Fig. 13).
	(d) Defective top control solenoid valves.	(d) If solenoid power lead(s) is hot, solenoid valve(s) is defective. Replace top control solenoid valve.

TROUBLE DIAGNOSIS GUIDE – TOP ERECT CYCLE – TOP LOCK (FIG. 13)

1 NO TOP LOCK ACTION—TOP LOCK RELAY NOT FUNCTIONING (NO AUDIBLE CLICK)	(a) Defective top lock relay.	(a) Push top control switch up intermittently, while listening for click. If no click, check for voltage at orange wire terminal of relay connector. If wire is hot, relay is defective. Replace top lock relay. If orange wire terminal is dead proceed as in 5 (b), "Deck Lid Open – Top Erect Cycle." The top lock relay may be bypassed and the top lock motor may be energized by a jumper wire from center receptacle to the black-red wire receptacle of top lock relay connector. See 1 (e).
	(b) Defective circuit from top control switch, through top up limit switch front, and upper back panel limit switch to top lock relay. **Remove top front bow cover to reach top lock motor and switches.**	(b) TOP CONTROL SWITCH RELEASED. Check out circuit wiring and switches using self-powered test light (Fig. 13). See 1 (c) and (d).

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TROUBLE DIAGNOSIS GUIDE — TOP ERECT CYCLE — TOP LOCK (FIG. 13) (Continued)

Malfunction	Probable Cause	Corrective Action
1 NO TOP LOCK ACTION—TOP LOCK RELAY NOT FUNCTIONING (NO AUDIBLE CLICK) (Continued)	(c) Defective top up limit switch front.	(c) Open top No. 1 bow cover. Check between wire terminals of switch. If light does not come on, switch is defective. Replace top up limit switch front.
	(d) Defective upper back panel limit switch.	(d) Check between red-green and orange wire terminals. If test light does not come on, switch is defective.
	(e) Defective top lock motors or circuit. See 5 (a), "Deck Lid Open–Top Erect Cycle."	(e) If top lock motor or circuit is found to be defective when relay is bypassed by jumper, check the motor circuit for voltage at the live side of the motor connector. If circuit is dead, repair circuit (black-red wire). If circuit is hot, motor is defective. Replace top lock motor.

TROUBLE DIAGNOSIS GUIDE — TOP ERECT CYCLE — UPPER BACK PANEL RETRACT (FIG. 14)

1 NO UPPER BACK PANEL RETRACT ACTION—RELAY NOT FUNCTIONING (NO AUDIBLE CLICK)	(a) Defective upper back panel retract relay.	(a) Push top control switch up intermittently while listening for relay click. If no click, check for voltage at the red-white wire receptacle of the relay connector. If circuit is hot, relay is defective. Replace upper back panel retract relay. If circuit is dead, proceed as in 1 (b).
	(b) Defective circuit from top control switch, through the top lock limit switch, and the upper back panel retract relay.	(b) TOP CONTROL SWITCH RELEASED. Check out circuit wiring and switches using self-powered test light (Fig. 14), see 1 (c) and (d).
	(c) Defective top lock limit switch.	(c) Open No. 1 top bow cover and apply test light between the terminals of switch. (The switch plunger should be fully depressed when top is locked). If light does not come on, switch is defective. Replace top lock limit switch.
	(d) Defective upper back panel limit switch.	(d) Using self-powered test light, check between the green-white and the red-white wire terminals of the switch. If light does not come on, make sure the switch is properly adjusted before deciding it is defective (Fig. 20).
	(e) Defective upper back panel motor or power circuit (Fig. 14).	(e) Disconnect motor leads at motor. Use a jumper between each motor lead and bus bar on relay panel. If motor does not operate, the motor is defective. Replace upper back panel motor. If motor operates, check the power circuits back to the relay and the 15-ampere circuit breaker.

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TROUBLE DIAGNOSIS GUIDE – TOP ERECT CYCLE – DECK LID CLOSE AND LOCK (FIG. 15)

Malfunction	Probable Cause	Corrective Action
1 NO DECK CLOSE ACTION— DECK CLOSE RELAY NOT FUNCTIONING	(a) Defective deck close relay.	(a) Check for voltage at black-green wire terminal on relay. If terminal is hot, relay is defective. Replace deck close relay. If black-green wire terminal is dead, proceed as in 1 (b).
	(b) Defective circuit from top control switch, through the upper back panel limit switch, and the deck closed limit switch to relay.	(b) TOP CONTROL SWITCH RELEASED. Check out circuit wiring and switches using self-powered test light (Fig. 15). See 1 (c) and (d).
	(c) Defective upper back panel limit switch.	(c) Check between violet and yellow wires of switch. If the light does not come on, switch is defective. Check switch adjustment before replacing switch.
	(d) Defective deck closed limit switch.	(d) Check between red wire terminals on deck closed limit switch with self-powered test light. If light fails to come on, switch is defective. Replace deck closed limit switch.
2 NO DECK CLOSE ACTION— DECK CLOSE RELAY FUNCTIONING. TOP-DECK MOTOR AND PUMP ASSEMBLY IS OPERATING	(a) Defective deck control solenoid valve.	(a) Check for voltage at deck control solenoid valve lead. If wire is hot, solenoid valve is defective. If wire is dead, check power circuit and repair.
3 NO DECK CLOSE ACTION— DECK CLOSE RELAY FUNCTIONING. TOP-DECK MOTOR AND PUMP NOT OPERATING	(a) Defective top-deck motor and pump assembly or power circuit.	(a) Check voltage at the yellow wire at top motor and pump assembly. If wire is hot, motor is defective. If wire is dead, check power circuit and repair.
4 NO DECK LOCK ACTION— DECK LOCK MECHANISM NOT FUNCTIONING WHEN DECK LID STARTS TO CLOSE	(a) Defective deck lock relay. **Deck lock relay is activated simultaneously with deck close relay.**	(a) If relay is not activated in the cycle, relay is defective.
5 NO DECK LOCK ACTION— DECK LOCK RELAY FUNCTIONING	(a) Open power circuit to deck lock motor or defective deck lock motor.	(a) When deck lid starts to close, observe deck lock mechanism. If deck lock mechanism is not functioning, disconnect the motor leads at the motor. Use a jumper between motor yellow-red lead and yellow-blue wire receptacle of deck lock relay connector. If motor operates, power circuit (yellow wire) is open. Repair circuit. If motor does not operate, motor is defective. Replace deck lock motor.

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MAINTENANCE SCHEDULE

GROUP 19

THOUSANDS OF MILES OR NUMBER OF MONTHS, WHICHEVER OCCURS FIRST (Except Where Noted)	As Required	6	12	18	24	30	36
ENGINE							
Change oil and filter		X	X	X	X	X	X
Adjust carburetor—Idle speed, idle mixture, and fast (cold) idle speed	X						
Clean carburetor air cleaner and filter		X	X	X	X	X	
Replace carburetor air cleaner filter							X
Replace crankcase oil filler breather cap			X		X		X
Check engine accessory drive belts and adjust or replace as required		X		X		X	
Clean positive crankcase ventilation system			X		X		X
Clean positive crankcase ventilation system valve		X	X	X	X	X	X
Check ignition timing and adjust as required			X		X		X
Check and adjust or replace distributor points	X						
Check and adjust or replace spark plugs	X						
Replace fuel filter		X		X		X	
Adjust accelerator pump lever	X						
Replace engine coolant							X*
Check engine coolant level	X						
TRANSMISSION							
Adjust Turbodrive transmission bands as required — Rear							X†
Adjust Turbodrive transmission bands as required — Front							X†
Check transmission oil level		X	X	X	X	X	X
CHASSIS							
Inspect and cross-switch wheels and tires		X	X	X	X	X	X
Check power steering reservoir fluid level		X	X	X	X	X	X
Check master cylinder fluid level		X	X	X	X	X	X
Check axle fluid level		X	X	X	X	X	X
Lubricate front suspension ball joints							X
Lubricate steering linkage							X
Change power steering filter							X
Check and adjust steering gear pre-load as required			X	X	X	X	X
Clean and pack front wheel bearings as required						X†	
Lubricate universal joints							X
Check brake lines and lining						X	
Check air conditioning system	ANNUALLY AT BEGINNING OF A/C SEASON						
Check front wheel alignment and adjust as required			X		X		X
Check tire pressure	X						
Check battery fluid level	X						
BODY							
Lubricate hood latch	X						
Lubricate hood auxiliary catch	X						
Lubricate door lock cylinders	X						
Lubricate luggage compartment lock cylinder	X						
Lubricate fuel filler door hinges	X						
Check convertible top operation	X						
Clean body drain holes	X						
Check convertible top fluid level	X						
Replace windshield wiper blades	X						
Lubricate door hinge and hinge check	X						
Lubricate hood hinge pivots	X						
Lubricate luggage compartment hinge pivots	X						

*Or every two years. †At mileage interval only.

MAINTENANCE OPERATIONS GROUP 20

PART 20-1 MAINTENANCE OPERATIONS

1 ENGINE

CHANGE OIL AND FILTER

REMOVAL

1. Raise the car.
2. Remove the oil pan drain plug, and allow the engine oil to drain into a container.
3. Place a drip pan under the filter assembly (Fig. 1).
4. Turn the filter counterclockwise and remove it from the adapter.

INSTALLATION

1. Clean the gasket surfaces at the adapter.
2. Coat the gasket on the filter with a light film of oil. Screw the filter onto the adapter until it is snug; then, advance it ¼ turn. **Do not overtighten the filter.**
3. Remove the drip pan and lower the car.
4. Fill the crankcase to its required level with the proper type and grade of lubricant.
5. Start the engine. Operate the engine at fast idle and check for oil leakage.
6. Add additional lubricant if required.

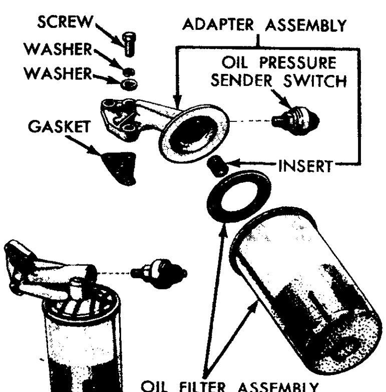

FIG. 1–Rotunda Oil Filter & Adapter

ADJUST CARBURETOR–IDLE SPEED, IDLE MIXTURE, AND FAST (COLD) IDLE SPEED

IDLE FUEL MIXTURE AND IDLE SPEED ADJUSTMENTS

The idle fuel mixture is controlled by the idle mixture adjusting screws (Fig. 2). Turn the screws inward to lean the mixture, and outward to enrich the mixture supplied to the intake manifold.

