

FRONT AXLE

The front axle assembly is a front wheel driving unit with specially designed steering knuckles, Fig. 1 and a conventional type differential with hypoid drive gears.

The front wheels are driven by axle shafts equipped with constant velocity universal joints which are enclosed in the steering knuckle housing.

The differential is mounted in the housing similar to that used in rear axle, except that the drive pinion shaft is toward the rear instead of the front and to the right of the center of the axle. This design allows placing front propeller shaft along right side of engine oil pan without reducing road clearance under engine.

The differential parts are interchangeable with those of the rear axle.

The axle is the full-floating type and can be removed without disassembling the steering knuckle.

Axle Shaft and Universal Joint Assembly

To remove axle shaft and universal joint assembly the following operations should be performed. See Fig. 2.

1. Remove wheel assembly.
2. Remove hub cap by inserting two screw drivers from opposite sides behind inner flange on cap and pry off.
3. Remove axle shaft cotter pin, nut and washer.
4. Remove axle shaft drive flange bolts and lock washers.
5. Apply the foot brakes and remove the axle shaft flange with puller furnished in tool kit, see Fig. 3.
6. Remove wheel bearing nuts and washers, No. 22, Fig. 2. First bend the lip on lock washer, No. 21 away from the nut with a chisel, remove the outer nut, lock washer, adjusting nut and bearing lock washer, Fig. 4. Wrench is furnished in tool kit.

