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1966 FORD

Falcon

CLUB WAGON

Econoline

and

Recreational Vehicle

SHOP MANUAL

1966

FORD FALCON CLUB WAGON, ECONOLINE and RECREATIONAL VEHICLE

SHOP MANUAL

Ford SERVICE PUBLICATIONS

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FOREWORD

This shop manual provides the Service Technician with complete information for the proper servicing of the 1966 Falcon Club Wagon, Econoline and Recreational vehicles.

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.

Ford SERVICE PUBLICATIONS

VEHICLE IDENTIFICATION

GROUP 1

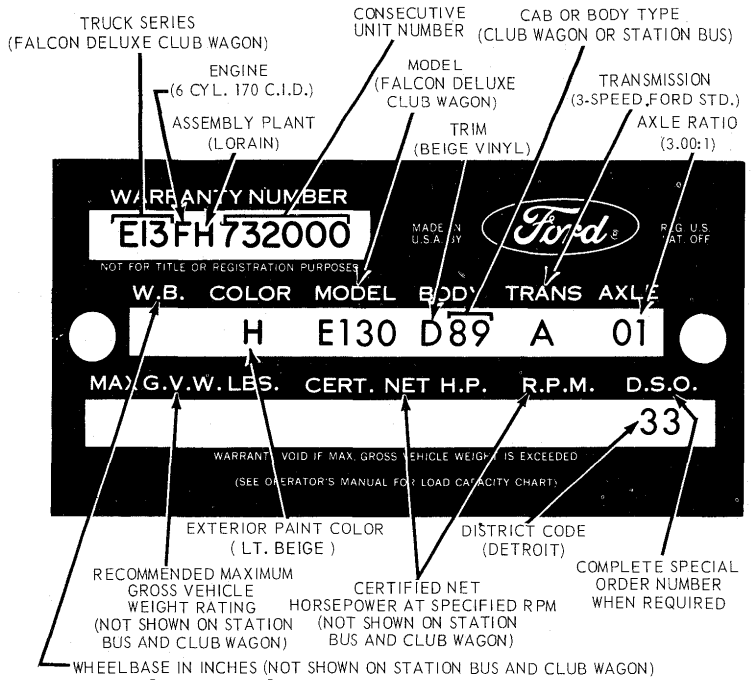

FIG. 1—Typical Rating Plate

Figure 1 illustrates the Econoline Rating Plate. The rating plate is attached to the rear (lock) face of the left front door. The official serial number, for title and registration purposes, is stamped on the right rear quarter body reinforcement gusset near the spare wheel retaining bracket. The official serial number is preceded and followed by an asterisk to prevent unauthorized alterating of numbers or symbols. Do not use the Vehicle Warranty Number which appears on the Warranty Plate for title or registration purposes.

VEHICLE WARRANTY NUMBER

The Warranty Number is the first line of numbers and letters appearing on the Rating Plate. (Fig. 1). The first letter and two numbers indicate the truck series. The letter following the truck series code designates the engine identification code. The letter following the engine identification code indicates the assembly plant at which the vehicle was built. The remaining numbers indicate the consecutive unit number. The charts that follow, list the various vehicle warranty number codes.

VEHICLE DATA

The Vehicle Data appears on the Rating Plate on the two lines following the Warranty Number. The first three digits under W.B. identify the wheel base in inches. The one or two letters under COLOR identify the exterior paint color (two letters designate a two-tone). The letter and three digits under MODEL designate the truck type within a series. The letter and numerals under BODY, designate the interior trim and body type. The letter identifies the interior trim scheme and the two numerals identify the body or cab type. The transmission installed in the vehicle is identified under TRANS by a letter code. The axle ratio is identified by either a letter and a number or two numbers under AXLE. Falcon Station Buses and Club Wagons will not show the code information under W.B. (wheelbase), MAX. G.V.W. LBS. (maximum gross vehicle weight pounds), CERT. NET H.P. (certified net horsepower) or R.P.M. (at revolutions per minute). The District Code (two-digit number), which appears between R.P.M. and D.S.O., identifies the district which ordered the vehicle. The numerals under D.S.O. reflect the Special Order Number (if the unit is other than standard production). The charts that follow list in detail the various vehicle data codes.

EXTERIOR PAINT COLOR CODES

Code	M-30J/M-32J* Spec. Number	Color
A	1724-A	Black
B	556-A	Turquoise
F	1226-A	Lt. Blue
C	1525-A	White
G	1526-A	Chrome Yellow
H	1912-A	Lt. Beige
J	1515-A	Red
L	1237-A	Dark Green
M	1619-A	White
W	1742-A	Med. Blue
Y	1269-A	Med. Blue Met.
3	1623-A	Lt. Blue
8	1955-A	Yellow

ASSEMBLY PLANT CODES

Code	Assembly Plant
A	Atlanta
D	Dallas
E	Mahwah
G	Chicago
H	Lorain
J	Los Angeles
K	Kansas City
L	Michigan Truck
N	Norfolk
P	Twin Cities
R	San Jose
S	Pilot Plant
T	Metuchen
U	Louisville
W	Wayne
Y	Wixom
Z	St. Louis

CONSECUTIVE UNIT NUMBER

Basically, the system assigns the monthly assignment of serial numbers into blocks as follows, beginning with August 1965.

August	**732,000 — 745,999**
September	**746,000 — 759,999**
October	**760,000 — 773,999**
November	**774,000 — 787,999**
December	**788,000 — 801,999**
January	**802,000 — 815,999**
February	**816,000 — 829,999**
March	**830,000 — 843,999**
April	**844,000 — 857,999**
May	**858,000 — 871,999**
June	**872,000 — 885,999**
July	**886,000 — 899,999**
August	**900,000 — 913,999**
August	**A00,000 — A13,999**

W.B. (WHEELBASE)

The wheelbase in inches is entered in this space. The Falcon bus and Club Wagon wheelbase will not be recorded.

INTERIOR TRIM CODES

Code	Trim Scheme
2	Blue Vinyl
3	Green Vinyl
4	Beige Vinyl
5	Red Vinyl
B	Blue Woven Plastic and Blue Vinyl
C	Green Woven Plastic and Green Vinyl
D	Beige Woven Plastic and Beige Vinyl
E	Red Woven Plastic and Red Vinyl

SERIES AND MODEL CODES

Series	Model	Body	
E10	E100	87A	Std. Pick-Up
	E100	87B	Dlx. Pick-Up
E11	E110	89B	Sta. Bus
	E114	89K	Sta. Bus①
E12	E120	89C	Club Wagon
	E124	89T	Club Wagon①
E13	E130	89D	Dlx. Club Wagon
	E125	89L	Dlx. Club Wagon①
E14	E140	89A	Van, Regular R.H. Side Doors
E16	E140	89J	Van, Regular R.H. Side Doors①
E14	E140	89E	Van, Display R.H. Fixed Windows
E16	E160	89M	Van, Display R.H. Fixed Windows①
E14	E140	89F	Van, R & L Fixed Windows
E16	E160	89N	Van, R & L Fixed Windows①
E14	E140	89G	Van, Cargo, R & L Side Doors
E16	E160	89R	Van, Cargo, R & L Side Doors①
E14	E140	89H	Van, Panel
E16	E160	89S	Van, Panel①

①Extended Body.

ENGINE CODES

Code	Type
A	6 Cyl. 240 CID (1V)
F	6 Cyl. 170 CID (1V)

TRANSMISSION CODES

Code	Transmission
C	3-Spd. Manual Shift
G	C-4 Automatic

AXLE CODES

Code	Ratio
01	3.50①
02	4.00①
07	3.00②
11	3.50②
12	4.11②
13	4.56②
A7	3.00③
B1	3.50③
B2	4.11③
B3	4.57③

①Ford 2300 lb.
②Ford 3500 lb.
③Locking Type Ford 3500 lb.

The following information (except District Code) does not apply to the Falcon Station Bus or Club Wagon warranty plates.

MAX. G.V.W. LBS.

The maximum gross vehicle weight in pounds is recorded in this space.

CERT. NET H.P. R.P.M.

The certified net horsepower at specified rpm is marked at this location.

D.S.O.

If the vehicle is built on a D.S.O., F.S.O., L.P.O. (special orders) the complete order number will be reflected under the DSO space including the District Code Number.

DISTRICT CODES

Code	District
11	Boston
12	Buffalo
13	New York
14	Pittsburgh
15	Newark
21	Atlanta
22	Charlotte
23	Philadelphia
24	Jacksonville
25	Richmond
26	Washington
31	Buffalo
32	Cleveland
33	Detroit
34	Indianapolis
35	Lansing
36	Louisville
41	Chicago
42	Fargo
43	Rockford
44	Twin Cities
45	Davenport
51	Denver
52	Des Moines
53	Kansas City
54	Omaha
55	St. Louis
61	Dallas
62	Houston
63	Memphis
64	New Orleans
65	Oklahoma City
71	Los Angeles
72	San Jose
73	Salt Lake City
74	Seattle
81	Ford of Canada
83	Government
84	Home Office Reserve
85	American Red Cross
89	Transportation Services
90-99	Export

BRAKES

GROUP 2

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PART 2-1 GENERAL BRAKE SERVICE

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1 DIAGNOSIS AND TESTING

PRELIMINARY TESTS

1. Check the fluid level in the master cylinder and add Rotunda R-103-A Super Heavy-Duty brake fluid (B7AZ-19542-A) as required.

2. Push the brake pedal down as far as it will go while the vehicle is standing. If the brake pedal travels more than halfway between the released position and the floor, check the operation of the automatic adjusters. To check adjuster operation, inspect the brake shoes and the adjuster mechanisms for binding or improper installation, follow the procedure described under Brake Shoe Adjustments in Part 2-2, Section 2.

Make several reverse stops to insure uniform adjustment at all wheels.

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

4. Should one of the brakes be locked and the vehicle 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 vehicle should be road tested only if the brakes will safely stop the vehicle. 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. For each of the symptoms encountered, check and eliminate the causes which are also listed in Table 1. To check for brake chatter or surge, apply the brakes lightly from approximately 50 mph.

2 COMMON ADJUSTMENTS AND REPAIRS

BRAKE PEDAL ADJUSTMENT

When the brake pedal free-travel (which is the movement of the brake pedal before the push rod touches the master cylinder piston) is less than ¼ inch or more than 7/16 inch, the brake pedal should be adjusted.

1. Push the brake pedal down by hand, and check the free-travel. If the free-travel is not within specifications, raise the front end of the truck and position safety stands.

2. From underneath the truck, remove the retaining bolts and the forward splash shield.

3. Loosen the lock nut on the eccentric bolt and rotate the bolt (Fig. 11, Part 2-2) until the free-travel is within ¼-7/16 inch.

4. Hold the bolt securely, and torque the lock nut to 12-24 ft-lbs.

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	Vehicle 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					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 Bearings	X				X								
Distorted or Improperly Adjusted Brake Shoe	X	X	X		X	X		X			X	X	
Faulty Retracting Spring	X				X								
Drum Out of Round	X				X		X						
Linings Glazed or Worn			X		X	X	X	X			X	X	X
Oil or Grease on Lining			X		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
Tire Tread Worn						X					X		
Poor Lining to Drum Contact							X						
Loose Front Suspension							X						
Threads Left by Drum Turning Tool Pulls Shoes Sideways											X		
Cracked Drum								X					

5. Recheck the pedal free-travel to make sure that the adjustment did not change when the lock nut was tightened.

6. Install the forward splash shield and attaching bolts, remove the safety stands, and lower the vehicle.

HYDRAULIC SYSTEM BLEEDING

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

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 brake fluid which has been drained from the hydraulic system.

1. Position a suitable ⅜-inch box wrench (Fig. 1) 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.**

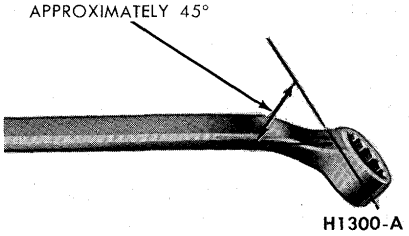

FIG. 1—Wrench for Bleeding Brake Hydraulic System

2. Submerge the free end of the tube in a container partially filled with clean brake fluid, and loosen the bleeder fitting approximately ¾ turn.