The idle speed (air) adjustment screw (Fig. 2) is used to adjust idle speed. Turn the screw outward to increase speed. Conversely, turn the screw inward to decrease speed. Turning the screw outward leans the mixture, thus requiring an adjustment at the idle mixture screws.

If one of the idle adjustments is changed, the other idle adjustments may also be affected. It is necessary that the adjustments be made in the

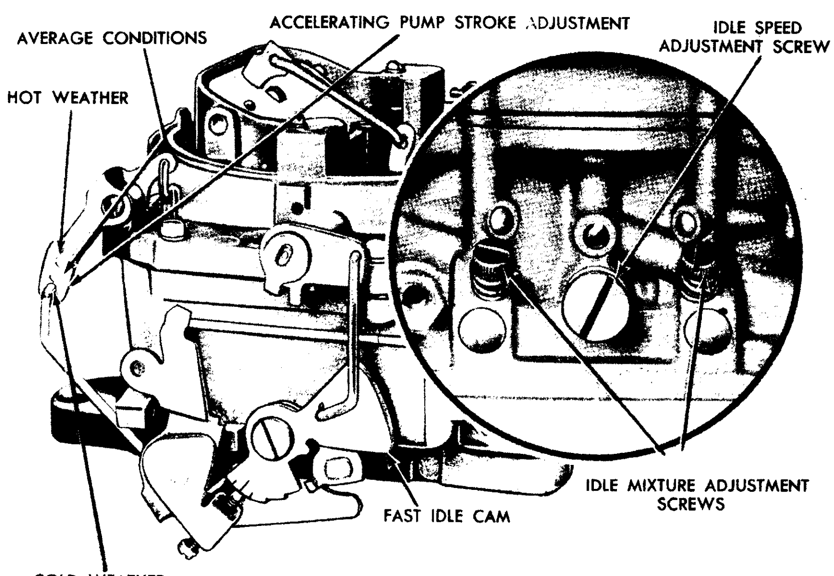

FIG. 2–Idle Fuel Mixture, Idle Speed and Accelerator Pump Stroke Adjustments

order listed, and all of the idle adjustments that follow the one being made must be checked:

1. Idle Mixture Adjustment.
2. Hot Idle Rpm Adjustment.
3. Fast Idle Rpm Adjustment.

When setting the engine idle speed on cars equipped with an air conditioner, the air conditioner should be turned off and the air cleaner removed. **If the air conditioner is turned on (with the air cleaner removed), a slight roughness of the engine idle may be noted. This may be disregarded, since the air cleaner traps vapors and allows them to enrich the mixture to again regain a smooth idle.**

Hot Idle RPM Adjustment

1. Run the engine until it reaches normal operating temperature. If the engine is cold, it should be run for approximately one-half hour at 1200 rpm to stabilize the temperature.

2. Allow the throttle to drop back to the normal idle speed position. Attach a tachometer to the engine. Remove the vacuum line from the vacuum power unit of the automatic vacuum release parking brake assembly, and plug the vacuum line. Set the parking brake. **It is necessary to inactivate the vacuum power unit to keep the parking brake engaged during the adjustment procedures.**

3. Place a small weight on the idle compensator spring to hold the compensator closed. **If the compensator is open, because of high underhood temperatures, the idle speed adjustment would be incorrect when the compensator closes.**

4. Adjust the idle speed and mixture screws (Fig. 2) to obtain the specified engine idle speed with the transmission selector in DRIVE position. **The final mixture setting should be slightly on the rich side.**

5. Remove the weight from the compensator spring.

Fast Idle RPM Adjustment. This adjustment is made only after the engine has been run for 30 minutes at 1200 rpm.

1. With the engine at a stabilized, normal operating temperature and the fast idle screw resting on the lowest (slowest) step of the cam, adjust the fast idle screw (Fig. 2) to obtain the specified fast idle rpm with the transmission in DRIVE range.

2. Remove the tachometer. Turn off the engine. Connect the vacuum line to the vacuum power unit of the vacuum release parking brake assembly.

3. Install the air cleaner assembly.

CLEAN CARBURETOR AIR CLEANER AND FILTER

REMOVAL

1. Remove the wing nuts retaining the air cleaner assembly to the carburetor and the air duct.

2. Remove the air cleaner assembly from the carburetor. **To prevent dirt from entering the carburetor, the filter element must never be removed when the air cleaner body is mounted on the carburetor.**

3. Remove the cover and filter element. Discard the air cleaner mounting gasket on the carburetor if it is excessively worn or damaged.

FILTER ELEMENT

The filter element must never be cleaned with a solvent or cleaning solution. Also, oil must not be added to the surfaces of the filter element or air cleaner body.

There are two procedures that can be used to clean the air filter element. One method is performed with the use of compressed air. The other is performed by tapping the element on a smooth horizontal surface.

Compressed Air Method. Direct a stream of compressed air through the element in the direction opposite that of the intake air flow, that is from the inside outward. **Extreme care must be exercised to prevent rupture of the element material.**

Tapping Method. Hold the element in a vertical position and tap it lightly against a smooth, horizontal surface to shake the dust and dirt out. **Do not deform the element or damage the gasket surfaces by tapping too hard.** Rotate the filter after each tap until the entire outer surface has been cleaned.

Inspection. Hold the filter in front of a back-up light and carefully inspect it for any splits or cracks. If the filter is split or cracked, replace it.

BODY AND COVER

Clean the air cleaner body and cover with a solvent or compressed air. Wipe the air cleaner dry if a solvent is used. Inspect the air cleaner body and cover for distortion or damage at the gasket mating surfaces. Replace the cover or body if they are damaged beyond repair.

INSTALLATION

1. Install a new air cleaner mounting gasket, if necessary. Install the air cleaner body on the carburetor so that the word "FRONT" faces the front of the car.

2. Place the element in the air cleaner body. **Make sure the element gasket is properly seated.** Install the cover and connect the air duct to the air cleaner. Tighten the retaining wing nuts.

REPLACE CARBURETOR AIR CLEANER FILTER

REMOVAL

1. Remove the wing nuts retaining the air cleaner assembly to the carburetor and the air duct.

2. Remove the air cleaner assembly from the carburetor. **To prevent dirt from entering the carburetor, the filter element must never be removed when the air cleaner body is mounted on the carburetor.**

3. Remove the cover and filter element. Discard the filter element. Discard the air cleaner mounting gasket if it is excessively worn or damaged.

INSTALLATION

1. Install a new air cleaner mounting gasket, if necessary. Install the air cleaner body on the carburetor so that the word "FRONT" faces the front of the car.

2. Place the new element in the air cleaner body. **Make sure the element is properly seated.** Install the cover and connect the air duct to the air cleaner. Tighten the retaining wing nuts.

REPLACE CRANKCASE OIL FILLER BREATHER CAP

CHECK ENGINE ACCESSORY DRIVE BELTS AND ADJUST OR REPLACE AS REQUIRED

Adjust the tension of the drive belts as follows:

1. Remove the alternator splash shield. Loosen the alternator mounting bolts.

2. Loosen the alternator adjusting bracket bolt.

3. Install the belt tension gauge on the fan drive belts (Fig. 3). Move the alternator toward or away from

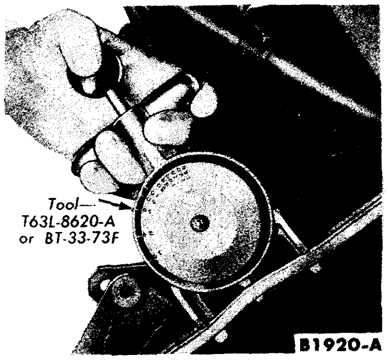

FIG. 3–Fan Drive Belt Tension Adjustment

the engine until the specified belt tension is obtained. Remove the gauge. Tighten the alternator adjusting bracket bolt; then tighten the alternator mounting bolts. Install the tension gauge and check the belt tension.

4. **On cars equipped with air conditioning,** remove the bolts securing the compressor to the support bracket that is attached to the cylinder head.

Loosen the bolts securing the compressor to the compressor mounting bracket.

Install the tension gauge on the compressor clutch drive belt. Move the compressor toward or away from the engine until the specified belt tension is obtained. Remove the gauge. Tighten the compressor to support bracket bolts. Install the tension gauge and check the belt tension.

5. **New belt(s):** Run the engine for 10 minutes, then check the tension of the belts to make certain that they are within the reset specifications. Adjust the belts, if required.

6. Install the alternator splash shield.

CLEAN POSITIVE CRANKCASE VENTILATION SYSTEM

The positive crankcase ventilation components are shown in Fig. 4.

REMOVAL

1. Remove the air cleaner.
2. Loosen the clamp securing the hose to the regulator valve. Remove the hose and clamp. Remove the regulator valve from the ventilation tube fitting.
3. Loosen the clamps securing the hose to the ventilation tube and carburetor spacer. Remove the hose and clamps.
4. Loosen the ventilation tube bracket retaining nuts and washers, then slide the ventilation tube out.
5. Remove the retaining bolts securing the outlet adapter to the valve push rod chamber cover. Remove the outlet adapter gasket and oil separator element.

CLEANING

Clean the valve, element, tube and outlet adapter in clean carburetor solvent and dry them with compressed air. Clean the rubber hose connections with a low-volatility, petroleum-base solvent and dry them with compressed air.

INSTALLATION

1. Install the oil separator element in the valve push rod chamber cover. Make certain the screen is positioned snugly around the edges of the opening.
2. Coat a new outlet adapter gasket with oil-resistant sealer and position it on the push rod chamber cover. Position the outlet adapter on the cover and install the retaining bolts.
3. Slide the ventilation tube brackets under the retaining washers and nuts. Tighten the nuts. Install the regulator valve in the ventilation tube fitting.
4. Install the hose and clamp on the outlet adapter and regulator valve. Position and tighten the clamp.
5. Install the hose and clamps on the carburetor spacer and ventilation tube.
6. Install the air cleaner.

