

SERVICE
MANUAL
1948-1952
FORD TRACTOR
MODEL 8N

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Chapter

I

DESCRIPTION AND SPECIFICATIONS

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III. DESCRIPTION.

The Model 8N Ford tractor is provided with a steering gear assembly of the automotive ball nut type. It is a highly efficient, easily serviced unit which is readily adjustable to compensate for wear. This steering gear has a low driver fatigue factor because of easy steering and a minimum of road shock.

The tractor is equipped with a four forward and one reverse gear transmission. The transmission contains constant-mesh helical gears, assuring quiet running and providing for long life.

The power take-off is driven from the transmission countershaft. A power take-off adapter is available to extend the shaft when such extension is necessary for fitting certain implements. The adapter meets the American Society of Agricultural Engineers' specifications for a standard tractor hitch. Any implement built to these standards may be hitched to the Ford tractor without the purchase of additional accessories.

The tractor hydraulic system consists of a piston pump driven directly by the power take-off shaft, and a self-contained hydraulic unit which includes the ram cylinder and control linkage. The hydraulic pump and unit are located in the center housing and employ the transmission oil as the hydraulic fluid. This design reduces the possibility of external oil leakage, and greatly reduces repair costs.

The belt pulley assembly is self-contained, and is driven by the power take-off shaft. The pulley assembly is easily mounted on the tractor and has a separate oil supply.

The differential assembly is of the heavy duty truck type, and is driven by the transmission main shaft. The differential furnishes the power directly to the semi-floating rear axles.

112. SPECIFICATIONS.

The following specifications are given as an aid to the mechanic in repairing the Model 8N Ford tractor.

a. General.

Type..... 4-wheel, general purpose

Wheelbase 70 in. at 48 in. tread width
 Over-all length, front to drawbar 115 in.
 Over-all height 54½ in.
 Over-all width, normal tread 64¾ in.
 Tire size:
 Front 4.00 x 19—4 ply
 Rear 10.00 x 28—4 ply
 Front tread 48 to 76 inches in 4-inch steps
 Rear tread 48 to 76 inches in 4-inch steps
 Ground clearance:
 Front axle 21 in.
 Rear axle 21 in.
 Center 13 in.
 Turning circle radius (with use of brakes):
 Made by outer front wheel 8 ft.
 Made by centerline of tractor at rear axle 3½ ft.
 Shipping weight (including gasoline, oil, water, tires filled
 with air, operator not included) 2,410 lbs.
 Drawbar height 8½ to 34¼ in., 18 in. standard setting

Gear Ratio	Final Gear Reduction	Speeds at 1500 R.P.M.	Speeds at 2000 R.P.M.
1 Low (first)	73.33 to 1	2.54 M.P.H.	3.40 M.P.H.
2 Plowing (second)	57.04 to 1	3.28 M.P.H.	4.37 M.P.H.
3 Cultivating (third)	41.45 to 1	4.51 M.P.H.	6.02 M.P.H.
4 High (Fourth)	19.86 to 1	9.40 M.P.H.	12.54 M.P.H.
5 Reverse	44.64 to 1	4.19 M.P.H.	5.58 M.P.H.

b. Capacities—U. S. Measure.

Fuel tank 9 gals. standard
 1 gal. reserve
 10 gals. total
 Engine oil pan (less filter absorption) 6 qts.
 Transmission, hydraulic lift, and differential 5 gals.
 Cooling system 12 qts.
 Oil bath air cleaner Fill to indicated level
 Belt pulley 1 qt.
 Tire pressure:
 10.00 x 28—4 ply 12 lbs.
 4.00 x 19—4 ply 26 lbs.

c. Engine.

Type	4-cylinder "L" head
Rated speeds	1500 and 2000 R.P.M.
Idle speed	400 R.P.M.
Cylinder bore	3.188 in.
Stroke	3.75 in.
Piston displacement	119.7 cu. in.
Torque	84 lbs. ft. at 1500 R.P.M.
Compression ratio	6.0 to 1
Sleeves	Dry type
Piston	Cast steel
Rings:	
Compression	2
Oil	1
Piston pin	Full floating
Rod bearings	Replaceable shell-type
Main bearings	Replaceable shell-type
Crankshaft	Cast steel, static and dynamic balanced
Compression pressure at cranking speed (sea level)	90 lbs. minimum

d. Ignition System.

Type	Battery
Distributor:	
Firing order	1-2-4-3
Drive	Directly by camshaft
Automatic spark advance	Centrifugal governor
Initial timing (degrees of crankshaft)	Top dead center
Maximum advance (degrees of crankshaft)	24°
Distributor breaker cam	4 lobe
Breaker contacts	1 set
Breaker contact spacing	0.015 in.
Spark plugs:	
Type	Marked H-10
Size	14 mm
Gap	0.025 to 0.028 in.

e. Carburetor.

Type	Single up-draft
Idle fuel adjustment	1 screw
Main fuel jet	1 screw
Idle speed	1 screw

f. Governor.

Type Variable speed, mechanically operated, centrifugal type
 Governed speed range 800 to 2200 R.P.M.
 Maximum governed speed adjustment 1 screw

g. Cooling System.

Radiator cap (pressure type):—

Pressure valve opens at $3\frac{1}{4}$ to $4\frac{1}{4}$ lbs. per sq. in.

Vacuum valve opens at $\frac{1}{2}$ to 1 lb. per sq. in.

Water Pump:

Type Centrifugal

Drive V-belt

Fan:

Type 6-blade pull

Drive V-belt

Thermostat:

Location Cylinder head outlet hose

Starts to open 160-165° F.

Fully open 190-200° F.

h. Electrical System.

Generator:

Type 3-brush

Drive V-belt

Rating:

1500 Engine R.P.M. 10 amps

Maximum output 11 amps

Capacity 119 watts

Generator regulator:

Cutout closing voltage 6.0 to 6.3 volts

Voltage regulation 7.0 to 7.3 volts

Battery:

Type 6-volt

Drive Automatic engagement

i. Transmission.

Type Constant mesh

Release bearing (pre-lubricated) Ball bearing

Pedal free travel $\frac{3}{4}$ in.

j. Rear Axle.

Type Semi-floating

Ratio 6.66 to 1

k. Brakes.

Type	Internal expanding
Control	Individual, mechanical
Adjustment at each wheel	1 screw
Brake pedal free play	$\frac{3}{4}$ in.
Thickness of lining	0.187 in.
Width of lining	2.000 in.
Length of lining	12.910 in.
Total brake lining area (two wheels)	103.3 sq. in.

l. Steering Gear.

Type	Automotive ball nut
Ratio, turns of steering wheel for total travel of pitman arms, at 48 in. wheel tread	2.25
Steering wheel diameter	18 in.

m. Hydraulic System.

Type	Internal
Maximum pressure	1500-1700 lbs. per sq. in.
Pump:	
Type	Scotch yoke piston
Drive	Direct power take-off shaft
Capacity:	
2000 engine R.P.M.	2.85 gals. per min.
1500 engine R.P.M.	2.15 gals. per min.
Control	Manual and automatic
Oil supply	Transmission and differential

n. Power Take-off Adapter.

Spline	$1\frac{3}{8}$
Speed (1500 Engine R.P.M.)	545 R.P.M.

o. Belt Pulley.