3. Push the brake pedal down slowly thru 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 bleeder tube.

4. When the fluid is completely free of air bubbles, close the bleeder fitting and remove the bleeder tube.

5. Repeat this procedure at each brake wheel cylinder in the following order: left rear, right front, and left front. Refill the master cylinder reservoir after each wheel cylinder is bled and when the bleeding operation is completed. The fluid level should be within ⅜ inch from 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 tool 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 ⅜-inch box wrench (Fig. 1) on the bleeder fitting on the right rear brake wheel cylinder. Attach a bleeder 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 bleeder tube, close the bleeder fitting and remove the tube.

7. Repeat this procedure at each brake wheel cylinder in the following 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.

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 by turning the handle counterclockwise and pushing it down.

2. Pull the parking brake handle up one notch from its normal released position.

3. Raise the vehicle.

4. Turn the lock nut in front of the equalizer (Fig. 13, Part 2-2) several turns forward.

5. Turn the adjusting nut forward against the equalizer until a moderate drag is felt when turning the rear wheels in the direction of forward rotation.

6. When the cables are properly adjusted, tighten the lock nut.

7. Release the parking brake, and make sure that the brake shoes return to the fully released position and no drag is felt when turning the rear wheels.

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 them with compressed air.

2. Brush all dust from the backing plates and the 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 any rivet head 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 vehicle has 24,000 or more miles of operation on the brake linings or signs of overheating are present when relining brakes, the wheel cylinders should be disassembled and inspected for wear and entrance of dirt into the cylinder. The cylinder cups should be replaced at this time to avoid 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 them. Refer to Part 2-2, Section 4 for refinishing.

PART 2-2 BRAKE SYSTEM

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DESCRIPTION AND OPERATION

HYDRAULIC SELF-ADJUSTING BRAKE SYSTEM

Single-anchor, internal-expanding, and self-adjusting hydraulic brakes are used on Econoline vehicles.

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 connected to the secondary brake shoe by means of the cable

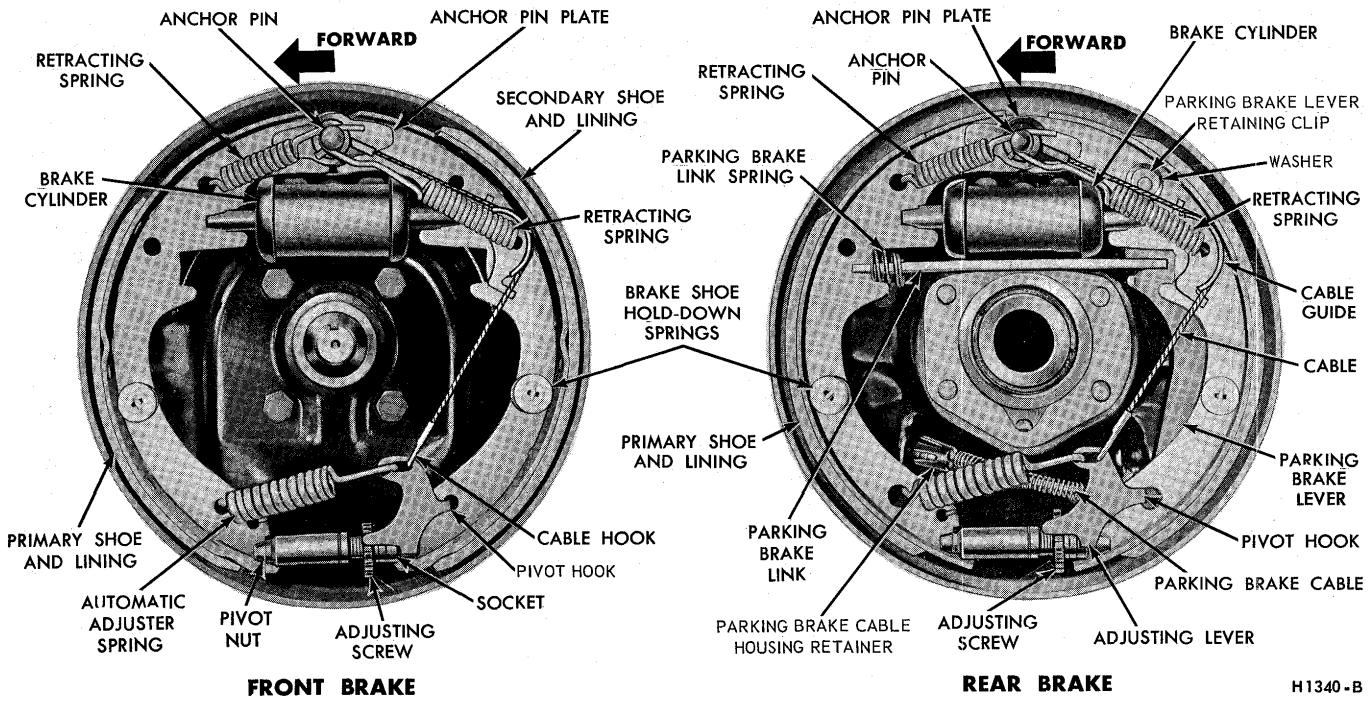


FIG. 1—Self-Adjusting Brake Assemblies

guide. The adjuster spring is hooked to the primary brake shoe and to the lever.

The automatic adjuster operates only while the vehicle is moving rearward and the brake pedal pressure is firmly applied.

With the vehicle 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 adjuster spring pulls the lever downward causing the star-wheel to turn and expand the shoes. The star-wheel is turned one tooth at a time as the linings progressively wear.

With the vehicle 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.

PARKING BRAKE

An independent hand - 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 as shown in Fig. 1.

When the handle is pulled the primary and secondary brake shoes are forced against the rear brake drums. The handle is held in the applied position by the engagement of a spring loaded pawl with a ratchet. Turning the handle counterclockwise disengages the pawl from the ratchet to release the brakes.

2 IN-VEHICLE ADJUSTMENTS AND REPAIRS

BRAKE SHOE ADJUSTMENT

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.

Considerable time savings can be made when performing one of these operations, by using Rotunda Tool HRE 8650 to adjust the brake shoes while the drum is removed. Use the following procedure:

1. Insert the tool into the brake drum as shown in Fig. 2. Adjust the spread of the tool and lock in place with the lock knob.

2. Reverse the tool as shown in Fig. 3 and apply to the brake shoes. Adjust the brake shoe diameter to fit the gauge. Hold the automatic adjusting lever out of engagement while rotating the adjusting screw, to prevent burring the screw slots. Make sure the adjusting screw rotates freely. If necessary, lubricate the adjusting screw threads with a thin, uniform coating of C1AZ-19590-B Grease.

3. Rotate Tool HRE 8650 around the brake shoes to be sure of the setting.

4. Apply a small quantity of high-temperature grease to the points where the shoes contact the carrier 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 3-4, Section 2.

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

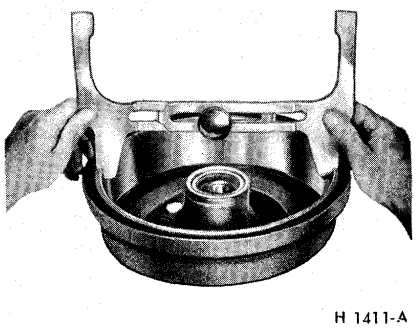


FIG. 2—Measuring Drum

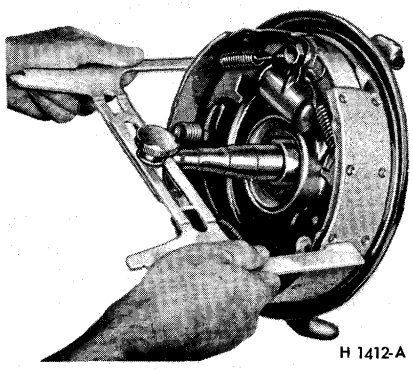


FIG. 3—Measuring Shoes

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

6. Complete the adjustment by applying the brakes several times while backing the vehicle.

FRONT BRAKE DRUM

REMOVAL

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

2. Remove the wheel cover or hub cap, wheel, and bearing dust cap. Remove the cotter pin, nut lock, nut, and washer.

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

If the brake drum will not come off, insert a narrow screwdriver through the brake adjusting hole in the carrier 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. 4). **Back off the adjustment only if the drum cannot be removed. 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 adjusting screw was backed

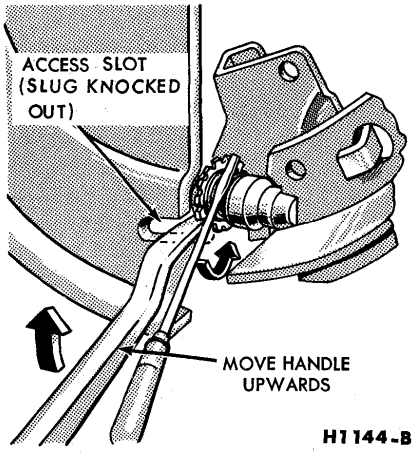


FIG. 4—Backing Off Brake Adjustment

off, check to make sure that the adjusting lever is still properly seated 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 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 3-4, Section 4.

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

2. Adjust the brake shoes as outlined above, using Rotunda Tool HRE 8650.

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

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

5. Install the wheel and hub cap.

REAR BRAKE DRUM

REMOVAL

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

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

If the brake drum will not come off, insert a narrow screw driver through the brake adjusting hole in the carrier 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. 4). **Back off the adjustment only if the drum cannot be removed. 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 adjusting screw was backed off, check to make sure that the adjusting lever is still properly seated in the shoe web.

INSTALLATION

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

2. Adjust the brake shoes as outlined above, using Rotunda Tool HRE 8650.

3. Place the drum over the brake assembly and into position.

4. Install the three attaching nuts and tighten securely. Install the wheel on the axle shaft flange studs against the drum, and tighten the nuts to specifications.

BRAKE SHOE AND ADJUSTING SCREW

REMOVAL

1. With the wheel and drum removed, install a clamp over the ends of the brake cylinder as shown in Fig. 5.

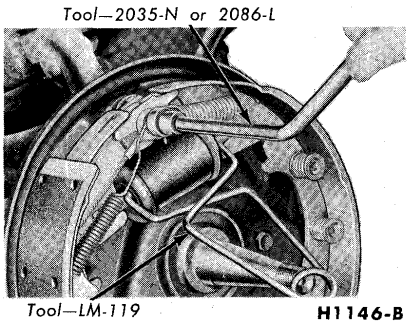


FIG. 5—Typical Retracting Spring Removal

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

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

4. Remove the shoe hold-down springs, shoes, adjusting screw, pivot nut, socket and automatic brake adjusting parts.

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

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

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

3. Position the brake shoes on the carrier plate, and install the hold-down spring pins, springs, and cups. Use aluminum colored springs for the primary shoe and purple springs for the secondary shoe. On the rear brake, install the parking brake link, spring, and washer. Connect the parking brake cable to the parking brake lever (Fig. 1).

4. Place the cable anchor over the anchor pin with the crimped side toward the carrier plate.

5. Install the primary shoe to anchor (short) spring with the tool shown in Fig. 6.

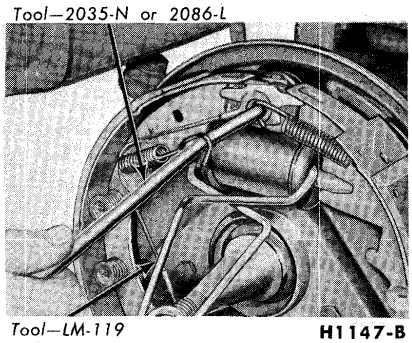


FIG. 6—Typical Retracting Spring Installation

6. 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.