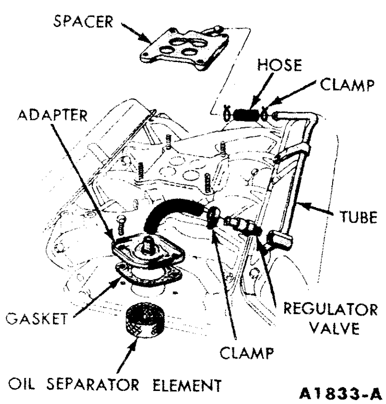

FIG. 4–Positive Crankcase Ventilation System

CLEAN POSITIVE CRANKCASE VENTILATION SYSTEM REGULATOR VALVE

REMOVAL

1. Remove the air cleaner.
2. Loosen the clamp securing the hose to the regulator valve. Remove the hose and clamp. Remove the regulator valve from the ventilation tube fitting.
3. Clean the valve in clean carburetor solvent and dry it with compressed air.
4. Install the regulator valve in the ventilation tube fitting.
5. Install the hose and clamp on the regulator valve. Position and tighten the clamp.
6. Install the air cleaner.

CHECK AND ADJUST IGNITION TIMING

TIMING MARK LOCATIONS

The crankshaft damper (Fig. 5) has 15 timing marks ranging from top dead center (TDC) to 30° before top dead center (BTDC). Refer to specifications for the correct ignition timing.

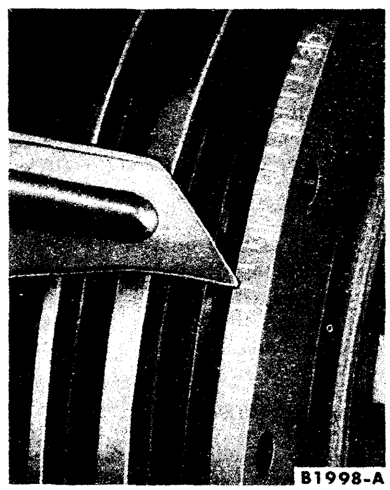

FIG. 5–Timing Marks

TIMING

1. Disconnect the vacuum line. If necessary, clean and mark the desired timing mark (Fig. 5).
2. Attach a timing light to the number one spark plug.
3. Connect a tachometer to the engine.

NOTE: When connecting a tachometer to a car equipped with

a transistorized ignition, connect the leads to the tachometer block (positive lead to red terminal, negative to black).

4. Start the engine and adjust the speed to the specified rpm for initial timing adjustment. Allow the engine to warm up.

5. Observe the timing with the light.

6. If the timing is not correct, loosen the hold down bolt and rotate the distributor clockwise to advance the timing or counterclockwise to retard it.

7. Tighten the hold down bolt and check the timing.

CHECK AND ADJUST OR REPLACE DISTRIBUTOR POINTS

Unsnap the distributor cap retaining clips, lift the distributor cap off the distributor housing, and position the cap out of the way (if necessary, remove the air cleaner and/or the high tension wire to gain access to the distributor).

Lift the rotor off the cam. Remove the dust cover (transistorized ignition).

INSPECTION

Replace the distributor point assembly if the contacts are badly burned or excessive metal transfer between the points is evident. Metal transfer is considered excessive when it equals or exceeds the gap setting.

REMOVAL

1. Remove the primary distributor-transfer is considered excessive when (if equipped) from the breaker plate.

2. Remove the screw nearest the distributor points, then remove the distributor point assembly.

INSTALLATION

1. When installing new distributor points, reverse the procedure for removal and make sure that the ground wire is attached to the distributor point assembly attaching screw which is furthest from the distributor points.

2. If the used points are serviceable, set the gap using a dwell meter.

To set the gap width with a dwell meter:

Connect the dwell meter following the manufacturer's instructions.

NOTE: On a car equipped with transistor ignition, make sure that the dwell meter is connected to the tachometer block rather than the coil.

Operate the engine at idle speed and note the reading on the dwell meter.

Stop the engine and adjust the gap (decreasing the gap increases the dwell). Now check the dwell again.

Repeat this procedure until specified dwell is obtained.

If new points are installed, set the gap to specifications using a feeler gauge.

3. Install the dust cover (transistorized ignition).

4. Install the rotor. Install the distributor cap on the distributor housing and snap the retaining clips in place.

5. Install the air cleaner and/or the high tension lead if either was removed.

The distributor point assembly consists of the stationary point bracket assembly, breaker arm and the primary wire terminal. Distributor points can be cleaned with chloroform and a stiff bristle brush. Replace the distributor point assembly if the contacts are badly burned or excessive metal transfer between the points is evident. Metal transfer is considered excessive when it equals or exceeds the gap setting.

To remove the distributor points:

1. Unsnap the distributor cap retaining clips, lift the distributor cap off the distributor housing, and position the cap out of the way (remove the air cleaner and the distributor-to-coil high tension wire to gain access to the distributor).

2. Lift the rotor off the cam. Remove the dust cover (transistorized ignition).

3. Working from the inside of the distributor, remove the primary distributor-transistor lead and condenser wire (if equipped) from the breaker plate.

4. Remove the screw nearest the distributor points, then remove the distributor point assembly.

5. When installing new distributor points, reverse the above procedure and make sure that the ground wire is attached to the distributor point assembly attaching screw which is furthest from the breaker points.

CHECK AND ADJUST OR REPLACE SPARK PLUGS

REMOVAL

1. Remove the wire from each spark plug by grasping the moulded cap of the wire only. **Do not pull on the wire because the wire connection inside the cap may become separated or the weather seal may be damaged.**

2. Clean the area around each spark plug port with compressed air, then remove the spark plugs.

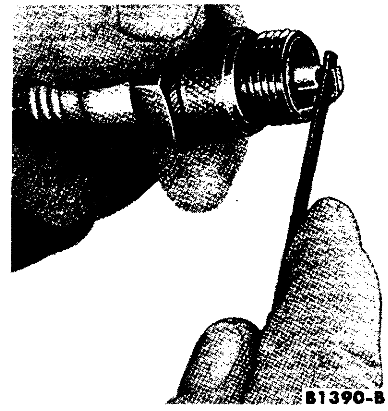

FIG. 6—Cleaning Plug Electrode

ADJUSTMENT

Set the spark plug gap to specifications by bending the ground electrode (Fig. 7).

Examine the firing ends of the spark plugs, noting the type of deposits and the degree of electrode erosion.

Clean the plugs on a sand blast cleaner, following the manufacturer's instructions. **Do not prolong the use of the abrasive blast as it will erode the insulator.** Remove carbon and other deposits from the threads with a stiff wire brush. Any deposits will retard the heat flow from the plug to the cylinder head

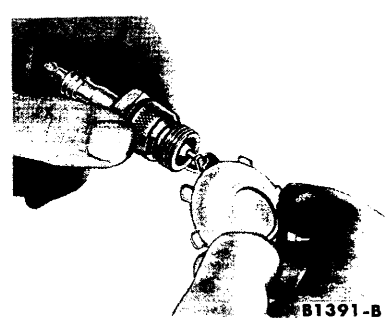

FIG. 7—Gapping Spark Plug

causing spark plug overheating and pre-ignition.

Clean the electrode surfaces with a small file (Fig. 6). Dress the electrodes to secure flat parallel surfaces on both the center and side electrode.

After cleaning, examine the plug carefully for cracked or broken insulators, badly pitted electrodes, and other signs of failure. Replace as required.

INSTALLATION

1. Install the spark plugs and torque each plug to 15-20 ft-lbs. When a new spark plug is installed in a new replacement cylinder head, torque the plug to 20-30 ft-lbs.
2. Connect the spark plug wires. Push all weather seals into position.

REPLACE FUEL FILTER

A replaceable fuel filter is located between the fuel pump and the carburetor fuel inlet line (Fig. 8).

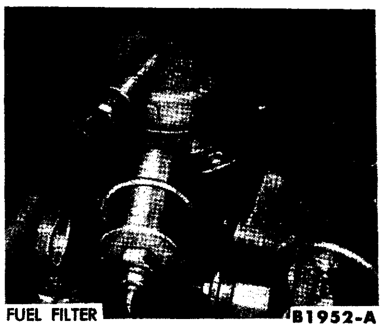

FIG. 8—Fuel Filter

REPLACEMENT

1. Disconnect the fuel line from the filter. Unscrew the filter from the fuel pump.
2. Screw the new filter into the fuel pump. **Do not over-tighten it.** Connect the fuel line to the fuel filter. **Use a wrench on the filter connection to prevent it from turning when connecting the line.**
3. Operate the engine and check the fuel line and filter connections for leaks.

ADJUST ACCELERATING PUMP LEVER

OPERATING ROD

1. With the accelerating pump operating rod in the top hole (long pump stroke) of the pump arm and the throttle plates closed, measure the distance from the top surface of the air horn to the top of the plunger shaft (Fig. 9). The distance should be within specification.
2. To adjust the distance, bend the accelerating pump operating rod at the existing lower bend, as necessary (Fig. 9).

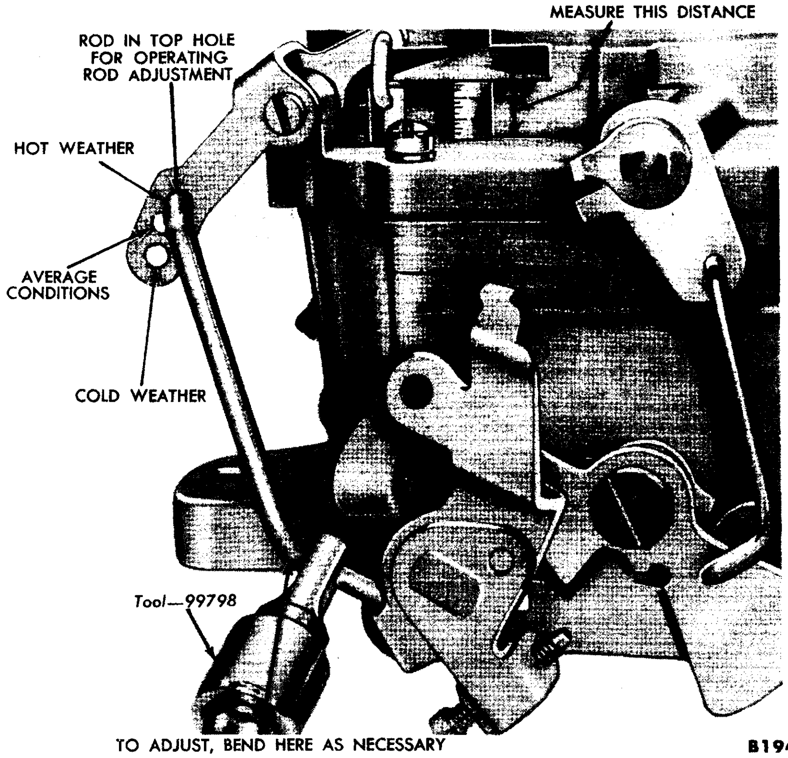

FIG. 9—Acceleration Pump Adjustment

PUMP STROKE

The accelerating pump stroke adjustment compensates for the fuel needs of the engine during extremes of hot or cold temperature. Insert the accelerating pump operating rod into the appropriate hole in the pump arm for the climate in which the car is to be driven (Fig. 9).

