

PRELIMINARY
PASQUALI SERVICE MANUAL

This is a partial release of our Pasquali Service Manual. It includes those sections which have caused our dealers some difficulty in accomplishing efficient repairs.

We will appreciate your comments and suggestions on improving this manual. Feel free to contact Dave Coons concerning questions or suggestions.

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SPECIFICATIONS FOR PASQUALI RUBBER-TIRED, 4-WHEEL DRIVE, AIR-COOLED, DIESEL-POWERED, ARTICULATED UTILITY TRACTOR.

The specifications listed below are for a Pasquali 4-wheel drive, articulated diesel tractor adaptable to a wide range of applications including, but not limited to:

- * Rough & Finish Mowing
- * Roto-Tilling
- * Snowblowing
- * Trenching
- * Front End Loading
- * Backhoeing
- * Vibratory Plowing (Cable Laying)
- * Backfilling
- * Pulling or Towing
- * General Agricultural Applications

MODELS

Delivered in ready-to-run condition, operated only as required for manufacturers' qualification tests.

ENGINES

(1) and (2) cylinder, 4-stroke, air-cooled diesel ranging from 44 cu. inches to 82 cu. inches of displacement. Machine equipped with running-time meter.

ELECTRICAL

Twelve volt system with electric start. 96 amp/hour battery. Charging system - alternator with electronic voltage regulator.

TIRES

Wide range of options:

- 31 x 15.5 x 15 cleated tires for flotation with maximum traction.
- 31 x 15.5 x 15 turf tires for flotation on soft mowed terrain.
- 9.5 x 16 Power Torque cleated tires for agricultural applications.
- 7.5 x 16 tires for variable widths, while providing exceptional traction.

STEERING

Hydraulically actuated, articulated steering for short radius turns and maneuverability around shrubs, tree or other obstacles.

Tractor has oscillating capability to assure stability and traction on uneven or rutted terrain.

FOUR-WHEEL DRIVE

Drive system is equipped with full differentials front and rear with ability to lock out differential on the front axle for maximum traction

FINAL DRIVE

3 speeds forward, 1 reverse, used in conjunction with 3 ranges to give 9 forward speeds ranging from .4 mph to 15 mph and 3 reverse speeds ranging from .9 mph to 10 mph.

HYDRAULIC SYSTEM

Equipped with direct drive gear pump available in a range of displacements from 3.1 to 5.4 gpm. System standard with built-in filter, pressure relief adjustable 1500 to 2000 psi.

BRAKES

Mechanical brakes on rear wheels with standard locking hand brake.

HITCH

Standard 3-point hitch compatible with category I implements.

Fixed drawbar.

Optional hydraulics to operate remote hydraulics on implements.

PTO

(2) speed PTO, 540 and 760 RPM. Standard options available to provide PTO speeds in excess of 2000 RPM's upon request.

SAFETY FEATURES

Low center of gravity combined with wide stance to assure maximum stability on steep grades.

Safety start switch standard to assure tractor cannot be started while drive train is engaged.

Roll-over protection (ROPS) available.

COMPATIBLE IMPLEMENTS & ACCESSORIES

1. Mowing Equipment
 - a. 4' & 5' single spindle rotary brush mowers.
 - b. 4', 5' & 6' flail mowers.
 - c. 56" cycle bar mowers.
 - d. Triple blade rotary mowers, 4' and 5'.
2. 3', 4' & 5' Rotary Tillers
3. 4', 5' & 6' Two-Stage Snowblowers
4. Installed Implements
 - a. Front mount loader
 - b. Bull dozer blade
 - c. Rear mount backhoe
 - d. Rear mount trencher
 - e. Rear mount vibrating plow

Tractor can be set up and equipped with a wide range of standard 3-point hitch mounted implements.

The installed accessories can be taken on and off in a reasonable amount of time to make maximum utilization of this equipment.

SAFETY INSTRUCTIONS

The Pasquali line of tractors has been designed and tested with this goal in mind; "to reduce or minimize the potential for accidents." However, with careless or improper operation, coupled with inadequate maintenance, the possibility for personal injury to the operator increases. The following listed safety instructions are meant to remind the operator of some of the more obvious hazards associated with operating mechanical equipment coupled with some less obvious operating characteristics associated with articulated tractors. Please read them carefully before operating our equipment.

Before Operating

1. Read and understand that portion of this manual that covers the operation of this vehicle. Be familiar with all of the controls and know how to stop quickly.
2. Keep all safety shields in place and confirm that all safety devices are operable.
3. Wear long pants and substantial shoes. If you are working in heavy brush or in orchards with low-hanging limbs, safety glasses and a helmet are advisable.

4. Be sure that the safety start switch is adjusted so that the tractor can only be started when the clutch pedal is fully depressed disengaging the drive clutch.
5. Verify that the PTO speed selection lever is in neutral. If you are not using the PTO, the 1-3/8" 6-splined stub shaft should be removed and stored in the toolbox under the front hood. Place the protective rubber boot over the PTO shaft socket to eliminate contamination from entering into the splined receiver.
6. Fill fuel tank with #2 diesel fuel before starting the engine.

Note: The Pasquali tractor line is powered by air-cooled diesel engines. Under NO circumstances should you use gasoline or any mixture of gasoline and diesel fuel. It is imperative that ONLY #2 diesel fuel be used in these engines.

While Operating

7. Start and operate the tractor only while sitting in the seat.
8. Before starting the engine:
 - a. Assure drive transmission levers are in neutral.
 - b. Assure PTO shift lever is in neutral.

- c. Set the parking brake.
 - d. Depress the clutch fully to activate the safety start switch.
9. After starting the engine, release the clutch slowly to confirm the transmission levers are in fact, in neutral.
10. Do not run the engine in a closed area without adequate ventilation. The exhaust fumes can cause great discomfort and might prove to be hazardous.
1. The tractors are designed to be operated by a single person. Under no circumstances should they carry passengers.
2. Operating these tractors safely requires constant attention; to minimize risks and maintain control, the operator should:
- a. Operate the equipment only in daylight or where there is good artificial light.
 - b. Watch for deep holes or other hidden hazards.
 - c. Do not drive too closely to deep ditches, creeks or other hazards.
 - d. Reduce speed when on rough terrain or making sharp turns, particularly when on a hillside.
 - e. Avoid sudden stops and starts.
 - f. Do not leave the tractor unattended while it is running.
 - g. Keep the tractor in gear while going down a steep grade.
 - h. Adjust the weight distribution if wheels come off the ground.
13. Shut off the engine and set the hand brake before making any adjustments or repairs on the tractor.
14. Do not touch the engine or muffler while the engine is running. It is hot enough to cause a burn.
15. To reduce fire hazard, keep the engine free of grease, grass, leaves or other flammable material.
16. Do not over-speed the engine. Maximum speed of the engine is 3000 RPM's unloaded. Any adjustments to the governor settings should be made by a trained, authorized dealer, using an external tachometer.
17. Do not check the engine oil level or hydraulic oil level with the tractor running. Do not add hydraulic oil or engine lubricating oil with the engine running.

REMOVE & REPLACE CLUTCH

Access to the dry, single-stage clutch is obtained by unbolting the engine/bell housing assembly from the front face of the transmission. (1, Fig. 1)

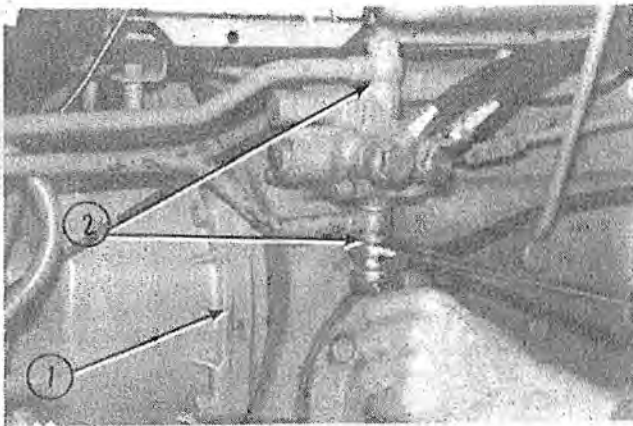


FIG. 1

In preparation to remove the engine/bell housing assembly, you must disconnect:

- (1) Hydraulic pressure and return lines at the lift valve.
(2, Fig. 1)
- (2) The accelerator and fuel shut-off cables (Fig. 2) and the decompression cable if applicable.

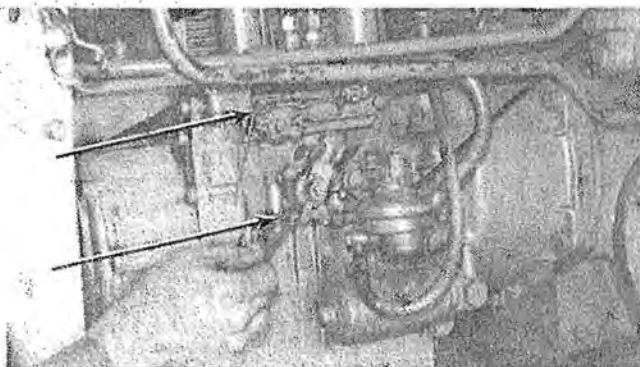


FIG. 2

- (3) Fuel supply line (Fig. 3) and excess fuel return lines from the injectors to the fuel tank.

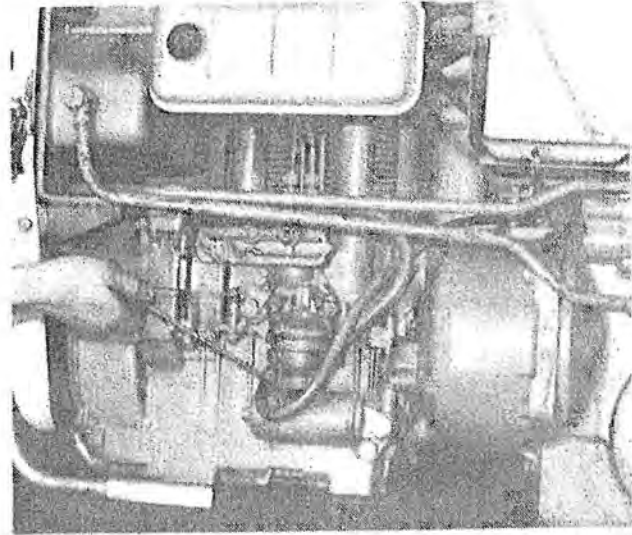


FIG. 3

- (4) Electrical wire bundles at the starter switch, the light switch, oil pressure warning light, starter, and voltage regulator.

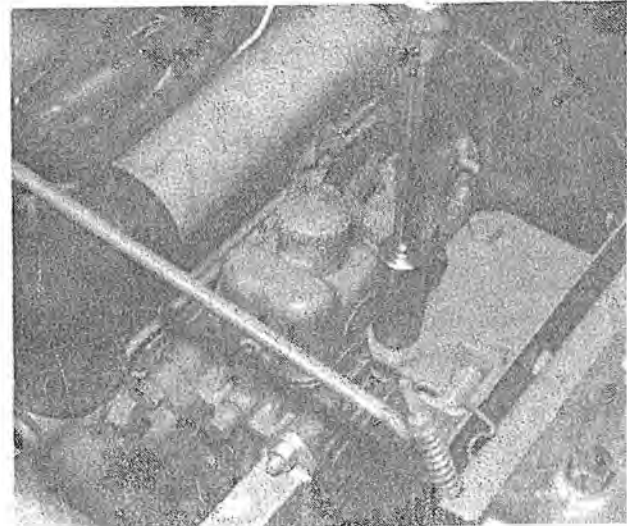


FIG. 4

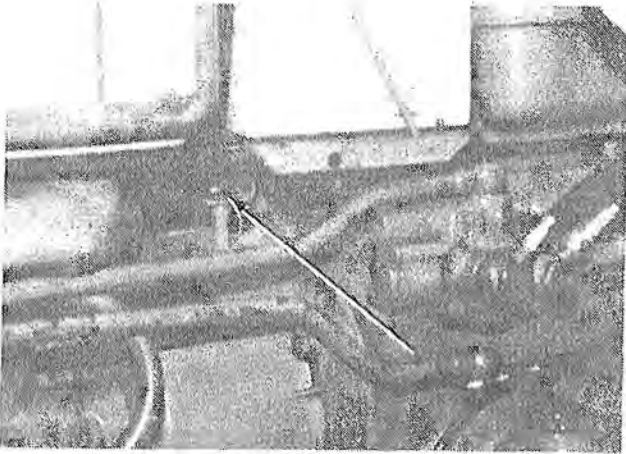


FIG. 5

(5) The (2) 10 x 16mm. bolts at the top (Fig. 4) and the (2) 8 x 55mm. bolts that secure the bottom of the battery case to the engine/bell housing assembly. (Fig. 5)

After verifying that the engine is clear for removal, remove the (6) 10 x 35mm. bolts securing the aft face of the bell housing to the front of the transmission. (Fig. 6)

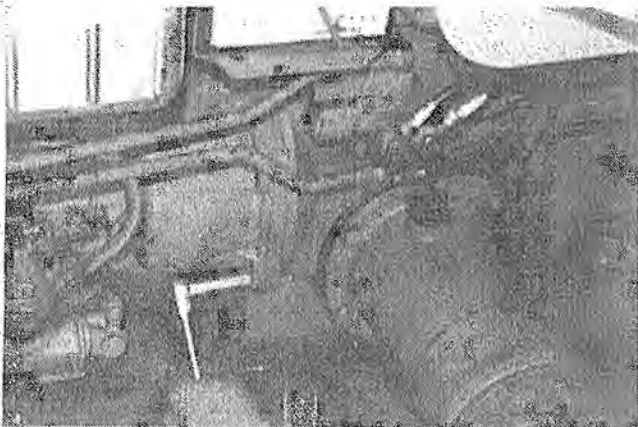


FIG. 6

Note: Support the engine/bell housing assembly prior to removing all (6) bolts. (Fig. 7)



FIG. 7

Roll the engine forward off the transmission pilot shaft. (Fig. 8)

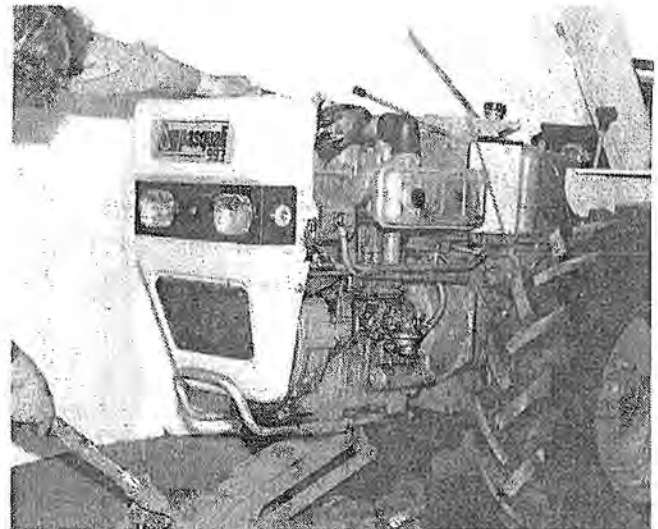


FIG. 8

Remove (6) 8 x 20mm. bolts securing the pressure plate to the flywheel and remove the friction disc.

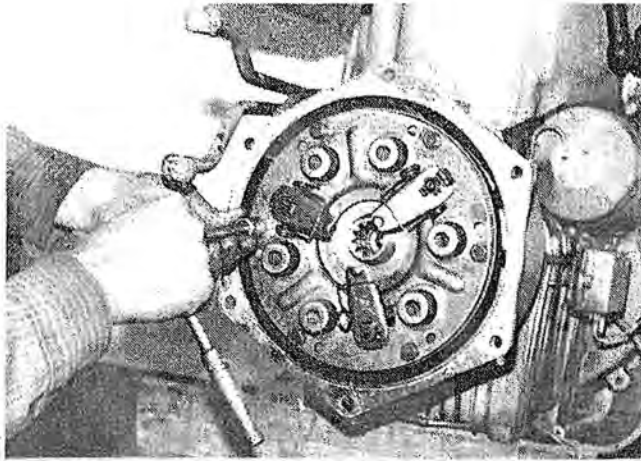


FIG. 9

Remove and replace all worn and damaged parts.

- (1) Check torque on flywheel nut, 200 ft./lbs. (Fig. 10)

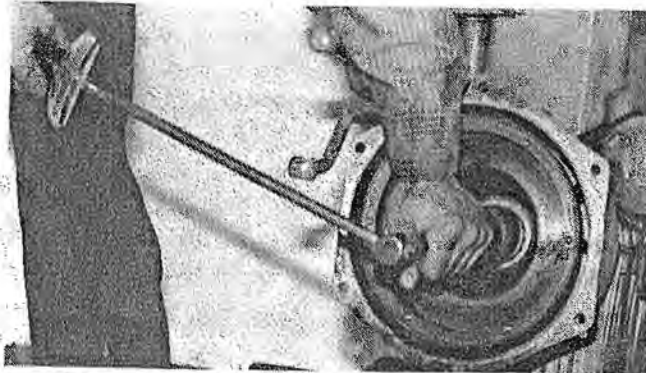


FIG. 10

- (2) Inspect pilot bearing.
(3, Fig. 11)
- (3) Inspect flywheel friction face.
(4, Fig. 11)

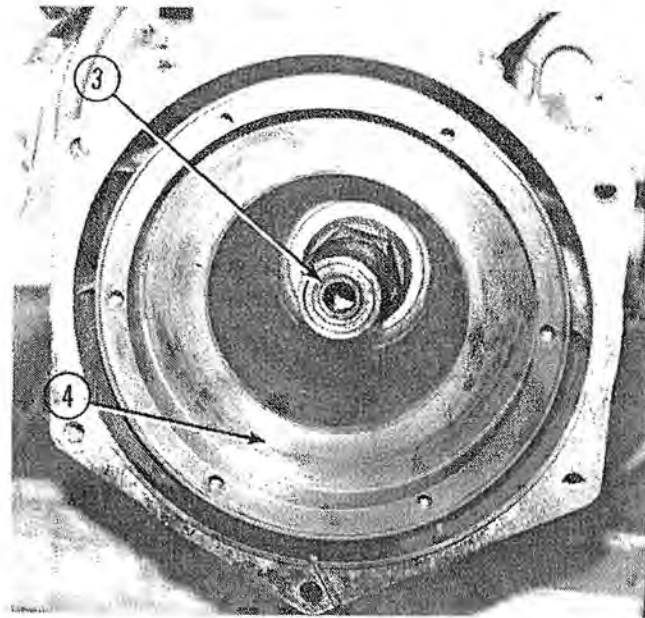


FIG. 11

- (4) Inspect throw-out bearing.
(Fig. 12)

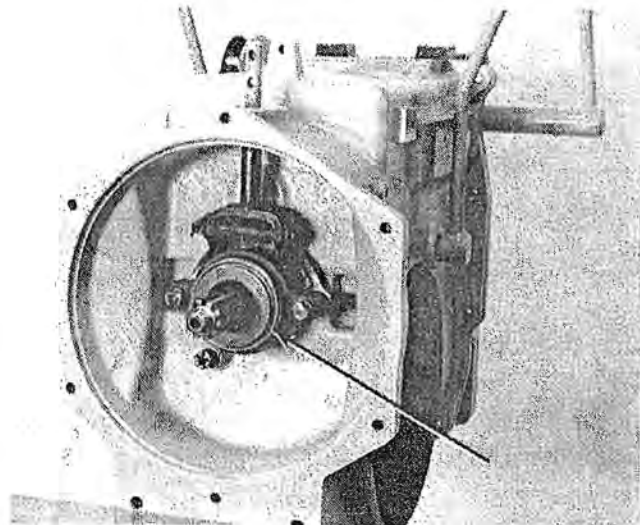


FIG. 12

Position the friction disc onto the flywheel and secure it by bolting the pressure plate to the flywheel using the (6) 8 x 20mm. bolts and lockwashers (finger tight only).

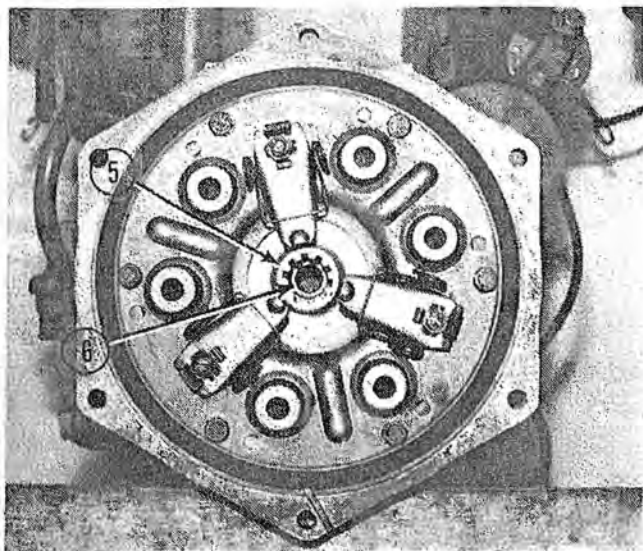


FIG. 13

Align the splined hub of the friction disc (5, Fig. 13) to the pilot bearing (6, Fig. 13) and torque the (6) 8 x 20mm. bolts 15/17 ft./lbs.