7. Install the secondary shoe to anchor (long) spring (Fig. 6).

Be certain that the cable end 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.

On front brakes, install the shoe retracting assist spring.

8. Apply high-temperature (C4AZ-19590-A) grease to the threads of 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 truck 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 truck, the socket end of the adjusting screw is stamped with an R or L (Fig. 7). The adjusting pivot nuts can be distinguished by the number of lines machined around the body of the nut. Two lines indicate a right nut; one line indicates a left nut.

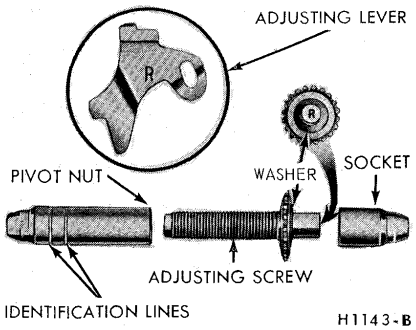


FIG. 7—Adjusting Screw and Lever Identification

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

10. Hook the cable hook into the hole in the adjusting lever from the backing plate side. The adjusting levers are stamped with an R or L to indicate their installation on a right or left brake assembly (Fig. 7).

11. Position the hooked end of the adjuster spring into the large hole in the primary shoe web, and connect the loop end of the spring to the adjuster lever hole.

12. 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).

13. 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 one tooth above the center line of the adjusting screw. If the contact point is below this center line, 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. 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 11¼ inches (plus or minus 1/64 inch) from the far edge of the cable anchor hole to the inside edge 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. Repair the hook or 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

The cylinder does not have to be removed from the carrier plate for disassembly, inspection, or overhaul. However, if the inspection reveals severe scoring or damage, the cylinder must be removed for replacement.

DISASSEMBLY

1. Remove the rubber boots (Fig. 8). Remove the pistons, cups, and return spring from the cylinder bore.

2. Remove the bleeder screw.

INSPECTION

1. Wash all parts in clean dena-

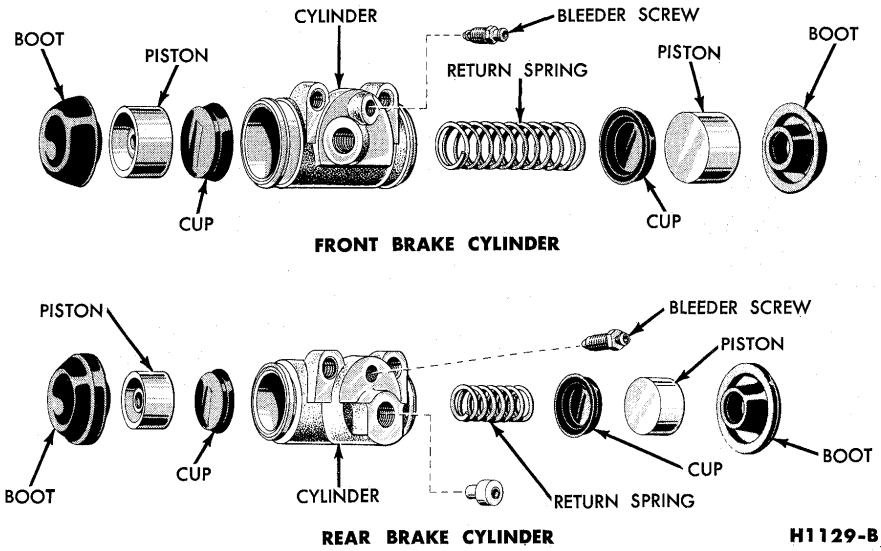


FIG. 8—Front and Rear Wheel Cylinders

tured alcohol, and dry with compressed air.

2. Check all internal parts for excessive wear or damage. **If any internal part requires replacing, all should be replaced.**

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

4. Check to be sure that the bleeder hole 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 (Fig. 8) in their respective positions in the cylinder bore. 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 drum.

2. Place a clamp over the ends of the brake cylinder.

3. Remove the brake shoe assembly, following steps previously outlined in this section.

4. Disconnect the brake line from the brake cylinder. To disconnect the hose at a front cylinder, loosen the pipe 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 pipe fitting that connects the tube to the cylinder.

5. Remove the two cylinder retaining screws at the back side of the carrier plate, and remove the cylinder.

INSTALLATION

1. Place the brake cylinder into position against the carrier plate, and secure with two screws and lock washers. Torque to specification.

2. On a front cylinder, install a new copper gasket over the hose fitting. Screw the hose assembly into the cylinder. Engage the opposite end.

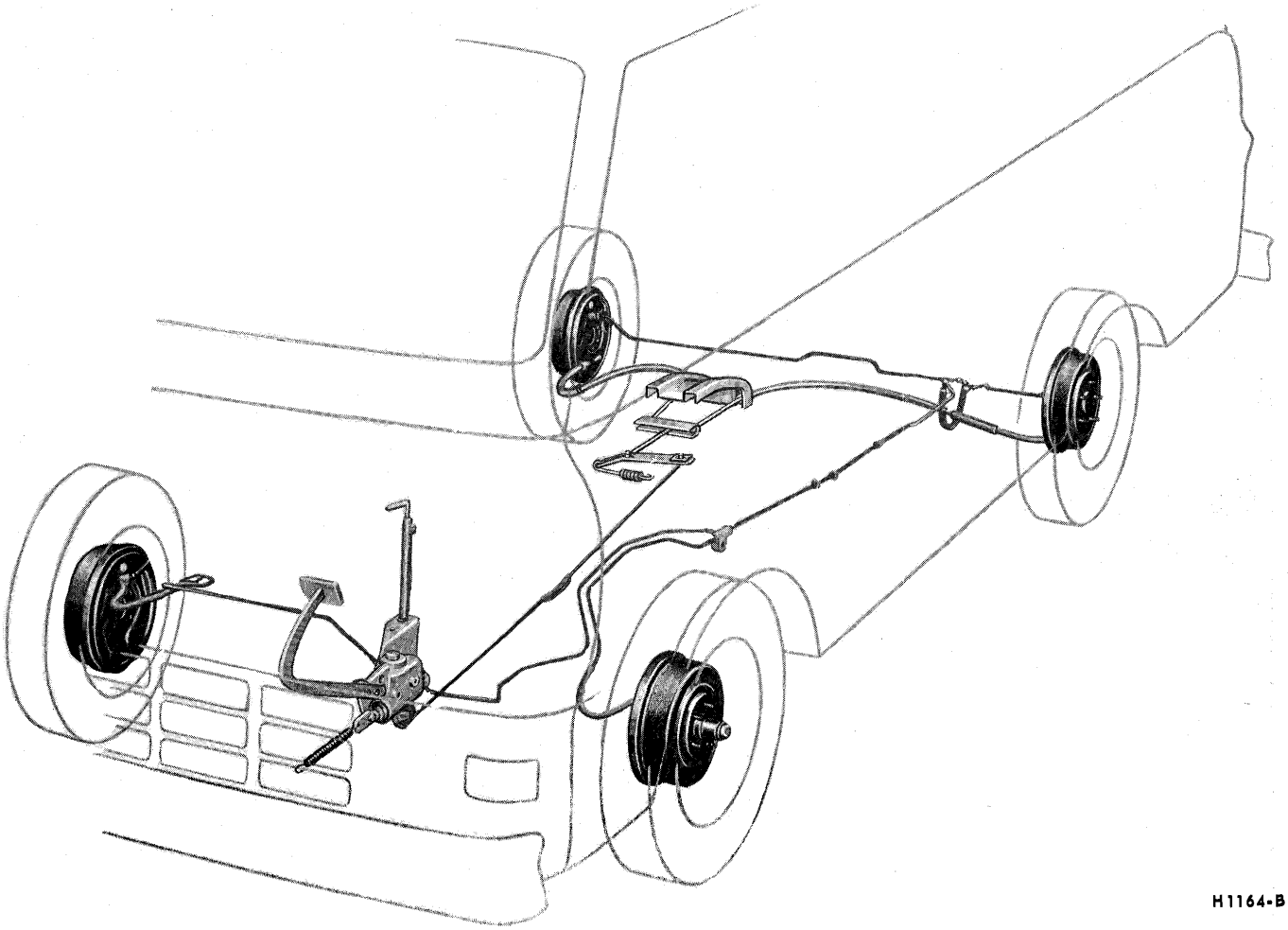
BRAKE CARRIER PLATE REPLACEMENT

REMOVAL

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

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

3. If the rear carrier plate is being replaced, rotate the axle shaft so that the hole in the axle shaft flange lines up with the carrier plate retain-



H1164-B

FIG. 9—Brake System

ing nuts, and remove the nuts. Pull the axle shaft assembly out of the housing with Tool T60K-4234-A and T50T-100-A, then remove the carrier plate.

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

INSTALLATION

1. Position a new **rear** carrier 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 attaching bolts and against the carrier plate. Install the attaching nuts through the access hole in the axle shaft flange, and torque to specification.

Position a new **front** carrier plate to the wheel spindle, install the attaching bolts and nuts, and torque to specification.

2. Install the brake shoes and the brake cylinder as outlined in this section.

3. Connect the brake line to the brake wheel cylinder, then install the wheel and brake drum.

4. Adjust the brake shoes 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. 9).

Always bleed the entire hydraulic 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 double-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 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. 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. Install the horseshoe-type retaining clip, and connect the tube to the hose with the tube fitting nut (Fig. 10).

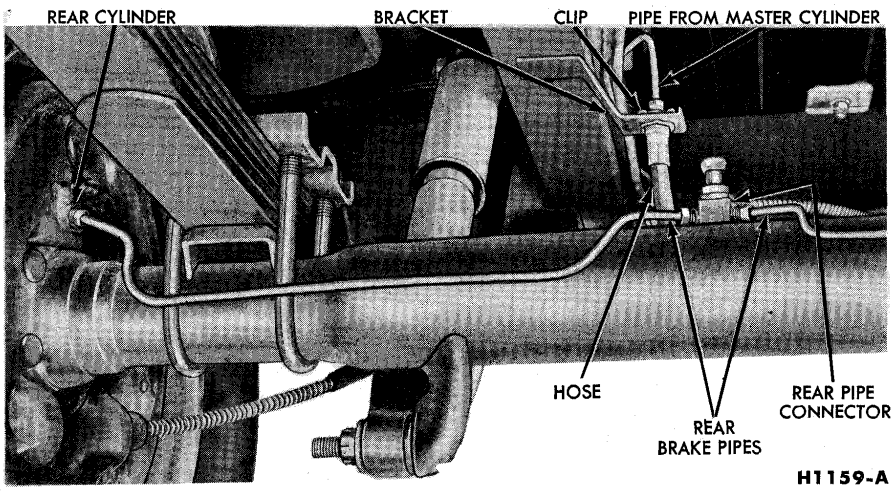


FIG. 10—Rear Brake Hose and Pipe Connections

3 REMOVAL AND INSTALLATION

MASTER CYLINDER

REMOVAL

1. Raise the front end of the truck and position safety stands.

2. Remove the attaching bolts and the forward splash shield.

3. Disconnect the brake pedal return spring (Fig. 11).

4. Remove the lock nut and the eccentric bolt, which connect the return spring bracket and the master cylinder push rod to the brake panel bracket.

5. Remove the snap ring from the brake pedal pivot pin.

6. Remove the fitting bolt (attaches the outlet fitting to the end of the cylinder) and two washers. The outlet fitting will remain suspended by the brake lines (Fig. 12).

7. Remove the two mounting bolts that secure the cylinder between the two mounting brackets. To prevent the brake pedal and master cylinder from swinging freely after the mounting bolts are removed, hold the master cylinder firmly when removing the mounting bolts.

8. Swing the cylinder down, and remove it from the brake pedal pivot pin.

INSTALLATION

1. Place the brake pedal pivot pin bushings in the pivot-pin bore in the cylinder body. Mount the cylinder on the pivot pin.