REPLACE ENGINE COOLANT

1. Remove the radiator cap slowly. **Sudden release of the pressure will cause "false boiling" and ejection of coolant.** Open the radiator drain cock and remove the cylinder block drain plugs to drain the cooling system.
2. Clean or flush the cooling system, if required.

To fill the cooling system:

1. Close the radiator petcock and install the cylinder block drain plugs.

Move the heater control dial indicator clockwise to the "MAX" heat zone.

2. Fill the system with coolant to a point one inch below the bottom of the supply tank filler neck.

Install the pressure cap and turn it clockwise until the first stop is reached. **This will allow the cooling system to vent entrapped air into the atmosphere. Do not tighten the cap fully.**

3. Operate the engine until normal operating temperatures are reached. **After the initial fill, the coolant level drops due to the displacement of entrapped air.** Add more coolant to fill the supply tank to the required level. Tighten the pressure cap.
4. Check the cooling system for leakage. Move the heater control dial indicator to the "MIN" heat zone. Turn the ignition key to the "OFF" position.

CHECK ENGINE COOLANT LEVEL

The coolant level should be kept 1 inch below the bottom of the filler neck.

2 TRANSMISSION

ADJUST TRANSMISSION BANDS

FRONT BAND ADJUSTMENT

The front band is adjusted **externally.** The adjusting screw is threaded through the left front side of the transmission case (Fig. 10). Tools 7345 and 7345-L are required to adjust the front band (Fig. 11).

1. Raise the car. Remove the transmission linkage splash shield.

2. Remove all dirt from the adjusting screw threads, then oil the threads. Loosen the adjusting screw lock nut.

3. Tighten the adjusting screw with tool 7345 until the tool handle "breaks" over center. **If the adjusting screw is tighter than wrench capacity (10 ft-lbs), loosen the adjusting screw and readjust the screw.**

4. Back the adjusting screw off exactly **three turns. Severe damage may result if the adjusting screw is not backed off exactly three complete turns.**

5. Hold the adjusting screw stationary and tighten the lock nut to 35-40 ft-lbs.

REAR BAND ADJUSTMENT

1. Fold back the floor mat to expose the right side of the floor pan.

2. Remove the access hole cover from the floor pan. Remove all dirt from the adjusting screw threads, then oil the threads (Fig. 12).

3. Loosen the rear band adjusting screw lock nut with tool 7195-C, as shown in Fig. 12. Using the T-handle on the tool, tighten the adjusting screw until the wrench overruns. **If the screw is found to be tighter than wrench capacity (10 ft-lbs), loosen the screw and retighten until the wrench overruns.**

4. Back off the adjusting screw 1½ turns. Hold the adjusting screw stationary, and tighten the adjusting screw lock nut to approximately 35-40 ft-lbs.

Severe damage may result if the adjusting screw is not backed off exactly 1½ turns.

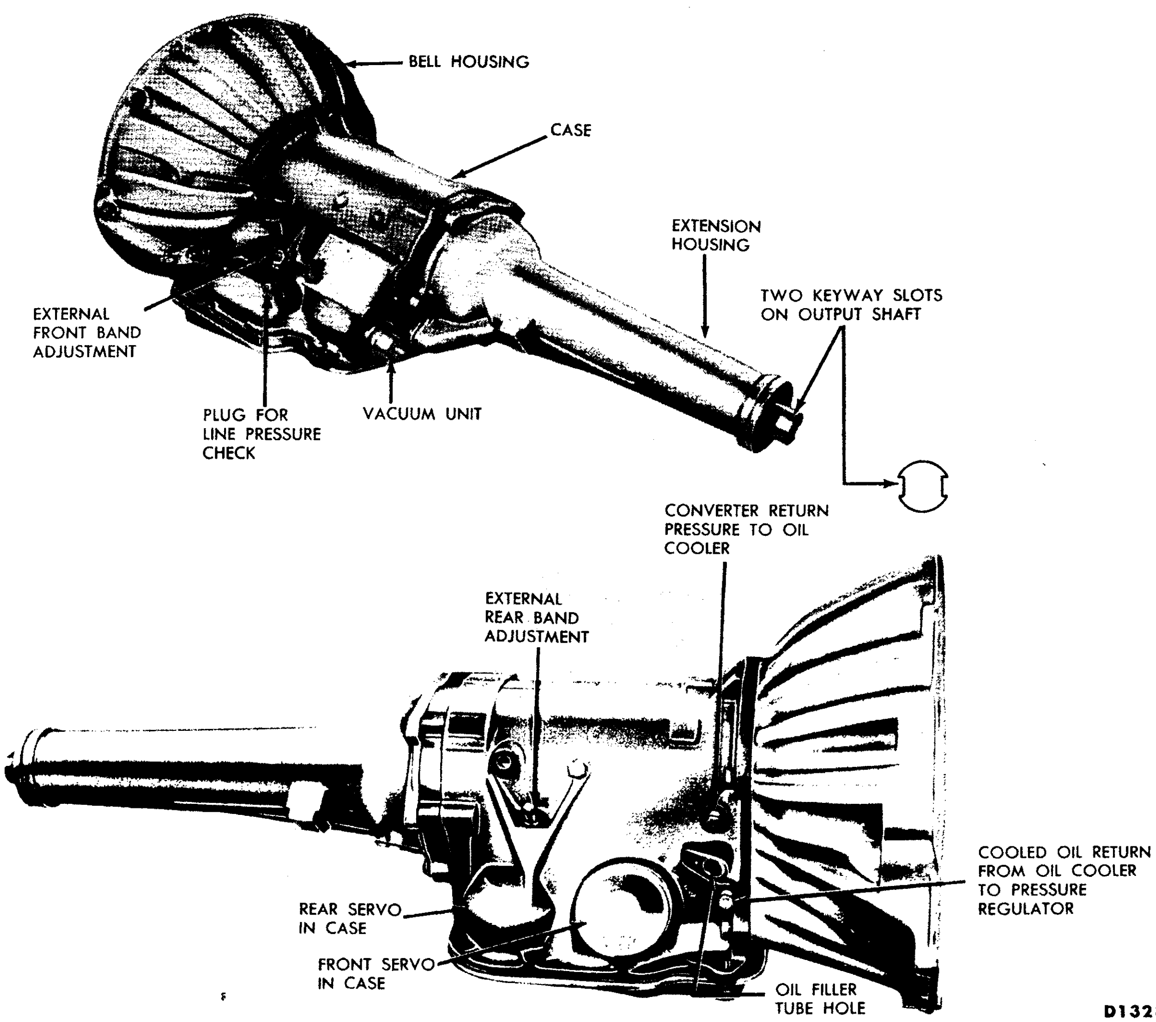

FIG. 10–External Transmission Components

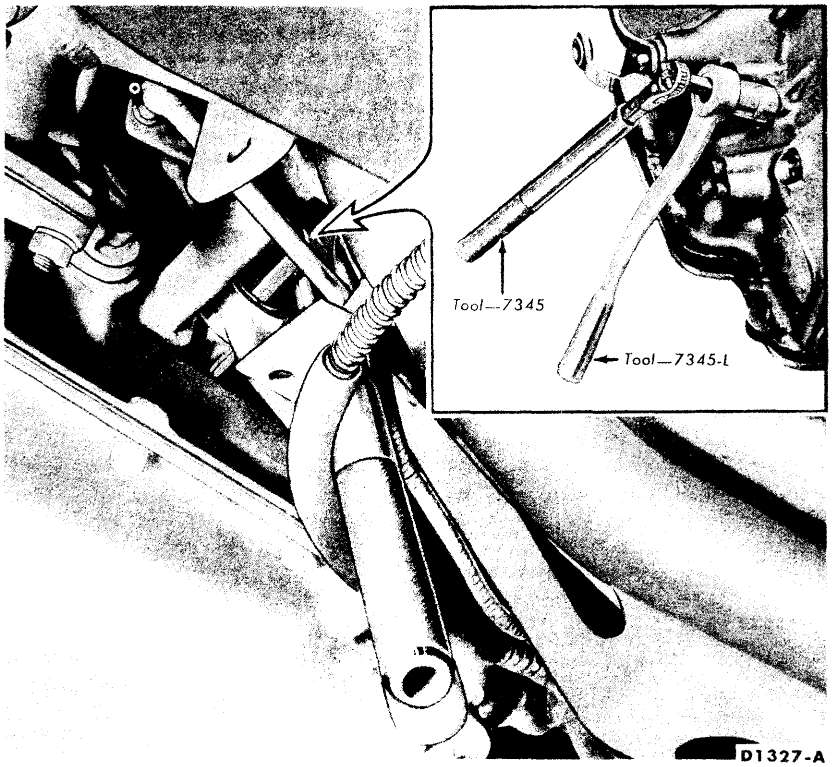

FIG. 11—Front Band Adjustment

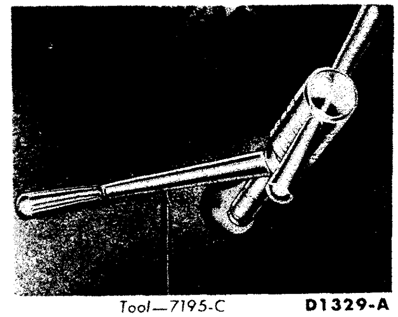

FIG. 12—Rear Band Adjustment

CHECK TRANSMISSION FLUID LEVEL

The transmission fluid level should be checked using the following procedure:

1. Make sure that the car is standing level. Then firmly apply the parking brake.
2. Run the engine at normal idle speed. If the transmission fluid is cold, run the engine at fast idle speed (about 1200 rpm) until the fluid reaches its normal operating temperature. When the fluid is warm, slow the engine down to normal idle speed.
3. Shift the selector lever through all positions, and place the lever at P. Do not turn off the engine during the fluid level checks.
4. Clean all dirt from the transmission fluid dipstick cap before removing the dipstick from the filler tube.
5. Pull the dipstick out of the tube, wipe it clean, and push it all the way back into the tube.
6. Pull the dipstick out of the tube again, and check the fluid level. If necessary, add enough fluid to the transmission through the filler tube to raise the fluid level to the F (full) mark on the dipstick. **Do not overfill the transmission.**

3 CHASSIS

INSPECT AND CROSS-SWITCH WHEELS AND TIRES

Switch the tires according to Fig. 13. Tighten the wheel lugs to the specified torque.