Pulley speed (2000 engine R.P.M.)	1358 R.P.M.
Belt speed (2000 engine R.P.M.)	3199 ft. per min.
Pulley size (standard)	9 in.

Chapter II STEERING GEAR

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The steering system includes the steering gear, steering wheel, and steering drag links between the pitman arms and the front axle spindle arms. The steering gear is of the recirculating ball bearing worm and nut type. Anti-friction steering is achieved by steel balls which serve as rolling contacts between the worm and nut.

Rotation of the steering tube shaft moves the ball nut along the worm. The left steering sector engages the rack on the ball nut, and is thereby rotated through an arc by the movement of the ball nut (fig. 2). The right sector engages the left sector and rotates the same number of degrees in the opposite direction. The pitman arms transfer the motion of the sector to the spindle arms through the drag links.

121. ADJUSTMENTS.

When the wheels are in the straight ahead position, all backlash should be removed, but if the wheels are turned to the extreme right or left, a slight backlash will be present due to the gear tooth design. This characteristic permits a backlash adjustment for wear between the worm nut teeth and the sector gears in the much used center position without causing binding or tightness in less used portions of the sector gears and worm nut.

Steering gear adjustments may be checked before removing the unit from the tractor or disassembling the unit. Adjusting the steering gear on the tractor in many cases will eliminate excessive backlash caused by improper adjustment between the sectors and the ball nut.

To determine the cause of excessive backlash, first check the adjustment of the steering tube bearings. Disconnect the drag links from the pitman arms. Turn the steering wheel to the right or left to the end of its travel, then back about $\frac{1}{2}$ turn. Measure the force required to rotate it by use of a spring scale attached to the rim (fig. 7). If a force from $\frac{1}{2}$ to $1\frac{1}{2}$ pounds will maintain the wheel in

motion during the next $\frac{1}{2}$ turn toward the center position, the tube shaft bearings do not require adjustment. Proceed as instructed in pars. a and b below. If no adjustment is required, proceed as instructed in par. b only.

a. Steering Tube Shaft Bearing Adjustment. The actual adjustment of the steering tube shaft bearings requires the removal of the steering gear from the tractor.

(1) *REMOVE STEERING GEAR.* Remove the steering wheel with a puller.

To remove the hood, shut off the fuel at the fuel shut-off valve, and disconnect the fuel line to the carburetor. Remove the four cap screws that secure the hood to the instrument panel. Remove the cap screws that secure the hood to the front axle support. Remove the intake air screen and connection. Lift off the hood.

Remove the air cleaner, tool box, battery, battery box, and choke rod.

Disconnect the throttle rod at its rear end, the governor compensating spring at the housing end, the starter wire at the switch end, and the oil line at the oil gauge.

Remove the two bolts that secure the steering gear to the instrument panel. Lift the instrument panel assembly off the steering shaft, but do not detach any of the wiring.

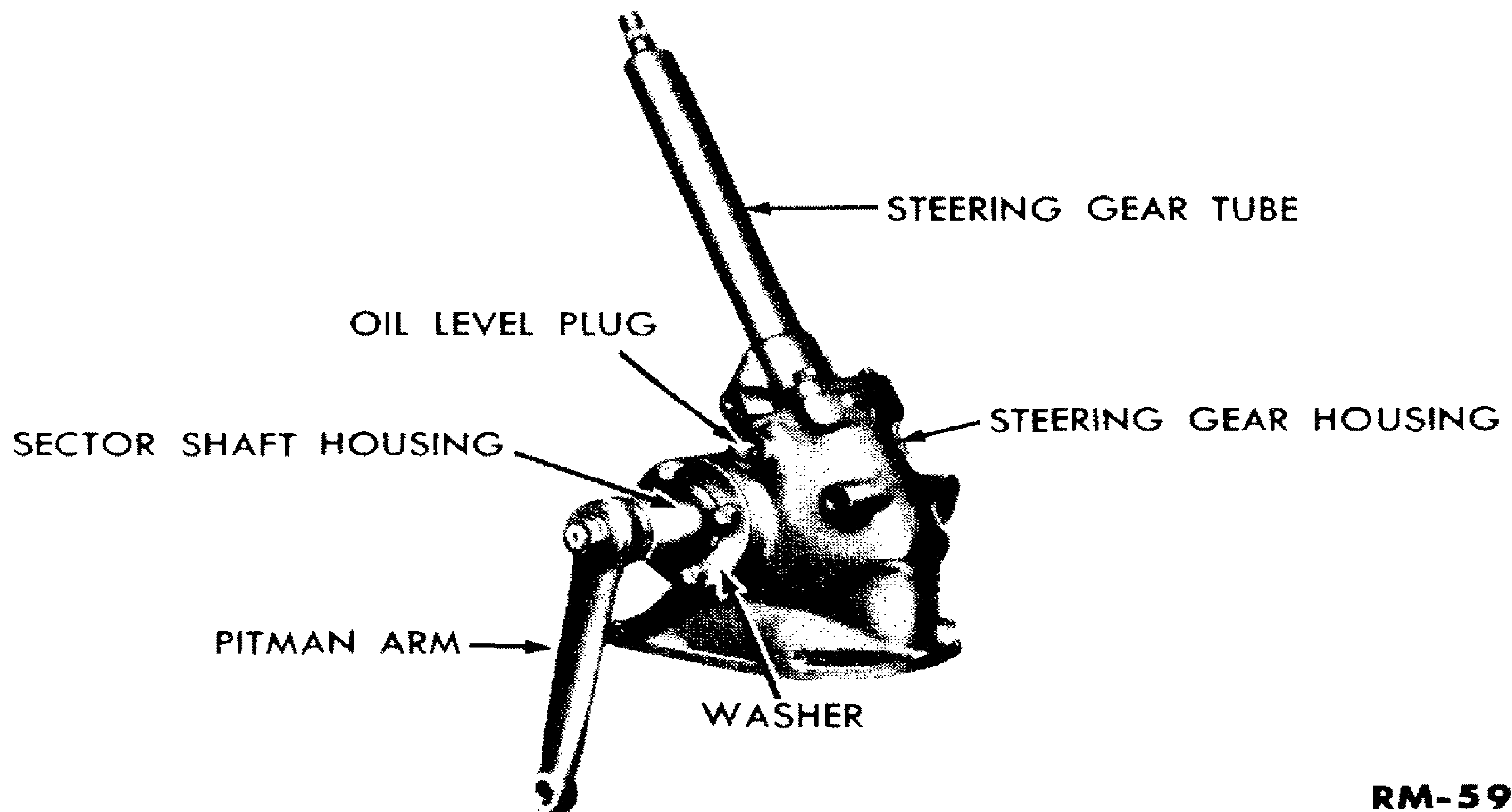
Remove the four bolts at the base of the steering gear, and lift out the assembly.

(2) *ADJUST STEERING TUBE SHAFT BEARINGS.* Remove the four cap screws that secure the steering tube to the steering gear housing. Pull the steering tube upward to remove or install shims as required. Shims vary in thickness and only those of the correct thickness must be removed or added to complete the adjustment. For example, if the spring scale reading was approximately $\frac{1}{4}$ pound, only one of the thinnest shims need be removed. It is better to have the bearings adjusted tightly rather than loosely, because loose bearings permit hammering and produce subsequent failure.

Reassemble the steering gear, and check the adjustment as outlined above.

b. Sector Adjustment. If the steering wheel has been removed, it must be installed temporarily to complete the sector adjustment.