2. Swing the cylinder up and into position between the mounting brackets (Fig. 12). Install the mounting bolts and the pivot-pin snap ring (Fig. 11). Torque the mounting bolts to 23-29 ft-lbs.

3. Connect the outlet fitting to the master cylinder by installing the fitting bolt and new washers (one washer on each side of the outlet fitting).

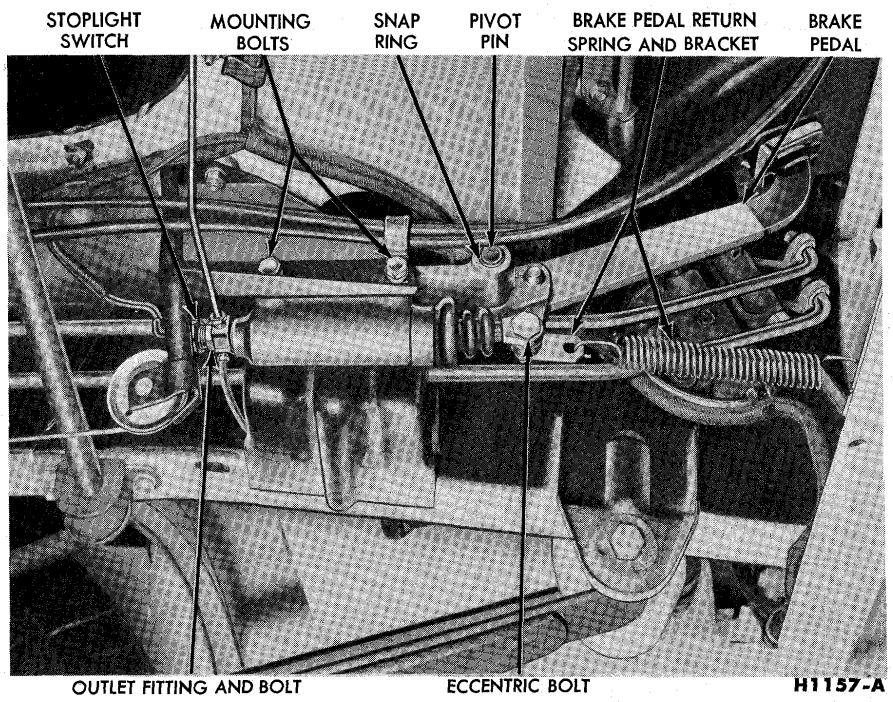


FIG. 11—Brake Master Cylinder—Installed

4. Connect the push rod and the return spring bracket to the brake pedal with the eccentric bolt and nut.

5. Connect the return spring to the bracket (Fig. 11).

6. Bleed the hydraulic system as outlined in Part 2-2.

7. Adjust the brake pedal free-travel at the eccentric bolt as outlined under **Brake Pedal Adjustment** in Part 2-1. Torque the eccentric bolt nut to 12-24 ft-lbs.

8. Apply chassis lubricant to the grease fitting at the brake pedal pivot.

9. Install the splash shield and retaining bolts, remove the safety stands, and lower the truck.

BRAKE PEDAL

REMOVAL

1. Working inside the cab, fold back the floor mat and remove the retaining screws and the steering column floor pan cover. Pull up the rubber seal.

2. Raise the front end of the truck, and place safety stands into position.

3. From underneath the vehicle, remove the attaching bolts and the forward splash shield.

4. Disconnect the brake pedal return spring, and remove the brake pedal eccentric bolt, return spring bracket, and nut (Fig. 11).

5. Remove the snap ring from the pivot pin, slide the brake pedal and pivot pin assembly out of the pivot pin bore in the master cylinder, and lower the assembly from the left side of the floor pan.

6. Remove the bushings from the pivot pin bore in the master cylinder.

INSTALLATION

1. Install the pivot pin bushings in the pivot pin bore in the master cylinder.

2. Insert the brake pedal pivot pin into the bore, then connect the master cylinder push rod and the return spring bracket with the eccentric bolt and nut. Do not tighten the nut at this time.

3. Connect the brake pedal return spring at the bracket, and install the snap ring on the pivot pin.

4. Adjust the brake pedal free-travel, and torque the eccentric nut to 12-24 ft-lbs.

5. Apply chassis lubricant to the grease fitting at the brake pedal pivot.

6. Replace the forward splash shield, and secure with attaching bolts. Remove the safety stands and lower the vehicle.

7. Position the rubber seal at the brake pedal in the cab, install the steering column floor pan and secure with attaching screws.

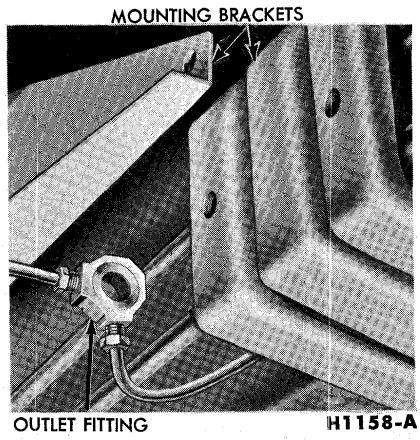


FIG. 12—Brake Master Cylinder Mounting Bracket

PARKING BRAKE HANDLE

REMOVAL

1. Push the equalizer lever slightly forward, and disconnect the ball end of the cable from the lever (Fig. 13).

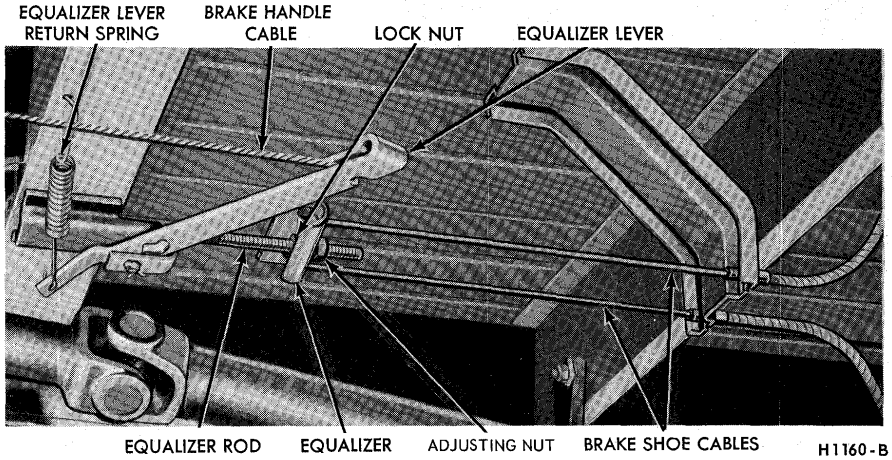


FIG. 13—Parking Brake Linkage

2. Pull the brake handle up, and disconnect the cable end from the ratchet bar.

3. Remove the lock pin from the ratchet bar, and remove the brake handle from the brake handle housing assembly.

INSTALLATION

1. Position the ratchet bar in the brake handle housing assembly.

2. Install the lock pin in the ratchet bar, and connect the cable end to the ratchet bar.

3. Push the equalizer lever slightly forward, and insert the ball end of the cable in the slot on the equalizer lever (Fig. 13).

4. Adjust the parking brakes as outlined in Part 2-1.

PARKING BRAKE EQUALIZER TO HANDLE CABLE

REMOVAL

1. Push the equalizer lever slightly forward, and disconnect the ball end of the cable from the lever (Fig. 13).

2. Remove the cotter pin, clevis, and pulley from the parking brake bracket.

3. Raise the ratchet bar retainer out of the last (full release stop) notch of the ratchet bar, and allow the ratchet bar to slide down the housing until it bottoms.

4. Remove the cable from the ratchet bar.

5. Remove the cable from the cable guide.

INSTALLATION

1. Place the cable ball in the ratchet bar cable slot, and raise the ratchet bar until the ratchet bar retainer engages the full release stop notch of the ratchet bar.

2. Position the cable in the pulley, and install the pulley in the parking brake bracket with the clevis and cotter pin.

3. Route the cable rearward, through the cable guide, and connect it to the equalizer lever.

4. Check the operation of the brake handle, and adjust the equalizer rod until the cables are free of any slack.

PARKING BRAKE EQUALIZER TO REAR WHEEL CABLE

REMOVAL

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

2. Remove the three attaching nuts that hold the brake drum in place, back off the brake shoes, and remove the drum.

3. Loosen the adjusting nut on the equalizer rod, and disconnect the cable from the equalizer (Fig. 13).

4. Remove the hair pin retainer that holds the cable housing to the bracket on the crossmember and pull the cable and housing out of the bracket (Fig. 13).

5. Remove the bolt, nut and lock washer that connect the cable rear clip to the frame side member. Remove the clip from the cable.

6. Working on the wheel side of the rear brake assembly (Fig. 1), compress the prongs on the cable retainer so that they can pass through the hole in the carrier 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 through the carrier plate hole.

INSTALLATION

1. Pull enough of the cable through the housing so that the end of the cable may be inserted over the slot in the parking brake lever (Fig. 1).

2. Pulling the excess slack from the cable, insert the cable housing into the carrier plate access hole so that the retainer prongs expand.

3. Thread the front end of the cable housing through the frame bracket and install the hair pin retainer (Fig. 13).

4. Install the rear clip on the cable, and fasten the clip to the bracket on the frame sidemember with the attaching bolt, lock washer and nut.

5. Insert the ball end of the cable into the equalizer and tighten the adjusting nut on the equalizer rod slightly (Fig. 13).

6. Install the rear drum. Tighten the three attaching nuts that retain the drum, and install the wheel and hub cap.

7. Adjust the rear brake shoes as outlined in Section 2. 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 0.005 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.

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.

BRAKE SHOE RELINING

Brake linings that are worn to within 1/32 inch of the rivet head or have been saturated with grease or oil should be replaced. Worn linings can score the brake drum. **When any lining requires replacement, it should be replaced in sets of two —both front or both rear wheels.**

Inspect brake shoes for distortion, cracks and looseness. If any of these conditions exist, the shoe should be discarded. **Do not repair a defective brake shoe.**

1. Wash the brake shoes thoroughly in a cleaning solvent. Remove all burrs and rough spots from the shoe.

2. Check the inside diameter of the brake drum. If the drum is less than 0.030 inch oversize, standard lining may be installed. Oversize lining should be installed, if the drum is 0.030-0.060 inch oversize.

3. Position the new lining on the shoe. Insert and secure the rivets at the center holes. Install the remaining rivets. Install all parts supplied in the kit. **Ford replacement linings are ground, and no further grinding is required.**

4. Check the clearance between

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

MASTER CYLINDER OVERHAUL

The master cylinder will have to be removed from the truck and overhauled on the bench. Follow the foregoing procedure for removal and installation.

DISASSEMBLY

1. Clean the outside of the cylinder, remove the filler cap and gasket (Fig. 14), and pour out any remaining fluid.

2. Place the cylinder in a vise, and remove the rubber boot from the push rod end of the cylinder.

3. Remove the retainer spring from the push rod end of the cylinder, then remove the retainer, piston, cup, spring and valve assembly, and valve seat from the cylinder bore.

INSPECTION AND REPAIR

1. Clean all 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 of the parts supplied.

2. Check all openings to be sure they are open and free from foreign matter.

3. Check the spring valve at the forward end of the piston. If the spring is loose or has moved so that the piston parts are open, replace the piston.