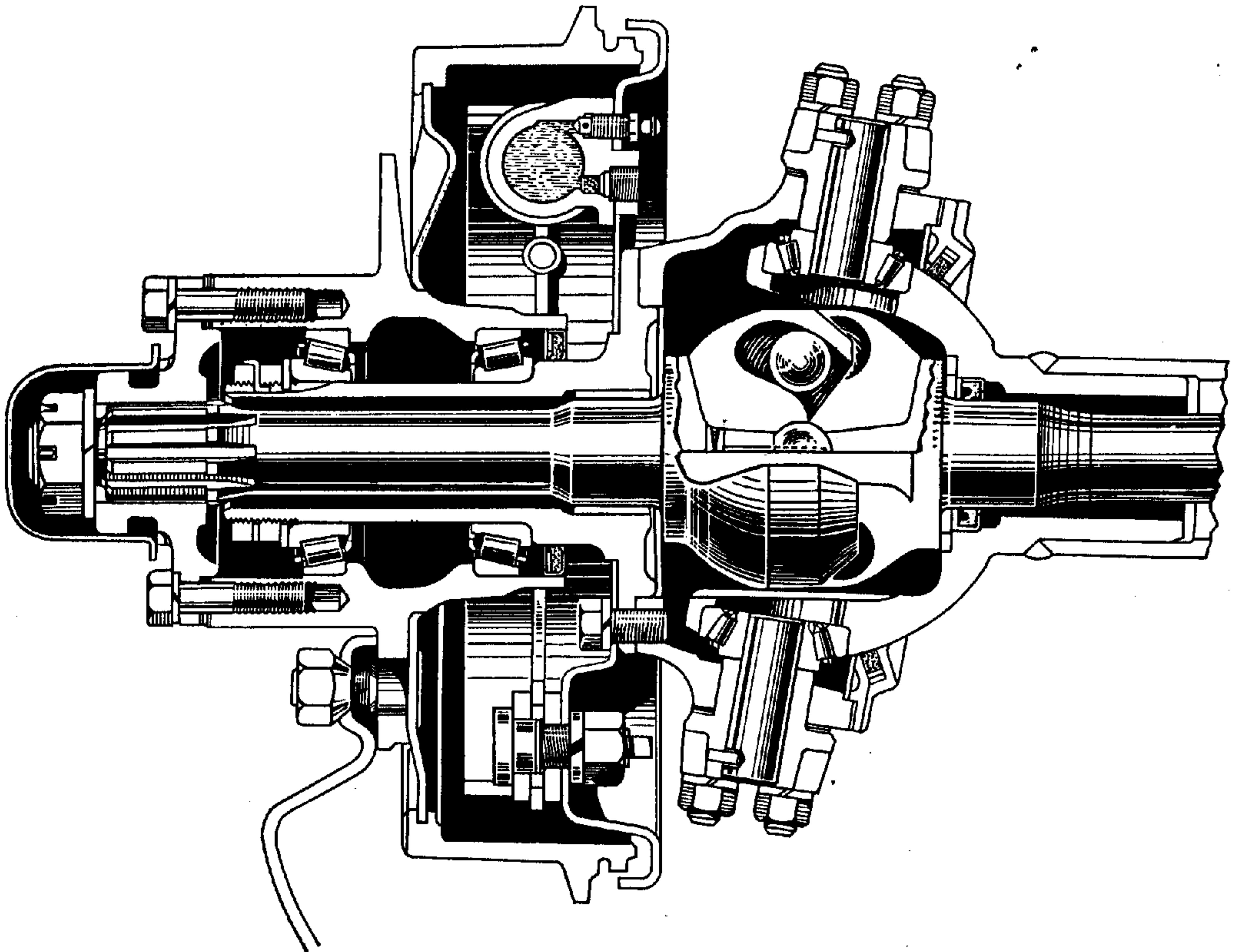


FIG. 1—FRONT WHEEL

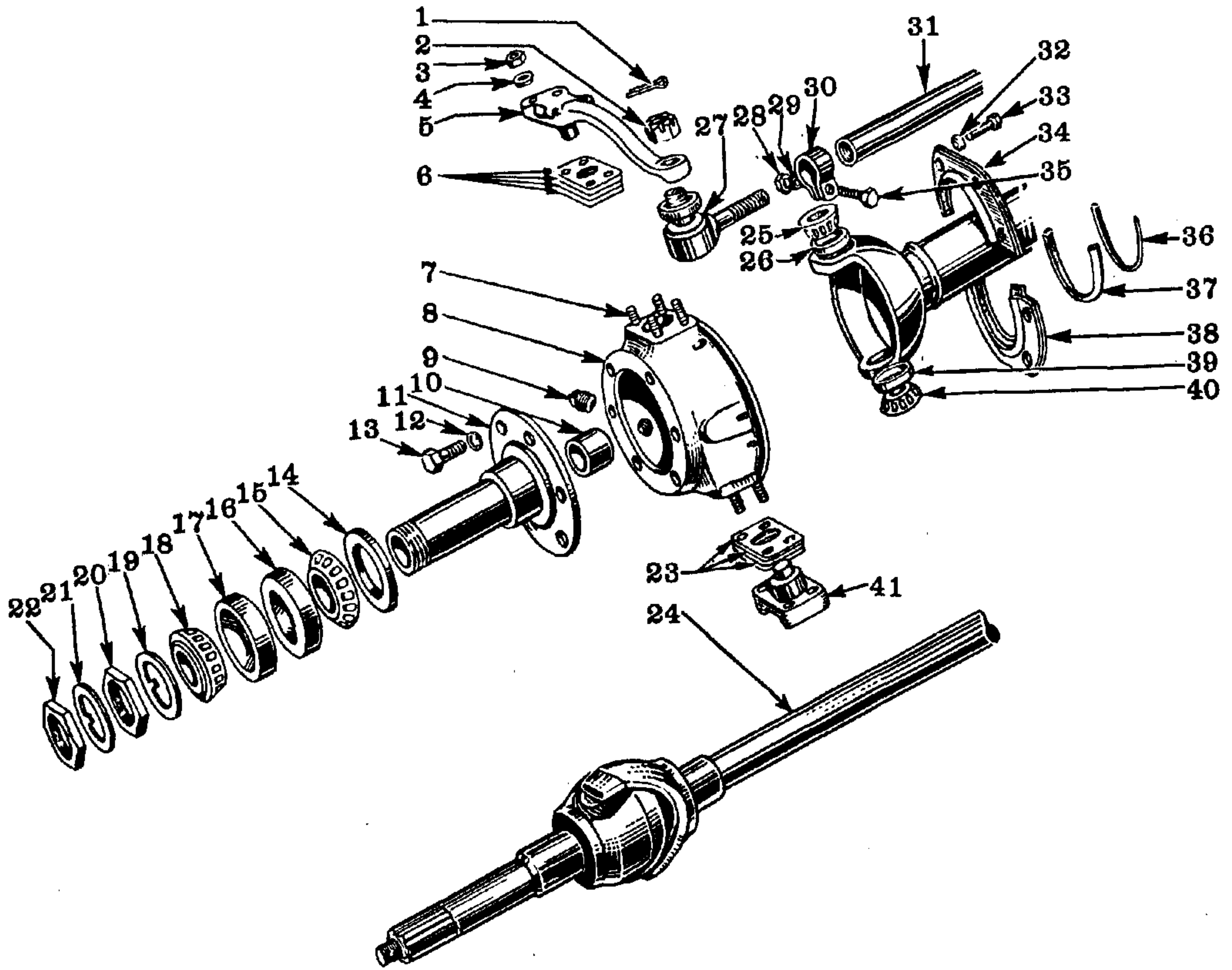


FIG. 2—FRONT AXLE, STEERING KNUCKLE AND WHEEL BEARINGS

(Bendix Universal Joint)