Turn the steering wheel until the pitman arms are parallel and both point to the rear approximately 15° . Hold the steering wheel in this position, and feel for backlash by grasping the left pitman arm. If no backlash is apparent, no adjustment is required. If backlash is present, adjust the left sector.



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Fig. 1—Steering Gear Assembly

Remove the four cap screws that secure the sector shaft bearing housing to the steering gear housing, and turn the sector shaft bearing housing and its metal gasket counterclockwise (as viewed from the left side of the tractor) to the next set of notching holes. Replace and tighten the four cap screws.

Check the effect of the adjustment by measuring the force required to turn the steering wheel through the straight ahead position, with the pitman arms parallel. This measurement is taken with a spring scale as described above. Two to three pounds should be required to maintain the steering wheel in motion through the straight ahead position.

It is usually necessary to adjust the right sector if the left has been moved. Proceed as instructed for the left sector, except that the right sector shaft bearing housing must be turned in a clockwise direction, as viewed from the right side of the tractor, to remove excessive backlash. $2\frac{1}{2}$ to 6 pounds should be required to maintain the steering gear in motion through the straight ahead position after both right and left sectors have been adjusted.

122. DISASSEMBLY.

To disassemble the steering gear, remove the nut that secures each pitman arm to the sector shafts. Remove each pitman arm with a puller. Remove the four cap screws that secure each sector shaft housing to the steering gear housing. Lift each sector shaft housing, thrust washer, gasket, and sector shaft from the steering gear hous-

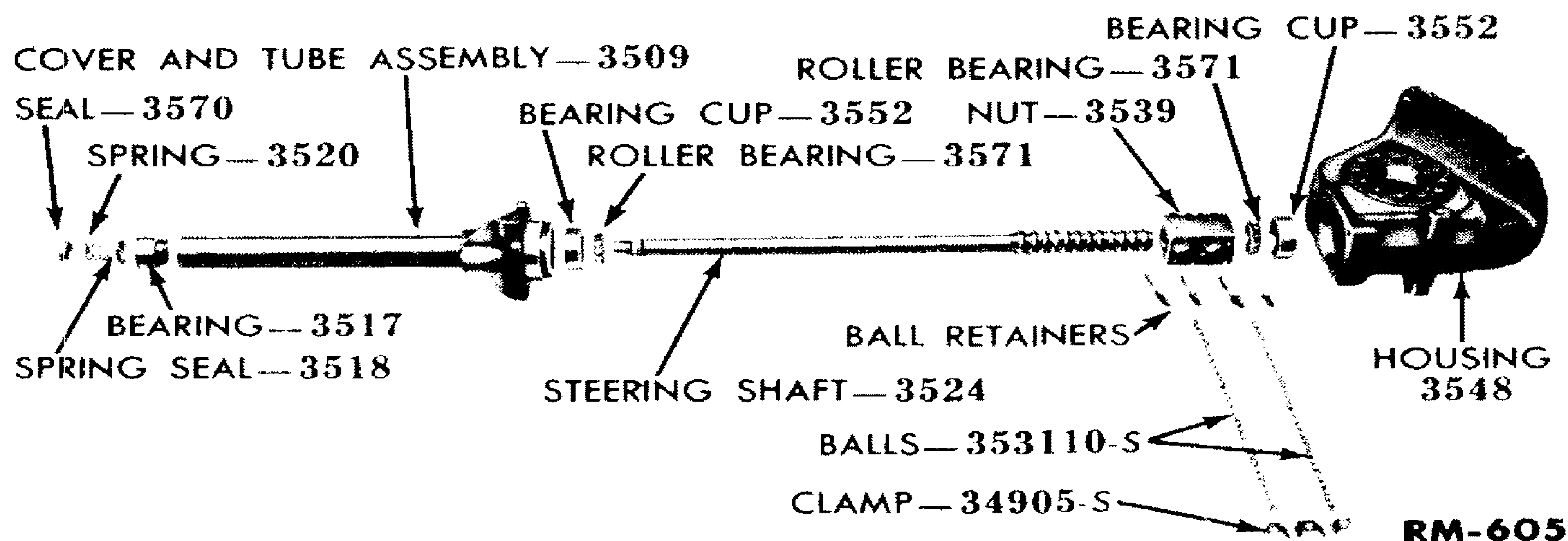


Fig. 2—Steering Tube Shaft, Disassembled

ing. Remove the four cap screws that secure the steering tube to the steering gear housing. Lift the tube and shaft assembly (fig. 1) from the housing.

CAUTION: *When the steering gear is partially or completely disassembled, the ball nut assembly must not be permitted to turn so that it reaches the end of the worm on the steering shaft as this action may damage the ball retainer.*

Remove the three screws and clamp from the ball nut assembly (fig. 2). Lift the two ball retainers from the assembly and remove the ball bearings.

123. INSPECTION AND REPAIR.

Before inspection, clean all parts thoroughly in cleaning fluid and blow them dry with compressed air.

a. Inspection. Inspection of the steering gear must cover the following seven items:

(1) **STEERING TUBE.** Replace the steering tube (fig. 2) if it is bent or otherwise damaged. Replace the bearing race if it is scored or pitted. If the bearing at the top of the steering tube is damaged, it must be replaced.

(2) **ROLLER BEARINGS.** Replace a roller bearing if any of the rollers have flat spots, or if any of the rollers are missing.

(3) **STEERING TUBE SHAFT AND BALL NUT.** The individual parts of the steering shaft and ball nut must be inspected to determine the condition of the assembly.

(a) **STEERING TUBE SHAFT.** Replace the entire steering shaft and ball nut assembly if the worm on the shaft is pitted or otherwise damaged.