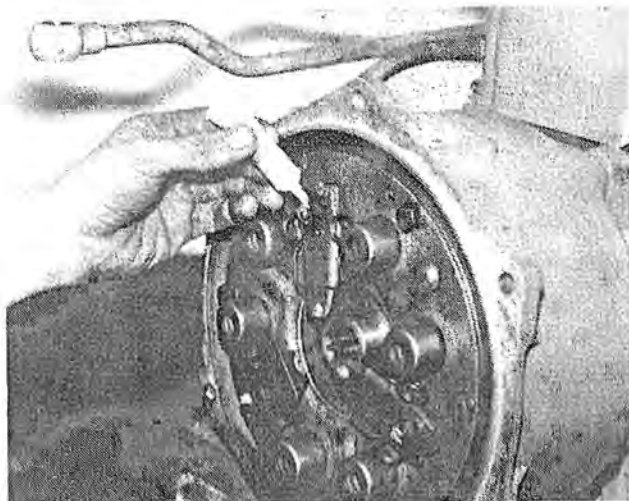


FIG. 15

Note: After the fingers are adjusted, lock the adjusting screw by staking the lock ring on the nut into the screw slot (Fig. 15) and apply a thread locking compound. (Fig. 16)

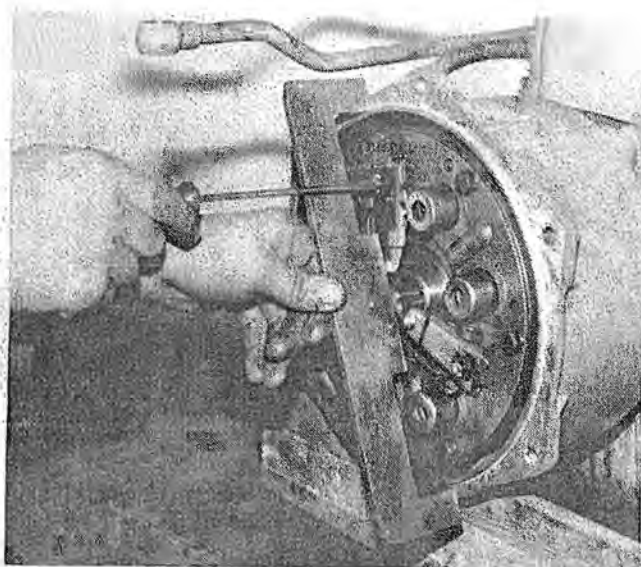


FIG. 14

Using the set gauge, adjust the height of the (3) three clutch fingers to 20mm. (Fig. 14)

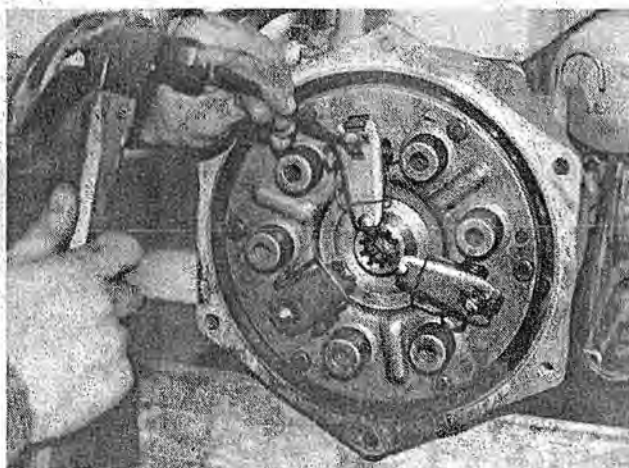


FIG. 16

Re-assemble the engine/bell housing assembly back onto the transmission face in reverse order of disassembly.

FRONT STUB AXLE DISASSEMBLY

Removing the front stub axle assembly provides access to the inner and outer bearings, the outer oil seal and the final drive reduction hub.

Drain the front gear case, or tip the axle up in such a manner so that the oil in the case will not flow over the bottom lip of the axle housing.

After removing the wheel and working through the access slot in the face of the stub axle flange, remove (6) 10 x 25 mm. bolts that secure the bearing retaining cup to the face of the axle. (1, Fig. 1)

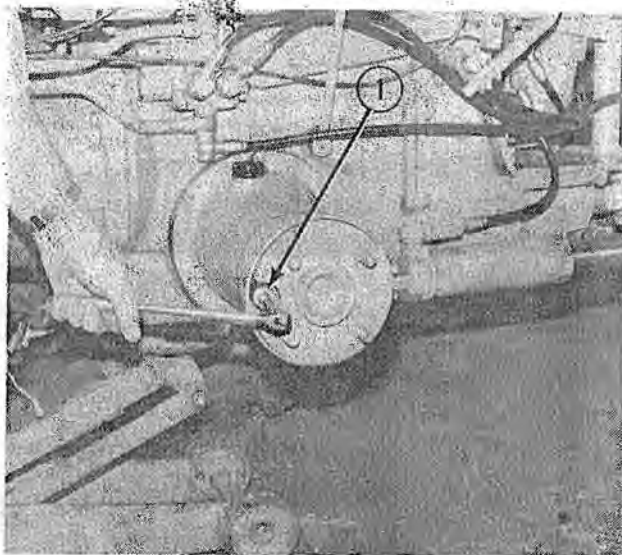


FIG. 1

Attach a slide hammer to the axle flange using as many studs as practical, preferably all four. (1, Fig. 2)

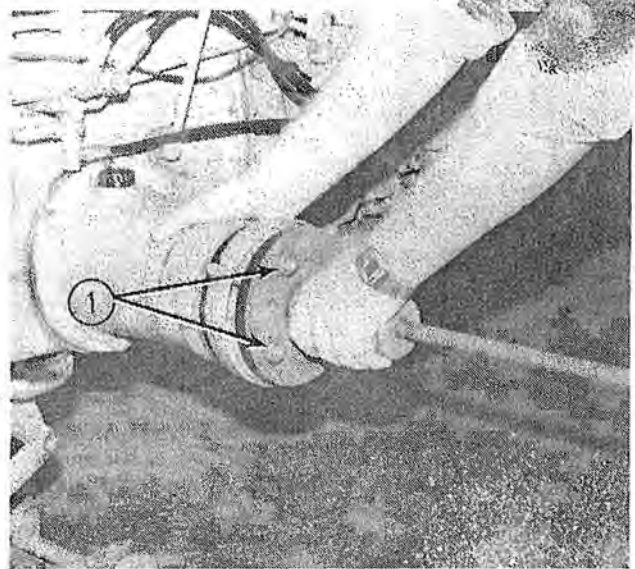


FIG. 2

Remove the stub axle assembly from the axle casting.

Note: If all of the wheel studs are broken off, you may temporarily weld some 3/8" diameter bolts to the face of the axle flange to attach the slide hammer to.

After the axle is removed, knock off these bolts and grind the face flush.

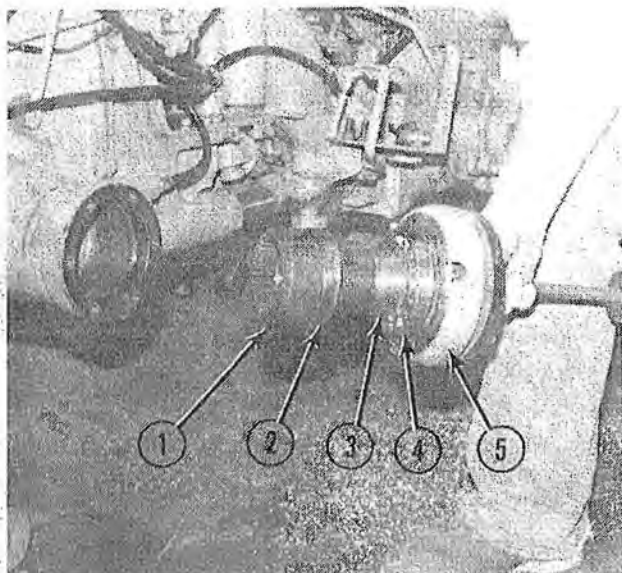


FIG. 3

Figure 3 identifies the key parts of the front stub axle sub-assembly.

(1, Fig. 3) Final drive reduction hub.

(2, Fig. 3) Inner bearing.

(3, Fig. 3) Stub axle.

(4, Fig. 3) Outer bearing.

(5, Fig. 3) Bearing and seal retainer cup.

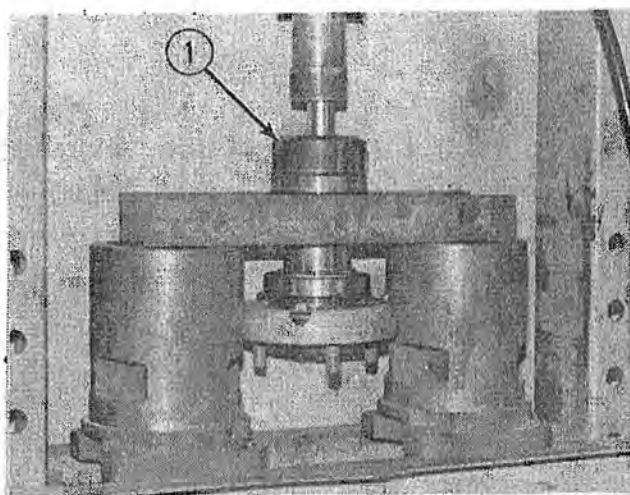


FIG. 4

The inboard splined end of the stub axle can be pressed out of the reduction hub. (1, Fig. 4)

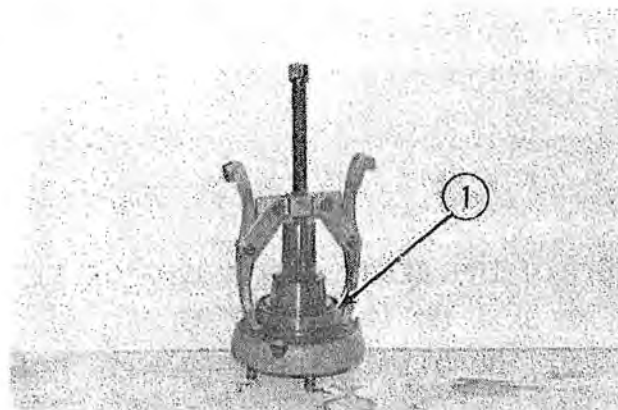


FIG. 5

After removing the snap ring and washer, the outboard bearing can be removed using any commercial gear puller (1, Fig. 5) or your press.

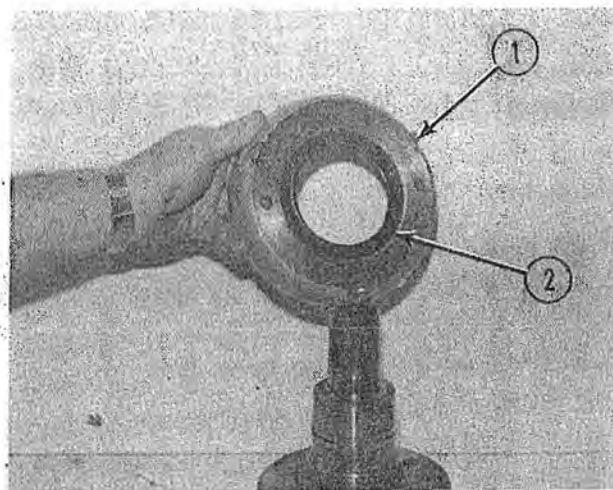


FIG. 6

The bearing and seal retainer cup (1, Fig. 6) can then be removed to remove and replace the outer oil seal. (2, Fig. 6)

Replace outer oil seal.

After removing the discrepant seal, clean the counter bore carefully. Use a good grade of gasket sealer (Permatex) to seal the OD of the seal to the bearing and seal retainer cup. Use caution not to get the gasket sealer onto the lip area of the oil seal. Install the seal into the cup.

Polish the OD of the stub axle where the seal is in contact with it. (Use 400 grit emery or finer.) Do not scratch or gouge this sealing surface.

Reassemble the front stub axle sub-assembly in reverse order of disassembly.

Replace wheel studs.

Broken or stripped wheel studs can be driven out of the stub axle flange and replaced with the axle out of the tractor.

Support the axle flange on the inboard side and press or drive the damaged stud through the axle flange.

Grind the rear face of the flange flush to remove all weld.

Press or drive the new stud through the back face of the flange. Be sure the head of the new stud is flush with the back face of the axle flange. (You may use a wheel nut and some washers to pull the new stud through the flange and hold it securely against the back face as you weld it.)

Tack weld the head of the new stud to the back face of the flange securely.

Assemble the front stub axle sub-assembly back into the axle casting. Be sure to position a new gasket between the inboard face of the bearing and seal retainer cup and the outboard end of the axle housing.

Use the slide hammer to properly seat the outboard bearing into the axle housing.

Install the (6) 10 x 25 mm. bolts and torque to 32-36 ft./lbs. This completes the re-installation of the front axle sub-assembly.

FRONT AXLE REMOVAL AND RE-INSTALLATION

Removal of the left front axle provides access to the front ring gear and differential carrier. It also must be removed so the differential lock linkage may be disconnected allowing the right front axle to be removed.

Remove the front wheel (wheels).

Disconnect the forward power steering attach bracket from the axle housing by removing the (4) 10 x 30 mm. bolts. (1, Fig. 1)

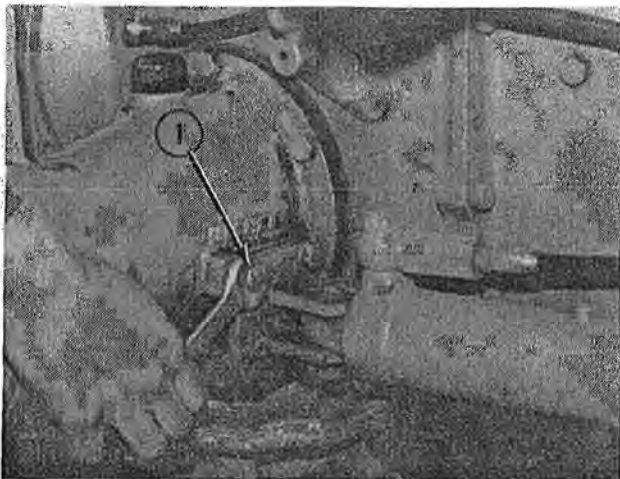


FIG. 1

Drain the gear box lubricant from the front case.

Remove the (6) 10 x 30 mm. bolts attaching the axle casting to the transmission case. (1, Fig. 2)

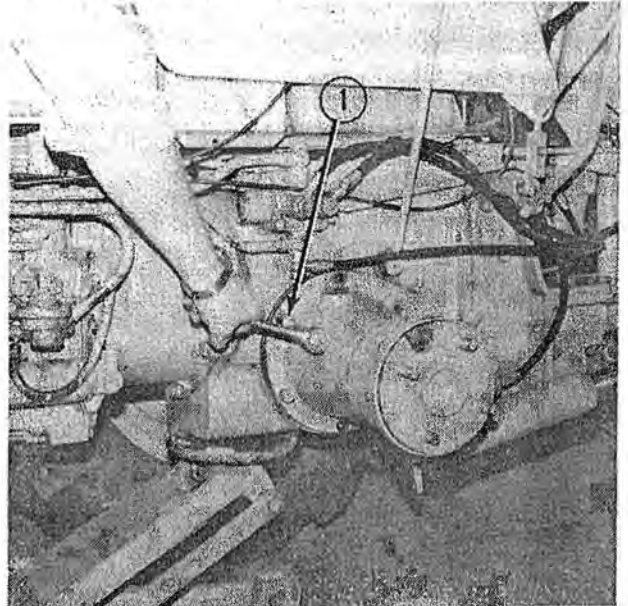


FIG. 2

Remove the left front axle sub-assembly from the front case. (See Fig. 3)

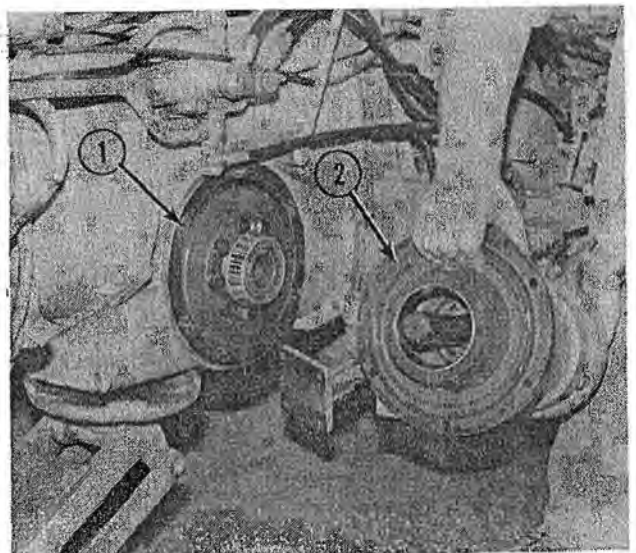


FIG. 3

Reach in and remove the ring gear and differential carrier assembly. (1, Fig. 3)

Note: (2, Fig. 4) is the sliding collar that locks out the front differential.

(3, Fig. 4) is the splasher gear that rolls lubricant up onto the pilot shaft and then up to the main power shaft in the transmission.

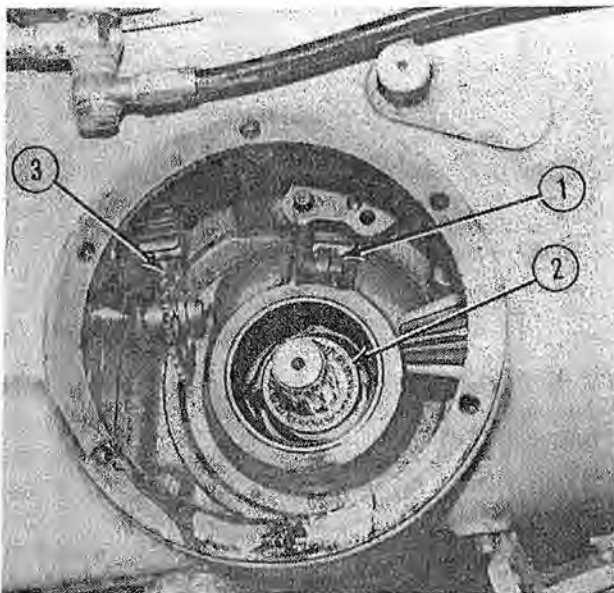


FIG. 4

Proceed with the removal and replacement of the damaged parts.

If it is necessary to remove the right hand front axle assembly, disconnect the front differential shift linkage by removing the cotter pin. (1, Fig. 4)

Re-installation of the front axles can be accomplished in reverse order of disassembly. The 10 mm. bolts securing the axle to the gear box and the power steering attach brackets to the axle housing are to be torqued to 32-36 ft./lbs.

You may then disconnect the right hand power steering attach bracket and remove the (6) 10 x 30 mm. fasteners securing the axle housing to the transmission case.

CAUTION: Care must be exercised to replace and re-install the gasket between the axle flange and the transmission case.
(1, Fig. 3)

These shims are selectively installed to obtain the correct fit between the ring and pinion gear.

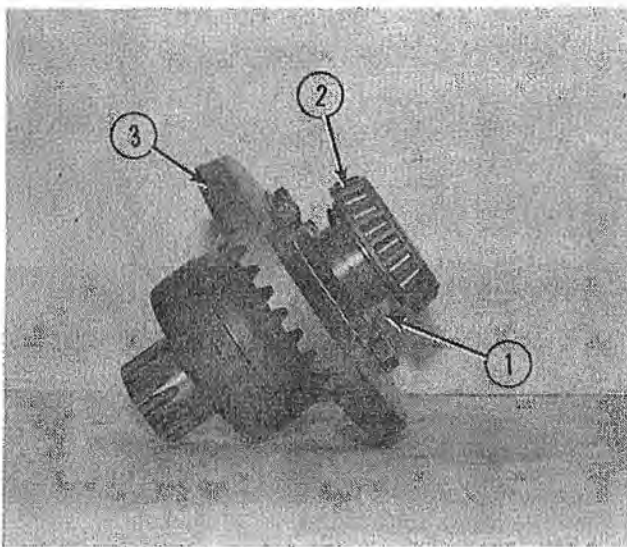


FIG. 5

Attention should also be directed to replacing any shims (1, Fig. 5) installed between the tapered roller bearing (2, Fig. 5) and the ring gear (3, Fig. 5) at the factory.

DISASSEMBLY AND RE-ASSEMBLY OF
FRONT AND REAR DIFFERENTIAL
SUB-ASSEMBLY

Once the left front, or right rear, axle sub-assemblies are removed from their respective cases, the ring gear and differential carrier assemblies can easily be removed for inspection and/or repair.

Disassembly.

Tap back the locking tabs securing the (8) 10 x 30 mm. bolts.
(1, Fig. 1)

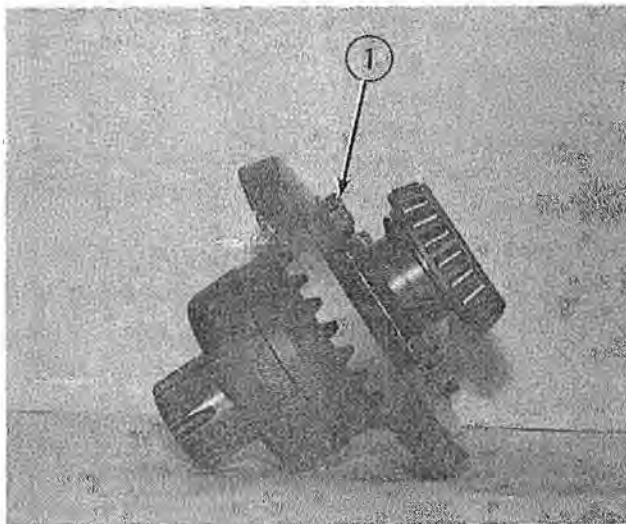


FIG. 1

Remove the (8) bolts securing the differential carrier to the ring gear.

Figure 2 identifies the parts of the front and rear ring gear and differential carrier sub-assemblies.