CHECK POWER STEERING RESERVOIR FLUID LEVEL

Start the engine, turn the steering wheel all the way to the left and right several times, and shut off the engine.

Check the fluid level in the reservoir. If the level is low, add enough fluid to raise the level to the F mark on the dipstick. On a car equipped with air conditioning, fill the reservoir to within ¼-inch of the top. **Do not overfill the reservoir.**

CHECK MASTER CYLINDER FLUID LEVEL

Remove the filler cap from the master cylinder.

Fill the reservoir to ⅜-inch from the top.

Install the filler cap.

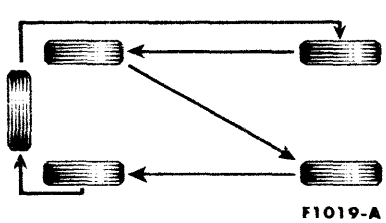

FIG. 13—Tire Cross-Switching Diagram

CHECK AXLE FLUID LEVEL

The lubricant level should be maintained at the bottom edge of the filler plug hole with the specified lubricant.

LUBRICATE FRONT SUSPENSION BALL JOINTS

Clean the area around the plugs, remove the plugs and install lubrication fittings. Lubricate the ball joints and remove the lubrication fittings. Install the plugs.

LUBRICATE STEERING LINKAGE

Clean the area around the plugs, then remove them.

Install lubrication fittings.

Apply the recommended lubricant to each steering linkage fitting with a pressure gun, remove the lubrication fittings and replace the plugs.

CHANGE POWER STEERING FILTER

Remove the power steering pump reservoir cover, spring, and washer. Remove all fluid from the reservoir with a suction gun. Lift the filter from the reservoir. Wipe the reservoir clean with a lint-free cloth. Place a new filter on the seat. Position the washer and spring on the cover stud. Install a new gasket in the cover. Install the cover on the reservoir and add fluid.

CHECK STEERING GEAR PRELOAD

1. Remove the fluid from the power steering reservoir with a suction gun.
2. Disconnect the fluid return line from the reservoir. Place the end of the return line in a container and turn the steering wheel in both directions as required to discharge the fluid from the gear.
3. Working from under the car, disconnect the Pitman arm from the steering gear.
4. Remove the hub cap from the steering wheel.
5. Attach an inch-pound torque wrench to the steering wheel attaching nut (Fig. 14).

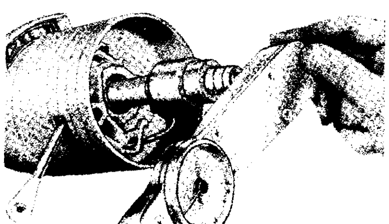

FIG. 14—Checking Steering Gear Preload

6. Measure the force required to move the worm shaft approximately 20° away from the stop.
7. If the reading is not within 6-8 in-lbs, loosen the adjuster lock nut and turn the bearing adjuster to obtain the proper reading. Tighten the lock nut, making sure the adjuster does not turn. Recheck the preload.
8. Locate the mechanical center of the steering gear by rotating the steering wheel right or left to the stop, then back it off 1¾ turns.
9. Rotate the steering gear to the left stop. Using an inch-pound torque wrench, back it off at a constant pull, reading the torque at the exact mechanical center.

Rotate the gear to the right stop and take the reading in the opposite direction.

If two slightly different readings are obtained, the larger should be recorded as total on-center meshload.

10. If total over-center meshload is not within 15-17 in-lbs, loosen the sector adjuster lock nut (Fig. 15) and turn the adjuster screw to obtain proper adjustment.

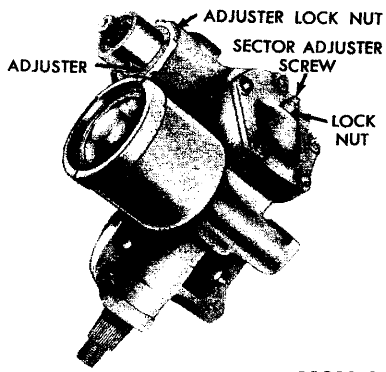

FIG. 15—Preload and Meshload Adjustment

NOTE: 1/16 turn of the adjuster will increase the meshload approximately 2 in-lbs.

Tighten the adjuster lock nut making sure the adjusting screw does not turn. Check the meshload.

CLEAN AND PACK FRONT WHEEL BEARINGS

1. Raise the car until the wheel and tire clear the floor.
2. Insert a narrow screwdriver through the brake adjusting hole at the inner side of the brake backing plate, and disengage the adjusting lever from the adjusting screw. While holding the adjusting lever away from the screw, back off the adjusting screw with the brake adjusting tool. **Be very careful not to burr, chip, or damage the notches in the adjusting screw, otherwise the self-adjusting mechanism will not function properly.**
3. Remove the wheel cover or hub cap. Remove the grease cap from the hub. Remove the cotter pin, nut lock, adjusting nut, and flat washer from the spindle. Remove the outer bearing cone and roller assembly.
4. Pull the wheel, hub, and drum assembly off the wheel spindle.
5. Remove the grease retainer (Fig. 16) and the inner bearing cone and roller assembly from the hub.

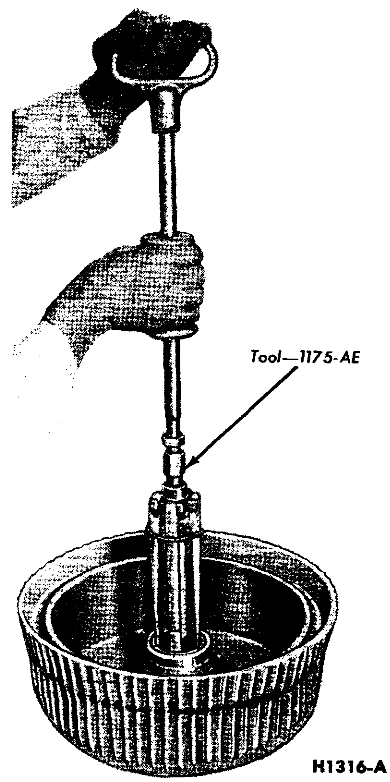

FIG. 16—Removing Grease Retainer

6. Clean the lubricant off the inner and outer bearing cups with solvent.
7. Soak a new grease retainer in light engine oil at least 30 minutes before installation. Thoroughly clean the inner and outer bearing cones and rollers with solvent, and dry them thoroughly. Do not spin the bearings dry with compressed air.

Inspect the bearing cups, cones and rollers for wear or damage, and replace them if necessary. The cone and roller assemblies and the bearing cups should be replaced as a unit if damage to either is encountered.

8. Thoroughly clean the spindle and the inside of the hub with solvent to remove all old lubricant.

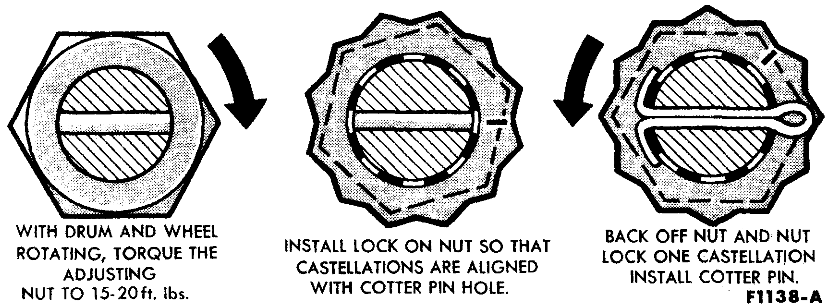

FIG. 18—Front Wheel Bearing Adjustment

Cover the spindle with a clean cloth, and brush all loose dust and dirt from the brake assembly. **To prevent getting dirt on the spindle, carefully remove the cloth from the spindle.**

9. Pack the inside of the hub with specified wheel bearing grease. Add lubricant to the hub only until the grease is flush with the inside diameter of both bearing cups.

10. Pack the bearing cone and roller assemblies with wheel bearing grease. A bearing packer is desirable for this operation. If a packer is not available, work as much lubricant as possible between the rollers and cages. Lubricate the cone surfaces with grease.

11. Place the inner bearing cone and roller assembly in the inner cup, and install the new grease retainer with the tool shown in Fig. 17. **Be sure that the retainer is properly seated.**

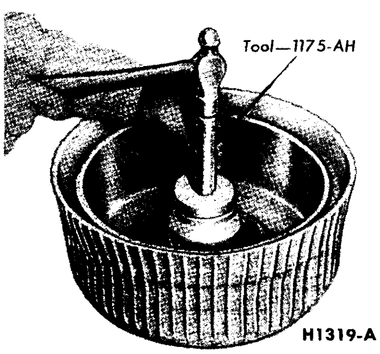

FIG. 17—Grease Retainer Installation

12. Install the wheel, hub, and drum assembly on the wheel spindle. **Keep the hub centered on the spindle to prevent damage to the grease retainer or the spindle threads.**

13. Install the outer bearing cone and roller assembly and the flat washer on the spindle, then install the adjusting nut.

14. While rotating the wheel, hub, and drum assembly, torque the adjusting nut to 15-20 ft-lbs to seat the bearings (Fig. 18).

15. Locate the nut lock on the adjusting nut so that the castellations on the lock are aligned with the cotter pin hole in the spindle.

16. Back off both the adjusting nut and the nut lock together until the next castellation on the nut lock aligns with the cotter pin hole in the spindle.

17. Install a new cotter pin. Bend the ends of the cotter pin around the castellations of the nut lock to prevent interference with the radio static collector in the grease cup. Install the grease cap.

18. Adjust the brake shoes. Install the wheel cover.

LUBRICATE UNIVERSAL JOINTS

Clean the area around the plugs, then remove them. Install special lubrication fittings and lubricate with special tool (Fig. 19). Remove the lubrication fitings and install the plugs.