No.	Willys Part No.	Ford Part No.	Name	No.	Willys Part No.	Ford Part No.	Name
1	5152	72025-S	Tie Rod Stud Nut Cotter Pin	24	A-809	GPW-3206-A	Axle Shaft and Universal Joint Assembly (Bendix type) — Right Hand (Ford GPW-3207-A; Willys A-810 Left Hand)
2	10558	351059-S7	Tie Rod Stud Nut	25	52940	GP-3161	King Pin Bearing Cone and Rollers
3	630598		Steering Arm Nut	26	52941	GP-3162	King Pin Bearing Cup
4	6010	34807-S	Steering Arm Nut Lockwasher	27	A-847	GP-3290	Tie Rod Socket Assembly Left Hand (Ford GP-3289; Willys A-838 Right Hand)
5	A-1712	GPW-3113	Upper Steering Arm—Left Hand (Ford GPW-3112; Willys A-1710 Right Hand)	28	636575	34083-S2	Tie Rod Socket Clamp Nut
6	A-830	GP-3117-A	King Pin Adjusting Shims	29	5010	34807-S	Tie Rod Socket Clamp Nut Lockwasher
7	A-1714	357703-S	Steering Arm Stud—Upper (A-5504 Dowel Stud—Upper Outside Front and Inside Rear)	30	A-1706	51-3287	Tie Rod Socket Clamp
8	A-811	GP-3148-A2	Steering Knuckle Right Hand (Ford GP-3149-A2; Willys A-812 Left Hand)	31	A-1705	GPW-3281	Tie Rod Tube Right Hand (Ford GPW-3282; Willys A-1709 Left Hand)
9	5140	353064-S	Steering Knuckle Filler Plug	32	52510	34941-S	Knuckle Oil Seal Screw Lockwasher
10	A-853	GP-3206	Wheel Bearing Spindle Bushing	33	A-872	355483-S	Knuckle Oil Seal Screw
11	A-851	GP-3105	Wheel Bearing Spindle Assembly	34	A-813		Steering Knuckle Oil Seal Assembly—Half
12	6010	34807-S	Brake Disc Screw Lockwasher	35	A-1707	24916-S2	Tie Rod Socket Clamp Screw
13	A-877	355552-S	Brake Disc Screw	36	A-818	GP-3139	Steering Knuckle Oil Seal Felt Pressure Strip
14	A-864	GP-1177	Hub Oil Seal Assembly	37	A-819	GP-3135	Steering Knuckle Oil Seal Felt—Half
15	52942	GP-1201	Wheel Bearing Cone and Rollers	38	A-813	GPW-1088	Steering Knuckle Oil Seal Assembly—Half
16	52943	GP-1202	Wheel Bearing Cup	39	52941	GP-3162	King Pin Bearing Cup
17	52943	GP-1202	Wheel Bearing Cup	40	52940	GP-3161	King Pin Bearing Cone and Rollers
18	52942	GP-1201	Wheel Bearing Cone and Rollers	41	A-828	GP-3140	Lower King Pin Bearing Cap
19	A-865	GP-1218	Wheel Bearing Lockwasher				
20	A-866	GP-4252	Wheel Bearing Nut				
21	A-867	GP-1124	Wheel Bearing Nut Lockwasher				
22	A-866	GP-4252	Wheel Bearing Nut				
23	A-830	GP-3117-A	King Pin Adjusting Shims				

7. Remove wheel hub and drum assembly with bearings taking care not to damage oil seal.
8. Remove brake tube and brake backing plate screws, No. 13, Fig. 2.
9. Remove spindle No. 11.
10. The complete axle shaft and universal joint assembly No. 24 can now be pulled out of the axle housing. Care should be taken not to injure the outer oil seal assembly in axle housing.

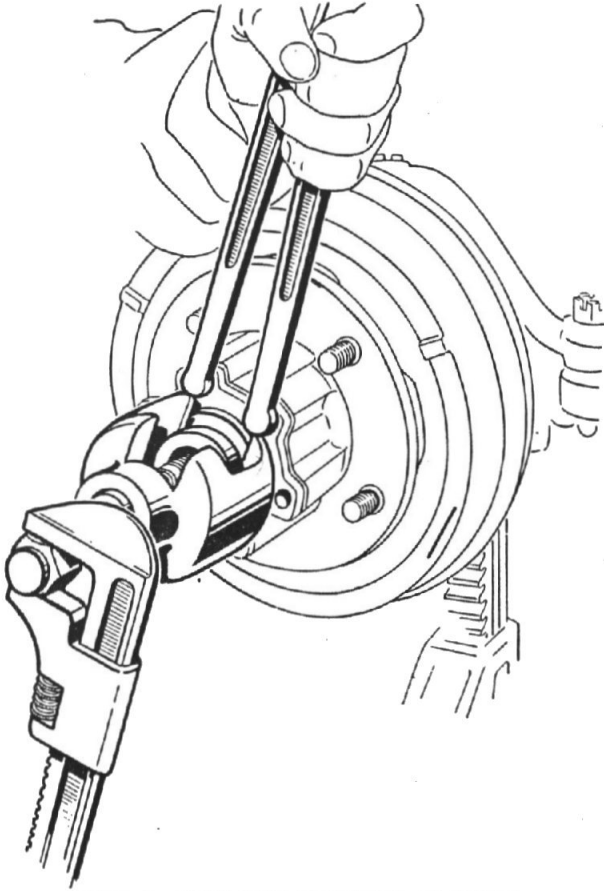


FIG. 3—PULLING DRIVING FLANGE

Disassembly (Bendix Joint)

After the axle shaft assembly has been removed, the universal joint may be disassembled as follows:

1. Wash the axle shaft and universal joint thoroughly in cleaning fluid.
2. Using a drift and hammer, drive out the retainer pin which locks the center ball pin in wheel end of shaft. See Fig. 5.
3. Bounce the wheel end of the shaft on a block of wood to cause the center ball pin to move into the drilled passage in the wheel end of the shaft.
4. Pull the two halves of the joint apart and then bend sharply at the universal. Rotate the center ball until grooved side lines up with ball raceway. This permits the adjacent ball to be moved past the center ball and removed from the joint. The remaining three driving balls and center ball will then drop out.