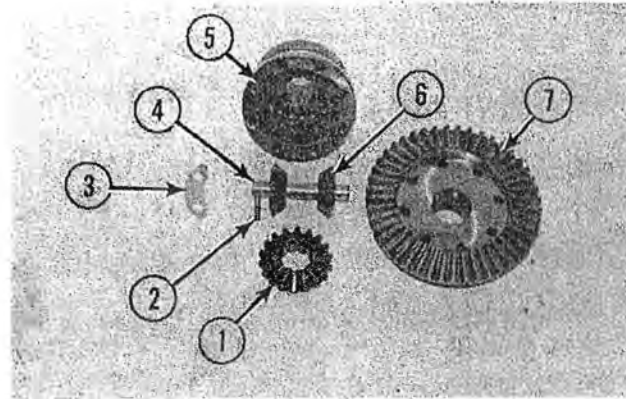


FIG. 2

- (1, Fig. 2) Planetary gears.
- (2, Fig. 2) Retaining pin.
- (3, Fig. 2) Locking plate.
- (4, Fig. 2) Cross pin.
- (5, Fig. 2) Differential carrier.
- (6, Fig. 2) Satellite gears.
- (7, Fig. 2) Ring gear.

Remove the planetary gears

(1, Fig. 2) from the ring gear (7, Fig. 2) and carrier, (5, Fig. 2) pull the retaining pin (2, Fig. 2) from the face of the carrier, tap out the cross pin (4, Fig. 2) and remove the (2) satellite gears (6, Fig. 2).

Inspect all components of the ring gear and differential carrier sub-assemblies for defective parts and replace as required.

Tap the locking tabs securely around the bolt heads, locking them in place. (Figure 3)

The ring gear and carrier assembly is now ready for re-installation.

Assembly

Re-assemble the planetary gears (1, Fig. 2) into the differential carrier (5, Fig. 2) and the ring gear. (7, Fig. 2)

Position the satellite gears (6, Fig. 2) into the carrier and slide the cross pin (4, Fig. 2) through them and secure with the retaining pin. (2, Fig. 2)

Seat the carrier assembly into the ring gear, position the locking plates, and re-install the (8) 10 x 30 mm. bolts, tightening to 32-36 ft./lbs. of torque.

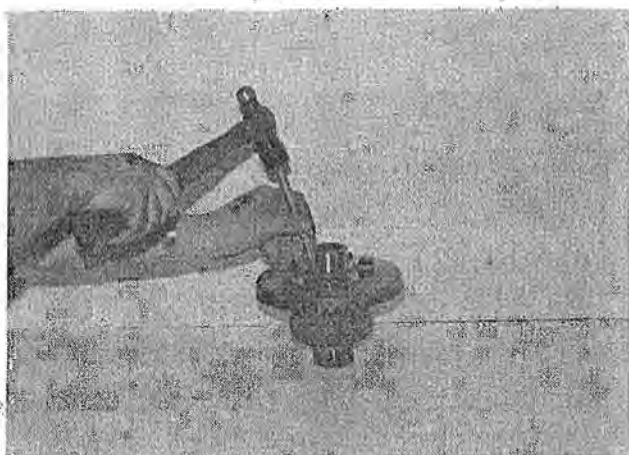


FIG. 3

REAR AXLE REMOVAL

Removal of the rear axle assemblies provides access to the differential gear group and the PTO final drive gears. The differential can only be removed from the right side.

Remove 3-point hitch arms if equipped.

Support rear section of tractor by jacking on the differential housing.

Remove rear wheel(s).

The brake rock-shaft must be rotated or removed in order to remove the left or right axle housings. Accomplishing this requires disassembly of the brake actuating mechanism on the tractor's right side. (See Figure 1.)

To aid in orientation, Figure 1 identifies the parts of the brake actuating mechanism on the right side.

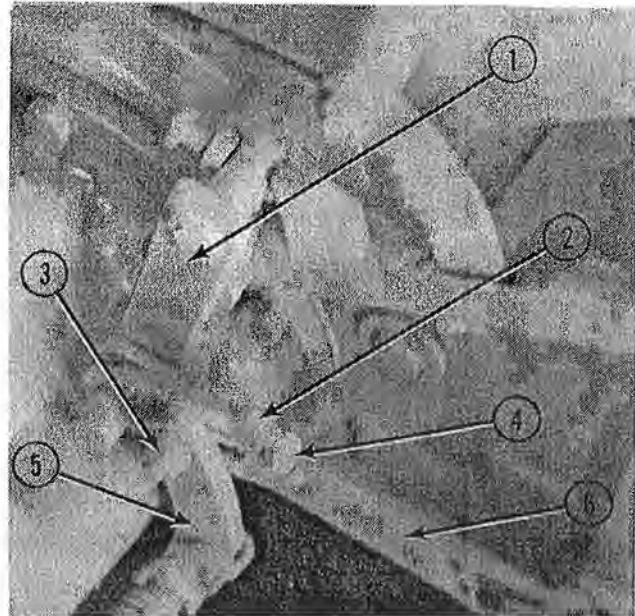


FIG. 1

- 1) Right brake rock-shaft arm.
- 2) Stop plate.
- 3) Shoulder bolt.
- 4) Right adjustment bolt.
- 5) Right brake lever.
- 6) Pedal adjustment bar.

Proceed as follows with disassembly of right side brake linkage.

Pry right brake lever forward to allow removal of brake adjusting bolt. (See Figure 2.)

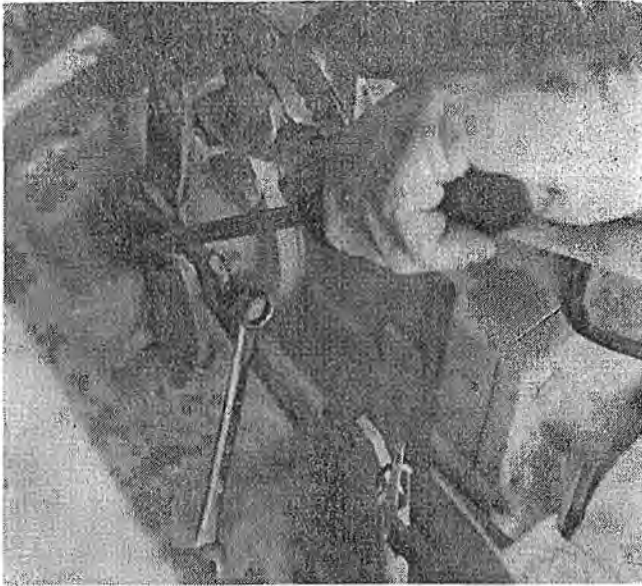


FIG. 2

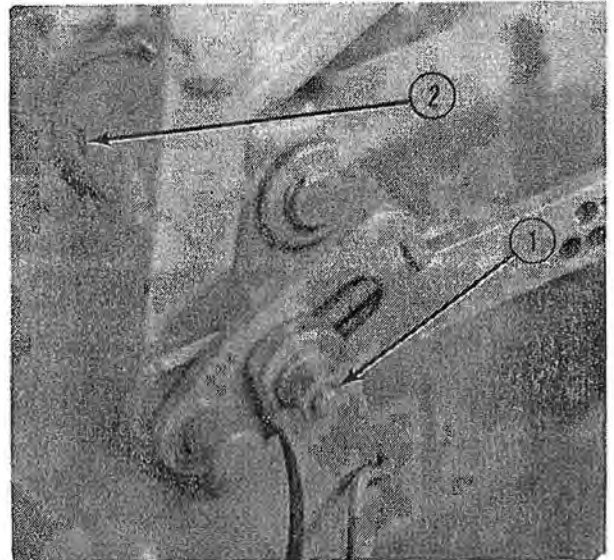


FIG. 3

Pry brake lever forward and remove stop plate (1, Fig. 4) and pedal adjustment bar. (2, Fig. 4)

The right rock-shaft arm can now be removed from rock-shaft. (3, Fig. 4)

Remove shoulder bolt. (1, Fig. 3)

Remove 8 mm. bolt connecting pedal adjustment bar to pedal.

Remove roll pin in rock-shaft. (2, Fig. 3)

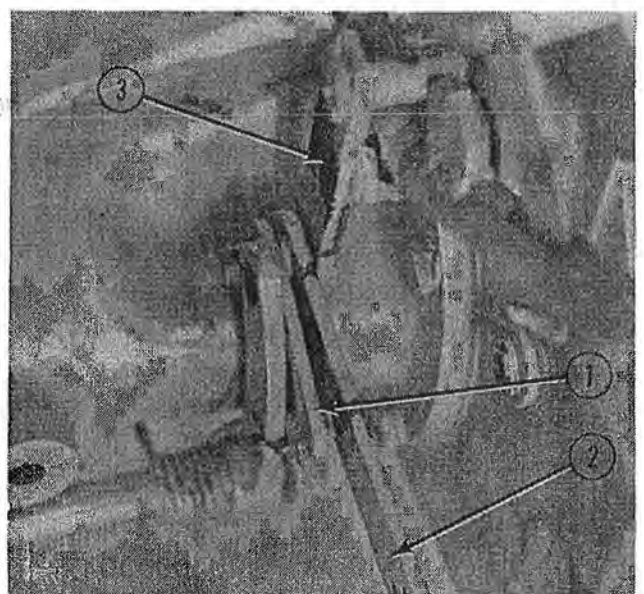


FIG. 4

Note: Right arm is splined to rock-shaft. Removal of the hand brake lever may facilitate removal of arm.

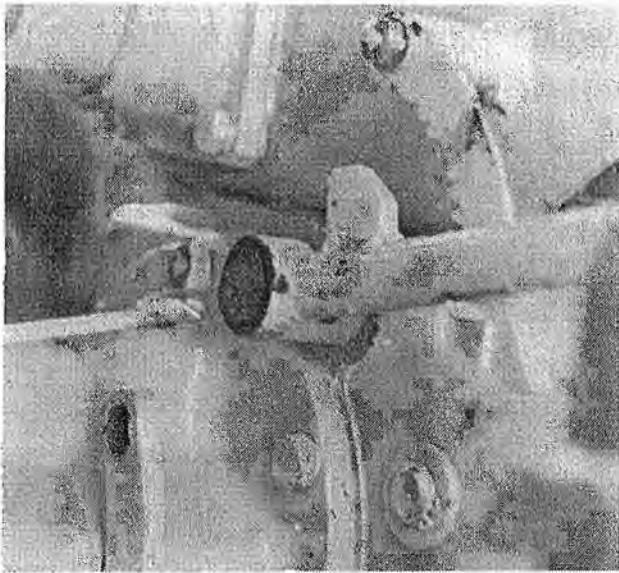


FIG. 5

Now right axle housing is clear for removal. (See Figure 5.) The left axle housing is cleared for removal by rotating rock-shaft. (1, Fig. 6)

Remove (6) 10 x 30 mm. hex bolts holding axle housing to differential housing (2, Fig. 6) and remove axle housing.

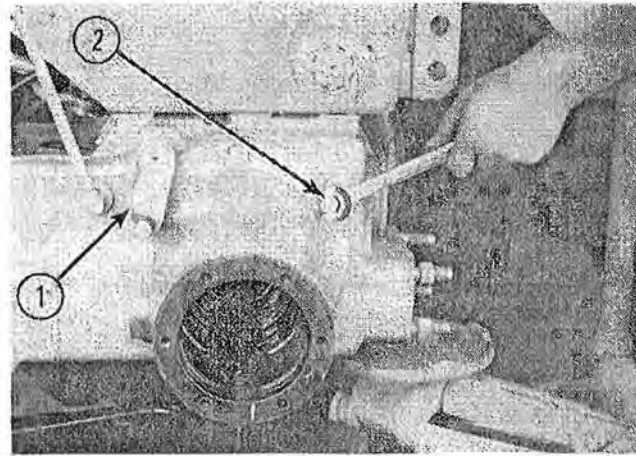


FIG. 6

Re-assembly is done in reverse order of disassembly. Install new gaskets. Torque axle housing bolts to 45 ft./lbs.

Alignment of right rock-shaft arm is gained by sighting through roll pin hole. (1, Fig. 7)

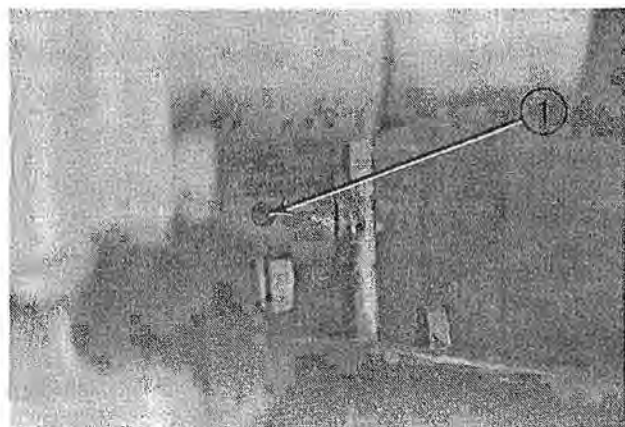


FIG. 7

REAR AXLE DISASSEMBLY

Disassembly of axle gives access to inner and outer bearings, outer oil seal and reduction gears.

Remove 6 x 18 mm. screw holding brake drum and remove brake drum. (1, Fig. 8)

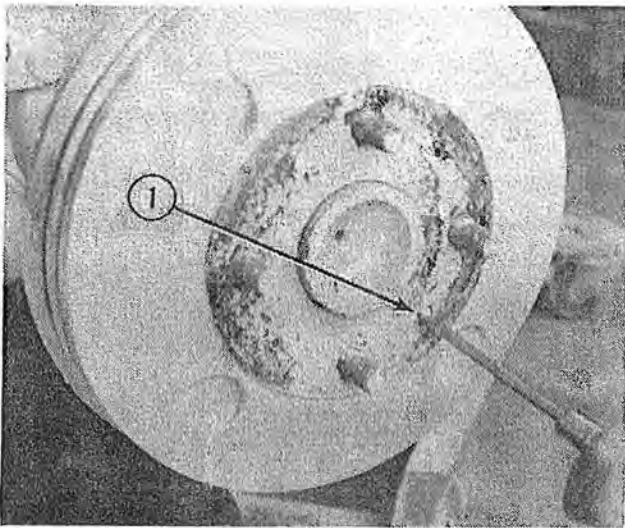


FIG. 8

Remove (6) 10 x 25 mm. hex bolts through access hole in axle flange. (1, Fig. 9)

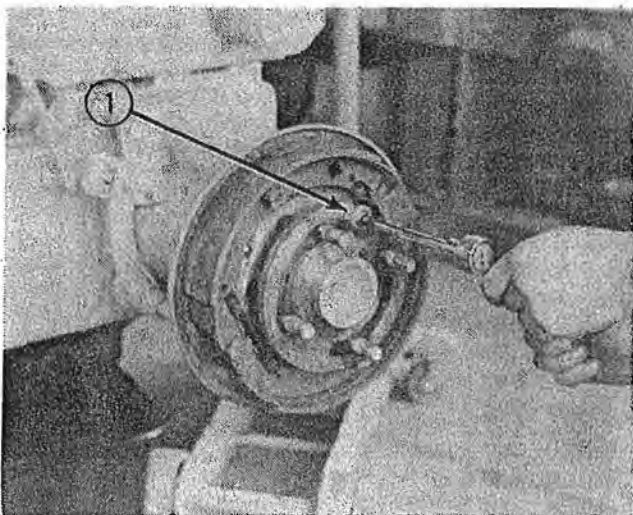


FIG. 9

Attach slide hammer to wheel studs on axle flange. (1, Fig. 10)

Unclip spring on brake lever to reduce tension. (2, Fig. 10)

Brake lever will slide off brake rock-shaft (3, Fig. 10) and ear on axle housing (4, Fig. 10) as the axle and brake plate are removed.

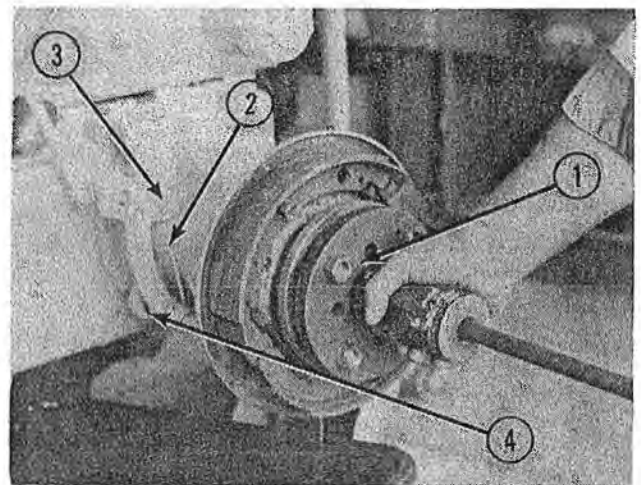


FIG. 10

Refer to disassembly of front axle when removing reduction gears, bearings and seal, as these parts are identical in front and rear axles. (See Figure 11.)

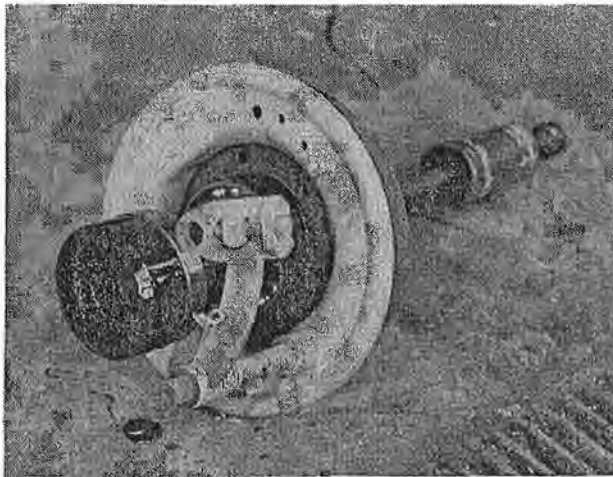


FIG. 11

Re-assembly is in reverse order.

Note: Model 986 and smaller tractors do not have final drive gear reduction.

BRAKE INSPECTION AND REPAIR

Support rear section of tractor with jack.

Remove 8 mm. bolt fastening brake pedal to adjustment bar. (1, Fig. 12)

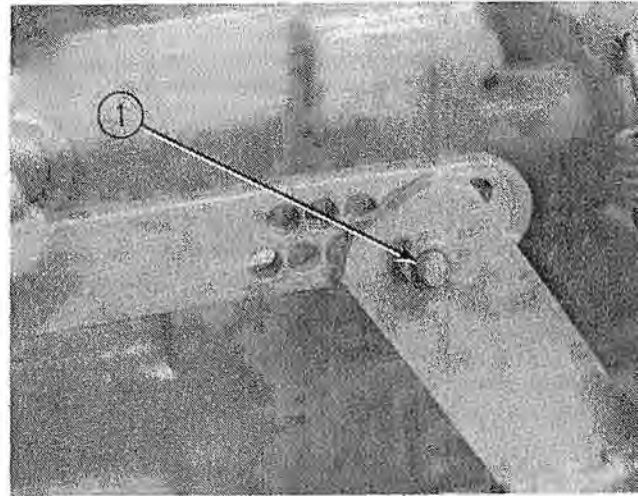


FIG. 12

Remove wheel and brake drum as outlined in axle removal procedure

Inspect brake drum for cracks, scores and wear. (1, Fig. 13)

New drum I.D. is 248 mm.

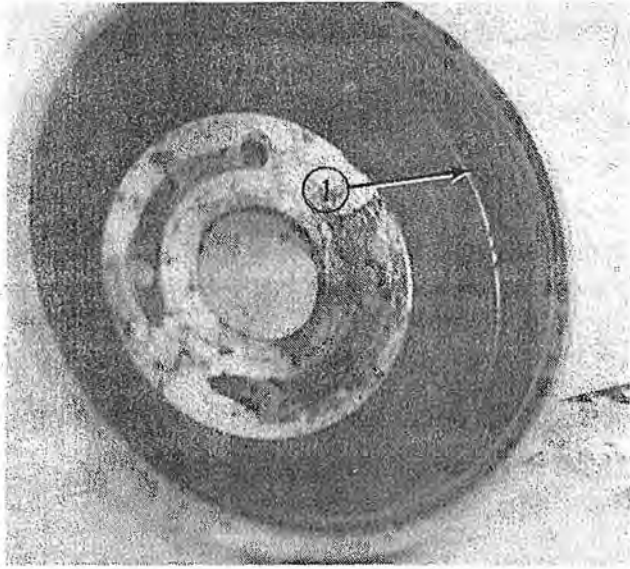


FIG. 13

Inspect lining on brake shoes for wear or defect. New lining thickness is 5 mm.

To remove shoes, detach cotter pin, washers and spring which retain shoes to brake backing plate.
(1, Fig. 14)

Remove the (2) return springs.
(2, Fig. 14)

Inspect actuating cam (3, Fig. 14) and return springs. Repair or replace all worn or damaged parts.

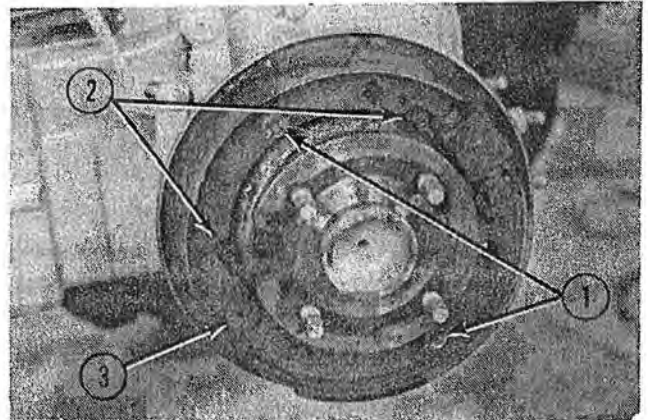


FIG. 14

Re-assembly is in reverse of disassembly.

BRAKE ADJUSTMENT

On articulated tractors, there are two adjustments required for proper brake performance.

- 1) There is an adjustment on each wheel brake lever for the purpose of uniform braking on each wheel when pressure is applied to pedal.

Access to adjustment bolts is gained by prying the brake lever forward, thereby making bolt head accessible from carrier for adjustment. Refer to Figure 2.