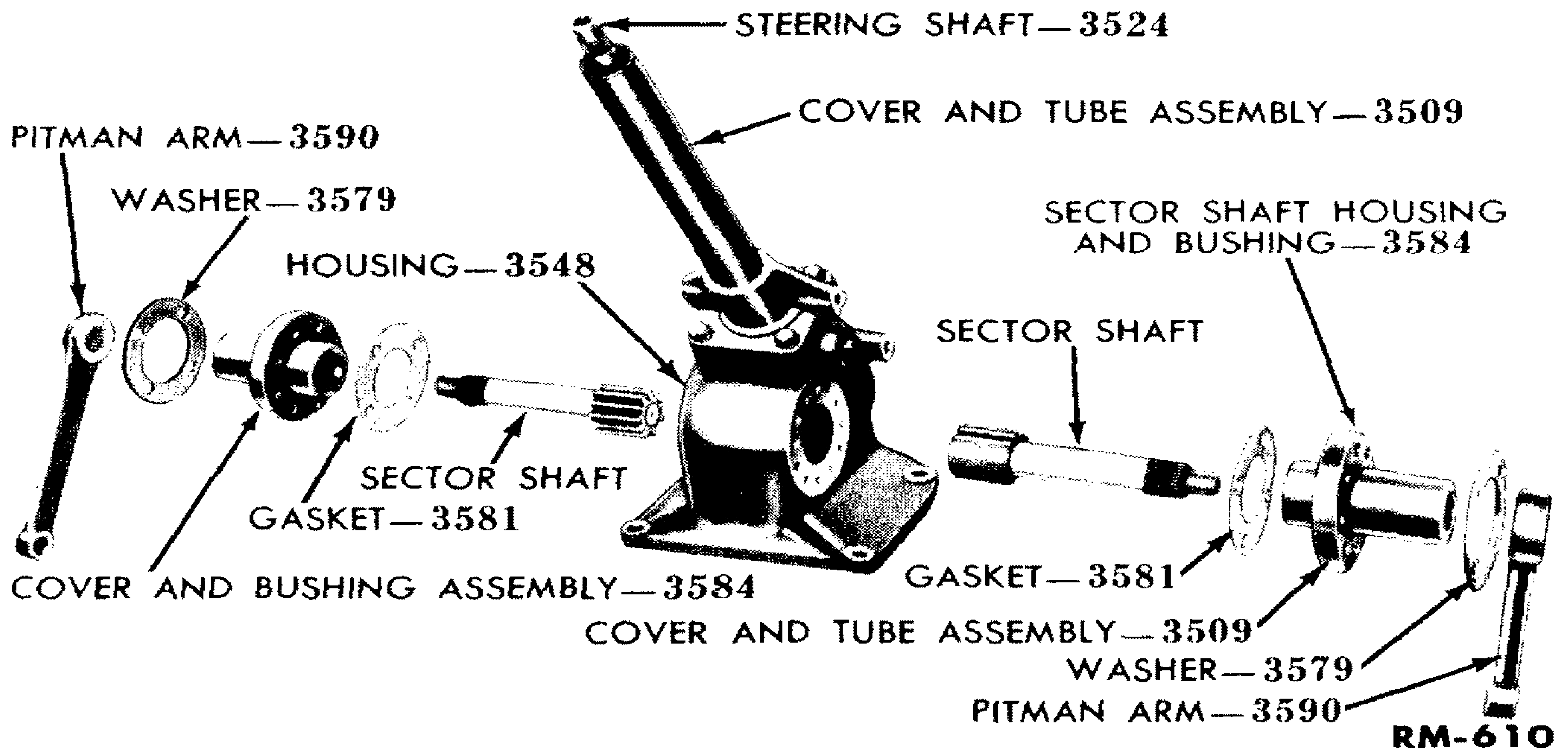


Fig. 3—Sector Shafts, Disassembled

(b) **BALL NUT.** Replace the entire steering shaft and ball nut assembly if the teeth are worn or if the ball race is pitted.

(c) **BALL BEARINGS.** Replace the entire steering shaft and ball nut assembly if any balls are worn, chipped, or pitted. Be sure that there are 60 balls within the assembly. Since these balls are held to a very close tolerance, it is not advisable to replace them individually.

(d) **BALL RETAINERS.** Replace the retainers if they are bent, damaged, or will not permit free passage of the balls.

(4) **STEERING GEAR HOUSING.** Replace the steering gear housing (fig. 3) if it is cracked or otherwise damaged. Replace the lower steering shaft bearing race if it is scored or pitted.

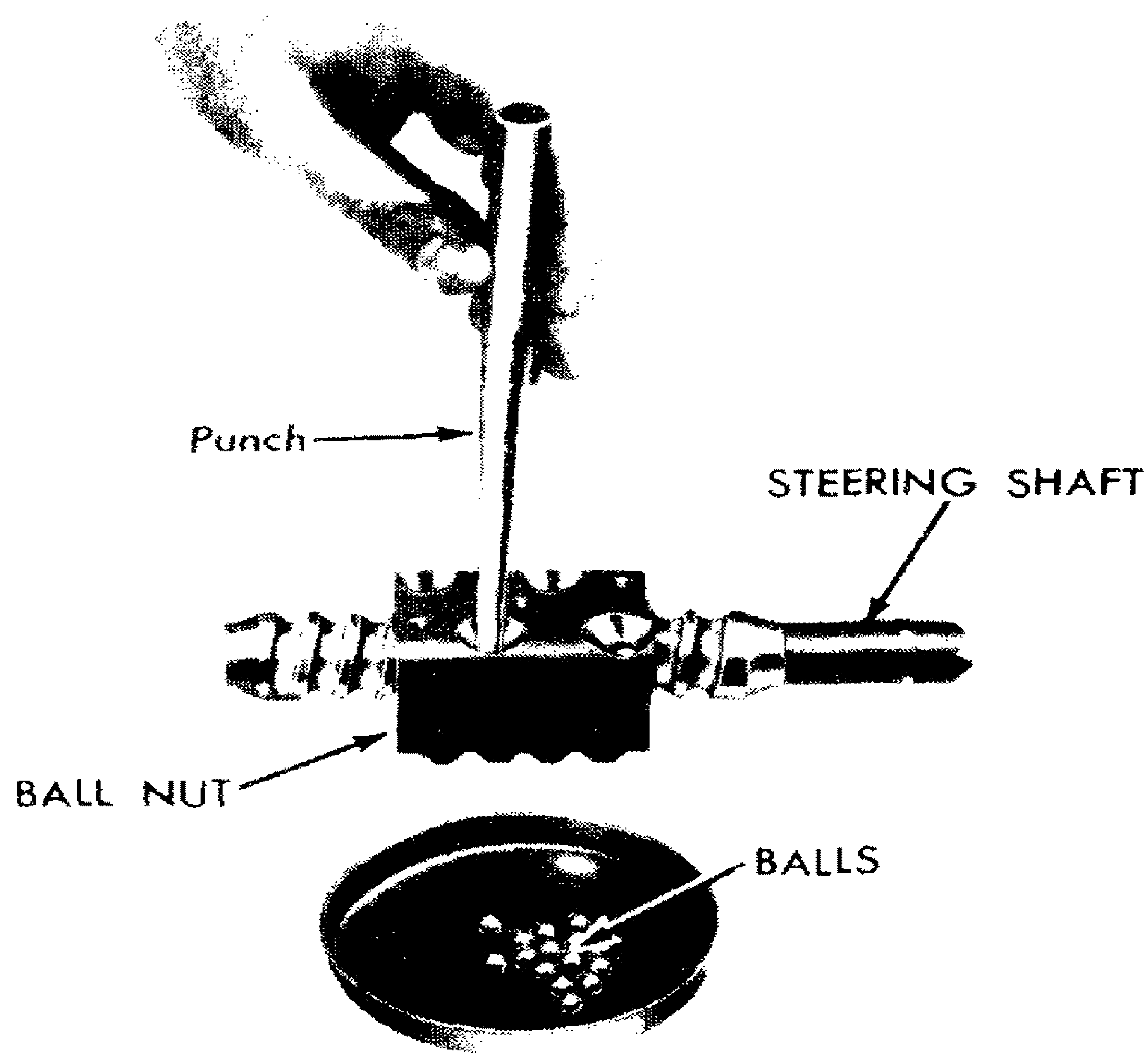
(5) **PITMAN ARM.** Replace a pitman arm (fig. 3) that has been damaged in any way.

(6) **SECTOR SHAFT HOUSING.** Replace the housing if it is damaged. Replace the sector shaft bushings if they are damaged or worn.

(7) **SECTOR SHAFT.** Replace a sector shaft (fig. 3) if the teeth or bearing surface are excessively worn.

b. Repair. To replace a bearing race, remove it from the housing or steering tube shaft with a puller. To install a bearing race, press it in place, making sure that it is seated firmly against the shoulder in the housing or steering tube.