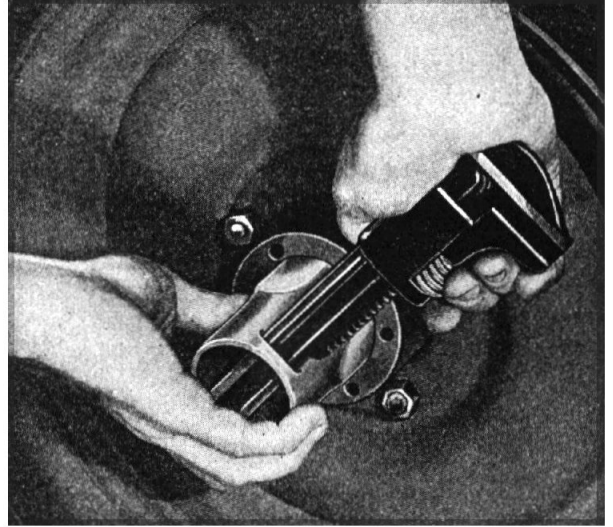
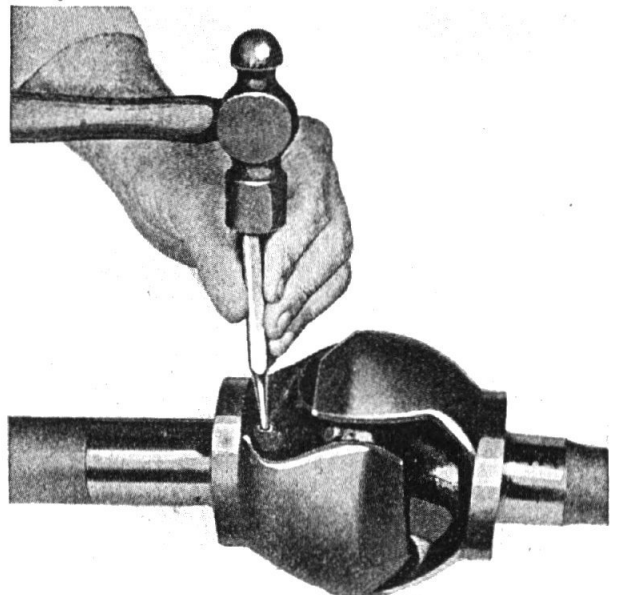


FIG. 4—REPLACING HUB NUT

Inspect the ball raceways for excessive wear. Fig. 6. If a raceway is badly worn the complete axle and universal joint assembly should be replaced. If the center ball pin is worn, it should be replaced. Inspect the center ball and the four driving balls for scratches, grooves or flat spots and replace if necessary. The driving balls (.875" diameter) are available from .003" undersize to .003" oversize in steps of .001" to permit selective fitting. If any or all of the driving balls are to be replaced the old ball or balls should be measured with a micrometer and the same size new balls used. Selective assembly is not required when installing a new center ball.

FIG. 5—REMOVING RETAINER PIN
(Bendix Joint)

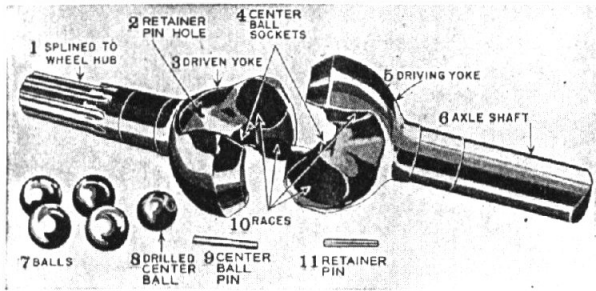


FIG. 6—AXLE SHAFT UNIVERSAL JOINT

Reassembly—(Bendix Joint)

1. Place the differential half of the axle shaft in a bench vise, with the ground portion of the shaft above the vise jaws.
2. Install the center ball (one with hole drilled in it) in its socket in the shaft, hole and groove facing you.
3. Drop the center ball pin into the drilled passage in the wheel half of the shaft.
4. Place the wheel half of the shaft on the center ball. Then slip three balls into the raceways.
5. Turn the center ball until the groove in it lines up with the raceway for the remaining ball as shown in Fig. 7. Slip the ball into the raceway and straighten up the wheel end of the shaft.
6. Turn the center ball until the center ball pin drops into the hole drilled in the ball.
7. Install the retainer pin (lock pin) and prick punch both ends to securely lock in place.