- 2) The pedal adjustment bar located on right side has a series of holes drilled in it which changes distance between pedal and actuating mechanism.

This adjustment is responsible for pedal travel to brake engagement. Refer to Figure 12.

There also exists a third function for brake adjustment.

An expandable block located opposite the shoe expanding cam in the brake backing plate (1, Fig. 15) is adjustable to take up wear of the shoes

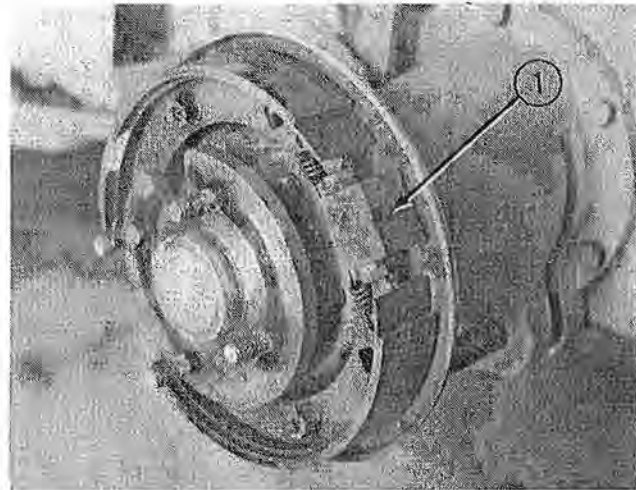


FIG. 15

This adjustment will be necessary in later life of the brake shoes to provide uniform shoe wear.

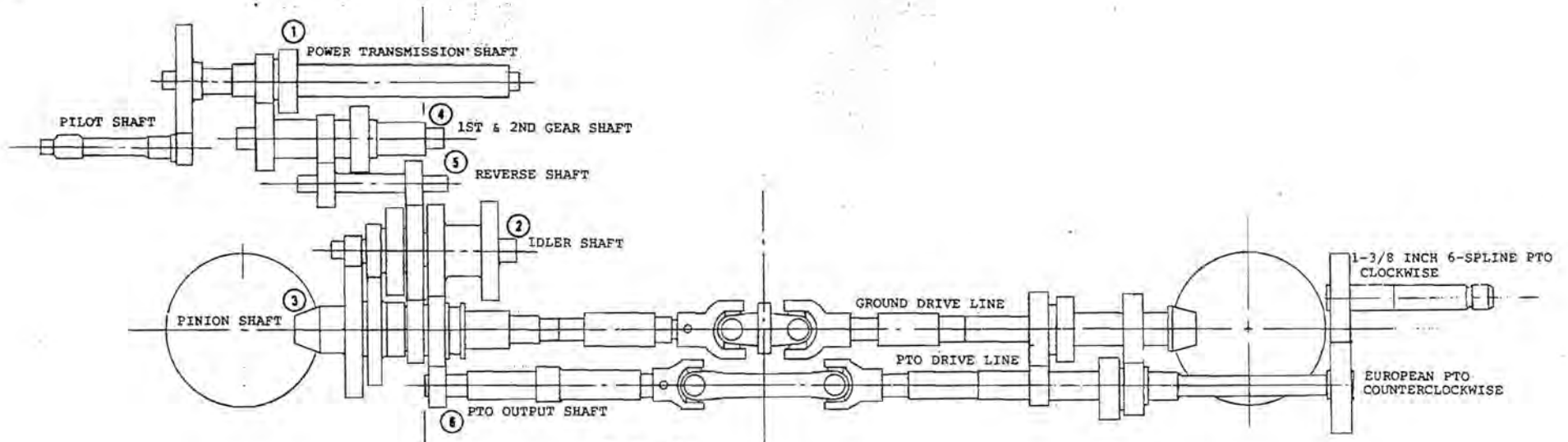


FIG. 1

Schematic of Power Path in all Pasquali Articulated Tractors

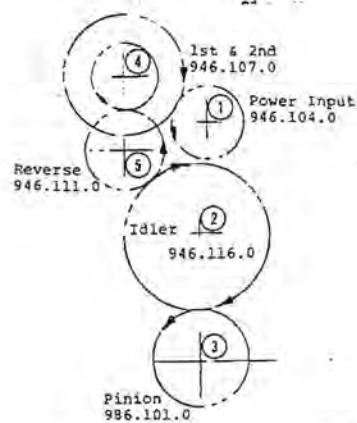


FIG. 3

First Gear

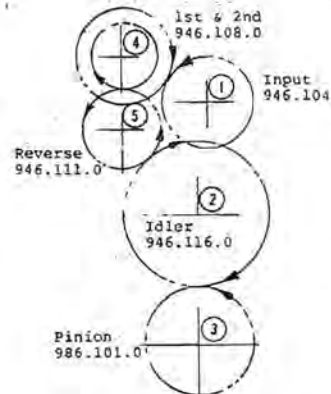


FIG. 4

Second Gear

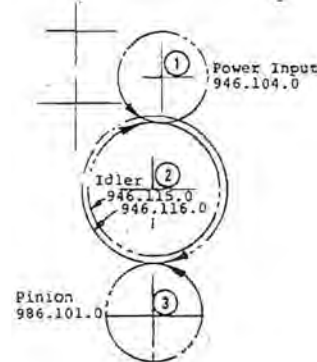


FIG. 5

Third Gear

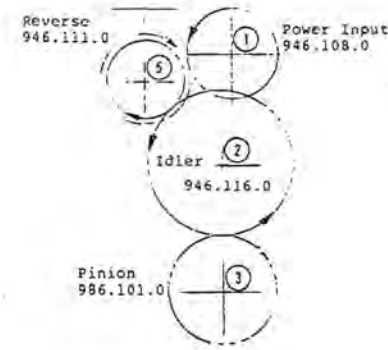


FIG. 6

Reverse Gear

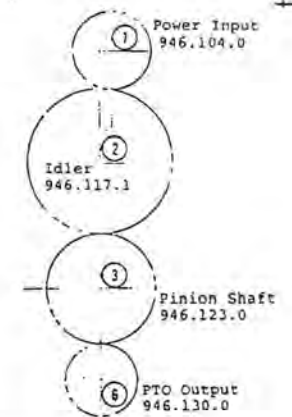


FIG. 7

540 & 760 RPM PTO

TROUBLE-SHOOTING DRIVE TRAIN PROBLEMS

General. After recognizing a problem in the drive train, it is important to trouble-shoot it systematically to reduce unnecessary tear down and aid in efficient repair.

The following information is provided to familiarize the serviceman with the power paths in all gears and ranges so that when testing the tractor, he can identify the area of rework.

For 1st & 2nd Gear--All Ranges (See Figs. 3 and 4)

Engine power is transmitted through the clutch located in the bell housing between the engine and transmission case, directly into the transmission power shaft. The transmission shifter on the power shaft drives shaft #4, which is in constant mesh with shaft #5, which in turn drives idler shaft #2, which finally drives the front pinion shaft #3.

For Reverse Gear--All Ranges

The power shaft #1, with its shifter, drives the reverse shaft #5, which in turn drives idler shaft #2, which again drives the range gears on the pinion shaft #3.

For 3rd Gear--All Ranges

In this case, the transmission shifter on the power shaft #1 drives the idler shaft #2 directly, which is in constant mesh with the range gears on the pinion shaft #3.

Note: The (3) ranges are all located on the pinion shaft. The ranges are selected by positioning the internal drive key so that it aligns with the high, medium or low range drive gears. These range drive gears are driven by, and are in constant mesh with, gears on the idler shaft.

For PTO 540 & 760 Speeds

The PTO shifter gear on transmission power shaft #1 meshes with the double gear on the idler shaft #2, which is in constant mesh with an idler on the pinion shaft #3, which finally drives the PTO output shaft #6.

SOME TYPICAL DRIVE TRAIN PROBLEMS
AND THEIR MOST LOGICAL CAUSES

Case I.

Symptoms

- 1) Transmission shift lever shifts normally.
- 2) No ground drive.
- 3) PTO shifts and operates normally.
- 4) Range lever may, or may not, shift normally.
- 5) No appreciable noise.

Probable Cause

- 1) Broken range drive key.

Case II.

Symptoms

- 1) Tractor has ground drive, but there are sharp cracking noises heard intermittently.
- 2) Transmission shifts normally through all gears and ranges.
- 3) After isolating the noisy axle, jack it up and rotate one wheel with the transmission in neutral. The other wheel should rotate in the opposite direction freely and without hesitation or noise.

Probable Cause

- 1) Inoperative differential. (Probably broken satellite gears.)

Case III.

Symptoms

- 1) Wheel does not rotate freely.
- 2) Noise isolated to axle housing.
- 3) Tractor shifts normally in all gears and ranges.
- 4) Possibly ground drive, only one axle.

Probable Cause

- 1) Final reduction in axle hub is damaged.

ISOLATING PROBLEM

To clutch housing area, transmission, PTO, final ground drive or rear wheel drive.

Note: This suggested troubleshooting procedure assumes that a noise accompanies the problem.

Prior to testing the tractor, inspect the exterior of the machine thoroughly.

- Look for leakage due to damaged cases, seals or gaskets.
- Check all shifting linkages, clutch linkages and operating levers for damage or binding.
- Check clutch free play, if incorrect, adjust to $3/8"$ to $1/2"$.

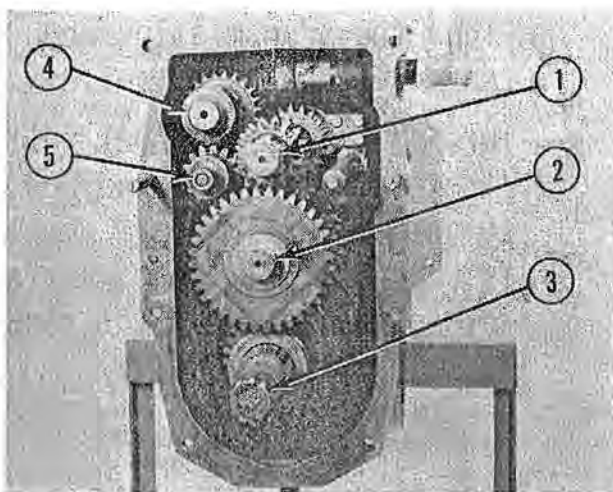


FIG. 2

Fig. 2 clarifies the identification of the shafts discussed in this procedure.

Proceed with noise isolation.

1. Place transmission, range, PTO and differential lock levers in a neutral position.
 - a. Run engine through a range of speeds 1200 to 2200 RPM's.
 - b. With the clutch engaged, check for noise or vibration:
 - In the flywheel or bell housing area.
 - In the bearings on the power transmission shaft.
 - c. With the clutch disengaged, check for noise or vibration:
 - In the throw-out bearing.
 - In the pilot bearing.
2. With the transmission lever in 1st gear and 2nd gear, and all others in neutral, check for noise or vibration:
 - In gears and bearings on 1st and 2nd gear shaft (4, Fig. 1)
 - In reverse shaft and bearings (5, Fig. 1)
 - In idler shaft (2, Fig. 1)
3. Transmission lever in 3rd gear, all others in neutral, check for noise or vibration:
 - In gears and bearings on idler shaft (2, Fig. 1)

4. Transmission lever in reverse, all others in neutral, check for noise or vibration:
 - In gears and bearings on reverse shaft (5, Fig. 1)
 - In gears and bearings on idler shaft (2, Fig. 1)
 - In twin gear on idler shaft (2, Fig. 7)
 - In idler on pinion shaft (3, Fig. 7)
 - In gears and bearings on PTO output shaft (6, Fig. 7)
 - In PTO drive line through the center of the tractor.
 - In gears and bearings on PTO input shaft, rear case.
 - In gears and bearings in lower PTO output shaft, rear case.
 - In gears and bearings in upper PTO output shaft, rear case, 1-3/8" - 6-spline.
5. Range lever in low, medium and high range successively; transmission in any gear; PTO in neutral; differential lock in neutral; Check for noise or vibration:
 - In gears and bearings on idler shaft (2, Fig. 1)
 - In gears and bearings on front pinion shaft (3, Fig. 1) and in rear pinion and ring gear.
 - In gears and bearings in front and rear differential.
 - In final drive reduction in all axles (excluding model 986)
6. PTO lever in 540 or 760; ground speed PTO lever under the seat in the "independent" position (raised up); all others in neutral; Check for noise or vibration:
 - In shifter on power input shaft (1, Fig. 7)
7. To perform a check on the front differential lock:
 - Place the transmission and range levers in neutral.
 - Turn the steering wheel fully right and then left and observe to see if the outboard wheel is scuffing. If both wheels rotate freely, the differential lock is inoperable.

Note:

Confirmation of suspected gear train problems can often be quickly isolated and confirmed by:

- 1) Removing the left front axle assembly from the transmission case. This provides direct access to visually inspect:

- a) Both front axle sub-assemblies.
- b) The front differential carrier.
- c) The front ring and pinion gear.
- d) The front differential lock.
- e) You may also probe the aft section of the transmission case with a magnet to pick up debris associated with a gear box problem.

(See 1, Fig. 8.)

- 2) Removing the right aft axle from the rear differential housing provides access to visually inspect and check:
 - a) Both rear axle sub-assemblies.
 - b) The rear differential carrier.
 - c) The rear ring and pinion gear.
 - d) PTO final drive gears.

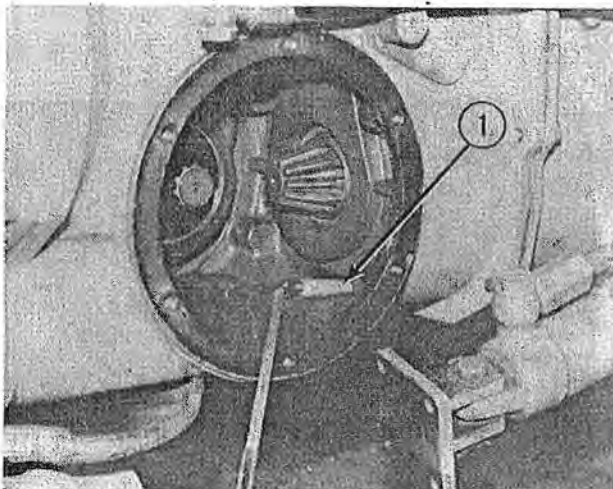


FIG. 8

DISASSEMBLY OF THE TRACTOR IN THE MIDDLE

Disassembling the tractor in the middle provides access to:

- (1) Ground drive & PTO drive through the central steering section.
- (2) Front transmission.
- (3) Input shafts to rear differential.
- (4) Final PTO drive.
- (5) Oscillating and articulation mechanism.

The tractor will be separated at the aft end of the front transmission and the forward end of the steering weldment. (1, Fig. 1)

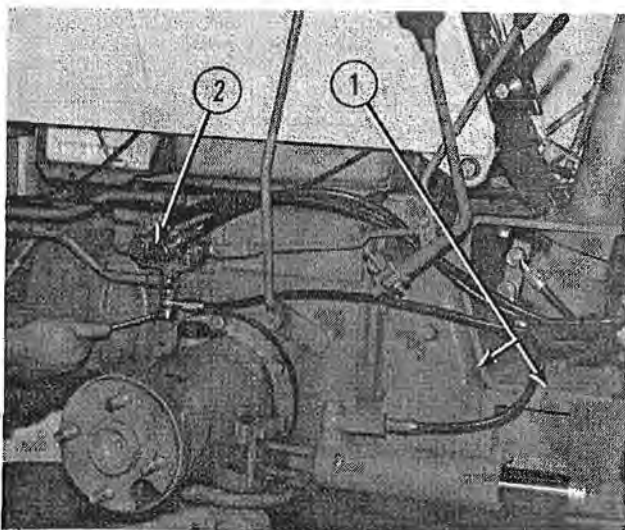


FIG. 1

Prior to separating the tractor, you must disconnect or remove:

- (1) Hydraulic lines to rear lift and power steering manifold block at control valve. (2, Fig. 1)
- (2) Clutch cable under deck plate. (Fig. 2)

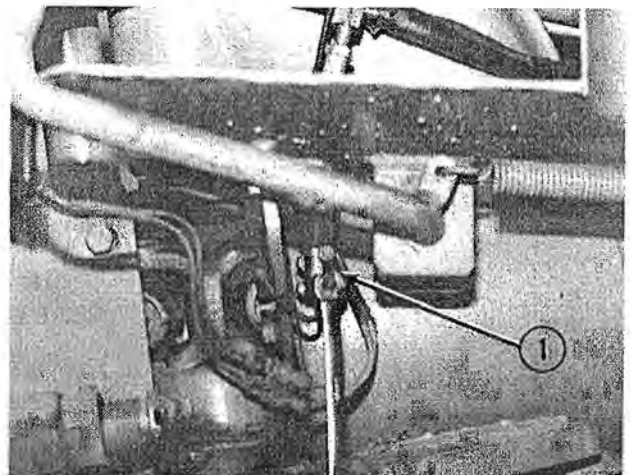


FIG. 2

- (3) Electrical junction block under seat.
- (4) Hydraulic steering cylinders at the axle housing by removing (4) 10 x 30mm. bolts each side. (1, Fig. 3)

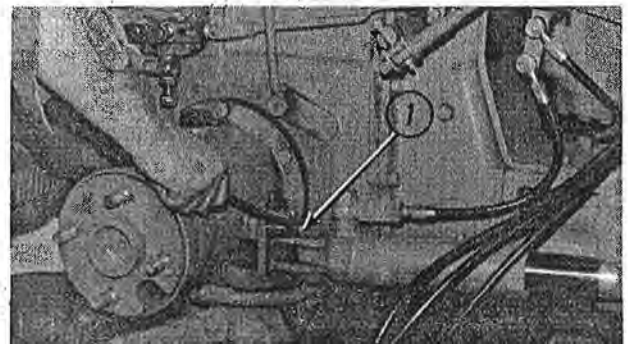


FIG. 3

(5) Hydraulic lift lever. (1, Fig. 4)

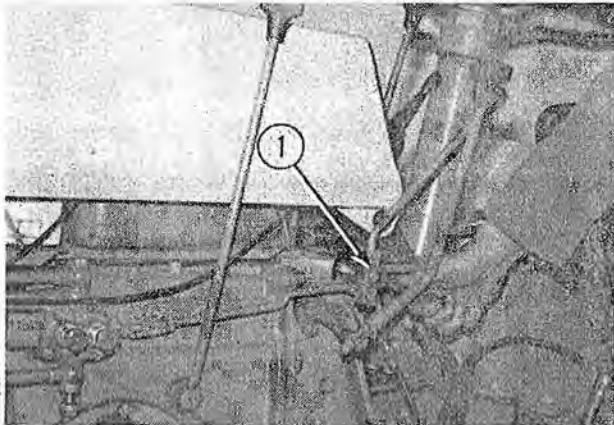


FIG. 4

(6) Power steering input and return hoses at the manifold block. (1, Fig. 5)

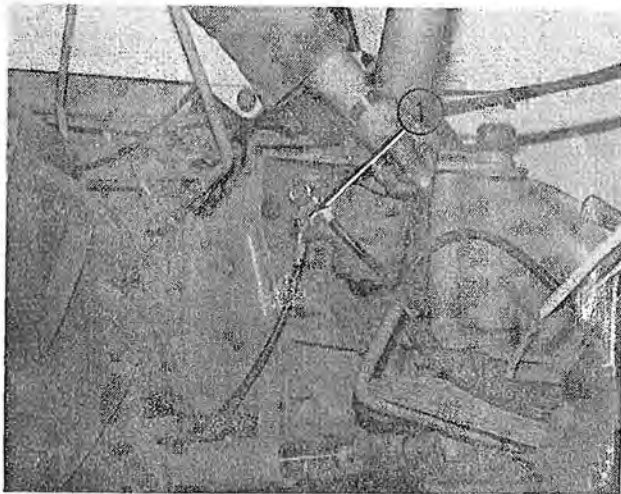


FIG. 5

(7) The dash panel by removing (2) 10mm. bolts and nuts and loosening the hexagon mounting stud for the hydraulic lift lever. (1, Fig. 6)

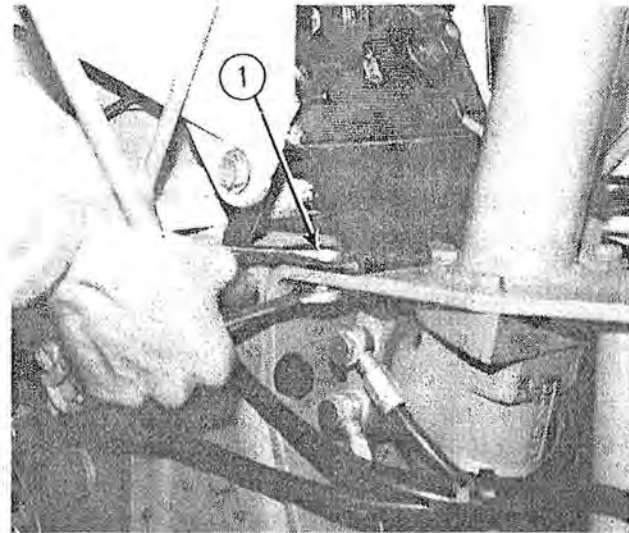


FIG. 6

(8) The drive shaft shield by removing (4) 8 x 12mm. bolts. (1, Fig. 7)

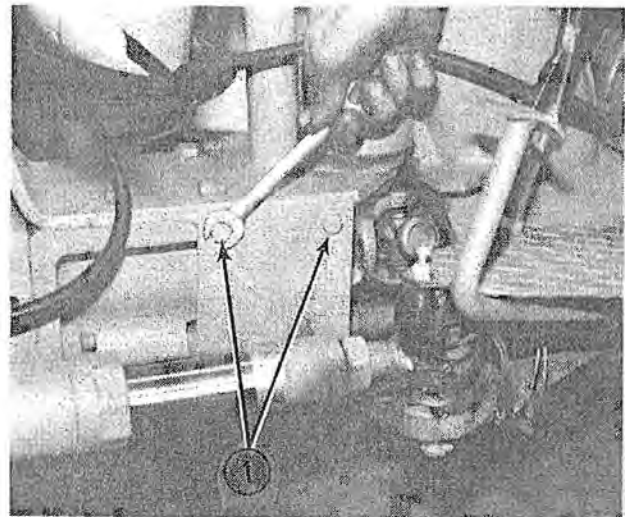


FIG. 7

CAUTION: Place some blocking under the front end of the tractor. When separated, the front end is extremely nose-heavy.