4. Inspect the cylinder bore for score marks and rust. If either condition is present, the cylinder should be honed. **When honing, do not remove more than 0.003 inch as oversize parts are not available.**

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

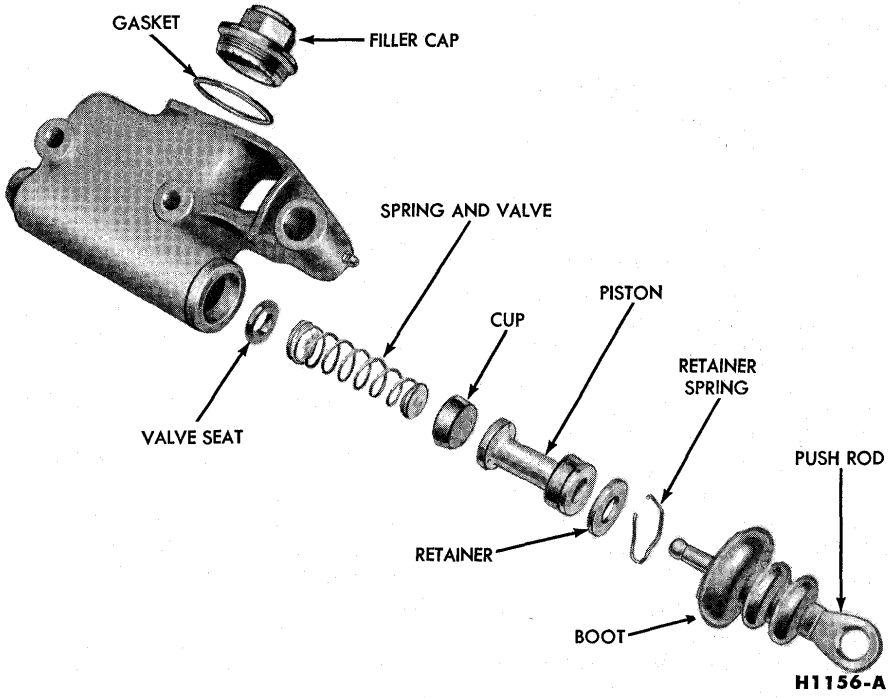


FIG. 14—Brake Master Cylinder—Disassembled

ASSEMBLY

1. Dip all parts except the cylinder body in clean, heavy-duty brake fluid.

2. Position the gasket and filler cap in the cylinder body, and finger tighten the cap.

3. Insert the valve seat, spring and valve assembly, and cup into the cylinder bore (Fig. 14).

4. Compress the piston against the cup, and install the retainer and retainer spring.

5. Position the push rod in the rubber boot, insert the push rod against the piston, and install the rubber boot on the cylinder body.

PART 2-3 SPECIFICATIONS

NOTE: All specifications are given in inches unless otherwise noted.

BRAKE CHECKS AND ADJUSTMENTS

Type of Check or Adjustment	Specification
Brake Pedal	Pedal Free Play ¼-7/16 inch
Brake Shoe Repair	Brake Lining Clearance (Midway between Rivets)
	Maximum 0.005 inch Lining Wear Limit
	(From Top of Rivets) Maximum 1/32 inch
Master Cylinder	Hydraulic Master Cylinder Bore, Honed Diameter, Maximum 1.003 inch

DIMENSIONS

Description		Front	Rear
Drum Inside Diameter		10.000	
Drum Maximum Boring Limit		10.060	
Lining Width	Primary	2.50	1.75
	Secondary	2.50	1.75
Wheel Cylinder Bore Diameter		1.125	0.8125
Master Cylinder Bore Diameter		1.000	

TORQUE LIMITS

Description	Ft-lbs
Master Cylinder Eccentric Bolt to Brake Pedal Assembly	12-24
Brake Tube Fitting	10-12½
Rear Brake Assy. & Bearing Retainer to Rear Axle Housing	30-35
Brake Cylinder to Brake Carrier Plate	11-19
Parking Brake Control to Front Floor	7-15
Master Cylinder to Mounting Bracket	23-29
Parking Brake Control to Mounting Bracket	23-29
Brake Hose	12-18
Brake Line Connection or Rear Axle Housing Bolt	12-18
Front Brake Carrier Plate to Spindle	45-60
Wheel Nuts	55-85

SUSPENSION, STEERING, WHEELS AND TIRES

GROUP 3

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

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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 4, 11, 13 and 17 as indicated.

FRONT WHEEL ALIGNMENT CHECKS

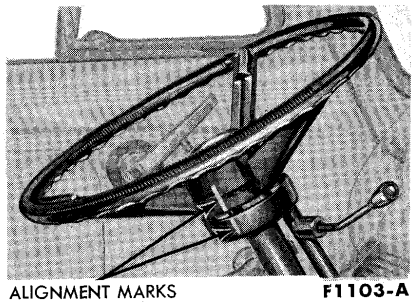
Do not attempt to check and adjust front wheel alignment without first making a preliminary inspection of the front end parts.

Check all factors of front wheel alignment before making adjustments.

EQUIPMENT INSTALLATION

Equipment used for front wheel alignment inspection must be accurate. If portable equipment is being used, perform all inspection operations on a level floor.

1. Drive the vehicle in a straight line far enough to establish the straight-ahead position of the front wheels, and then place corresponding chalk marks on the steering column and steering wheel hub (Fig. 1).



ALIGNMENT MARKS F1103-A

FIG. 1—Straight-Ahead Position Marks

Do not adjust the steering wheel spoke position at this time. If the front wheels are turned at any time during the inspection, align the chalk marks to bring the wheels back to the straight-ahead position.

2. Install the wheel alignment equipment on the vehicle. Whichever type of equipment is used, follow the installation and inspection instructions provided by the equipment manufacturer.

CAMBER

Check the camber angle at each front wheel.

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. The correct camber angle, or outward (positive) tilt, is listed in Part 3-5. The maximum difference between both front wheel camber angles should not exceed ¼°.

TABLE 1—Trouble Symptoms and Possible Causes

POSSIBLE CAUSES OF TROUBLE / TROUBLE SYMPTOMS	Jerky Steering	Loose Steering	Hard Steering	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	X	
4. Overloaded Front Axle			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	
12. Loose or Weak Shock Absorber					X	X		X	X			X		X	
13. Binding Spindle Bolt Bearings	X		X	X				X							
14. Loose Spindle Bolt Bearings						X						X			
15. Loose, Worn, or Damaged Steering Linkage or Connections	X	X			X	X		X		X		X			
16. Loose Steering Gear Mountings	X	X			X	X		X							
17. Incorrect Steering Gear Adjustment	X	X	X	X	X	X		X	X		X	X			
18. Incorrect Brake Adjustment	X				X		X					X			
19. Incorrect Front Wheel Bearing Adjustment	X	X			X	X	X	X				X			
20. Wheel Out of Balance	X					X						X		X	
21. Incorrect Front Wheel Alignment	X		X		X	X	X	X		X	X	X			
22. Out-of-Round Wheel or Brake Drum						X						X		X	
23. Frame or Underbody Out of Alignment	X						X					X			X
24. Bent Rear Axle Housing	X				X		X					X			X

CASTER

Check the caster angle at each front wheel.

Caster is the forward or rearward tilt of the top of the spindle bolt. If the spindle bolt tilts to the rear, caster is positive. If the spindle bolt tilts to the front, caster is negative. The correct caster angle, or backward (positive) tilt, is listed in Part 3-5. The maximum difference between both front wheel caster angles should not exceed ½°.

The caster angle reading on the gauge is true only when the vehicle frame is horizontal from front to rear. If sagging springs on the front, or large tires on the rear, cause the frame not to be level, the caster angle reading must be modified to take this into consideration. Setting the front wheels on blocks of appropriate height, or letting air out of the rear tires to level the frame are other methods of compensation.

TOE-IN

Check the toe-in with the front wheels in the straight-ahead position. Measure the distance between the extreme front and also between the extreme rear of both front wheels. Both of these measurements (front and rear of wheels) should be taken at an equal distance from the floor and at the approximate center line of the spindle. The difference between these two distances is the amount that the wheels toe in or toe

out. The wheels should always be adjusted to toe in according to specifications.

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.**

FRONT WHEEL TURNING ANGLE

When the inside wheel is turned 20°, the turning angle of the outside wheel should be as specified in Part 3-5. The turning angle cannot be adjusted directly, because it is a result of the combination of caster, camber, and toe-in adjustments and should, therefore, be measured only after these adjustments have been made. If the turning angle does not measure to specifications, check the spindle or other suspension parts for a bent condition.

SHOCK ABSORBER TESTS

To check a shock absorber removed from a vehicle, clamp the lower end (small diameter) in a vise, in a near vertical position, and pump a few times to expel any air. A good shock absorber will have a steady drag in both directions when operated by hand. If it operates without any drag, or is very hard to operate, it should be replaced.

2 COMMON ADJUSTMENTS AND REPAIRS

FRONT WHEEL ALIGNMENT ADJUSTMENTS

After front wheel alignment factors have been checked, make the necessary adjustments. Camber, caster, and toe-in can be adjusted if not within specifications.

Be sure that the vehicle is unloaded when making adjustments.

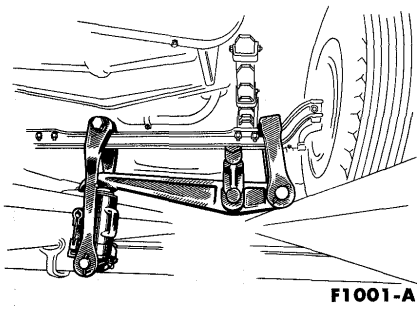


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FIG. 2—Typical Tool Installation For Camber Increase

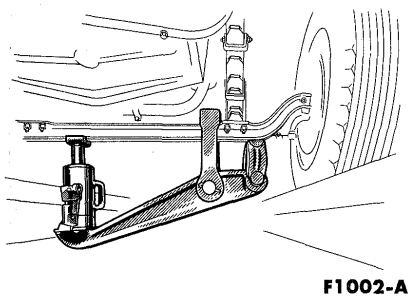

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FIG. 3—Typical Tool Installation For Camber Decrease

CAMBER

Camber can be adjusted by bending or straightening the front axle beam. Figure 2 shows a typical tool installation for increasing the camber angle. Figure 3 shows a tool installation for decreasing the camber angle.

In all cases, the bend should be made between the front spring pad and the spindle. Otherwise, the spring pads will be thrown out of parallel with each other.

When making camber adjustments with this type of tool, pull the bottom of the jack forward as the pressure is applied, so that the tool hangs at about the same angle as the spindle bolt (caster angle). This will prevent fore and aft bends from occurring in the axle beam. **Use a combination of blocks or shims that holds the tool in the best position.**

CASTER

The caster angle is controlled by the angle of the front spring pads, and changes as the load on the front axle increases or as the springs sag. The spring pads must be parallel to each other. Any change in the caster angle results from a twisted axle or spring sag.

If the springs have sagged, the caster angle can be adjusted by replacing the springs or by installing tapered wedges between the springs and the spring pads. An equal number of wedges should be installed on both sides. Position the thick edge of the wedges toward the rear of the truck to increase the caster, or toward the front to decrease the caster. **When installing wedges, be sure that the front spring tie bolts extend through the wedges and into the axle pilot hole.**

TOE-IN

If the toe-in is incorrect, loosen the clamp bolts at each end of the spindle connecting rod tube. Rotate the tube until the correct toe-in is obtained, and torque the clamp bolts to specifications (Part 3-5). Recheck the toe-in to make sure that no changes occurred when the bolts were tightened. The clamps should be positioned $\frac{3}{16}$ inch from the end of the rod with the clamp bolt at right angles and adjacent to the slot in the rod (Part 3-2, Fig. 6).

WHEEL BALANCING

Wheel balancing is the proper distribution of weight around a wheel and tire to counteract centrifugal forces acting upon the heavy area. The purpose of wheel balancing is to maintain a true running wheel perpendicular to its rotating axis. A properly balanced wheel will eliminate vibration and abnormal wear of suspension parts and tire wear.

To balance a wheel, carefully follow the instructions provided with the Rotunda Wheel Balancer.

3 CLEANING AND INSPECTION

FRONT END GENERAL INSPECTION

Do not check and adjust front wheel alignment without first making the following inspection for front end maladjustment, damage, or wear.

1. Check the air pressure in all the tires. Make sure that the pressures agree with those specified for the tires and vehicle model being

checked.