Disassembly (Rzeppa Joint)

After the shaft has been removed, the universal joint may be disassembled as follows, Fig. 4, Pg. 115:

1. Remove the three screws holding the front axle shaft to the joint and pull the shaft out of the splined inner race. To remove the axle shaft retainer, remove the retainer ring on the axle shaft.
2. Clean the universal joint in a suitable cleaning solution and lift out the axle centering pin.
3. Push down on various points of the inner race and cage until the balls can be taken out with the help of a small screw driver. Be careful not to damage parts.
4. After all the balls have been removed the inner race and cage can be turned over so the pilot cup is up, then remove the pilot cup.
5. There are two large elongated holes in the cage as well as four small holes. Turn the cage so

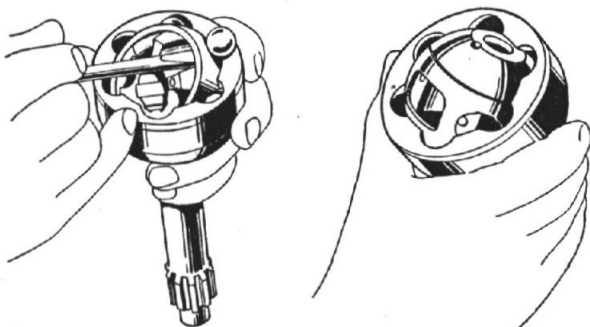


FIG. 8—DISMANTLING RZEPPA JOINT

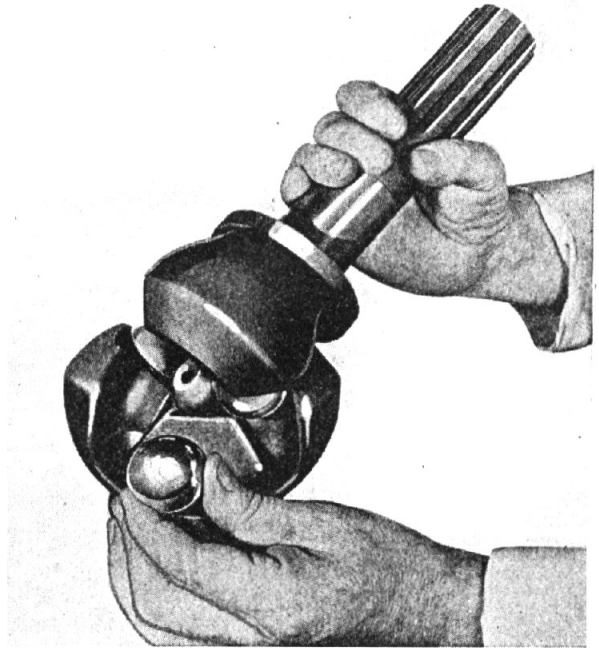


FIG. 7—ASSEMBLING UNIVERSAL JOINT BALLS

- two bosses in the spindle shaft will drop into the elongated holes and lift out cage.
6. To remove the inner race turn it so one of the bosses will drop into an elongated hole in the cage, shift the race to one side, and lift out opposite side.

Reassembly (Rzeppa Joint)

1. Reassembly of the joint is the reverse of dismantling. Care should be exercised not to damage parts and see that they are clean of all dirt and grit.

To Reassemble Axle Shaft and Universal Joint Assembly to Housing

1. Clean all parts so that they are free from dust and foreign matter.
2. Enter universal joint and axle shaft assembly in the housing, taking care not to injure the outer and inner oil seals. Enter spline end of axle into the differential and push in until the shoulder on the universal joint stops against the axle.
3. Install wheel bearing spindle.

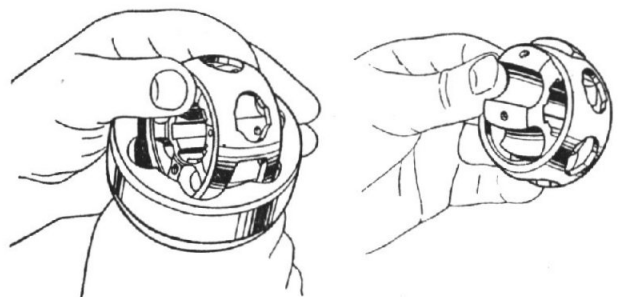


FIG. 9—REMOVING CAGE—RZEPPA JOINT

4. Install brake tube and bolt backing plate in position.
5. Grease wheel bearings and assemble bearings, wheel hub and drum on the wheel bearing spindle. Install wheel bearing washer, No. 19, Fig. 2, and adjusting nut, No. 20. Tighten nut until there is a slight drag on the bearings, when the wheel is turned, then back off approximately one-quarter turn. Install lock washer No. 21 and nut No. 22, tightening nut into place and then bending the lock washer over on the lock nut.
6. With Bendix joint install axle drive flange on axle splines, without shims.