To replace a sector shaft bushing, remove the seal and seal washer, then press the bushing from the housing, being careful not to damage the bore. Press the new inner bushing into the housing until



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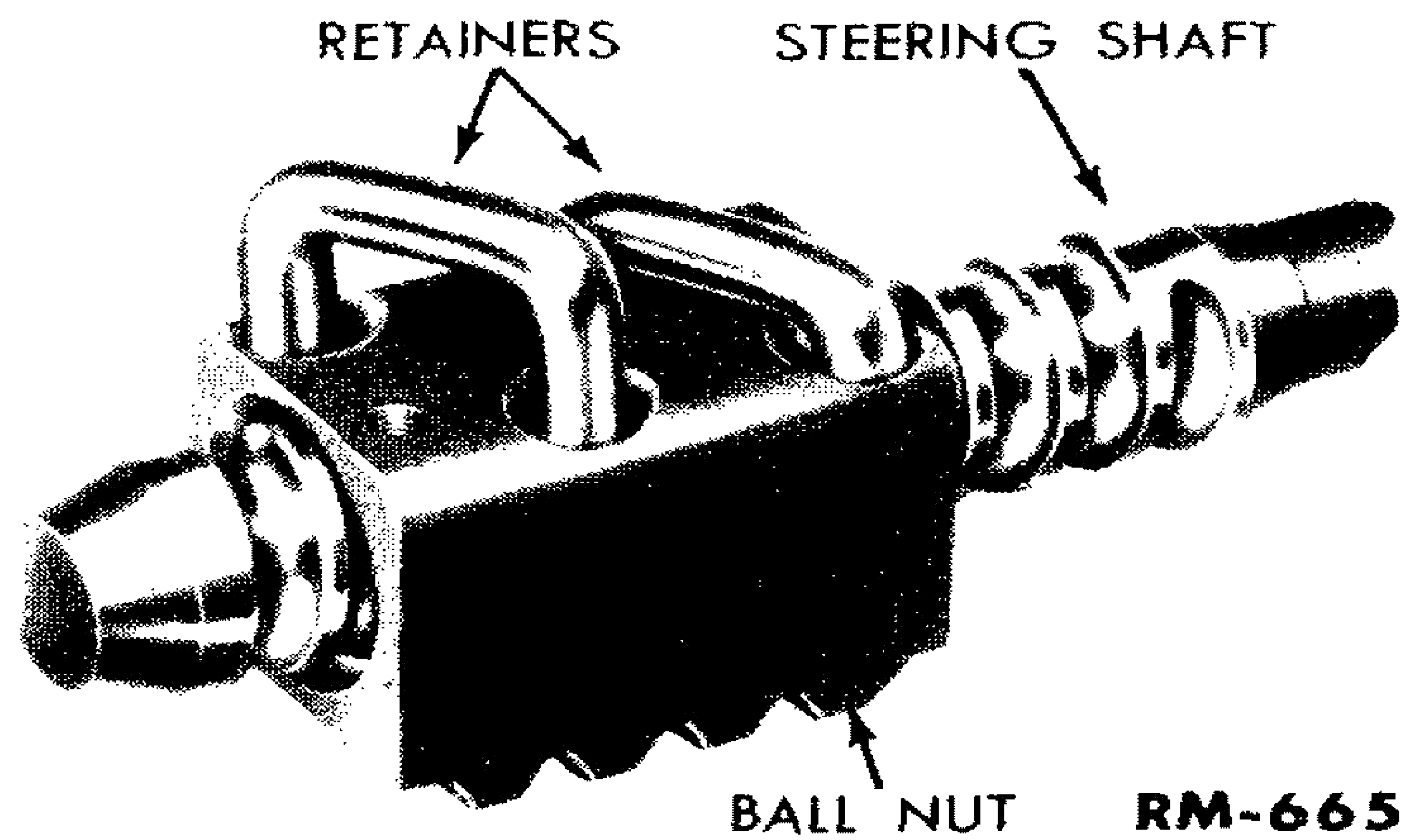
Fig. 4—Aligning Ball Nut on Steering Tube Shaft

it is $\frac{1}{8}$ inch below the face of the hub. Press the new outer bushing into the housing until it is level with, or slightly below, the bottom of the counterbore. Line ream both bushings in place to 1.125-1.126 inches in diameter.

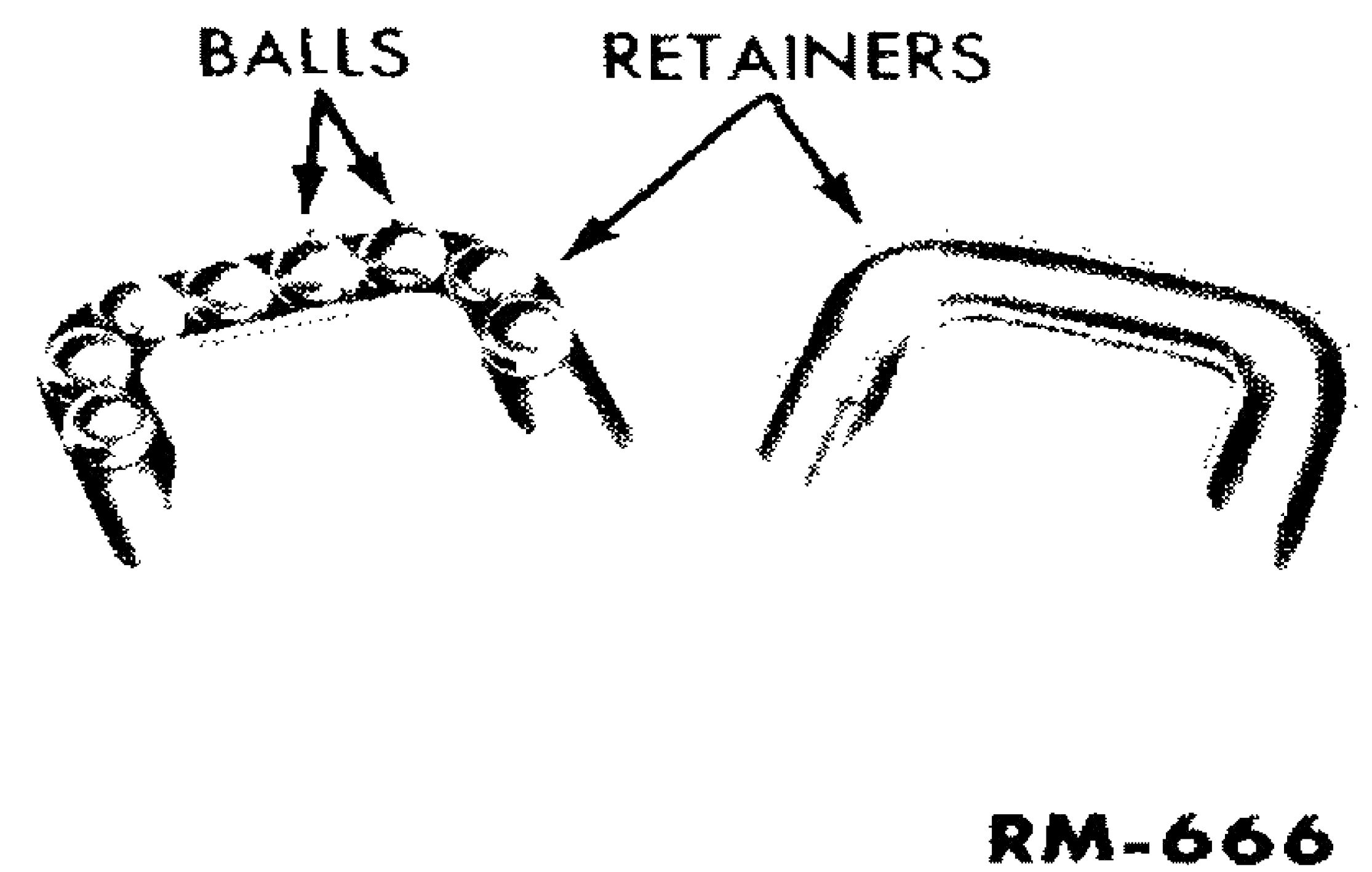
124. ASSEMBLY.