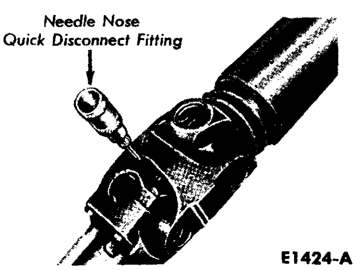

FIG. 19—Lubrication Tool

CHECK BRAKE LINES AND LINING

1. Raise all four wheels. Remove one of the front brake drums, and inspect the drum and the linings (the wheel bearings should be inspected at this time and repacked if necessary). **Do not let oil or grease touch the drum or the linings.** If the linings are worn to within $\frac{1}{32}$ inch of the rivet heads, replace or reline both sets (primary and secondary) on the front or rear wheels. **Under no circumstances replace one lining only, or one wheel set. Both front wheel sets or both rear wheel sets should be replaced whenever a respective lining or shoe is worn or damaged.** If the drum braking surface is excessively scored, refinish it. The condition of the remaining front linings is usually about the same as that of the one inspected. The rear brake linings may also need replacing at the same time.

2. Check the fluid level in the master cylinder reservoir. If necessary, add enough heavy-duty brake fluid to bring the level to within $\frac{3}{8}$-inch of the top of the reservoir.

3. With the parking brakes in the fully released position, check the brake cables. The cable adjustment should be just tight enough to remove the slack. **Excessive tightening may pull the brake shoes off their anchors.**

CHECK AIR CONDITIONING SYSTEM

AIR CONDITIONING

A quick test of the refrigerant supply can be made by observing the flow of refrigerant through the sight glass (Fig. 20).

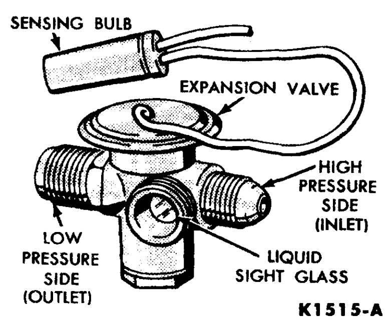

FIG. 20—Expansion Valve and Liquid Sight Glass

To check the refrigerant supply, place a large fan in front of the radiator to aid in cooling the engine. Set the servo control for maximum cooling and the blower on high. Operate the engine at 1300 rpm and observe the sight glass while the compressor is operating. There should be no bubbles in the sight glass after the start of the compressor. Bubbles will appear when the compressor starts but should clear after a few moments.

IDLE SPEED-UP CONTROL

1. Remove the air cleaner. Operate the engine and the air conditioner.
2. Place a finger on the air passage inlet tube projecting through the air horn. **If the idle speed-up control unit is operating correctly, the pull of vacuum will be sufficient to be felt by finger application and the engine rpm will decrease.**

CHECK FRONT WHEEL ALIGNMENT

If abnormal tire wear or ride and handling characteristics such as car lead or wander are experienced with properly inflated tires, the front end alignment should be checked.

PRELIMINARY

Whenever possible, front wheel alignment checks should be performed on stationary wheel aligning equipment. In the absence of such equipment, portable equipment may be used and the work may be performed on a level floor. The floor area should be level within ¼ inch from front to rear of the car and within ⅛ inch from side to side. It might be well, if portable equipment is used frequently, to mark off a known level area on the shop floor.

Prior to checking or setting the front wheel alignment, be sure all front suspension and steering system nuts and bolts are properly torqued. It is especially important to have the drag strut nut and the upper arm torque specification, as a loose nut or bolt can directly affect the caster or camber reading. The items which follow also should be checked and, if necessary, corrected before aligning the wheels.

1. Be sure the tires are inflated to the proper pressure at all four wheels.
2. Be sure the front wheel bearings are adjusted properly and that the wheels turn freely.
3. Check the shock absorbers for leaks. Replace the shock absorbers if necessary.
4. Check for looseness at the tie-rod ends. Looseness can affect the toe-in readings and adjustment. To inspect the front suspension for looseness or wear, it will be necessary to raise the car.

Do not raise the car by means of the lower suspension arms. This will release the tension on the lower ball joints.

5. Be sure the wheels are balanced.
6. Check the runout of each front wheel and tire using a dial indicator against the rim outer band. If the runout exceeds ⅛ inch, correction may be made by rotating the wheel on the drum. When the minimum runout has been obtained, mark the point of greatest runout so the wheels can be positioned as shown in Fig. 21 when checking the front end alignment. Hold a piece of chalk against the wheel rim or the tire sidewall while spinning the wheel. The chalk will mark the rim or tire at the point of greatest runout.

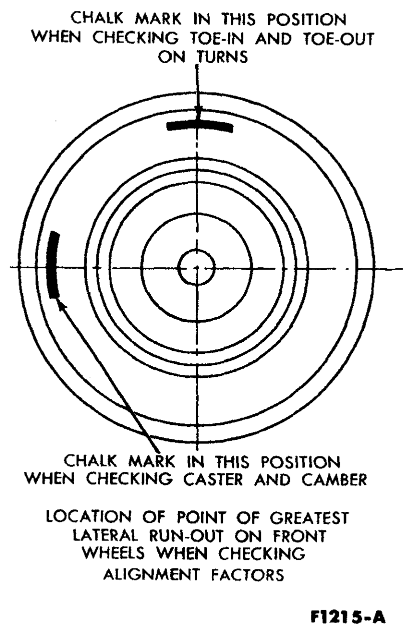

FIG. 21—Front Wheel Position For Checking Alignment

CASTER

1. Position the car on a level floor or on runway-type wheel alignment equipment. Position a suitable gauge on the front wheels and check the caster angle. Correct caster is 0° to negative 1½°. The maximum difference between wheels should not exceed ½° with ¼° preferred.
2. To adjust caster, raise the hood. Loosen the bolts that secure the upper suspension arm shaft to the frame member and, with the aid of a pry bar, move the shaft in or out, as required. A movement of approximately 3/32 of an inch at either the front or rear bolt location will change the caster ½°. Inboard movement of the front bolt, or outboard movement of the rear bolt, will change caster in the negative direction. Outboard movement of the front bolt, or inboard movement of the rear bolt, will change caster in the positive direction.
3. When the caster is correct, torque the shaft retaining bolts to 100-125 ft-lbs and check the caster and camber to insure the readings have not changed.

CAMBER

1. With the car on runway-type wheel alignment equipment, or on a level floor, position a suitable gauge on the wheels and check the camber angle. Correct camber is 0° to positive ¾°. The maximum difference between wheels should not exceed ½° with ¼° preferred.
2. To adjust camber, raise the hood. Loosen the bolts that secure the upper suspension arm shaft to the frame member and, with the aid of a pry bar, move the shaft in or out, as required. A movement of approximately 3/64 inch of the entire shaft will change the camber ¼°. Inboard movement will change the camber in the negative direction. Outboard movement will change the camber in the positive direction.
3. When the camber is correct, torque the shaft retaining bolts to 100-125 ft-lbs and check the camber and caster to insure the readings have not changed.

TOE-IN

Toe-in is adjusted by means of the sleeve at the outer end of each spindle connecting rod. The toe-in specification is 1/16 of an inch to 3/16 of an inch.

1. Set the front wheels in the straight-ahead position. To be sure the wheels are straight-ahead, push the car backward about six feet; then, pull it forward about three feet. The last movement of the car must be forward to position the wheels properly.

2. Remove the cap from the steering wheel hub by pressing downward and turning the cap to the left. Make sure the alignment mark on the hub of the steering wheel is lined up with the mark on the end of the steering shaft. The mark on the end of the shaft indicates the high-point of the steering gear. With the front wheels straight-ahead, the alignment marks should be vertical and the steering wheel spokes should be in their normal position.

3. To adjust toe-in, loosen the two clamps on each spindle connecting rod sleeve. Lengthen or shorten both spindle connecting rods an equal amount to obtain the correct toe-in. Lengthening both rods increases toe-in.

4. Torque the adjusting sleeve clamp bolts to 22-28 ft-lbs. **To prevent interference, both bolts should be in a vertical position on the rear side of the sleeve and the clamps should not project beyond the ends of the sleeve.**

CHECK TIRE PRESSURE

Check all tires for specified pressures (cold).

CHECK BATTERY FLUID LEVEL

The battery is mounted under the hood at the right front side of the engine compartment.

Keep the fluid in each battery cell up to the level of the ring in the bottom of the filler well. Generally, tap water may be added unless it has a high mineral content or has been stored in a metal container. If the tap water is unsuitable for the reasons stated above, then distilled water should be used.

4 BODY

LUBRICATE HOOD LATCH

Apply lubricant M99C40-A or -B to all pivot points and to the striker plate as required to eliminate any binding condition. Operate the latch mechanism several times to be sure that the lubricant has effectively worked in.

LUBRICATE HOOD AUXILIARY LATCH

Apply lubricant M99C40-A or -B to all pivot points as required to eliminate any binding conditions. Operate the catch several times to be sure that the lubricant has effectively worked in.

LUBRICATE DOOR LOCK CYLINDERS

Apply lock lubricant M2C20 sparingly through the key slot. Insert the key and operate the lock several times to be sure that the lubricant has effectively worked in.

LUBRICATE LUGGAGE COMPARTMENT LOCK CYLINDER

Apply lock lubricant M2C20 sparingly through the key slot. Insert the key and operate the lock several times to be sure that the lubricant has effectively worked in.

LUBRICATE FUEL FILLER DOOR HINGES

Apply lubricant M99C40-A or -B to the hinge pivot points as required to eliminate any binding condition. Open and close the door several times to be sure that the lubricant has effectively worked in.

CHECK CONVERTIBLE TOP OPERATION

If convertible top operation becomes sluggish or slow, check the hydraulic reservoir fluid level. Fluid level should be approximately ¼ inch from the filler opening. The proper fluid is automatic transmission fluid "Type A, Suffix A."

CLEAN BODY DRAIN HOLES

Body drain holes located in the bottom of the door panels and lower body side panels (rocker panels) not protected by rubber valves should be checked occasionally. Use a small screwdriver or awl to clean these holes of obstructions.

CHECK CONVERTIBLE TOP FLUID LEVEL

1. Open the deck lid and raise the top.
2. Remove the right side luggage compartment liner.
3. Place absorbent cloths below the filler plug.
4. Remove the filler plug, and check the fluid level. It should be level with the bottom edge of the hole.
5. If the level is low, check the system for leaks, adding automatic transmission fluid "Type A, Suffix A" as necessary.
6. Replace the filler plug.
7. Replace the luggage compartment liner.