Measure the space with a Feeler Gauge between the outer end of the wheel hub and the inner face of the drive flange, Fig. 10. This will determine the amount of shims to be installed. In order to have proper clearance in the universal joint, it is necessary to add a .040" shim to those required as measured by the Feeler Gauge.

Remove driving hub and install the correct amount of shims replacing driving hub on spline shaft and install six cap screws.

With Rzeppa joint be sure to install all the shims as removed when dismantling the axle drive flange. (.060" shims in each side).

7. Assemble axle shaft washer, nut and cotter pin.
8. Install the Hub Cap.
9. Assemble Wheel.
10. Check front wheel alignment, which is covered under "Steering".
11. Bleed Brake.

Make certain the steering knuckle universal joint is lubricated through the filler plug in the knuckle housing. See Lubrication Chart, Page 12.

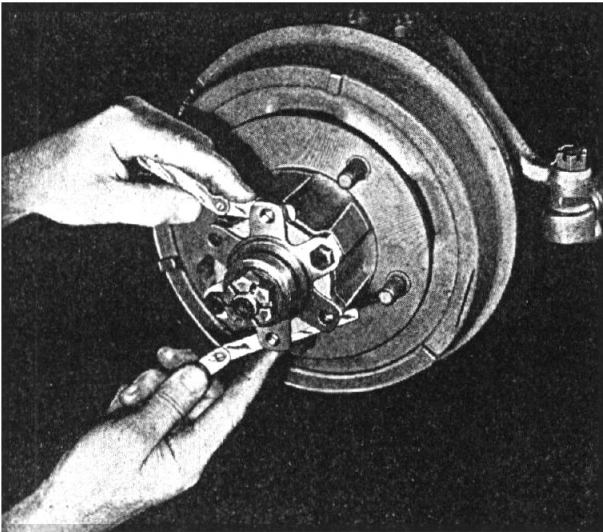


FIG. 10—CHECKING FLANGE END PLAY

Replacing Steering Knuckle Bearing

Replacement of the bearings or bearing cups on the king pins necessitates removal of the hub and brake drum assembly, wheel bearings, axle shaft, wheel bearing spindle and the steering knuckle. The steering knuckle should be disassembled as follows:

1. Remove the eight screws No. 33, Fig. 2 which hold the oil seal retainers in place No. 34 and 38.
2. Remove the four nuts holding the lower king pin bearing cap, No. 41.
3. Remove the four nuts, No. 3 holding the upper steering arm in place, and remove brake hose shield also arm No. 5. The steering knuckle No. 8 can now be removed from the axle.
4. Wash all parts in cleaning solution and inspect bearings and races for scores, cracks or chips. All damaged parts should, of course, be replaced.

In the event the bearing cups are damaged, they can be removed by the use of a driver or a suitable drift.

Reassembling Steering Knuckle

Reverse the procedure outlined above to reassemble the unit. When reinstalling the steering knuckle, sufficient shims must be installed under the arm and lower bearing cap so the proper tension will be maintained on the bearing. The shims are available in thicknesses of .003", .005", .010" and .030".

Install one each of the .003", .005", .010" and .030" shims over studs on the steering knuckle, top and bottom. Install the arm, and lower bearing cap, lock washers, and nuts, and tighten securely. Check the tension of the bearings by hooking checking scale in the hole in the arm at tie rod and socket, either remove or add shims until the load is approximately 25 to 35 inch pounds, without oil seal assembly in position. Make sure there are the same thickness of shims between arm and knuckle as between lower cap and knuckle.

Steering Knuckle Oil Seal

Replacement of the oil seal No. 34 and 38 can be made very easily by merely removing the eight screws which hold the oil seal in place. Before re-installing the oil seal examine the spherical surface of the axle for scores or scratches which might damage the seal. Roughness of any kind should be smoothed down with emery cloth.

Reinstall both upper and lower halves of the oil seal, making sure that the felt fits snugly at the points where the upper and lower halves come together, Fig. 11.

After driving in wet, freezing weather swing the

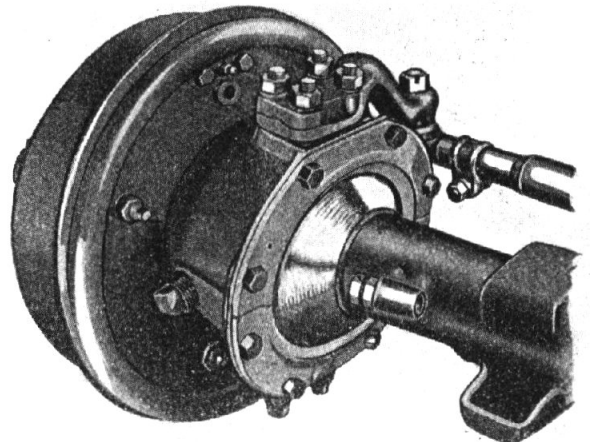


FIG. 11—STEERING KNUCKLE OIL SEAL

front wheels from right to left to remove moisture adhering to the oil seal and the spherical surface of the universal joint housing. This will prevent freezing with resulting damage to oil seal felts. Should the car be stored for any period of time, coat these surfaces with light grease to prevent rusting.