Assembly should be accomplished only when inspection shows that every part is in a serviceable condition.

a. **Steering Tube Shaft and Ball Nut.** Place the steering shaft on a bench and position the nut over the middle section of the worm with the ball retainer holes on top. Align the ball retainer holes with the grooves in the worm on the steering shaft (fig. 4). Drop 20 balls into one of the retainer holes, then slowly rotate the steering shaft to carry the balls away from the hole. Continue dropping the balls into the hole until the ball circuit is full to the bottom of both holes or until the end of the steering shaft worm has been reached. Where the balls were stopped by the end of the worm, they should be held in position with a clean, blunt tool while the steering shaft is rotated in the opposite direction. This will make it possible to drop more balls into the retainer hole. Extreme care should be exercised to make certain that no balls are outside the regular ball circuits. If balls



**Fig. 5—Removing or Installing
Ball Retainer**



**Fig. 6—Filling Ball
Return Guide**

remain in the groove between the two circuits, or at the ends, these balls cannot circulate and will cause ultimate failure of the steering gear.

It may be necessary to rotate the steering tube shaft alternately in both directions while, at the same time, holding the balls in place. This will make it possible to completely fill the ball circuit.

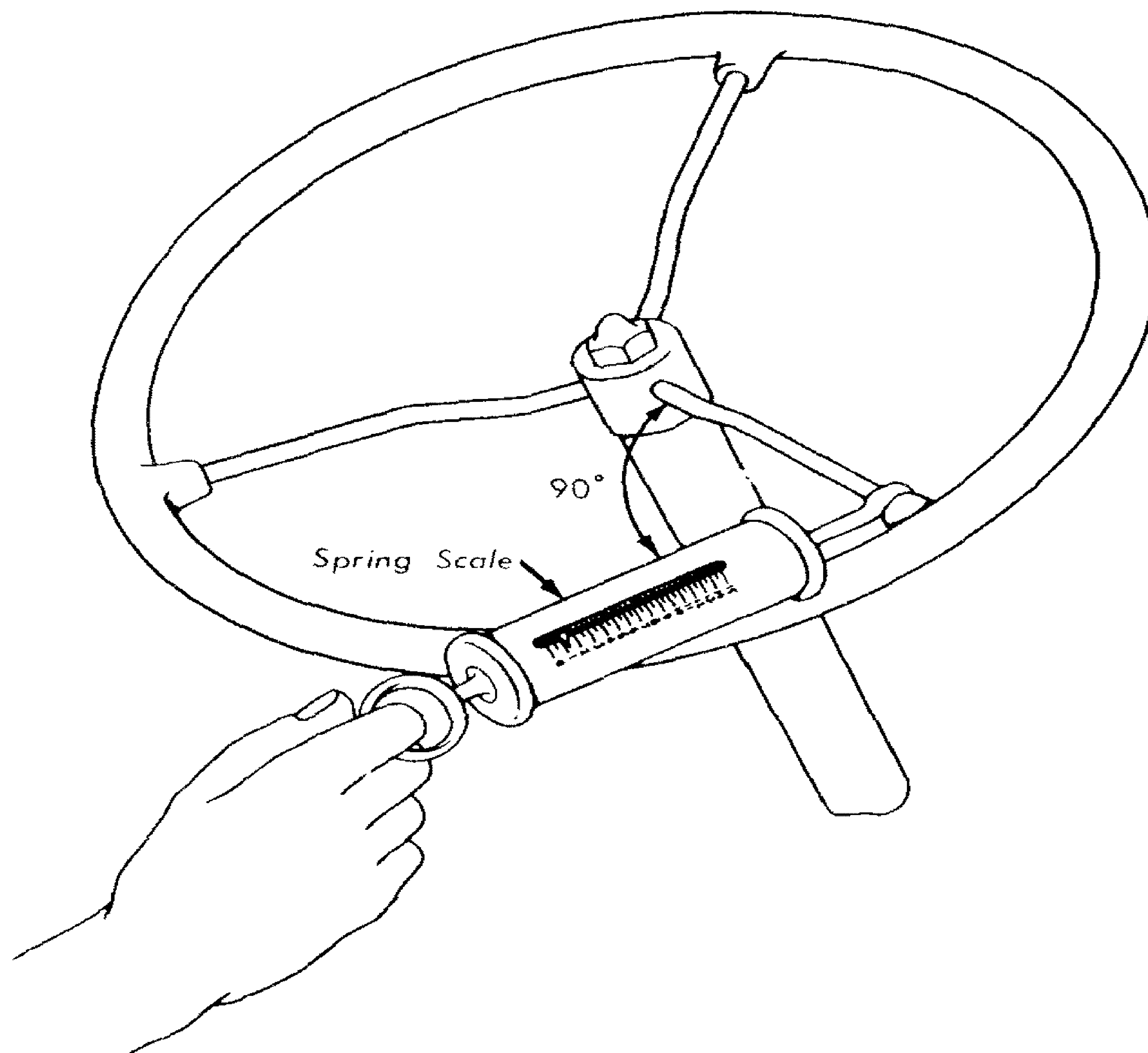
Lay one-half of the retainer on the bench, and fill it with 10 balls for the circuit being filled. Position the other half of the retainer over the balls, plug the ends with heavy grease, and insert the retainers into the retainer holes in the nut (fig. 6).

The second ball circuit is filled in the same manner.

Install the retainer clamp and three screws.

b. Installing and Adjusting Steering Tube Shaft and Sectors. Position a roller bearing in the bearing race in the housing on the upper bearing race of the shaft (fig. 2).

Place shims on the housing to an approximate thickness of 0.050 inch. Hold the steering tube shaft and ball nut assembly in place in the housing, with the rack teeth toward the sectors and the ball nut in the approximate center of the worm. Install the steering tube. Do not tighten the bolts so tight that damage to the bearings will result, especially when an insufficient thickness of shims have been used. Install the steering wheel and measure the force required to rotate it. This should be from 1 to 1½ pounds on a spring scale (fig. 7). Add or remove shims as required until the correct force is obtained. Be sure that the pulling force of the scale is at right angles to a steering wheel spoke when taking measurements.