2. Raise the front of the vehicle off the floor. **Do not use a bumper jack.** Grasp each front tire at the front and rear, and push the wheel inward and outward. If any free play is noticed between the brake drum and the brake carrier plate, adjust the wheel bearings. Replace the bearings if they are worn or damaged. Adjust and/or replace worn or damaged bearings as outlined in Part 3-4.

3. Grasp each tire at the top and bottom, and shake the wheel while watching the movement of the brake carrier plate. If the brake carrier plate moves more than 1/32 inch, rebush the spindles as outlined in Part 3-2.

4. Check all steering linkage for wear or maladjustment. Adjust and/or replace worn parts as outlined in Part 3-3.

5. Check the torque on the steering gear mounting bolts, and tighten if required. Check the front spring clips (U-bolts) and the spring tie bolt, and tighten them if necessary.

6. Rotate each front wheel slowly, and observe the amount of lateral or side runout. If the wheel runout exceeds 1/8 inch, replace the wheel or install the wheel on the rear. On a truck with cast wheels, runout can usually be corrected by loosening the rim clamp nuts and retightening them alternately and evenly. Then torque the nuts to specification.

WHEELS

Wheel stud nuts should be inspected and tightened to specifications regularly, to avoid accidental loosening of the wheels. Loose wheel stud nuts may cause elongation of the wheel stud holes resulting in shimmy and vibration.

Keep the wheels and hubs clean. Stones or lumps of mud wedged between the wheel and drum will 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.

TIRES

The tires should be checked frequently to be sure that the air pressures agree with those specified for the tires and vehicle model.

Inspect the tire treads, and remove all stones, nails, glass, or other objects that may be wedged in the tread. Check for holes or cuts that may permit air leakage from the tire, and make the necessary repairs.

Inspect the tire side walls for cuts, bruises, and other damage. If internal damage is suspected, remove the tire from the wheel for further inspection and repair or replacement.

Check the tire valve for air leaks, and replace the valve if necessary. Replace any missing valve caps.

FRONT WHEEL BEARINGS

When the front wheel bearings are excessively worn or damaged, check the bearing cups for proper installation before removing them for replacement. If a cup is improperly seated in the hub, inspect the hub for burrs, rough spots, or other irregular surfaces that would prevent seating the cup properly.

Bearing damage is often caused by lack of lubrication or improper adjustment. When installing bearing cups or cones and rollers, make sure that the specified lubricant is properly used. Adjust the bearings after installation, following the procedure given in Part 3-4.

CHECKING AND ADDING STEERING GEAR LUBRICANT

1. Remove the floor mat and the steering gear access plate.

2. Remove the steering gear housing filler plug.

3. With a clean punch or like instrument, clean out or push inward the loose lubricant in the filler plug hole.

4. Slowly turn the steering wheel to the **left** stop. If the lubricant rises within the filler plug hole as the wheel turns, there is sufficient lubricant in the gear. Skip steps **5** through **7** and proceed with step **8**. If the lubricant does not rise in the hole, perform all the following steps.

5. Turn the steering gear to the **right** stop in order to position the sector shaft teeth away from the filler plug hole.

6. Remove the cover-to-housing (top) retaining bolt.

7. Fill the gear through the filler plug hole until lubricant comes out of the cover bolt hole. Install the cover retaining bolt.

8. Install the filler plug, the steering gear access plate, and the floor mat.

PART 3-2 SUSPENSION

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1 DESCRIPTION AND OPERATION

FRONT AXLE

The front axles are of the I-beam type with the front wheel spindles attached to the ends of the axles (Fig. 4).

Each spindle is held in place on the axle by a spindle bolt. Steel-backed, bronze bushings are pressed into the upper and lower ends of the spindle bore to provide bearing surfaces for the spindle bolt. A thrust bearing is installed between the lower end of the spindle bore on the axle and the spindle to support the load on the axle. A spindle arm, to which the steering linkage is attached, is installed on each spindle.

FRONT AND REAR SPRINGS

Semi-elliptic, leaf-type front end rear springs are used on all vehicles. The springs are mounted parallel to the frame side members, and are held in place on the axles by spring clips (U-bolts). The front end of each spring is mounted to a shackle bracket with a bolt and nut. The rear end is mounted to a shackle assembly. Both the bracket and shackle are mounted on the underbody (Fig. 5).

SHOCK ABSORBERS

The hydraulic shock absorbers are of the direct, double-acting type. They provide a continuous damping effect both on compression and rebound. These shock absorbers are of telescopic design with rubber grommets at the mounting points for quiet operation. Since the shock absorbers are sealed, non-adjustable units, they must be replaced as complete assemblies.

2 IN-VEHICLE ADJUSTMENTS AND REPAIRS

FRONT SHOCK ABSORBER REPLACEMENT

1. Raise the vehicle on a hoist.
2. Remove the shock absorber lower attaching nut and washer (Fig. 1)
3. Remove the upper attaching nut and washer.
4. Remove the upper mounting bolt, and remove the shock absorber from the vehicle.
5. Transfer the sleeve from the lower bushing to the replacement shock absorber. If worn or damaged use a new sleeve.
6. Position the replacement shock absorber to the upper mounting bracket, insert the mounting bolt from the rear, install the attaching nut and washer, and torque to specifications.
7. Position the lower end of the shock absorber to the lower mounting stud, install the attaching nut and washer, and torque to specifications.

REAR SHOCK ABSORBER REPLACEMENT

1. Raise the vehicle on a hoist.
2. Remove the shock absorber lower mounting nut and bolt, and swing the lower end free of the mounting bracket on the axle housing (Fig. 2).
3. Remove the attaching nut from the upper mounting stud, and remove the shock absorber.
4. Transfer the sleeves from the upper and lower bushings to the replacement shock absorbers. If worn or damaged, use new sleeves.
5. Position the replacement shock absorber with rubber bushings and steel washers to the upper mounting bolt.
6. Swing the lower end of the shock absorber into the mounting bracket on the axle housing and install the washers, mounting bolt, and self-locking nut. Torque the nut to specification.
7. Install the self-locking nut on the upper mounting bolt. Torque the nut to specification.

STABILIZER BAR LINK REPLACEMENT

At both right and left stabilizer bar links perform the following steps.

1. Raise the front end of the vehicle. **Do not use a bumper jack.**

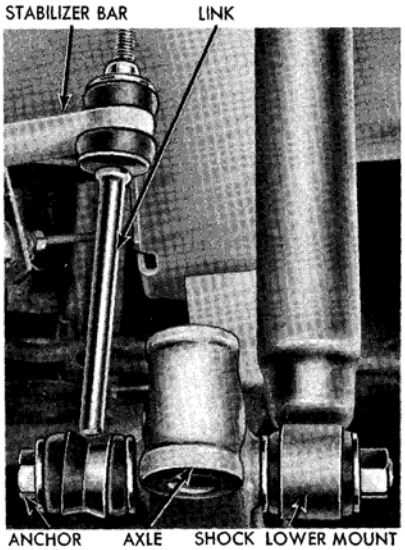

FIG. 1—Shock Absorber and Stabilizer Link Lower Connections

2. Remove the nut and washer that connect the link to the stabilizer bar.

3. Remove the nut and washer from the anchor bolt that attaches the lower end of the shock absorber and stabilizer bar link to the axle. Tap the anchor bolt out of the shock absorber, axle, and link (Fig. 1).

4. Position the lower end of the shock absorber and the replacement stabilizer bar link with bushing and washers in line with anchor bolt bore in the axle. Install the anchor bolt through the link, axle and shock absorber, then install the washer and retaining bolt to the anchor bolt.

5. Connect the link to the stabilizer bar with washer insulators and retaining nut.

6. Lower the vehicle.

SPRING BUSHING REPLACEMENT

1. Raise the vehicle on a hoist, position stands under the chassis, and lower the hoist slightly.

2. For a front spring, remove the front splash shield.

3. Remove the retaining nut from the spring front shackle bolt.

4. Install a Curtis jack (or a suitable block) between the spring and chassis to relieve the tension, then drive the front bolt from the spring eye and bracket with a drift.

5. Adjust the jack (or block) to move the spring eye down and out of the front shackle bracket.

6. Install a Snap-on bushing remover with proper adapter to the spring eye, and remove the bushing from the eye.

7. Remove the bushing from the tool.

8. Apply Lubriplate (COAZ-19584-A) to the outside of the new bushing, and install the new bushing to the spring eye using the Snap-on tool.

9. After the bushing is installed, remove the tool from the spring eye.

10. Adjust the Curtis jack (or block) so as to align the spring eye with the front shackle bracket.

11. Install the shackle bolt and nut and torque to specifications.

12. Remove the Curtis jack (or block) from the spring.

13. Position the front splash shield and install the attaching bolts after rebushing a front spring.

14. Lower the vehicle.

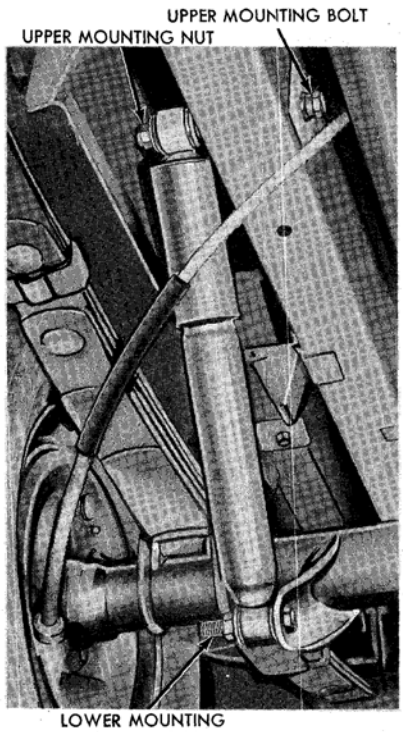

FIG. 2—Rear Shock Absorber

3 REMOVAL AND INSTALLATION

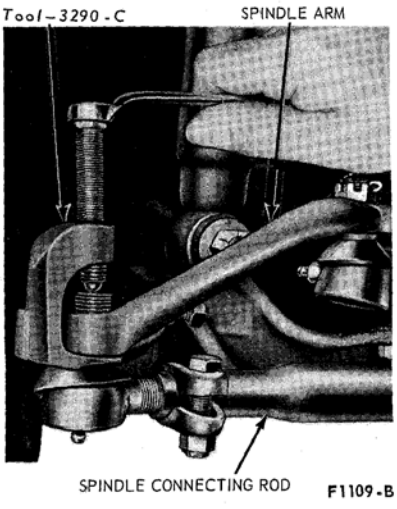

FIG. 3—Removing Spindle Connecting Rod

FRONT AXLE

REMOVAL

1. Raise the front of the vehicle and position safety stands.

2. Back off the brake adjustment, and remove both front wheel hub and drum assemblies.

3. Remove the cotter pin and retaining nut and disconnect and remove the spindle connecting rod from the spindle arms using the tool shown in Fig. 3.

4. Remove the cotter pin and retaining nut, and disconnect the steering drag link from the left spindle arm using the tool shown in Fig. 3.

5. At each front spindle, perform the following steps (Fig. 4).

a. Remove the spindle arm-to-spindle attaching nut and cotter pin, and drive the arm from the spindle with a soft hammer.

b. Drive the spindle bolt locking pin from the spindle bolt and axle.

c. Remove the threaded caps from the top and bottom of the spindle.

d. With a suitable drift, drive the spindle bolt from the spindle and axle. Remove the spindle and brake carrier plate as an assembly from the axle. Tie the assembly to the chassis with mechanics wire.

6. Position a floor jack under the front axle.

7. At each end of the axle, remove the nut and washer from the anchor bolt that attaches the lower end of the shock absorber and stabilizer link to the axle. Tap the anchor bolt out of the shock absorber, axle, and link (Fig. 1).