- (9) Remove the (2) 14 x 35mm. bolts threaded into the transmission housing and the (4) 12 x 30mm. bolts threaded into the lower drive shaft support casting, (1, Fig. 8)

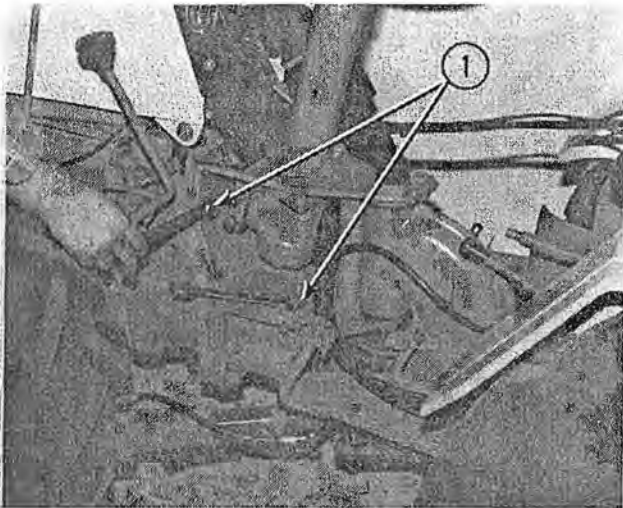


FIG. 8

The tractor is now ready to separate.

The forward section; consisting of the engine, transmission and front axle, may now be separated from the rear section; consisting of the central steering section, the rear differential case and rear axle.

Roll the aft half of the tractor to the rear. Make use of the shaft support casting as a shelf to support the central steering weldment. (1, Fig. 9)

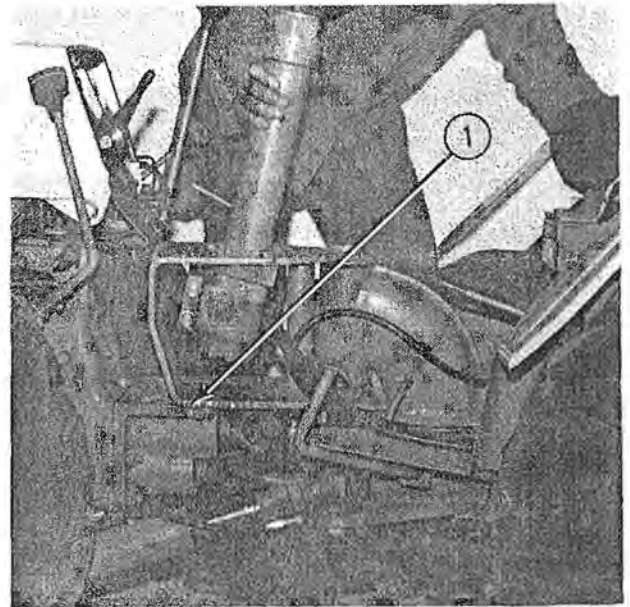


FIG. 9

NOTE: The ground and PTO drive lines will slide freely from the shafts on the aft portion of the tractor.

The forward and rear section may now be completely separated to facilitate trouble-shooting and repair.

REASSEMBLY OF TRACTOR HALVES

Slide the ground and PTO drive shafts onto their respective splined shafts on the aft section of the tractor. (Fig. 10)

Move the aft section forward and rest the central steering weldment on the shelf casting. (1, Fig. 10)

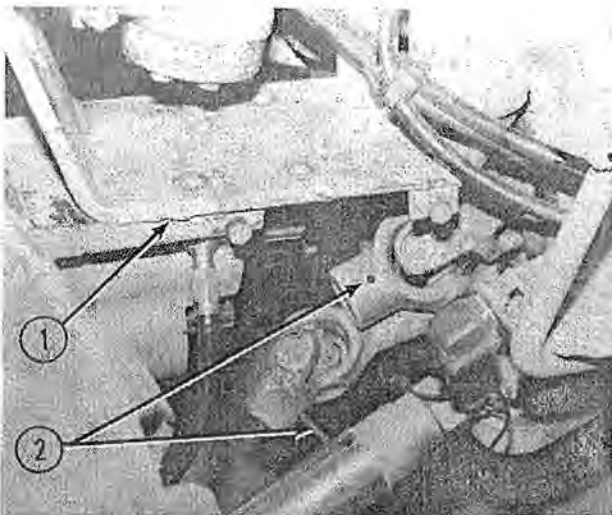


FIG. 10

NOTE: Adjust the jack under the front of the tractor so that the steering weldment is aligned and sets flat on the shelf casting. (1, Fig. 10)

Support the aft section of the tractor on a floor jack so the wheels can be turned. Roll the aft section forward until the ground drive shaft can be aligned and mated to its matching shaft (approx. 1/2" only) on the forward section of the tractor.

NOTE: With the wheels off the ground, rotate the aft drive shaft to align the roll pin holes. (2, Fig. 10)

Align the roll pin holes in the lower PTO drive shaft and mate it to the matching shaft on the forward section of the tractor.

Continue to roll the aft section forward until the shafts are fully mated. Reinstall the roll pins in both shafts.

Complete assembly in reverse order of disassembly.

DISASSEMBLY OF THE TRANSMISSION CASE

Will provide access to the primary gear case.

Access to the inside of the gear case is accomplished by removing the rear cover.

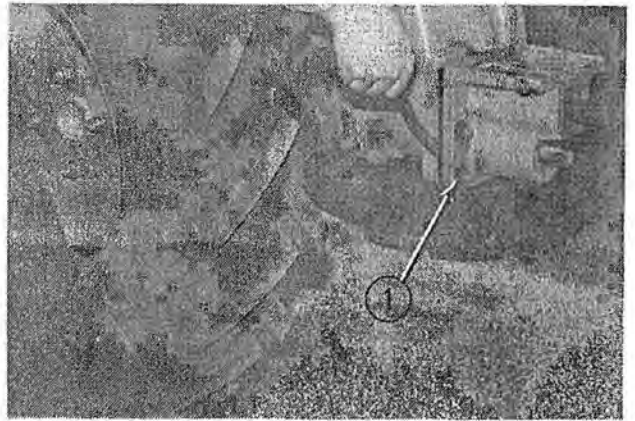


FIG. 2

(1) Prior to removing the rear cover, drain the transmission lubricant.

(2) Drive out the roll pins (1, Fig. 1) and remove drive shafts.

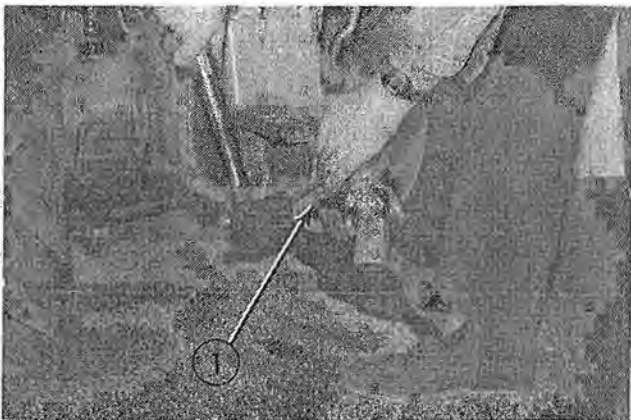


FIG. 1

Remove (6) 10 mm. bolts and (2) 10 mm. shoulder screws holding the rear cover to the main case. You may install (2) 10 mm. studs 2-1/2" to 3" long to support the rear cover as it is removed. (1, Fig. 3)

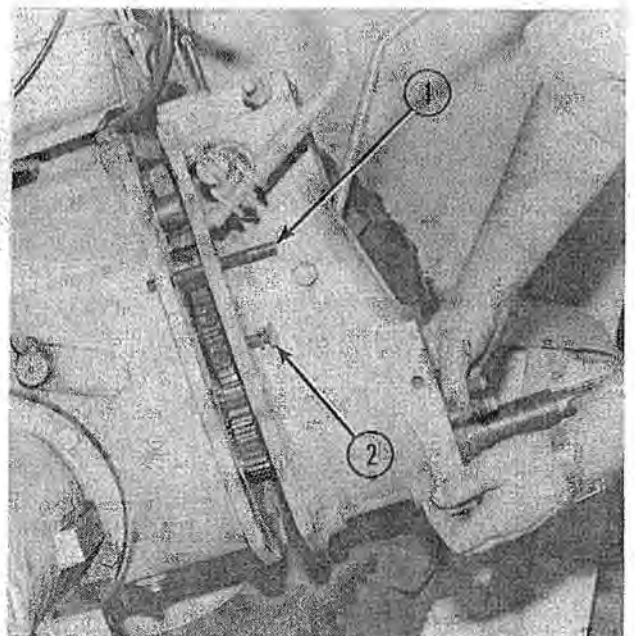


FIG. 3

(3) Remove (4) 14 mm. nuts and disassemble the shaft support casting. (1, Fig. 2)

Thread (2) of the 10 mm. bolts into the (2) tapped holes in the flange of the cover and back the cover away. (2, Fig. 3)

Note: Use caution to alternately tighten these (2) bolts to minimize binding as the cover is removed.

When the cover is backed off enough to overcome the presses (bearings and shafts) it may sag, yet not come completely off. Certain shaft assemblies may be coming with the cover, causing this condition.

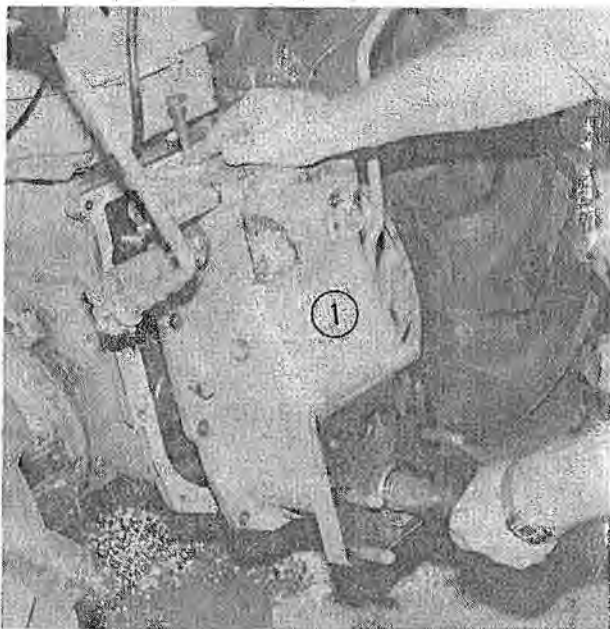


FIG. 4

Generally speaking, you can shake the cover (1, Fig. 4) and pull at the same time to separate it from the case. Do not use pry bars or heavy hammers. You may damage transmission components.

Once you have separated the cover from the case, remove all shaft assemblies from the cover.

Note: All transmission shafts and gears must be assembled into the front case before the cover is re-installed. The cover should have only bearings and PTO and range shifting levers installed in it before re-assembly.

You may now proceed to disassemble shafts and gears from the case to identify, remove and replace the discrepant parts.

DISASSEMBLY OF THE RANGE GEARS FROM THE FRONT PINION SHAFT

To remove and replace the range gears, the range drive key, the PTO idler gear or the pinion shaft.

Figure 5 illustrates the major parts of this sub-assembly.

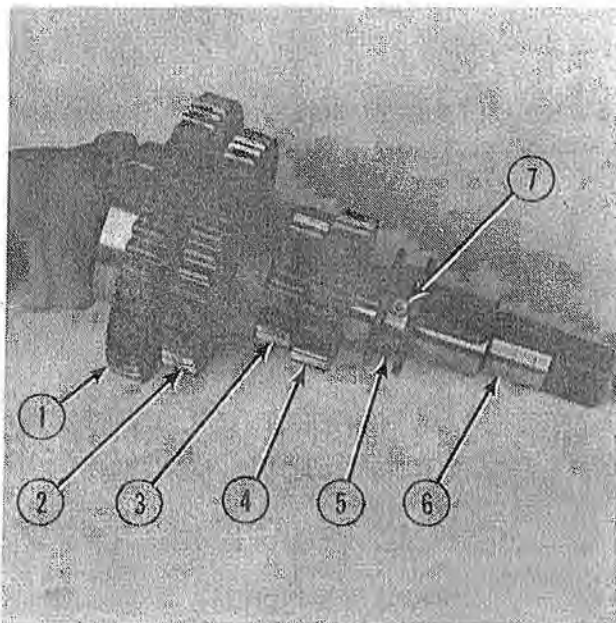


FIG. 5

- (1, Fig. 5) Low range gear.
- (2, Fig. 5) Medium range gear.
- (3, Fig. 5) High range gear.
- (4, Fig. 5) PTO idler gear.
- (5, Fig. 5) Range shifting collar.
- (6, Fig. 5) Front pinion shaft.

General. The desired range is selected by sliding the shifting collar (5, Fig. 5) fore or aft along the pinion shaft. The shifting collar (4, Fig. 6) is pinned to the aft end of the range actuator rod (3, Fig. 6) located in the center of the pinion shaft. The range drive key (2, Fig. 6) is then aligned with the appropriate range drive gear selected by the operator.

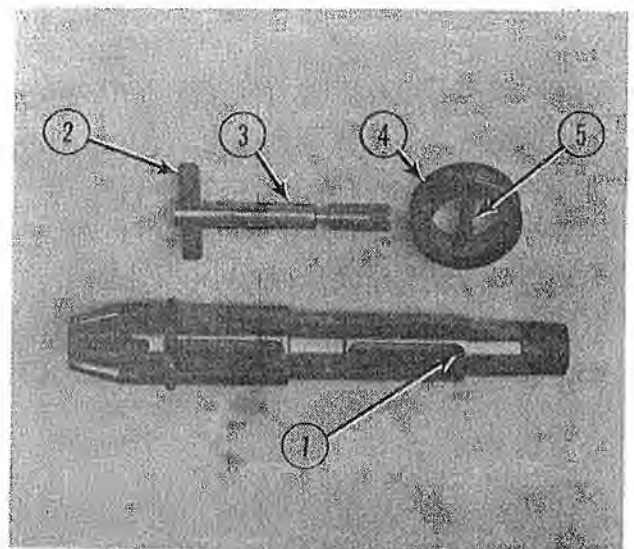


FIG. 6

Figure 6 illustrates the major parts of the range shifting mechanism.

- (2, Fig. 6) Range drive key.
- (3, Fig. 6) Range actuator rod.
- (4, Fig. 6) Shifting collar.
- (5, Fig. 6) Stepped pin.

DISASSEMBLY RANGE DRIVE KEY

Note: If the range drive key has broken, it can be replaced by removing the snap ring (1, Fig. 7) and thrust washer (2, Fig. 7) so that the PTO idler gear (3, Fig. 7) and range gears can be slid aft against the shift collar. This will provide access to remove and replace the range drive key.

IT IS NOT NECESSARY TO REMOVE THE SHIFTING COLLAR.

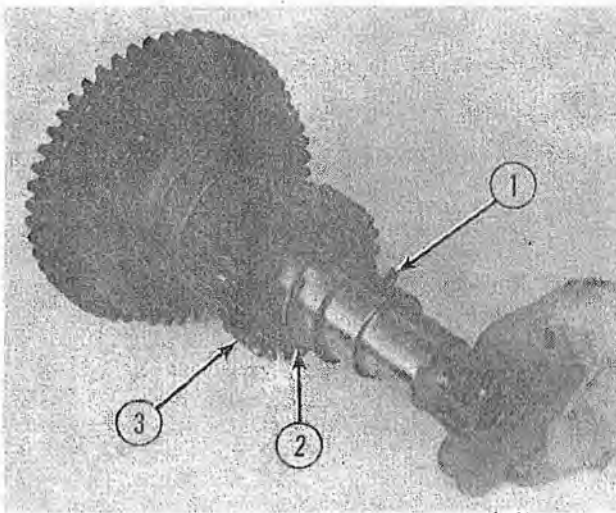


FIG. 7

COMPLETE DISASSEMBLY

Remove and replace PTO idler gear or any range gears.

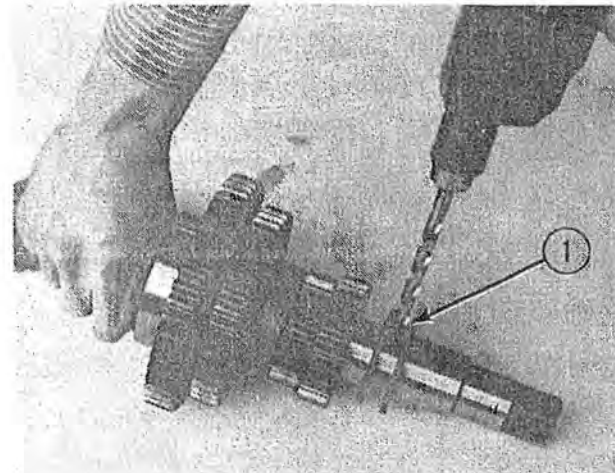


FIG. 8

The range shifting collar can be removed by punching or drilling out the peened-over end of the stepped pin that secures the shifting collar to the range actuator rod. (1, Fig. 8)

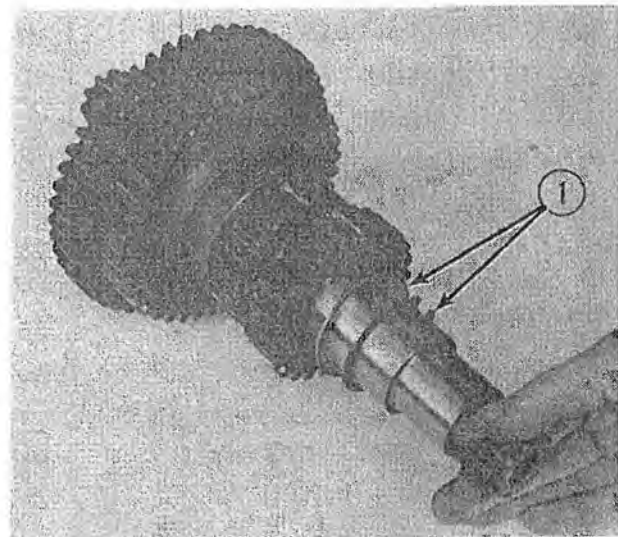


FIG. 9

After removing the snap ring (1, Fig. 9), the damaged parts can be removed and replaced.

If the range actuator rod must be removed from the pinion shaft (3, Fig. 6), drive the plug from the aft end of the shaft using a small punch or rod inserted into the rear slot in the pinion shaft (1, Fig. 6) to tap it out.

After replacing all damaged parts, the pinion shaft sub-assembly can be re-assembled in reverse order of disassembly.

Note: File the peened head of the pin flush with the bottom of the slot in the shifting collar after it is securely fastened.

The plug (1, Fig. 10) can be re-inserted into the hole in the aft end of the pinion shaft. Care should be taken not to damage the "O" ring used to seal transmission lubricant from leaking from the hollow shaft.

The small end of the stepped pin (2, Fig. 10) securing the shifting collar to the range actuator rod must be peened down into the countersink in the shifting collar to secure it.

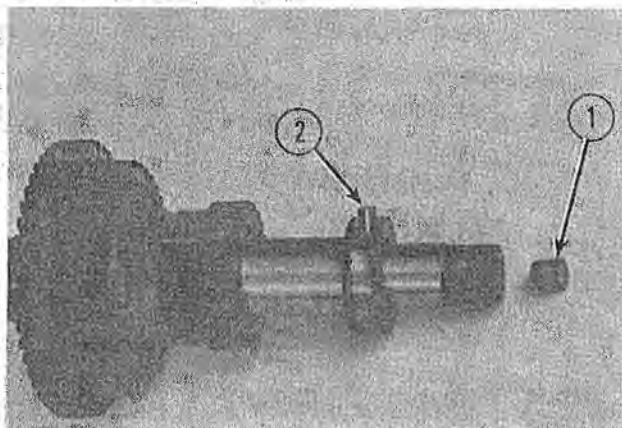


FIG. 10

RE-ASSEMBLY OF THE TRANSMISSION CASE

This procedure assumes that all gears and shafts have been removed from the transmission case and that the bearings and seals have been inspected and/or replaced.

Note: All bearings and seals should be pre-lubricated with a light grease, prior to re-assembly.

To aid in orientation, Figure 1 identifies the (5) shafts that will be re-assembled into the case.

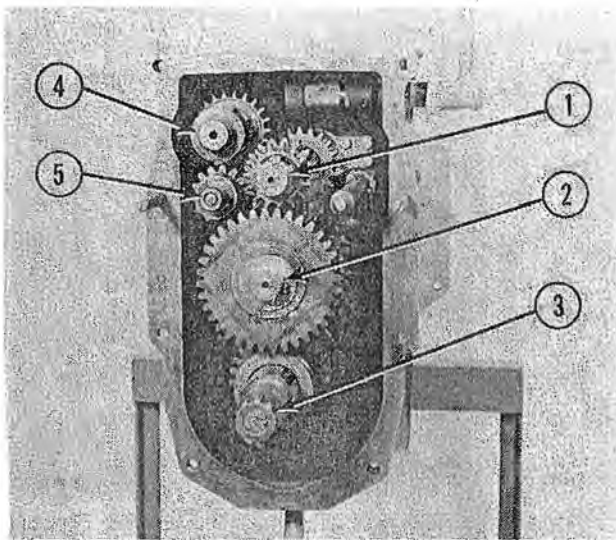


FIG. 1

(1, Fig. 1) Power transmission shaft.