Axle Shaft Outer Oil Seal

In the event it should be necessary to replace the axle shaft outer oil seal, remove the axle shaft and universal joint as described under the "Axle Shaft and Universal Joint".

The oil seal is a light press fit in the housing

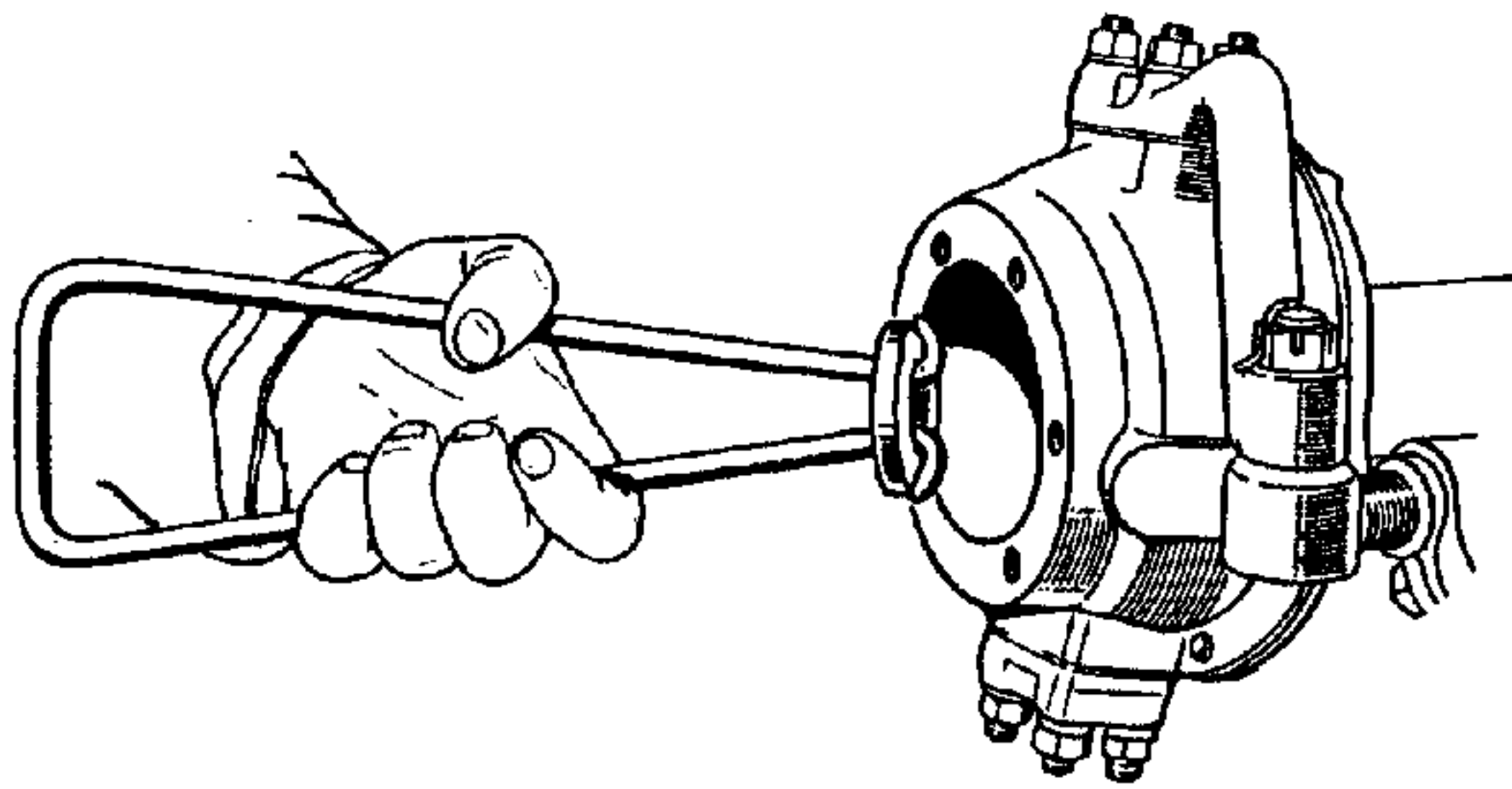


FIG. 12—REMOVING OIL SEAL

and will require a tool or puller for removal. Insert the ends of the puller behind the oil seal and tap the end of the puller lightly with a hammer. See Fig. 12.

Before installing a new seal make sure it has been soaked thoroughly in oil. This will not only make the leather more pliable but will avoid it being burned by friction with the axle shaft when the vehicle is driven.

After placing the oil seal in position in the housing, it can easily be driven in place by using a driver or a block of hard wood and a hammer.

When installing axle shaft and universal joint assembly exceptional care should be used to prevent damage to the oil seal.