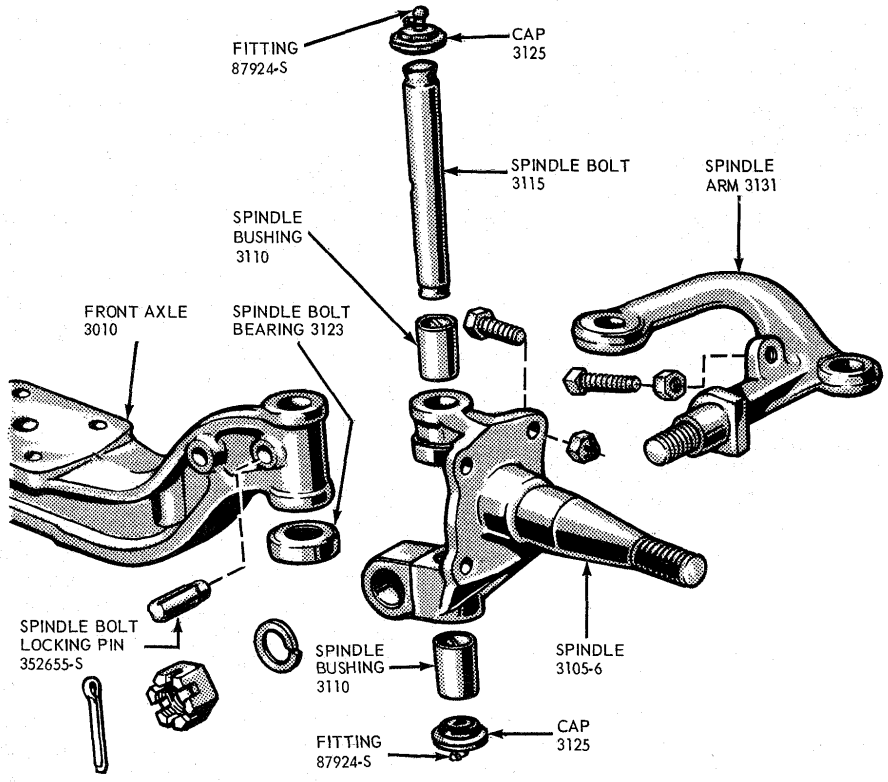

FIG. 4—Spindle Assembly

8. At each front spring, remove the attaching nuts, the two spring clips (U-bolts), and plate (Fig. 5).

9. Lower the jack and slide the axle from under the vehicle.

INSTALLATION

1. Place the axle on a floor jack, and position the axle under the vehicle.

2. Attach the axle to the two front springs by installing the spring clips, plates, and attaching nuts (Fig. 5).

3. At each end of the axle, align the lower end of the shock absorber and stabilizer link with the anchor bolt bore in the axle, then install the anchor bolt through the link, axle, and shock absorber. Install the washer and attaching nut to the anchor bolt (Fig. 1).

4. Remove the floor jack from under the axle.

5. At each end of the front axle, perform the following steps (Fig. 4).

a. Position the carrier plate and spindle assembly with the bearing to the end of the axle, and install the spindle bolt. Install the shims in the amount necessary to take up the clearance between the upper bore of the spindle and the axle. Be sure that the notch in the spindle bolt is aligned with the locking pin hole in the axle.

b. Install the spindle bolt locking pin.

c. Install the threaded caps in the upper and lower ends of the spindle.

d. Install the spindle arm on the spindle and secure with attaching nut and cotter pin.

6. Assemble the ends of the spindle connecting rod (with seals) to the spindle arms, and install the attaching nuts and cotter pins (Fig. 6).

7. Connect the steering drag link to the left arm, and install the attaching nut and cotter pin (Fig. 6).

8. Lubricate all front suspension fittings, adjust the brakes, install the wheel hub and drum assemblies, and adjust the front wheel bearings.

9. Remove the safety stands, lower the car, and adjust the tire pressures.

10. Check camber, caster and toe-in. Adjust the toe-in, tighten the spindle connecting rod end clamps, and adjust the spindle stops (Fig. 5). See Part 3-5 for stop adjustment.

SPINDLE

REMOVAL

1. Raise the front of the vehicle and install safety stands. **Do not use a bumper jack.**

2. Remove the front wheel hub and drum assembly.

3. Remove the attaching bolts, and remove the brake carrier plate from the spindle. Tie the plate to the chassis with mechanics wire.

4. If the spindle is being replaced, remove the spindle arm-to-spindle attaching nut and cotter pin; then drive the spindle arm from the spindle with a soft hammer (Fig. 6). If the original spindle is to be installed, leave the arm assembled to the spindle, but disconnect the spindle arm from the connecting rod end using the tool shown in Fig. 3. On the left spindle, also disconnect the steering drag link from the spindle arm using the same tool.

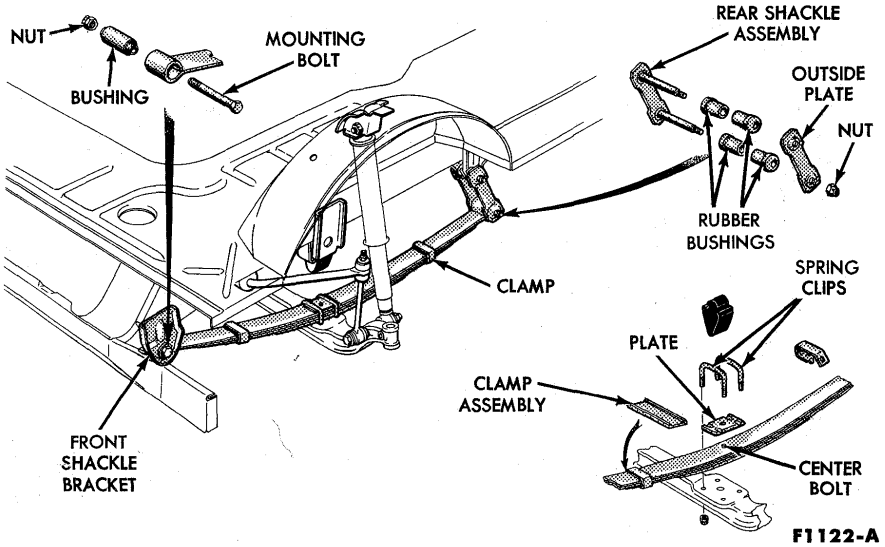

FIG. 5—Front Spring Installation

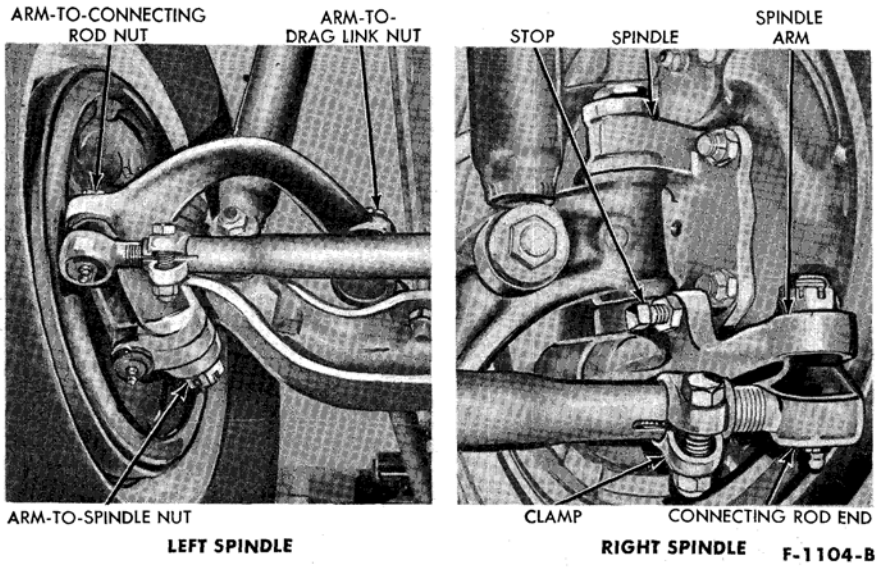

FIG. 6—Spindle Arm Connections

5. Drive the spindle bolt locking pin from the spindle bolt and axle.

6. Remove the threaded caps from the top and bottom of the spindle.

7. Drive the spindle bolt from the spindle and axle with a suitable drift, and remove the spindle and bearing from the axle.

INSTALLATION

1. Position the spindle and bearing to the axle, and install the spindle bolt (Fig. 4). Install the shims in the amount necessary to take up the clearance between the upper bore of the spindle and the axle. Be sure that the notch in the spindle bolt is aligned with the locking pin hole in the axle.

2. Install the spindle bolt locking pin.

3. Install the threaded caps in the upper and lower ends of the spindle bolt.

4. If a new spindle is being installed, assemble the spindle arm to the spindle with attaching nut and cotter pin.

If the original spindle is being installed with the arm assembled, connect the spindle arm to the connecting rod end. On a left spindle, also connect the steering drag link to the spindle arm. (Fig. 6).

5. Position the brake carrier plate to the spindle and install the attaching bolts.

6. Lubricate the spindle fittings, adjust the brakes (Part 2-2), install the wheel hub and drum assembly, and adjust the front wheel bearings.

7. Remove the safety stands, lower the car, and adjust the tire pressures.

8. Adjust the toe-in, tighten the spindle connecting rod clamps, and adjust the right and left steering stops (Fig. 6) to specification (Part 3-5).

FRONT SPRING

REMOVAL

1. Raise the front end of the vehicle, and support the chassis with safety stands. **Do not use a bumper jack.** Support the front axle with a floor jack or hoist.

2. Remove the front splash shield.

3. Disconnect the lower end of the shock absorber from the anchor bolt in the front axle (Fig. 1).

4. Remove the two spring clips (U-bolts) and the spring clip plate (Fig. 5).

5. Lower the spring, and remove the rear shackle nuts and outside plate.

6. Pull the rear shackle assembly and rubber bushings from the bracket and spring.

7. Remove the nut and mounting bolt that secure the front end of the spring, and remove the spring from the front shackle bracket.

INSTALLATION

1. Install new rubber bushings in the rear shackle bracket and in the rear eye of the replacement spring.

2. Position the spring assembly and connect the front eye of the spring to the front shackle bracket by installing the front mounting bolt and nut. Do not tighten the nut.

3. Mount the rear end of the spring by inserting the upper stud of the rear shackle assembly through the rear shackle bracket, and the lower stud through the rear eye of the spring (Fig. 5).

4. Install the outside plate to the rear shackle studs, and install the shackle nuts. Do not tighten the nuts at this time.

5. Position the spring center bolt to the pilot hole in the axle, and install the spring clips and plate. Do not tighten the attaching nuts at this time. **Be sure that the caster adjusting wedges are properly positioned.**

6. Raise the axle with the floor jack until the vehicle is free of the

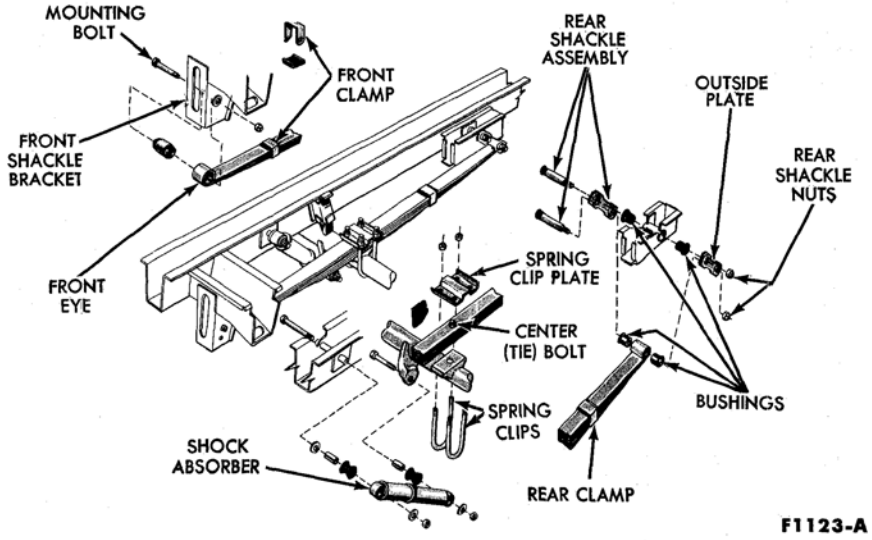

FIG. 7—Rear Spring Installation

stands, and connect the lower end of the shock absorber to the anchor bolt in the front axle (Fig. 1). Install the washer and nut.