(2, Fig. 1) Idler shaft.

(3, Fig. 1) Pinion shaft.

(4, Fig. 1) 1st & 2nd gear shaft.

(5, Fig. 1) Reverse shaft.

The first shaft to be re-assembled into the case is shaft #4, the 1st & 2nd gear shaft.(Fig. 2)

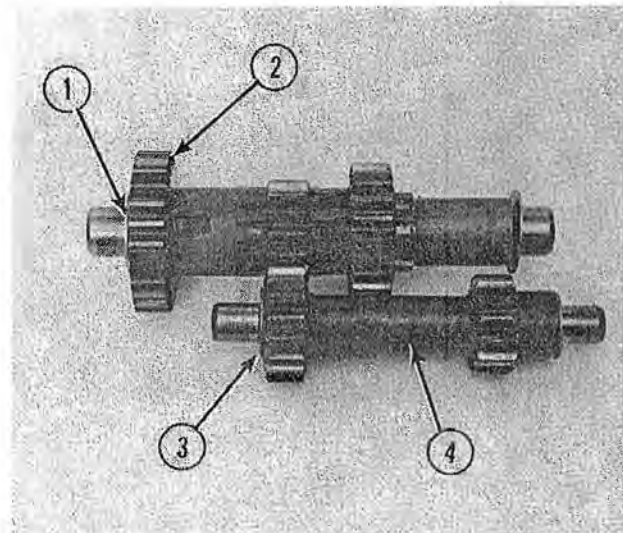


FIG. 2

Care must be taken to re-install the thrust washer (1, Fig. 2) on the forward end of the shaft and install the 26-tooth first gear (2, Fig. 2) so that the beveled teeth are facing aft.

Place the thrust washer (3, Fig. 2) on the forward end of the reverse shaft (4, Fig. 2) and install it into the case.

Position the large spur gear with the oil shield facing aft, so that it is balanced on, and meshed with, the pilot shaft located on the front wall of the transmission case.

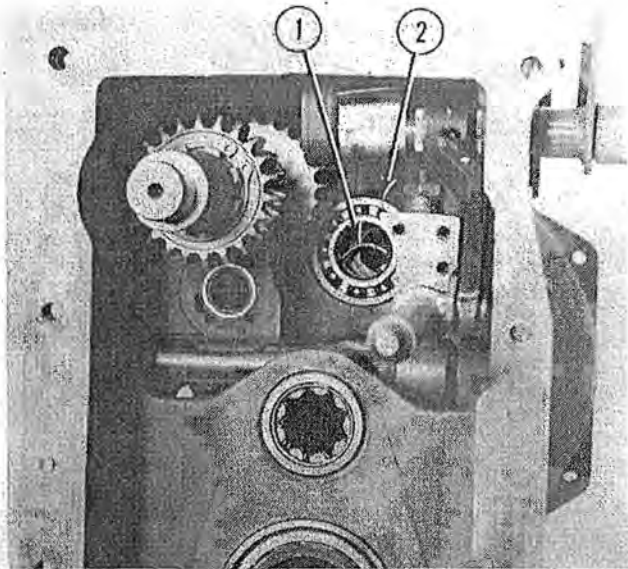


FIG. 3

Position the spacer bushing (1, Fig. 3) between the spur gear and the 2nd support bearing (2, Fig. 3) and install the power transmission shaft into the case.

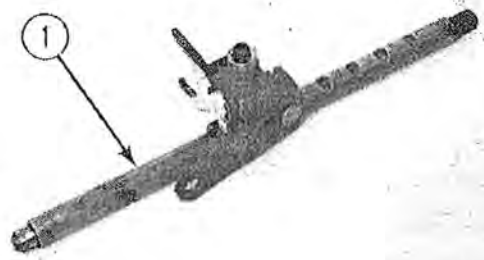


FIG. 4

Install the transmission shift detent rod with fork carrier attached (1, Fig. 4) into the upper left hand side of the case and secure with the set screw tapped in from the outside.

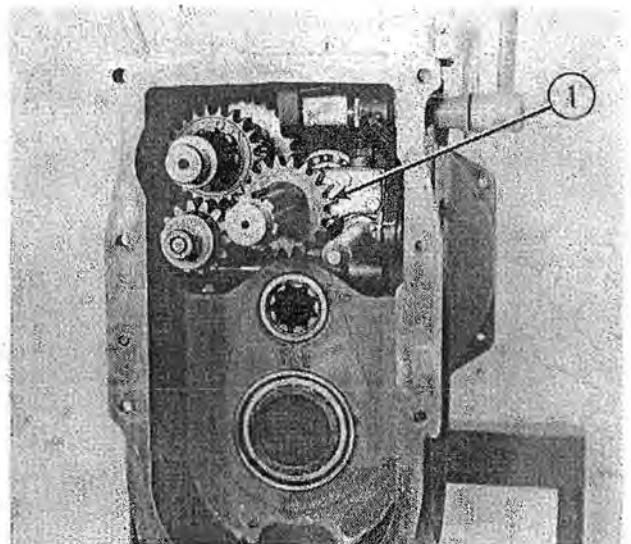


FIG. 5

At the same time, you may install the transmission shift gear into the shifting fork and onto the power transmission shaft.(1, Fig. 5)

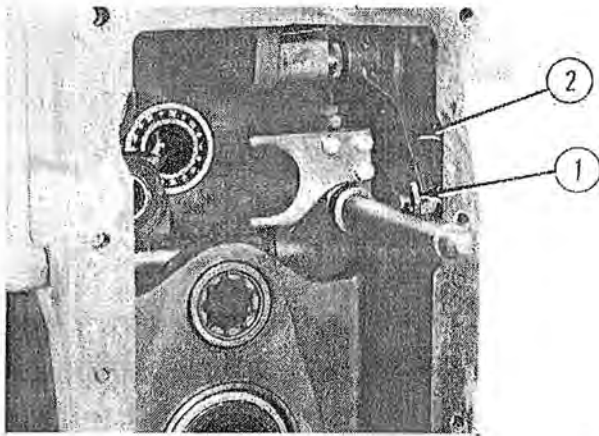


FIG. 6

Reconnect the shift fork carrier link to the arm of the transmission shift lever (2, Fig. 6) and secure with a cotter pin.

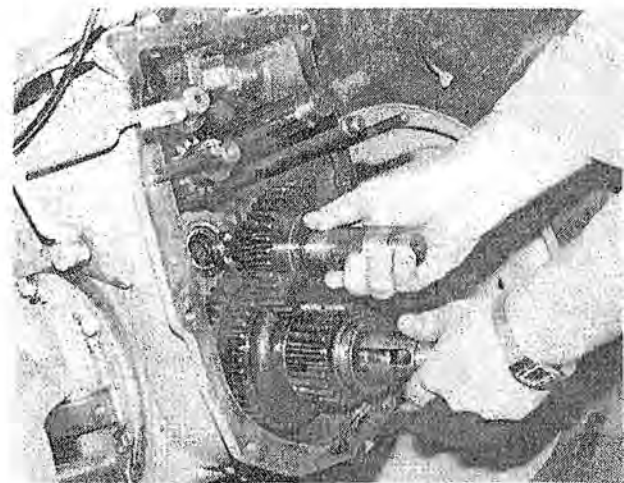


FIG. 8

Nest the idler shaft onto the pinion and range shaft sub-assembly and assemble them into the case. (Fig. 8)

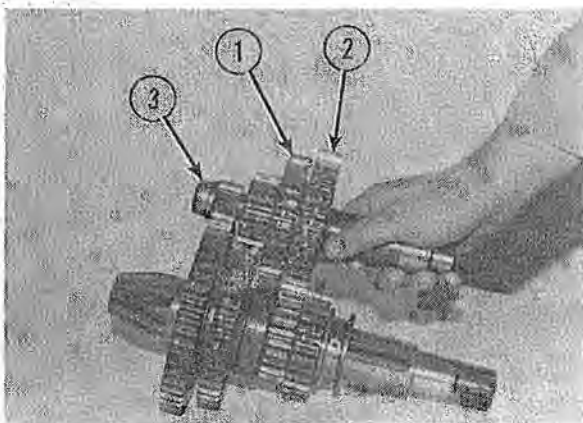


FIG. 7

Pre-assemble the 31-tooth (1, Fig. 7) and the 37-tooth spur onto the idler shaft. You will note that the inner race (3, Fig. 7) of the forward bearing on the idler shaft is also pre-assembled onto it.

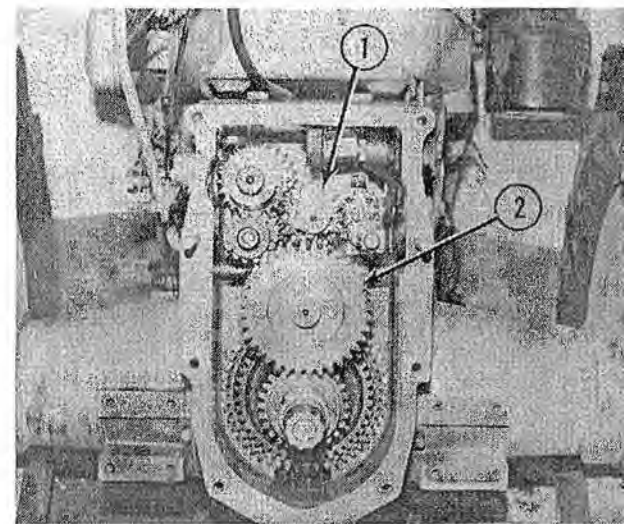


FIG. 9

You may now assemble the PT0 shifter gear (1, Fig. 9) onto the power transmission shaft along with the PT0 twin idler gear (2, Fig. 9) onto the idler shaft.

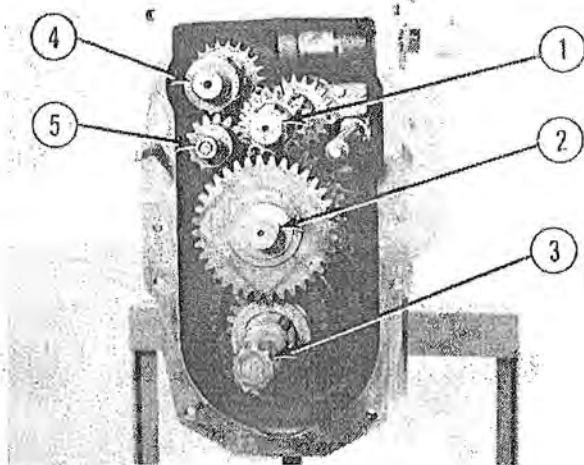


FIG. 10

Thrust washers can now be placed on the aft ends of idler shaft, (2, Fig. 10) the 1st and 2nd gear shaft (4, Fig. 10) and the reverse shaft. (5, Fig. 10)

The aft transmission cover can now be installed. At this point, all bearings and seals in the aft cover should have been inspected and/or replaced.

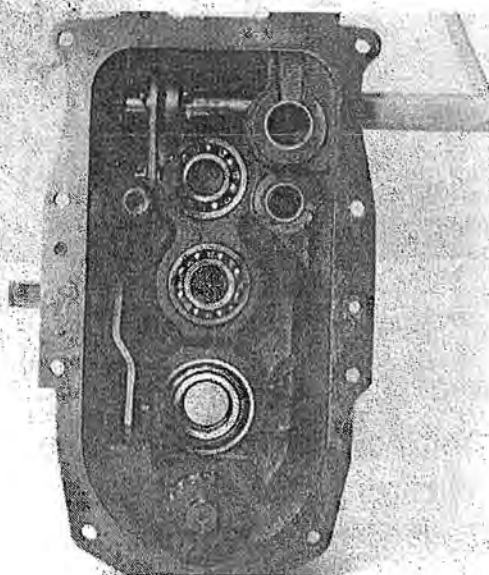


FIG. 11

Place range shifting collar in the low range position to aid in aligning the shift dogs.

Note: All bearings and seals in the aft cover should be pre-lubricated with a light grease prior to installation. (See Figure 11.)

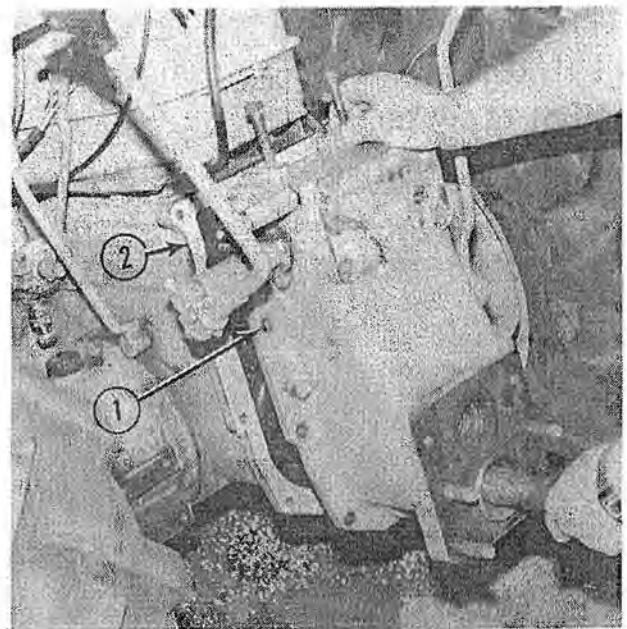


FIG. 12

Place a new gasket on the face of the main transmission case (2, Fig. 12) and install the (2) threaded support pins (1, Fig. 12) to guide the cover during installation.

Place the cover onto the (2) support pins and move it forward until you can engage the shifting dogs into the PTO slider gear (1, Fig. 13) and into the range shifting collar.

CAUTION: Tighten cover bolts so as to maintain a uniform gap between the cover and the case. An uneven gap may cause binding which can result in excessive force which can break the cover flange.

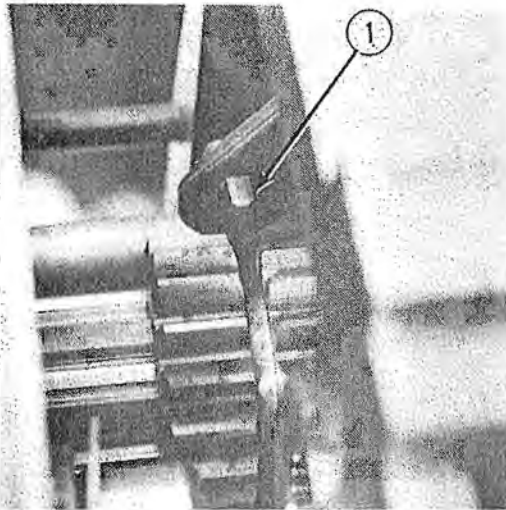


FIG. 13

After the cover is securely seated on the case, torque all 10 mm. bolts 32 to 36 ft./lbs.

Continue to close the cover, tapping on the face of the cover near and around the pinion shaft. As the cover draws up, re-install the (2) shoulder screws in the upper left hand corner and in the lower right hand corner. Remove the (2) support pins and re-install all of the 10 mm. bolts.

DISASSEMBLY OF THE CENTRAL STEERING SECTION

Will provide access to repair or replace parts in:

- (1) The articulating hinge "king pin," (1, Fig. 1)
- (2) The barrel casting upon which the front half of the tractor oscillates, (2, Fig. 1)
- (3) The aft gear case through the front cover,

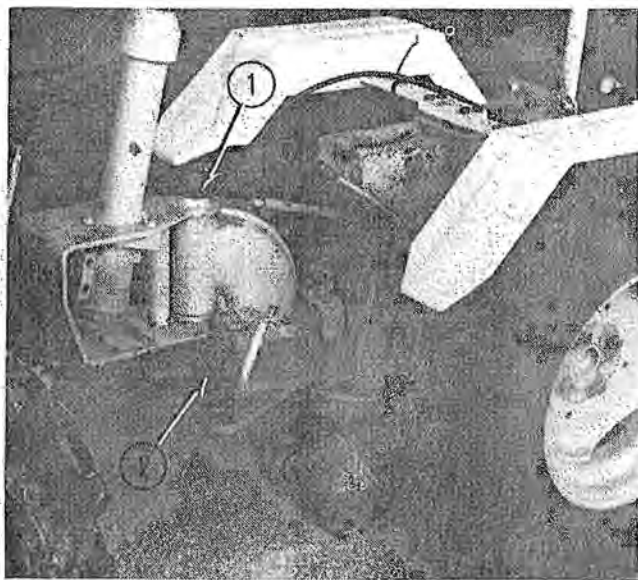


FIG. 1

Remove (4) 8 x 35 mm. bolts that secure the aft strap of the deck plate (1, Fig. 2) and (6) 10 x 25 mm. bolts that secure the leading edge of the deck plate (2, Fig. 2) to the barrel casting.

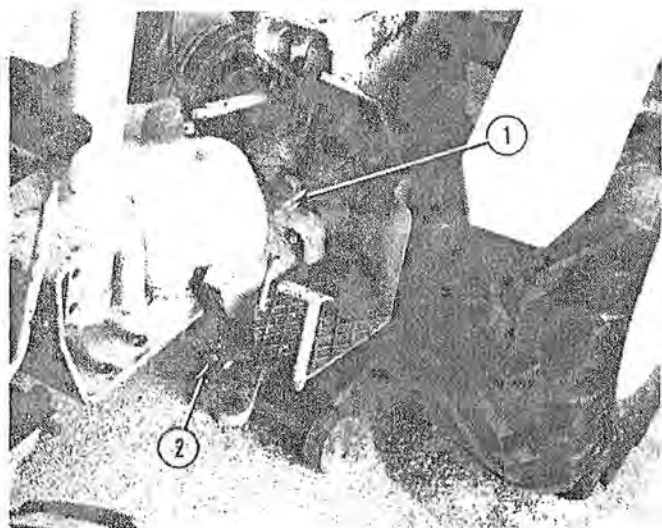


FIG. 2

Remove the 8 mm. locking nut and thread out the 8 x 22 mm. bolt that secures the brake pedal to the pedal adjustment bar, (2, Fig. 3)

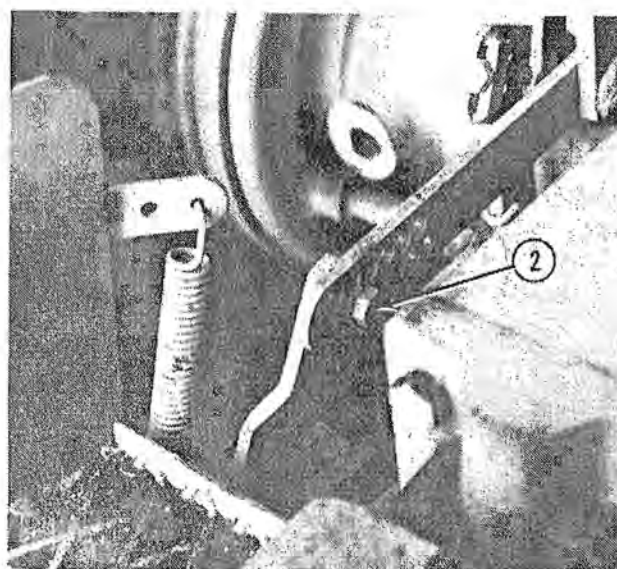


FIG. 3

Remove the deck plate and pedal assembly from the tractor.
(2, Fig. 4) Retain the (2) tension wear plates for re-assembly.
(3, Fig. 4)

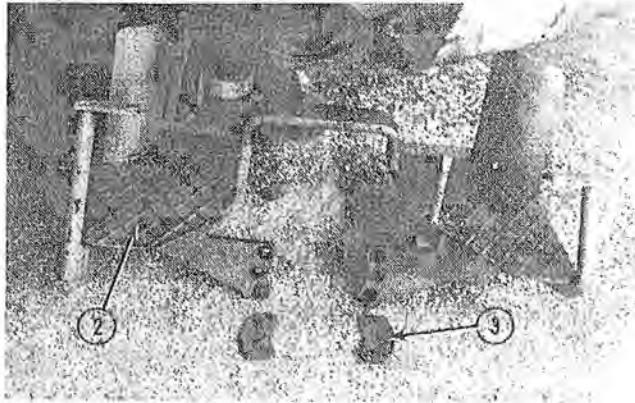


FIG. 4

Remove the rubber protective cup, (1, Fig. 5) pull out the cotter pin and remove the large castellated nut and thrust washer. Tap the articulating king pin down from the top,

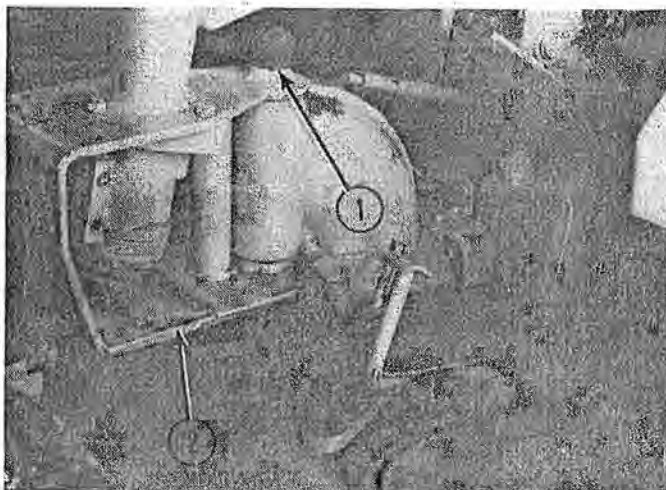


FIG. 5

Note: Use caution not to damage threads.

Remove the forward portion of the central steering section (2, Fig. 5) from the central support weldment.