Removing and Overhauling Differential

Inasmuch as the front axle differential assembly is identical with that of the rear axle assembly, refer to the section under "Rear Axle" for the proper procedure to follow in dismantling and assembling differential.

Steering Tie Rod and Bell Crank

These parts being part of the steering mechanism, they are covered in the section under "Steering."

FRONT AXLE TROUBLES AND REMEDIES

SYMPTOMS

PROBABLE REMEDY

Hard Steering

- Lack of lubrication..... Lubricate
- Tires soft..... Inflate to 30 lbs.
- Tight steering..... Adjust. See "Steering" Section

Low Speed Shimmy or Wheel Fight

- Spring Clips and Shackles loose..... Readjust or replace
- Front axle shifted..... Broken spring center bolt
- Insufficient toe-in..... Adjust
- Improper caster..... Reset
- Steering System loose or worn..... Adjust or overhaul steering gear, front axle or steering parts
- Twisted Axle..... Straighten or adjust

High Speed Shimmy or Wheel Fight

- Check conditions under "Low Speed Shimmy"
- Tire pressures low or not equal..... Inflate to 30 lbs.
- Wheels out of balance..... Balance—Check for patch
- Wheel runout..... Straighten
- Radial runout of tires..... Mount properly
- Wheel camber..... Same on both wheels
- Front springs settled or broken..... Repair or replace
- Bent steering knuckle arm..... Straighten or replace
- Shock absorbers not effective..... Replace
- Steering gear loose on frame..... Tighten
- Front springs too flexible..... Over lubricated

Tramp

- Wheels unbalanced..... Check and balance

Wandering

- Improper toe-in..... Adjust—Check for bent steering knuckle arm
- Broken front spring main leaf..... Replace
- Axle shifted..... Spring center bolt broken
- Loose spring shackles or clips..... Adjust or replace
- Improper caster..... Reset
- Tire pressure uneven..... Inflate to 30 lbs.
- Tightness in steering system..... Adjust
- Loose wheel bearings..... Adjust
- Front spring settled or broken..... Repair or replace

FRONT AXLE TROUBLES AND REMEDIES—Continued

SYMPTOMS	PROBABLE REMEDY
Axle Noisy on Pull	
Pinion and Ring gear adjusted too tight.....	Readjust
Pinion bearings rough.....	Replace
Axle Noisy on Coast	
Excessive back lash at ring and pinion gear.....	Readjust
End play in pinion shaft.....	Readjust
Rough bearing.....	Replace
Axle Noisy on Coast and Pull	
Ring and pinion adjusted too tight.....	Readjust
Pinion set too deep in ring gear.....	Readjust
Pinion bearing loose or worn.....	Readjust or replace
Back Lash	
Axle shaft universal joint worn.....	Replace
Axle shaft improperly adjusted.....	Readjust
Worn differential pinion washers.....	Replace
Worn propeller shaft universal joints.....	Replace

Emergency

Where difficulty is experienced with front axle differential making the vehicle inoperative, remove axle driving flanges. This will allow bringing vehicle in under its own power. Be sure front wheel drive shift lever is in the forward (disengaged) position.

FRONT AXLE SPECIFICATIONS

Front Axle

Make.....	Spicer
Drive.....	Through springs
Type.....	Full Floating
Road Clearance.....	8 ⁷ / ₁₆ "

Differential

Drive.....	Hypoid
Gear Ratio.....	4.88:1
Bearings.....	Timken Roller 2
Adjustment.....	Shims
Gears (Pinion).....	2

Oil Capacity (Pts.).....See Lubrication Chart, Page 12

Steering Knuckle Thrust Up and Down

Adjusted by shims, should have 25 to 35 inch-pounds pull without oil seal assembly in position.

Steering Knuckle

Bearings Upper and Lower.....Timken Roller

Turning Arc.....26°

Tie Rods

Number.....	2
Right hand length center to center.....	24 ¹ / ₄ "
Left hand length center to center.....	17 ¹¹ / ₃₂ "
Tie rod ends.....	Serviced as a unit

Steering Geometry

King Pin inclination.....	7 ¹ / ₂ °
Wheel camber.....	1 ¹ / ₂ °
Wheel caster.....	3°
Wheel toe-in.....	3/64"-7/32"

Bearings

Cone and Roller.....	24780
Differential side.....	Timken
Cup.....	24721
Shims.....	.003", .005", .010", .030"
Pinion Shaft.....	Timken
Cone and roller.....	Front 31593, Rear 02872
Cup.....	Front 31520, Rear 02820
Shims.....	.003", .005", .010", .030"
Wheel Hub.....	Timken
Cone—Roller.....	Inner 18590, Outer 18590
Cup.....	Inner 18520, Outer 18520
Steering Knuckle.....	Timken
Cone and roller... ..	Upper 11590, Lower 11590
Cup.....	Upper 11520, Lower 11520
Steering Bell Crank	
Bearing.....	Needle, Torrington B1210