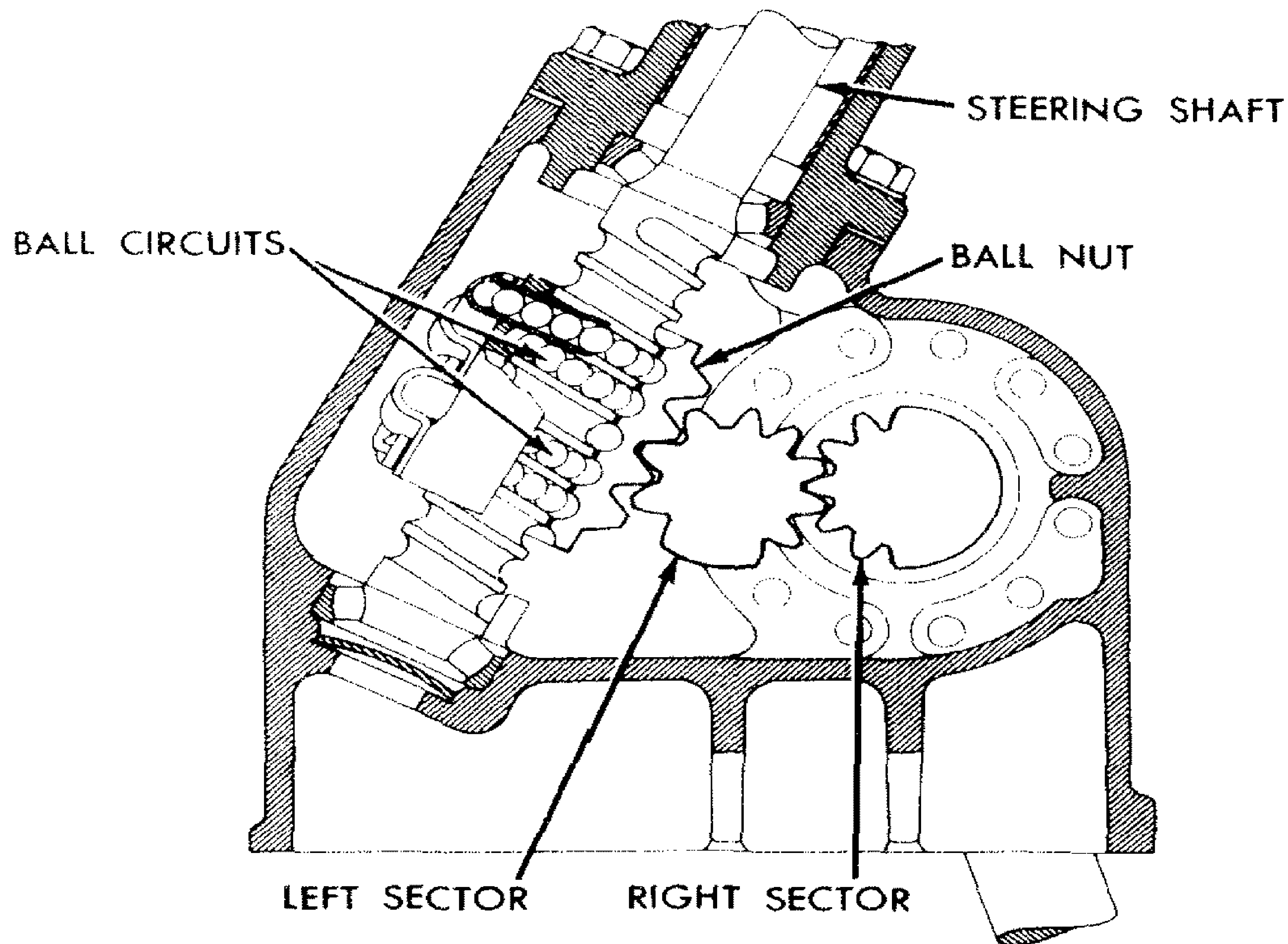
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Fig. 7—Checking Steering Adjustment

Hold the ball nut in your hand and rotate the steering shaft until the center tooth (2 teeth each side) lines up with the center of the left sector shaft opening.

Place the left sector shaft (3 large and 4 small teeth) and thrust washer in the sector shaft bearing housing, and position the metal gasket on the housing. Install this assembly in the steering gear housing with the center tooth of the three large sector teeth meshed in the center space of the teeth on the ball nut. While engaging the left sector shaft and ball nut, it may be necessary to hold the ball nut in position by reaching through the hole in the right side of the steering gear housing. The bearing is eccentric in the sector shaft bearing housing and should be installed with the notch located at the bottom.

Rotate the left housing counterclockwise (as viewed from the left side of the tractor) to eliminate backlash. Secure the sector shaft bearing housing by installing the washer and four cap screws. The adjustment between the left sector and ball nut should be such that



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Fig. 8—Timing Sector Shaft and Ball Nut

a pull of 2 to 3 pounds is required to turn the steering wheel through the straight ahead position (fig. 7).

Place the right sector shaft and thrust washer in the sector shaft bearing housing, and position the metal gasket on the housing. The right sector must be engaged with its center tooth meshed in the third tooth space on the left sector gear, counting from the solid section of the gear, located on the bottom, as shown in fig. 8. The tooth on the right sector can be identified by a dot or mark on the end of the tooth.

The tooth space on the left sector also can be identified by a dot or mark. The bearing is eccentric in the sector shaft bearing housing and should be installed with the notch located at the bottom. Rotate the housing clockwise (as viewed from the right side of the tractor) to reduce backlash.

The adjustment between the right and left sector should be such that the force required to turn the steering wheel through the straight ahead position is 3 to 6 pounds.

The steering gear assembly should be filled with S.A.E. 90 oil. This oil may be pumped into the right side of the steering gear housing through the pipe plug hole.

Chapter III TRANSMISSION

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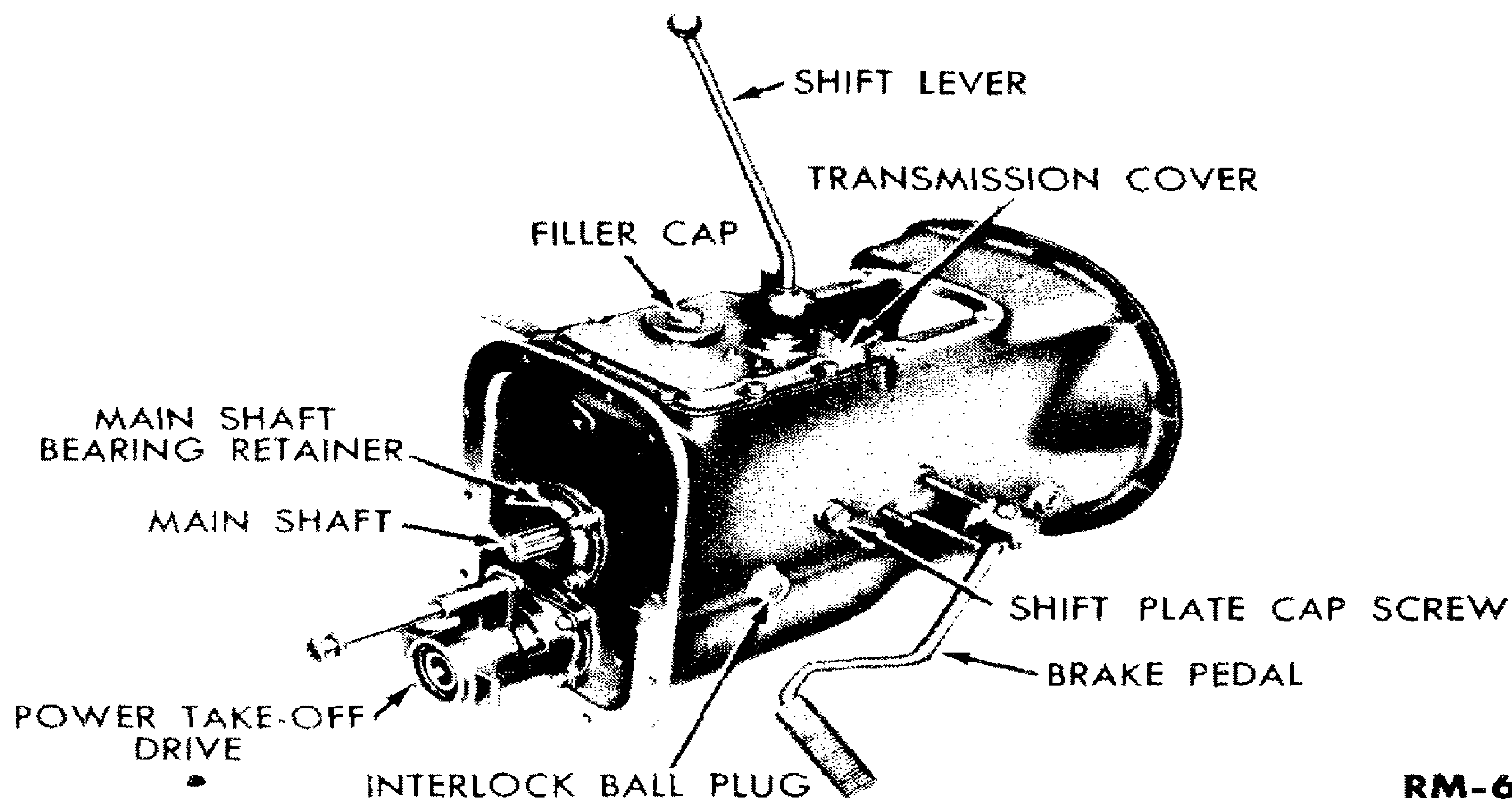
The Model 8N Ford tractor is equipped with a four-forward speed, constant-mesh transmission.