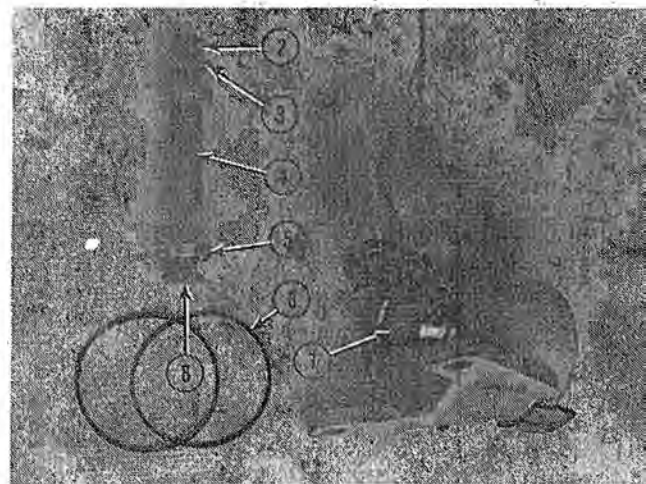


FIG. 6

To clarify identification of components associated with the articulating hinge pin, see Fig. 6.

- (2, Fig. 6) Castellated Nut
- (3, Fig. 6) Thrust Washer
- (4, Fig. 6) Spacer Tube
- (5, Fig. 6) Ball Bearing
- (6, Fig. 6) "O" Rings
- (7, Fig. 6) "Gooseneck" Central Support Weldment
- (8, Fig. 6) Articulating Hinge Pin

The gooseneck (2, Fig. 7) support section can now be removed from the barrel casting. (3, Fig. 7)

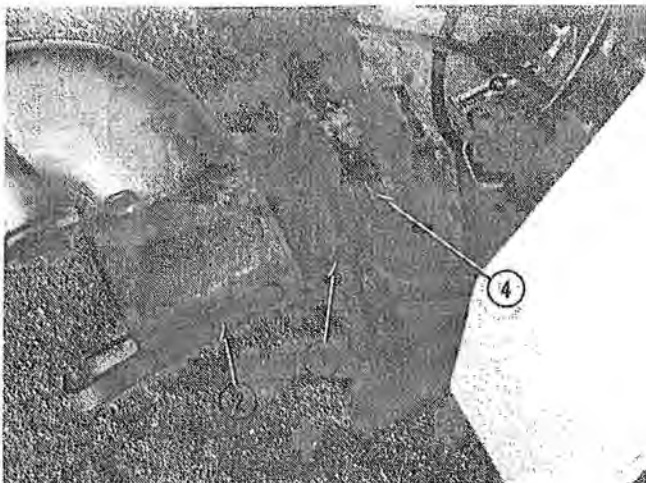


FIG. 7

Note: If the gooseneck cannot be removed easily, you may remove the (4) 14 mm. self-locking nuts (4, Fig. 7) that secure the barrel casting to the rear case cover. Then the barrel casting can be pressed or driven from the gooseneck support section.

The upper and lower ball bearings can be tapped out of the gooseneck support section using a mild steel bar. (Fig. 8)



FIG. 8

2, Fig. 9 shows the standard ball bearing that is normally installed top and bottom on the articulating king pin. 3, Fig. 9 is a poly-pemco substitute that can replace the lower bearing that may fail from repeated heavy shocking. This polymer bushing has good wear-resistant characteristics, plus, it can distribute and absorb the concentrated shock loading more effectively than a ball bearing.

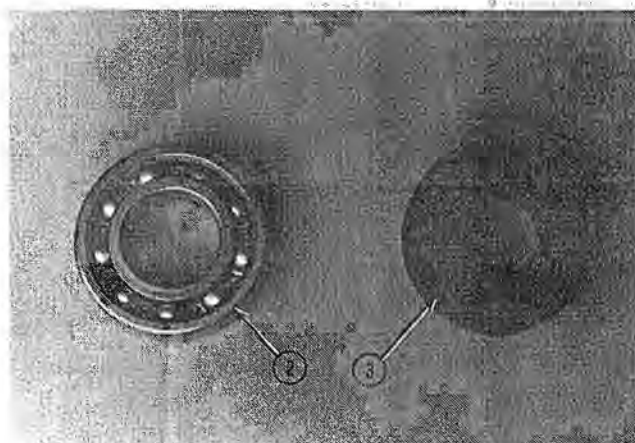


FIG. 9

DISASSEMBLY & RE-ASSEMBLY OF BARREL CASTING

The upper ground drive shaft (1, Fig. 10) can be tapped out by removing the snap ring (2, Fig. 10) that secures the bearing into the counterbore of the casting.

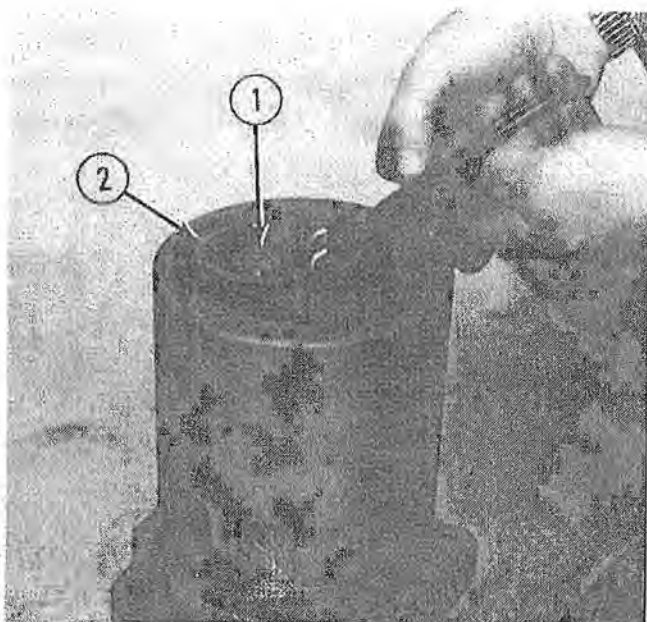


FIG. 10

The ball bearing that supports the lower PTO drive shaft can be tapped or pressed out of the barrel casting from the forward end.

Inspect and replace all discrepant parts. When re-installing the support bearings for both the ground and PTO drive shafts, take care to have the shielded side of these bearings facing forward. (1, Fig. 11)

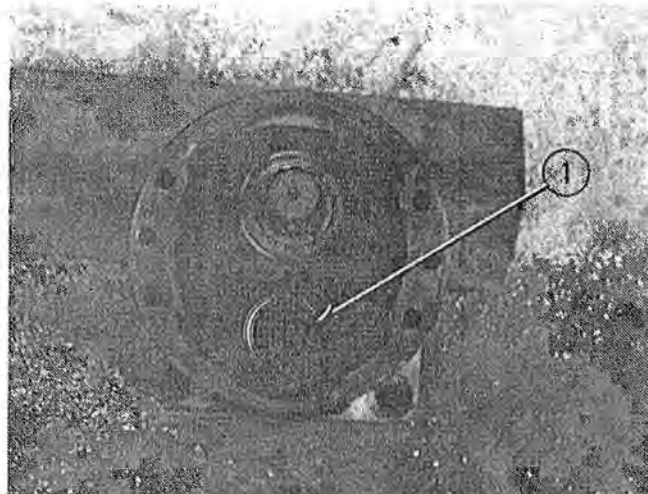


FIG. 11

The support bearing for the ground drive shaft should be pre-assembled onto the shaft and secured with the snap ring. The assembly may then be inserted into the casting from the forward end of the barrel casting.

Note: Use a soft brass or mild steel rod to seat the outer race of the bearing into the counter-bore and secure it with the snap ring.

Note: Experience has shown that the fasteners that secure the barrel casting to the rear case cover may loosen up under maximum loading. To minimize this condition, we recommend using a good thread sealing compound to secure the studs (3, Fig. 12) into the case cover.

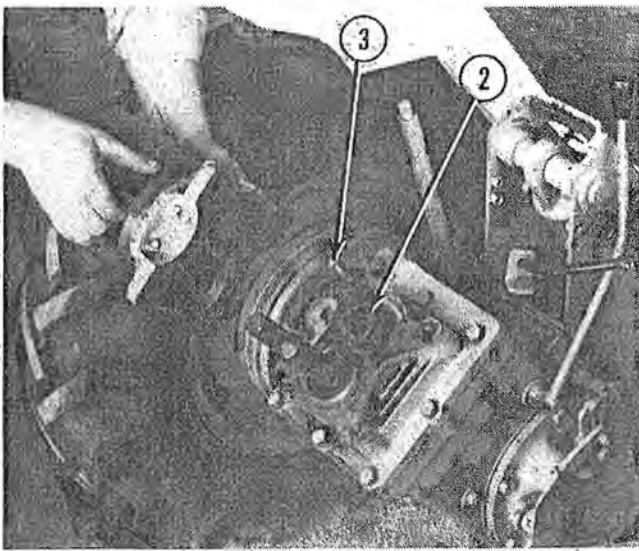


FIG. 12

After the studs are properly sealed and tightened into the cover, the barrel casting may be installed onto the cover. Be sure the ground drive coupler is in place. (2, Fig. 12)

Install the (4) flat washers and torque the (4) self-locking nuts 80-85 ft. lbs. of torque

REMOVING THE FRONT COVER TO THE REAR DIFFERENTIAL CASE:

Will provide access to:

1. The rear ground drive pinion shaft (2, Fig. 1).
2. The PTO input shaft (3, Fig. 1).
3. All seals and bearings for these (2) shafts.

Remove (6) 10 x 35 mm. bolts and (2) 10 mm. special shoulder screws (4, Fig. 1) that secure the cover to the rear case.

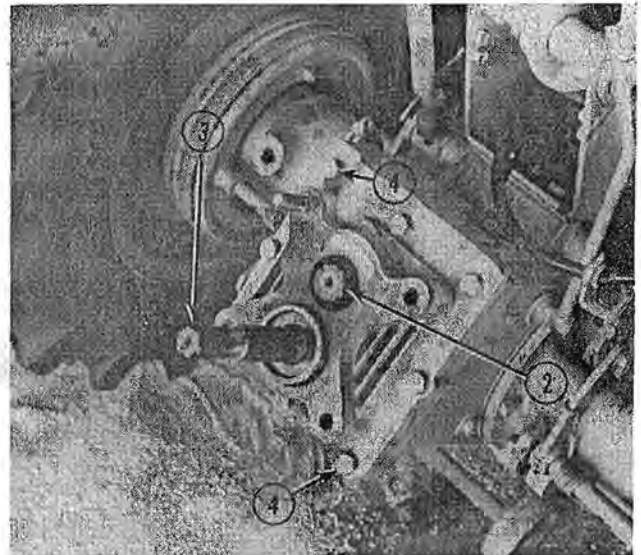


FIG. 1

Remove the cover, with the PTO input shaft installed into it (3, Fig. 1). Be sure that the needle bearing in the aft end of the PTO input shaft is in place.

Inspect cover and shaft assembly for defective parts and replace as required.

Note: Exercise caution when replacing the lower seal on the PTO shaft. This seal is not pressed up against a shoulder and care must be taken to assure the seal is straight with the bore (not tipped).

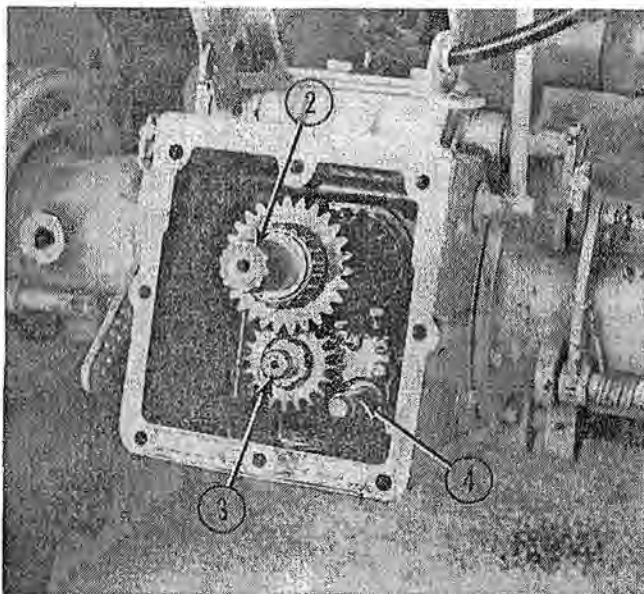


FIG. 2 .

Figure 2 shows the rear differential case with the cover removed and the

1. Rear pinion drive shaft in position (2, Fig. 2)
2. The PTO final drive shaft in position (3, Fig. 2)

3. The ground drive PTO shifter and drive gear in place (4, Fig. 2).

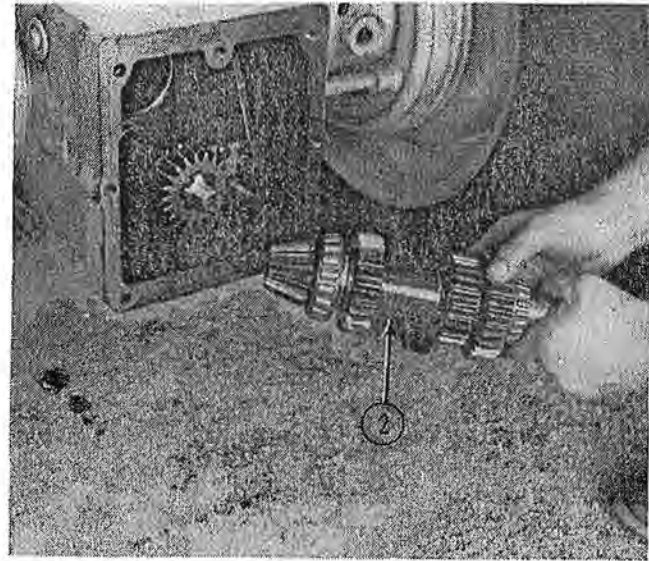


FIG. 3

Remove the pinion drive shaft from the rear case and inspect for damaged parts (2, Fig. 3).

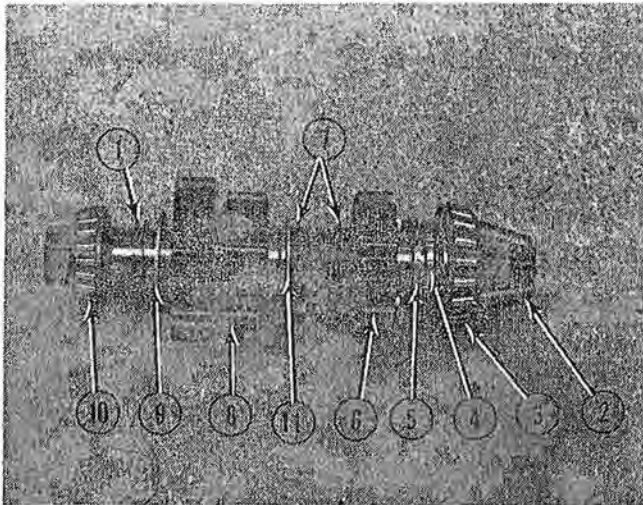


FIG. 4

Fig. 4 shows the assembly sequence of the parts mounted onto the pinion shaft.

Fig. 5 shows the same parts removed and laid out for easy identification.

- (1, Fig. 4 & 5) Backlash Shims
- (2, Fig. 4 & 5) Rear Pinion Shaft
- (3, Fig. 4 & 5) Rear Cone Bearing
- (4, Fig. 4 & 5) Split Thrust Rings
- (5, Fig. 4 & 5) Thrust Washer
- (6, Fig. 4 & 5) Ground Drive Gear & Pin
- (7, Fig. 4 & 5) Snap Ring
- (8, Fig. 4 & 5) PTO Idler Gear
- (9, Fig. 4 & 5) Thrust Washer
- (10, Fig. 4 & 5) Front Cone Bearing
- (11, Fig. 4 & 5) Thrust Washer

Disassemble discrepant parts from the pinion shaft and re-install replacement parts. Use caution to use the same number of backlash shims that were removed.

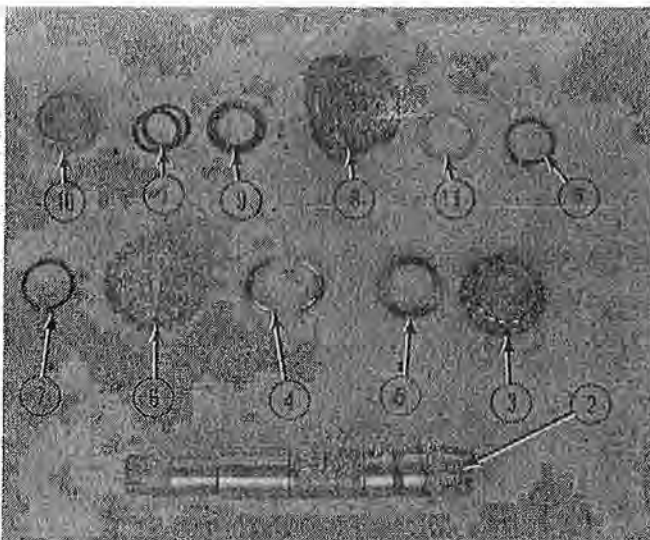


FIG. 5

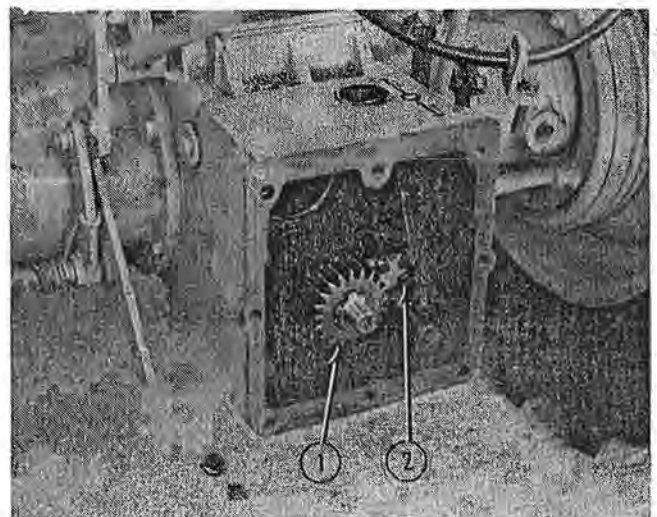


FIG. 6

The ground drive PTO shifter gear (1, Fig. 6) may be replaced by removing the (3) 6 mm. bolts (2, Fig. 6) that secure the shifting fork to the carrier.

After the shifter gear is replaced, torque the 6 mm. bolts to 8 - 10 ft/lbs. and tap the locking tabs into place to secure the bolts.

The PTO final drive is most easily removed with the left axle housing off. Refer to page 17 for detailed instructions on axle removal.

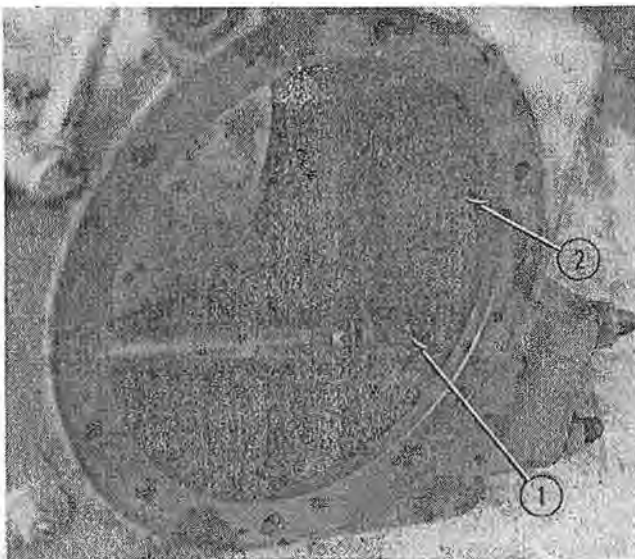


FIG. 7

Figure 7 shows the PTO final drive shaft looking through the rear axle attach hole. The spur drive gear (1, Fig. 7) is meshed and driving the SAE 1-3/8" 6-spline PTO gear (2, Fig. 7).

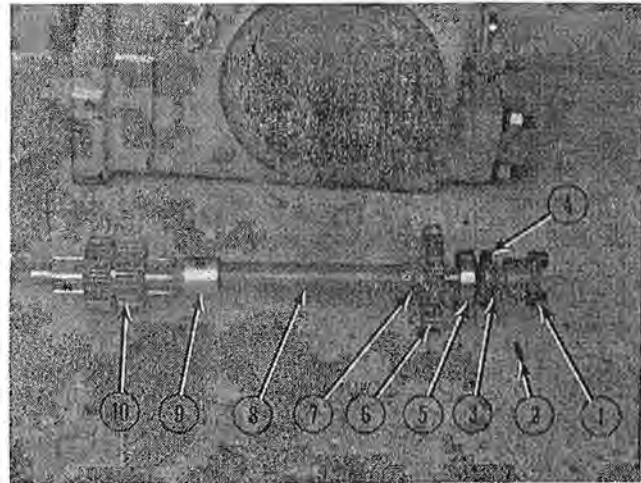


FIG. 8

Figure 8 identifies all parts assembled onto the PTO final drive shaft. They are listed below for identification purposes.

- (1, Fig. 8) Hourglass Drive Hub
- (2, Fig. 8) Rollpin
- (3, Fig. 8) Snap Ring (2)
- (4, Fig. 8) Oil Seal
- (5, Fig. 8) Rear Roller Bearing
- (6, Fig. 8) Spur Drive Gear
- (7, Fig. 8) Snap Ring (2)
- (8, Fig. 8) PTO Final Drive Shaft
- (9, Fig. 8) Support Bushing
- (10, Fig. 8) PTO Shifter Gear

To remove the PTO ground drive shaft from the case, you must tap out the No. 2 rollpin and slide off the No. 1 hourglass drive.

Remove the No. 3 snap ring from the shaft and the larger snap ring securing the seal into the bore. Hook out the No. 3 seal (will require destructive disassembly).

Remove the 2nd No. 3 snap ring from the locking groove and tap the shaft through the No. 6 spur drive gear and No. 9 support bushing.