REPLACE WINDSHIELD WIPER BLADES

Wiper blade replacement intervals will vary with the amount of use, type of weather, chemical reaction from road tars or salts and the age of the blades. Be sure that the windshield glass surface is not contaminated with oil, tree sap or other foreign substance which cannot be easily rubbed off.

Generally, if the wiper pattern across the glass is still uneven and streaked after these tests, replace the blades.

LUBRICATE DOOR HINGE AND HINGE CHECK

Apply lubricant M99C40-A or -B to the hinge pivot points as required to eliminate any binding condition. Open and close the door several times to be sure that the lubricant has effectively worked in.

Apply lubricant M99C40-A or -B to the door check as required to eliminate any binding condition. Open and close the door several times to be sure that the lubricant has effectively worked in.

LUBRICATE HOOD HINGE PIVOTS

Apply M99C40-A or -B lubricant to the hinge pivot points as required. Open and close the hood several times to be sure that the hinge pivots do not bind.

LUBRICATE LUGGAGE COMPARTMENT HINGE PIVOTS

Apply M99C40-A or -B lubricant to the hinge pivot points as required. Open and close the luggage compartment several times to be sure that the hinge pivots do not bind.

NOTES

LUBRICANT CHARTS AND SPECIFICATIONS

GROUP 21

LUBRICANT SPECIFICATIONS

Item	Part Number	Part Name	Ford Specification	Alternate Lubricant
Body Hinges	R-113-A or -B	Rotunda Silicone Lubricant	M-99C40-A or -B	
Brake Master Cylinder	R103-A-B, C	Rotunda Heavy Duty Brake Fluid	M-3833-D	Alternate fluid must meet SAE J70B specifications for 70R3 type extra heavy-duty brake fluid.
Distributor Cam		Distributor Cam Grease	M-1C-66-A	Use a good high temperature No. 2 grade sodium soap grease.
Distributor Wick and Bushing		Engine Oil—SAE 10W		
Front Suspension Ball Joints and Steering Linkage	C1AZ-19590-B	FoMoCo Ball Joint Grease	ESA-M-1C47-A	
Front Wheel Bearings	C2ZA-19585-A	FoMoCo Wheel Bearing Grease	ESA-M1C60-A	
Hood Latch and Safety Catch	R113-A or -B	Rotunda Silicone Lubricant	M-99C40-A or -B	
Lock Cylinders	R117-A	Rotunda Lock Lubricant	ESB-M-2C20-A	
Rear Axle	COLY-19A508-B	FoMoCo Hypoid Gear Lubricant	M2C16-B	
Convertible Top Reservoir Steering—Power (Pump Reservoir)	R-106-A	Rotunda Automatic Transmission Fluid	M2C33-C or D	Automatic Transmission Fluid marked "TYPE A, SUFFIX A".
Transmission (Automatic)	R106-A	Rotunda Automatic Transmission Fluid	M2C33-C or D	Only one quart of Automatic transmission fluid marked "TYPE A, SUFFIX A" may be used to "add to" factory fill.
Universal Joints	C1AZ-19586-B	FoMoCo Universal Joint Lubricant	M-1C57	Substitute lubricant must conform to Ford Specification.

ENGINE CRANKCASE OILS

Use of SAE 10W-30 oil will provide the proper viscosity for all normal ranges of outside temperatures. For operation at sustained outside temperatures below −10°F. a 5W-20 oil should be used.

Oil Quality

Use only oils which have been tested and certified by the maker as satisfying automobile manufacturers specifications for Engine Operating Sequence Tests for Service M.S. The Ford Motor Company specification covering these tests is M2C27. These tests are defined by ASTM committee D2 for Section G-IV of technical committee B and are published in the SAE Handbook.

These tests cover oil characteristics as follows:

Sequence I – Low Temperature Wear Prevention–(Cold Starts)

Sequence II – High Speed – High Temperature Wear Prevention

Sequence III – High Temperature Deposit Formation – (Varnish)

Sequence IV–Corrosion and Rust Prevention

Sequence V – Sludge Formation

If engine oils are used which do not meet these requirements, it will be necessary to change oil more frequently than every 6,000 miles.

If it is necessary to use an "MS" oil which is not certified by the marketer as having passed the Engine Operating Sequence Tests, the addition of Rotunda Oil Conditioner to the oil will satisfy the requirements.

Oil Filter

Use of the right oil filter is also essential to good engine life and operation. For 6,000-mile filter change intervals, filters must meet Ford Specification ES-COAE-6714-A.

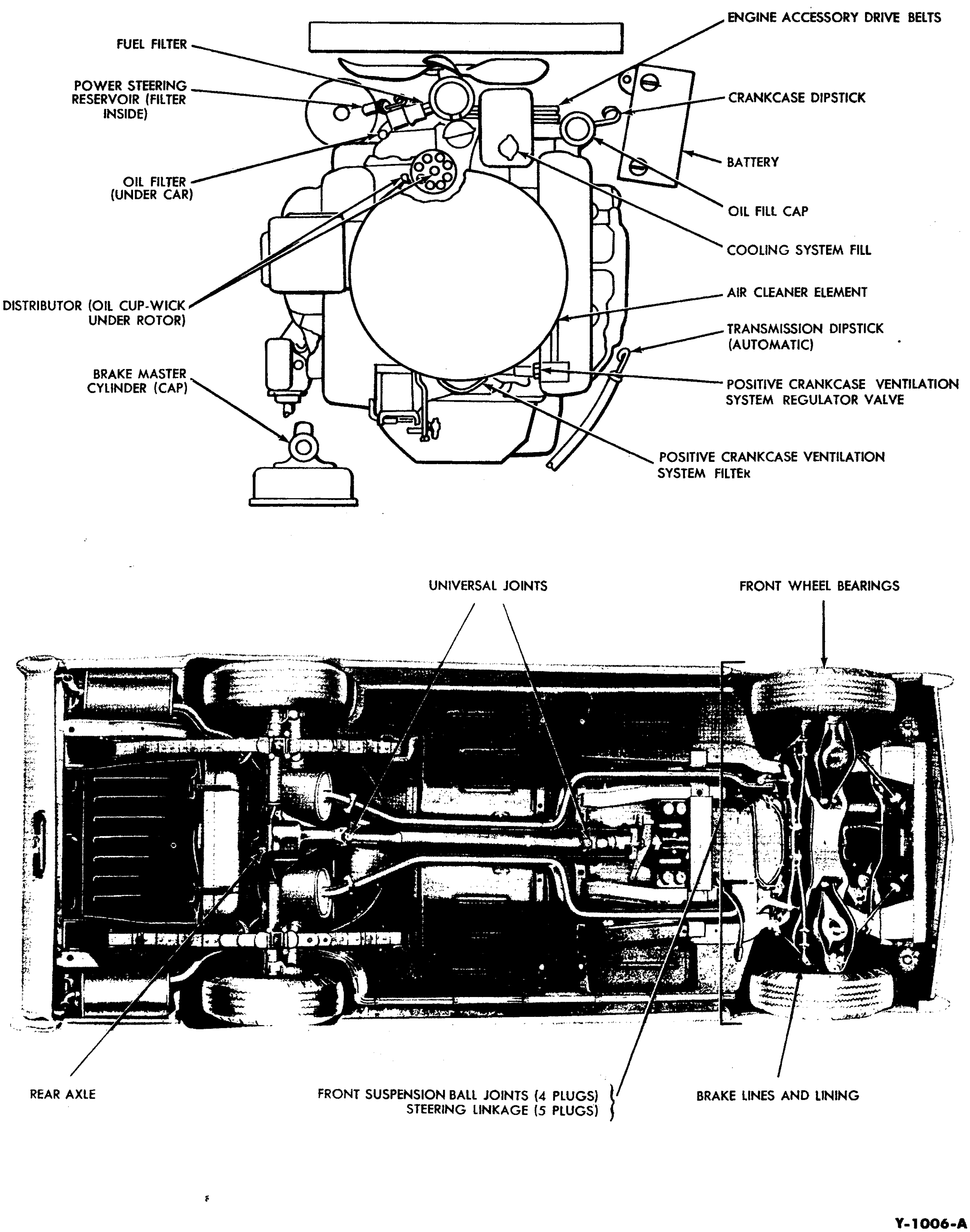

FIG. 1—Lubrication Chart

SPECIAL SERVICE TOOLS

GROUP 22

The usage of special service tools is illustrated and described in the text of this manual. Refer to the specific service procedure for the proper tool applications.

The numbers shown in the first columns are Ford tool numbers. The second column indicates former vendor tool numbers. These tools may be obtained from Ford by ordering by the **complete tool number** as shown in the first column.

BRAKES

Ford Tool No.	Former No.	Description
—	LM-119	Brake Cylinder Retaining Clamp
—	2018-A	Brake Adjusting Tool
—	2162	Adapter Cap
—	2035-N 2086-L	Brake Shoe R & R Spring
TOOL-33621	33621	Internal Snap Ring Pliers

SUSPENSION, STEERING, WHEELS AND TIRES

Ford Tool No.	Former No.	Description
T50T-100-A & TOOL-1175-AB	1175-AE	Seal Remover
TOOL-1175-AH	1175-AH	Seal Replacer
TOOL-1217-J	1217-J	Front Hub Outer Brg. Cup Replacer
TOOL-1217-K	1217-K	Front Hub Inner Brg. Cup Replacer
TOOL-1217-L	1217-L	Front Hub Outer Brg. Cup Remover
TOOL-1217-M	1217-M	Front Hub Inner Brg. Cup Remover
TOOL-3044-LA	3044-LA	Front Suspension Upper Arm Bushing Remover
T54P-3044-A	3069-H 3069-L	Front Suspension Upper and Lower Arm Overhaul Kit
T63P-3044-A	3044-AB-3	Front Suspension Lower Arm Bushing Remover and Replacer
TOOL-3068	3068	Front Suspension Upper Arm Bushing Adapter
TOOL-3069-AA	3069-AA 3069-AA-2	Front Suspension Lower Arm Bushing Remover
TOOL-3069-M	3069-M 3069-M-5	Lower Arm Bushings—Remover and Replacer Kit
TOOL-3290-C	3290-C	Tie Rod Ball Ends & Control Valve Ball Stud Remover
—	3500-E	Pressure Testing Gauge Assembly
T61B-3576-A	—	Sector Shaft Bushing and Seal Remover and Replacer
T62B-3576-A	—	Power Steering Gear Oil Seals Replacer Adapter
TOOL-3583-J	3583-J	Control Valve Bearing and Seal Remover & Replacer
TOOL-3590-L	3590-L	Steering Arm Remover
TOOL-3600-AA	3600-AA 3826	Bolt-On Type Steering Wheel Remover
T63B-3B673-A	—	Power Steering Sleeve & Spool Assembly Bearing Remover & Replacer
TOOL-5310-A	5310-A	Front Coil Spring Compressor
TOOL-6306-AG	6306-AG	Crankshaft Damper Remover & Power Steering Pump Sprocket Replacer
TOOL-33623-D	33623-D	Pump Oil Seal Pilot