131. DISASSEMBLY.

The transmission comprises seven principle subassemblies. These should be removed as follows.

a. Remove Subassemblies. Remove the cover assembly. Remove the top shift rail and plates by loosening the nut on the shift fork and turning out the screw until the shaft is free to slide on the fork. Slide the shift rail out of the rear of the housing. The interlock spring and ball will fall from the top of the housing as the rail is removed. Remove the large shift pivot screws from each outside face of the housing, and remove the shift plates.

Disconnect the clutch release bearing retaining springs, and remove the bearing.



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Fig. 9—Transmission

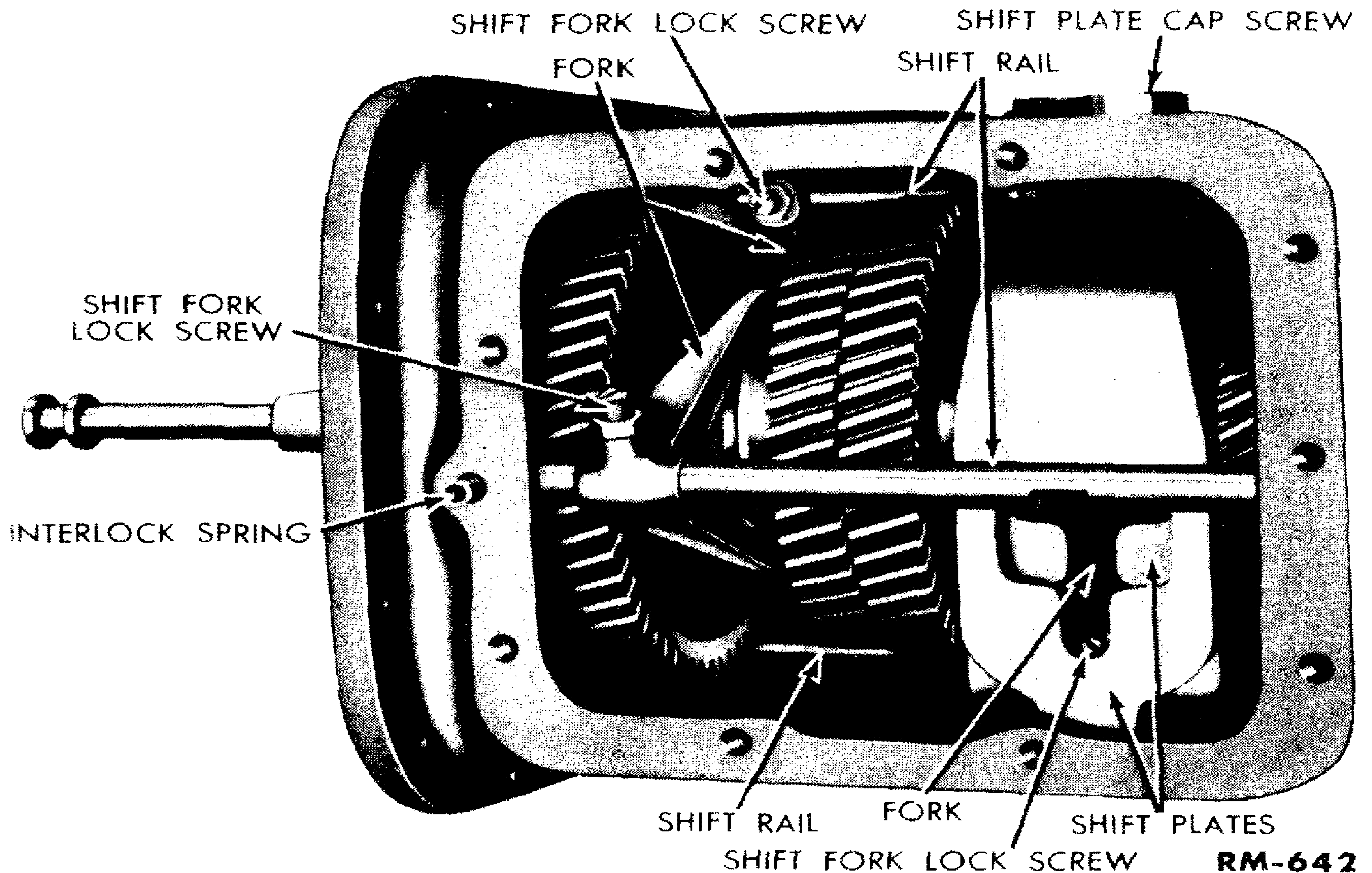


Fig. 10—Transmission With Cover Removed

To remove the main drive gear bearing retainer assembly, hold the shaft and retainer together, and remove the retainer and gear as a unit.

Remove the main shaft bearing retainer assembly, being sure that the metal shim pack is carefully identified as a unit. This will facilitate adjustment after assembly.

Remove the main shaft gear cluster as a unit. This should be accomplished slowly so as to avoid damaging the gear teeth.

Remove the two lower shift rails by removing the interlock screw plug, spring, and ball from each side of the housing. Loosen the nuts on the shift forks and turn out the screw until the shafts are free to slide on the forks. Slide the shift rails out of the rear of the housing.

Remove the power take-off shift assembly. Keep the metal shim pack carefully identified as a unit. This will facilitate adjustment after assembly.

Remove the countershaft gear cluster as a unit. Be careful not to damage the gear teeth.

Remove the reverse idler assembly. Tap the forward end of the shaft to remove it and the horseshoe-type retaining washer from the

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