7. Torque the spring front mounting bolt and nut, the rear shackle nuts, and spring clip nuts to specifications.

8. Install the front splash shield.

9. Remove the safety stands and lower the vehicle.

REAR SPRING

REMOVAL

1. Raise the rear end of the vehicle, and support the chassis with safety stands. Support the rear axle with a floor jack or hoist.

2. Disconnect the lower end of the shock absorber from the bracket on the axle housing (Fig. 2).

3. Remove the two spring clips (U-bolts) and the spring clip plate (Fig. 7).

4. Lower the spring and remove the rear shackle nuts and outside plate.

5. Pull the rear shackle assembly and rubber bushings from the bracket and spring.

6. Remove the nut and mounting bolt that secure the front end of the spring, and remove the spring assembly from the front shackle bracket.

INSTALLATION

1. Install new rubber bushings in the rear shackle bracket and in the rear eye of the replacement spring.

2. Position the spring assembly, and connect the front eye of the spring to the front shackle bracket by installing the front mounting bolt and nut. Do not tighten the nut.

3. Mount the rear end of the spring by inserting the upper stud of the rear shackle assembly through the rear shackle bracket, and the lower stud through the rear eye of the spring (Fig. 7).

4. Install the outside plate to the rear shackle studs, and install the shackle nuts. Do not tighten the nuts at this time.

5. Position the spring center bolt to the pilot hole in the axle, and install the spring clips and plate. Do not tighten the attaching nuts at this time.

6. Raise the axle with a floor jack or hoist until the truck is free of the stands and connect the lower end of the shock absorber to the bracket on the axle housing (Fig. 2).

7. Torque the spring front mounting bolt and nut, the rear shackle nuts, and spring clip nuts to specifications.

8. Remove the safety stands and lower the truck.

4 MAJOR REPAIR OPERATIONS

SPINDLE REBUSHING

1. Remove the spindle assembly from the axle as outlined under REMOVAL in the foregoing procedure.

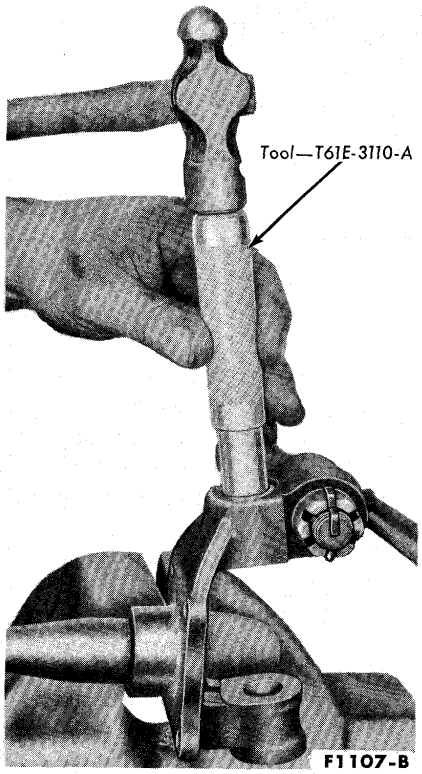

FIG. 8—Removing or Installing Spindle Bushing

2. Position the spindle in a vise and drive the bushing out of the spindle bore as shown in Fig. 8. Reverse the spindle in the vise, and drive out the other bushing.

3. Clean the spindle bores thoroughly.

4. Position a new bushing in the spindle bore. Drive the bushing into the spindle with the tool shown in Fig. 8. Reverse the spindle in the vise, and install the other bushing in the same manner.

5. Ream the bushings to fit the spindle bolt using the tool shown in Fig. 9.

6. Clean all the metal shavings from the bushings, and apply a light coat of oil to each bushing.

7. Install the spindle assembly to the axle as outlined under INSTALLATION in the foregoing procedure.

SPRING LEAF AND TIE BOLT REPLACEMENT

1. Remove the spring from the truck as outlined under REMOVAL in the foregoing procedures.

2. Cut and remove the two spring clamps.

3. Cut the nut from the spring tie bolt.

4. Remove the tie bolt and the spring leaf to be replaced.

5. Install the new spring leaf and align the leaves with a suitable drift.

6. Position the spring in a vise, and install the new tie bolt and nut.

7. Tighten the nut, cut off the tie bolt at the nut, and peen the remaining end of the bolt over the nut.

8. Install the two spring clamps.

9. Install the spring in the truck as outlined under INSTALLATION in the foregoing procedures.

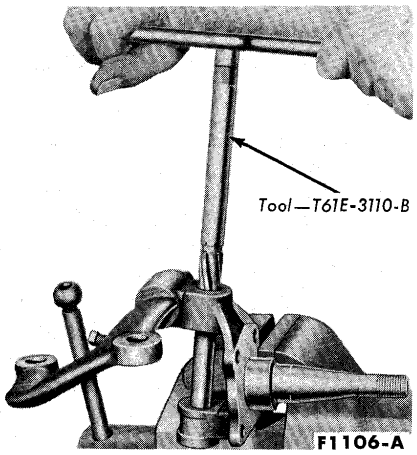

FIG. 9—Reaming Spindle Bushing

PART 3-3 STEERING

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1 DESCRIPTION

The steering gear is of the worm and recirculating ball type. The sector shaft rotates in bushings that are pressed into the gear housing and cover.

The worm bearing preload is controlled by a bearing adjuster which is threaded into the housing. The sector shaft mesh load is controlled by an adjusting screw located in the housing cover.

A steering gear identification tag is provided under one of the cover attaching bolts (Fig. 1).

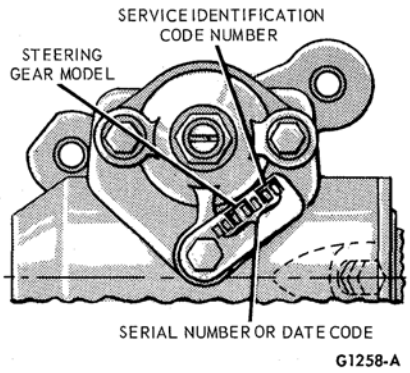

FIG. 1—Steering Gear Identification Tag

2 IN-VEHICLE ADJUSTMENTS AND REPAIRS

STEERING WORM AND SECTOR GEAR ADJUSTMENTS

The ball nut assembly and the sector gear must be adjusted properly to maintain minimum steering shaft end play (a factor of preload adjustment) and minimum backlash between sector gear and ball nut. There are only two possible adjustments within the recirculating ball-type steering gear, and **these should be made in the following order to avoid damage or gear failure.**

1. Fold the floor mat out of the way, pull up the rubber seal, and remove the steering column floor pan cover (six attaching screws).

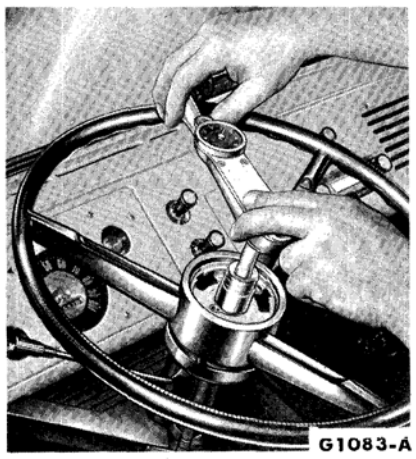

FIG. 2—Steering Gear Load Check

2. Raise the front of the vehicle and install safety stands.

3. Disconnect the drag link from the Pitman arm using tool 3290-C.

4. Remove the horn button or ring and spring assembly.

5. Remove the steering wheel, spring, and sleeve (Fig. 3).

6. Check the alignment of the shaft in relation to the bearing. The shaft must not contact bearing when rotated by moving the wheels from side to side. Adjust the steering column tube as detailed on page 12 if required.

7. Loosen the nut which locks the sector adjusting screw, and turn the

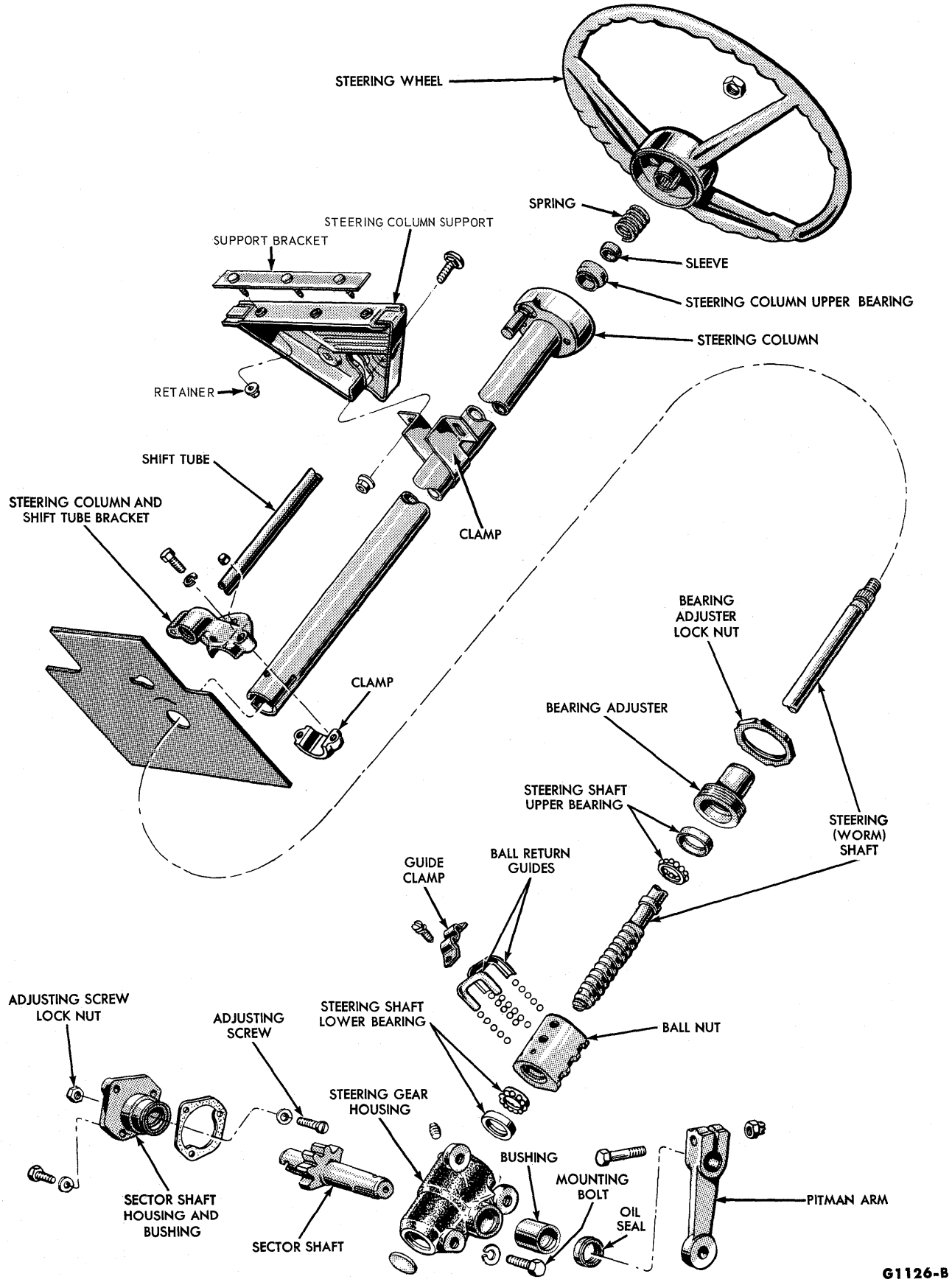

FIG. 3—Steering Gear and Related Parts