REAR AXLE

Ford Tool No.	Former No.	Description
T50T-100-A	T50T-100-C	Slide Hammer
T50T-100-A & TOOL-1175-AB	1175-AE	Seal Remover
TOOL-1225-DA	1225-DA	Axle Shaft Remover
TOOL-4000-C	4000-C	Differential Housing Spreader
TOOL-4005	4005	Engine Repair Stand Axle Adapter —Keyed Shaft
TOOL-4020-B	4020-B	Pinion Depth Gauge—Complete With Depth Micrometer and Gauge Block
TOOL-4201	4201	Pinion Shaft Drive Nut
TOOL-4201-C	4201-C	Differential Backlash & Runout Gauge With Univ. Bracket, Dial Indicator and Bracket
TOOL-4205-B	4205-B	Differential Assembly Bench Holder
TOOL-4205-C	4205-C	Axle Housing Dummy Bearings (1 pr.)
TOOL-4209-C	4209-C	Pinion Tension Scale With 4209-C12 Socket
TOOL-4221-C	4221-C	Differential Side Bearing Remover
TOOL-4222-H	4222-H	Differential Bearing Cone Replacer
TOOL-4235-C	4235-C	Axle Shaft & Bearing Remover
TOOL-4245-B	4245-B	Wheel Bearing Seal Replacer
TOOL-4616	4616	Drive Pinion Bearing Cup Replacer (Front)
TOOL-4621-A	4621-A	Drive Pinion Bearing Replacer
TOOL-4621-BA	4621-BA	Rear Pinion Bearing Remover
TOOL-4628	4628	Pinion Rear Bearing Cup Replacer
TOOL-4628-B	4628-B	Pinion Bearing Front Cup Remover
TOOL-4628-D	4628-D	Pinion Rear Bearing Cup Remover
TOOL-4676	4676	Pinion Shaft Oil Seal Replacer
T57L-4851-A	4851-K	Universal Joint Flange Holder
TOOL-4858-B	4858-B	Companion Flange & Pinion Bearing Replacer
—	4858-D	Companion Flange Remover—Mod.
TOOL-4858-G	4858-G	Pinion Flange Nut Adjusting Wrench (Use With Tool-4858-B)
TOOL-4859	4859	Companion Flange Dust Shield Replacer
TOOL-7657-J	7657-J	Extension Housing Bushing & Seal Replacer

DRIVE LINE

Ford Tool No.	Former No.	Description
TOOL-7657-J	7657-J	Extension Housing Bushing and Seal Replacer

AUTOMATIC TRANSMISSION

Ford Tool No.	Former No.	Description
TOOL-1175-AB	1175-AB	Seal Remover (head only)
T50T-100-A & TOOL-1175-AB	1175-AE	Seal Remover
TOOL-4201-C	4201-C	Differential Backlash & Runout Gauge, With Uni. Bracket, Dial Indicator & Bracket
TOOL-7000-AG	7000-AG	Extension Housing Bushing Remover—Automatic Transmission
TOOL-7000-CJ	7000-CJ	Transmission Overhaul Holding Fixture
—	7000-EHJ	Transmission Jack
—	7000-EG	Jack Adapter Kit
—	7000-LC	Jack Bracket Kit
TOOL-7000-DE	7000-DE	Air Nozzle, With Tool-7000-DD Rubber Tip
TOOL-7195-C	7195-C	Rear Band Adjustment Wrench
TOOL-7345-L	7345-L	Front Band Adjustment Wrench
TOOL-7657-J	7657-J	Extension Housing Bushing and Seal Replacer
T58L-7902-A	7937-A 7946-A	Welded Converter Sprag Driver and Gauge Post
T63P-7902-A	—	Converter Stator Check Adapter
TOOL-77067	77067	Dial Indicator Support Fixture
T59P-77370-B	7345	Front Band Torque Wrench
T59L-77515-B	77515-A	Rear Clutch Spring Compressor
TOOL-77530-A	77530-A	Clutch Assembly Fixture
TOOL-77565	77565	Front Clutch Spring Compressor
T63L-77837-A	77837	Front Pump Seal Replacer

ENGINE

Ford Tool No.	Former No.	Description
T53L-300-A	6000-BA	Engine Lifting Sling
—	3600-E	Piston Pull Scale
—	4201-D	Indicator Bracket Assembly—Less Indicator
TOOL-6000-K	6000-K	Engine Lifting Eyes—One Pair
TOOL-6011-E	6011-E	Cylinder Ridge Reamer
TOOL-6011-F	6011-F	Swivel Arm Only—To Convert 6011-A to 6011-E
TOOL-6085-L	6085-L	Cylinder Head Overhaul Fixture, 4 Pcs, 430 Engine
T58P-6085-B	6085-H	Valve Guide Reamer Kit
—	6110-E	Ring Groove Cleaner
TOOL-6135-F	6135-F	Piston Pin Remover & Replacer, 430 Engine
—	6149-E	Ring Compressor
—	6149-14	Ring Installer
TOOL-6261-AC	6261-AC	Camshaft Bearing Adapters, 430 Engines
T54T-6250-B & T52L-6261-CEE	6261-F	Camshaft Bearing Remover & Replacer
TOOL-6306-AG	6306-AG	Crankshaft Damper Remover & Pow. St. Pump Sprocket Replacer
TOOL-6306-AJ	6306-AJ	Crankshaft Damper Remover & Replacer
T58T-6306-A	6306-AH	Crankshaft Gear Remover
TOOL-6331-E	6331-E	Upper Main Bearing Insert Remover & Replacer
TOOL-6500-C	6500-C	Hydraulic Tappet Clip Replacer
TOOL-6500-E	6500-E	Hydraulic Tappet Leakdown Tester

ENGINE (Cont'd)

Ford Tool No.	Former No.	Description
TOOL-6500-F	6500-F	Hydraulic Tappet Plunger Remover & Replacer
TOOL-6505-F	6505-F	Valve Stem Clearance Checking Tool
TOOL-6513-ABA	6513-AB	Valve Holdup Air Adapter and Hose
TOOL-6513-DD	6513-DD	Valve and Clutch Springs Tester
—	6513-EE	Valve Spring Compressor—Head Off
TOOL-6513-J	6513-J	Valve Spring and Rocker Arm Compressor
TOOL-6513-K	6513-K	Push Rod Check Compressor
TOOL-6565	6565	Cam Lift Dial Indicator
TOOL-6565-AB	6565-AB	Cup-Shaped Adapter for Tool-6565
T58T-6701-B	6701-B	Crankshaft Rear Bearing Seal Replacer
T58L-101-A & T59L-100-B	7600-E	Clutch Pilot Bearing Remover

IGNITION SYSTEM

Ford Tool No.	Former No.	Description
T57L-12120-A	12132-B	Distributor Base Upper Bushing Replacer
T52L-12131-CAD	12131-C	Distributor Shaft Gear and Collar Retaining Pin Remover and Replacer Fixture
TOOL-12132	12132	Distributor Shaft Bushing Burnisher
T58L-12132-B	—	Distributor Body Holding Clamp
—	12132-B1 12132-H	Distributor Shaft Bushing Remover
—	12150-D 12150-E	Distributor Adjustment Wrench
TOOL-12151	12151	Distributor Point Tension Scale
T52L-12390-CAD	12390-C	Distributor Shaft Drive Gear Remover Kit
T57L-12390-A	12175-B	Tech. Gear and Drive Gear Locating & Installing Fixture

FUEL SYSTEM

Ford Tool No.	Former No.	Description
T62P-9A274-A	—	Fuel Line Tube Die
TOOL-9545	9545	Choke Unloader Gauge
TOOL-9550-AJ	9550-AJ	Float Gauge
TOOL-9564-A	9564-A	Float Bending Tool
TOOL-9581	9581	Throttle Shaft Bending Tool
TOOL-9597	9597	Wire Gauge
TOOL-9597-B	9597-B	Wire Gauge
TOOL-99798	99798	Throttle Connecting Link Bending Tool

COOLING SYSTEM

Ford Tool No.	Former No.	Description
TOOL-3600-AA	3600-AA	Bolt-On Type Steering Wheel Remover
T57L-7657-A	7657-F	Oil Seal Assembly Replacer
T52L-8501-DAD	8501-DD 8501-DD-18	Water Pump Overhaul Kit
T63L-8620-A	8620 BT-33-73-F	Belt Tension Gauge

CHARGING SYSTEM

Ford Tool No.	Former No.	Description
T58P-7563-A	—	Disc Clutch Pilot
T63L-8620-A	8620 BT-33-73-F	Belt Tension Gauge
TOOL-10044-A	10044-A	Generator Pole Screw Wrench
T63L-10300-A	—	Alternator Pulley Remover

STARTING SYSTEM

Ford Tool No.	Former No.	Description
TOOL-10044-A	10044-A	Generator Pole Screw Wrench

ELECTRICAL AND ACCESSORIES

Ford Tool No.	Former No.	Description
ACM-57-2-Tool	ACL-57-2	Leak Detector—Complete
ACM-57-3-Tool	ACL-53-3	Pressure Test Manifold—Complete With Hoses
ACL-53-18-Tool	ACL-53-18	Adapter—Freon Cylinder Valve
TOOL-J-8465	J-8465	Complete Test Light Unit
TOOL-J-8674	J-8674	Tester Adapter Kit

BODY

Ford Tool No.	Former No.	Description
T64N-16A605-A	—	Hood Torsion Bar Remover & Installer
T57P-53510-A	53510-A	Locknut Wrench (Convertible Top)

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