Inspect all parts carefully, replace those that are defective and re-assemble parts in reverse order of disassembly.

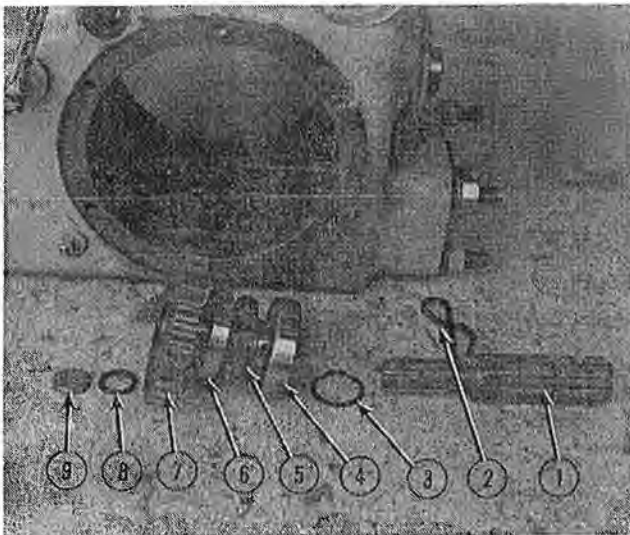


FIG. 9

Fig. 9 identifies parts associated with the SAE 1-3/8" 6-spline PTO shaft.

- (1, Fig. 9) SAE PTO Shaft
- (2, Fig. 9) Retaining Clip
- (3, Fig. 9) Snap Ring
- (4, Fig. 9) Rear Bearing
- (5, Fig. 9) Oil Seal
- (6, Fig. 9) Front Bearing
- (7, Fig. 9) Shaft & Gear Assembly
- (8, Fig. 9) "O" Ring
- (9, Fig. 9) Plug

The spur gear and shaft assembly (6, Fig. 9) can be removed by unclipping the snap ring (3, Fig. 9) from the shaft extending out the rear of the case. Tap the shaft from the rear into the case using a soft brass bar.

Inspect bearings and the seal carefully and replace discrepant parts.

Re-assemble the spur gear and shaft assembly along with the seals and bearings into the case in reverse order of disassembly.

GENERAL INFORMATION--PASQUALI HYDRAULIC SYSTEM

The Pasquali tractor comes equipped with a standard open-center hydraulic system that operates the rear lift and the optional power steering system.

In tractors other than model 988, the hydraulic gear type pump is driven directly off the engine crankshaft using a positive, no-slip, splined coupling. The hydraulic pumps have an identifying part number steel stamped into the housing as shown in figure. (1, Fig. 5) The displacement for each model pump is listed below.

Part No.	Displacement at 3000 RPM
AM 1.5	3.1 GPM
AM 2-20	4.4 GPM
AM 2-24	5.4 GPM

The primary pressure relief is mounted on the upper forward end of the tandem center lift valve. It is pre-set at the factory to 1500 psi.

Figure 6 shows the schematic for the standard hydraulic system with optional power steering.

Figure 7 shows the point to point hook-up of these same components.

TROUBLE-SHOOTING HYDRAULIC PROBLEMS

Steps to take:

- A. Know the system
- B. Ask the operator/owner
- C. Operate the machine
- D. Inspect the machine
- E. List possible causes
- F. Reach your conclusion
- G. Test your conclusion

1. System Inoperative

- a. No oil in system
 - Fill to full mark.
 - Check system for leaks.
- b. Oil low in reservoir
 - Check level and fill to full mark.
 - Check system for leaks.
- c. Oil of wrong viscosity
 - Refer to specifications for proper viscosity.
- d. Filter dirty or plugged
 - Drain oil and replace filters
 - Try to find source of contamination.

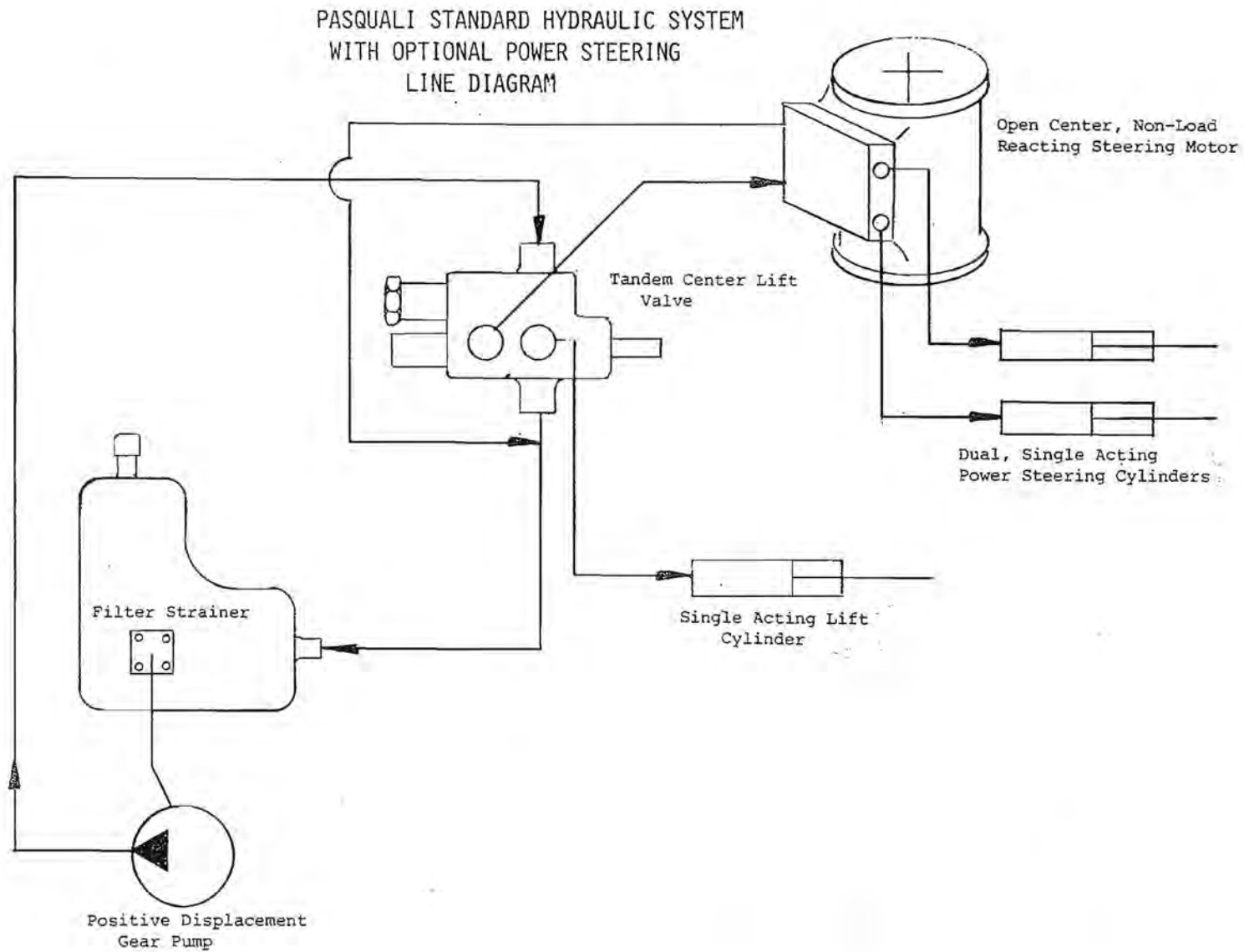


FIGURE 7

PASQUALI STANDARD HYDRAULIC SYSTEM
WITH OPTIONAL POWER STEERING

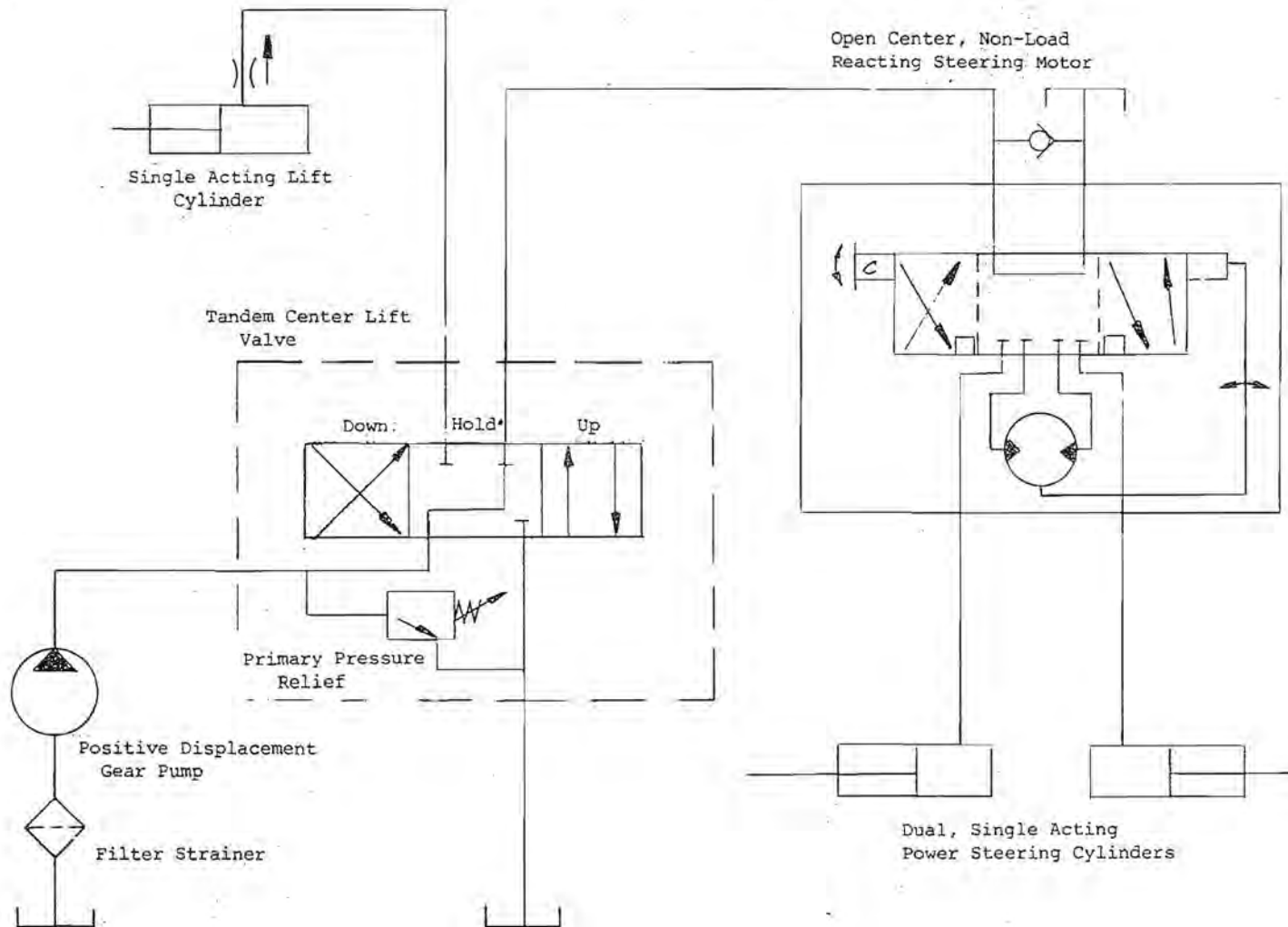


FIGURE 6

- e. Restriction in system
 - Oil lines could be dirty or have inner walls that are collapsing to cut off oil supply.
 - Clean or replace lines.
 - Clean orifices.
- f. Air leaks in pump suction line
 - Repair or replace lines.
- g. Dirt in pump
 - Clean and repair pump.
 - If necessary, drain and flush hydraulic system.
 - Try to find source of contamination.
- h. Badly worn pump
 - Repair or replace pump.
 - Check for problems causing pump wear such as misalignment or contaminated oil.
- i. Badly worn components
 - Examine and test valves, motors, cylinders, etc. for external and internal leaks.
 - If wear is abnormal, try to locate the cause.
- j. Oil leak in pressure lines
 - Tighten fittings or replace defective lines.
 - Examine mating surfaces on couplers for irregularities.
- k. Components not properly adjusted
 - Refer to machine technical manual for proper adjustment of components.
- l. Relief valve defective
 - Test relief valves to make sure they are opening at their rated pressure.

- Examine seals for damage that could cause leaks.
- Clean relief valves and check for broken springs, etc.
- m. Pump rotating in wrong direction
 - Reverse to prevent damage.
- n. Operating system under excessive load
 - Check specifications of unit for load limits.
- o. Hoses attached improperly
 - Attach properly and tighten securely.
- p. Slipping or broken pump drive
 - Replace couplers or belts if necessary.
 - Align them and adjust tension.
- q. Pump not operating
 - Check for shut-off device on pump or pump drive.

2. System Operates Erratically

- a. Air in system
 - Examine suction side of system for leaks.
 - Make sure oil level is correct.
 - Oil leak on the pressure side of the system could account for loss of oil.
- b. Cold oil
 - Viscosity of oil may be too high at start of warm-up period.
 - Allow oil to warm up to operating temperature before using hydraulic functions.

- c. Pump damaged
 - Check for broken or worn parts.
 - Determine cause of pump damage.
 - d. Dirt in relief valves
 - Clean relief valves.
 - e. Restriction in filter or suction line
 - Suction line could be dirty or have inner walls that are collapsing to cut off oil supply.
 - Clean or replace suction line.
 - Also, check filter line for restrictions.
3. System Operates Slowly
- a. Cold oil
 - Allow oil to warm up before operating machine.
 - b. Oil viscosity too heavy
 - Use oil recommended by the manufacturer.
 - c. Insufficient engine speed
 - Refer to operator's manual for recommended speed.
 - If machine has a governor, it may need adjustment.
 - d. Low oil supply
 - Check reservoir and add oil if necessary.
 - Check system for leaks that could cause loss of oil.
 - e. Adjustable orifice restricted too much
 - Back out orifice and adjust it.
 - Check machine specifications for proper setting.
 - f. Air in system
 - Check suction side of the system for leaks.
 - g. Badly worn pump
 - Repair or replace pump.
 - Check for problems causing pump wear such as misalignment or contaminated oil.
 - h. Restriction in suction line or filter
 - Suction line could be dirty or have inner walls that are collapsing to cut off oil supply.
 - Clean or replace suction line.
 - Examine filter for plugging.
 - i. Relief valves not properly set or leaking
 - Test relief valves to make sure they are opening at their rated pressure.
 - Examine valves for damaged seats that could leak.
 - j. Badly worn components
 - Examine and test valves, motors, cylinders, etc. for external and internal leaks.
 - If wear is abnormal, try to locate the cause.
 - k. Valve or regulators plugged
 - Clean dirt from components.
 - Clean orifices.
 - Check source of dirt and correct.
 - l. Oil leak in pressure lines
 - Tighten fittings or replace defective lines.
 - Examine mating surfaces on couplers for irregularities.

4. Overheating of Oil in System

- a. Operator holds control valves in power position too long, causing relief valve to open
 - Return control lever to neutral position when not in use.
- b. Using incorrect oil
 - Use oil recommended by manufacturer.
 - Be sure oil viscosity is correct.
- c. Low oil level
 - Fill reservoir.
 - Look for leaks.
- d. Dirty oil
 - Drain and refill with clean oil.
 - Look for source of contamination.
- e. Incorrect relief valve pressure
 - Check pressure and clean or replace relief valves.
- f. Internal component oil leakage
 - Examine and test valves, cylinders, motors, etc. for external and internal leaks.
 - If wear is abnormal, try to locate cause.
- g. Restriction in pump suction line
 - Clean or replace.
- h. Dented, obstructed or undersized oil lines
 - Replace defective or undersized oil lines.
 - Remove obstructions.
- i. Control valve stuck in partially or full open position
 - Free all spools so that they return to neutral position.

j. Heat not radiating properly

- Clean dirt and mud from reservoir, oil lines, coolers, and other components.

5. Foaming of Oil in System

- a. Low oil level
 - Fill reservoir.
 - Look for leaks.
- b. Water in oil
 - Drain and replace oil.
- c. Wrong kind of oil being used
 - Use oil recommended by manufacturer.
- d. Air leak in line from reservoir to pump
 - Tighten or replace suction line.
- e. Kink or dent in oil lines (restricts oil flow)
 - Replace oil lines.
- f. Worn seal around pump shaft
 - Clean sealing area and replace seal.
 - Check oil for contamination or pump for misalignment.

6. Pump Makes Noise

- a. Low oil level
 - Fill reservoir.
 - Check system for leaks.
- b. Oil viscosity too high
 - Change to lighter oil.
- c. Suction line plugged or pinched
 - Clean or replace line between reservoir and pump.
- d. Sludge and dirt in pump
 - Disassemble and inspect pump and lines.
 - Clean hydraulic system.
 - Determine cause of dirt.

- e. Reservoir air vent plugged
 - Remove breather cap, flush and clean air vent.
- f. Air in oil
 - Tighten or replace suction line.
 - Check system for leaks.
 - Replace pump shaft seal.
- g. Worn or scored pump bearings or shafts
 - Replace worn parts or complete pump if parts are badly worn or scored.
 - Determine cause of scoring.
- h. Broken or damaged pump parts
 - Repair pump.
 - Look for cause of damage like contamination or too much pressure.
- i. Sticking or binding parts
 - Repair binding parts.
 - Clean parts and change oil if necessary.

7. Pump Leaks Oil

- a. Damaged seal around drive shaft
 - Tighten packing or replace seal.
 - Trouble may be caused by contaminated oil.
 - Check oil for abrasives and clean entire hydraulic system.
 - Try to locate source of contamination.
 - Check the pump drive shaft.
 - Mis-alignment could cause the seal to wear.
 - If shaft is not aligned, check the pump for other damage.

- b. Loose or broken pump parts
 - Make sure all bolts and fittings are tight.
 - Check gaskets.
 - Examine pump castings for cracks.
 - If pump is cracked, look for a cause like too much pressure or hoses that are attached incorrectly.

8. Load Drops With Control Valve in Neutral Position

- a. Leaking or broken oil lines from control valve to cylinder
 - Check for leaks.
 - Tighten or replace lines.
 - Examine mating surfaces on couplers for irregularities.
- b. Oil leaking past cylinder packings or O-rings
 - Replace worn parts.
 - If wear is caused by contamination, clean hydraulic system and determine the source.
- c. Oil leaking past control valve or relief valves
 - Clean or replace valves.
 - Wear may be caused by contamination.
 - Clean system and determine source of contamination.
- d. Control lever not centering when released
 - Check linkage for binding.
 - Make sure valve is properly adjusted and has no broken or binding parts.

9. Control Valve Sticks or Works

Hard

- a. Misalignment or seizing of control linkage
 - Correct misalignment.
 - Lubricate linkage joints.
- b. Tie-bolts too loose (on valve stacks)
 - Use manufacturer's recommendation to adjust tie-bolt torque.
- c. Valve broken or scored internally
 - Repair broken or scored parts.
 - Locate source of contamination that caused scoring.

--Wear may be caused by external as well as internal contaminants.

--Check piston rod for scratches or misalignment.

c. Loose parts

--Tighten parts until leakage has stopped.

d. Piston rod damaged

--Check rod for nicks or scratches that could cause seal damage or allow oil leakage.

--Replace defective rods.

10. Control Valve Leaks Oil

- a. Worn or damaged O-rings
 - Replace O-rings (especially between valve stacks).
 - If contamination has caused O-rings to wear, clean system and look for source of contamination.
- b. Broken valve parts.
 - If valve is cracked, look for a cause like too much pressure or hoses that are attached incorrectly.

REMOVE & REPLACE HYDRAULIC PUMP AND FILTER

Note: This procedure is applicable for all pumps driven directly off the engine crankshaft. It cannot be used for model 988.

11. Cylinders Leak Oil

- a. Damaged cylinder barrel
 - Replace cylinder barrel.
 - Correct cause of barrel damage.
- b. Rod seal leaking
 - Replace seal.
 - If contamination has caused seal to wear, look for source.

Figure 1 shows a typical pump installation on Ruggerini-powered tractors. This same mount and drive set-up is used on the single-cylinder Lombardini powered tractors also. The major elements of the system are identified for your convenience.

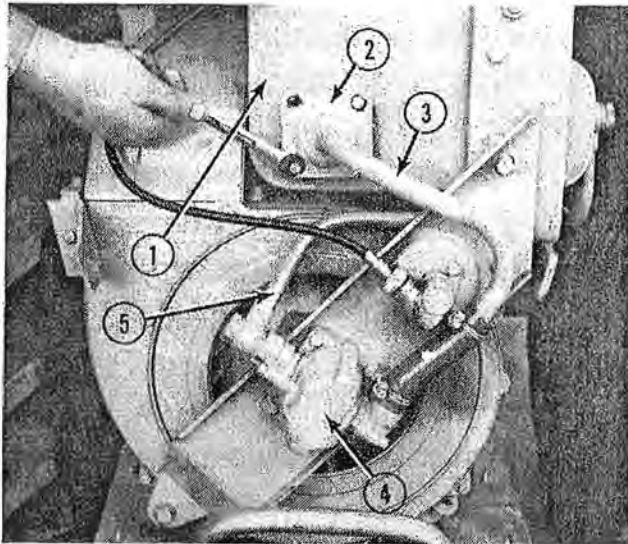


FIG. 1

- (1, Fig. 1) Reservoir
- (2, Fig. 1) Filter Cap
- (3, Fig. 1) Suction Line
- (4, Fig. 1) Pump Assembly
- (5, Fig. 1) Pressure Line

The hydraulic filter is a permanent steel mesh filter (1, Fig. 2) that is installed directly in the suction line sump located in the lower end of the reservoir.

It can be removed, cleaned and re-installed quickly and easily. Replace the gasket and re-torque the 6 mm. bolts 8-10 ft./lbs.

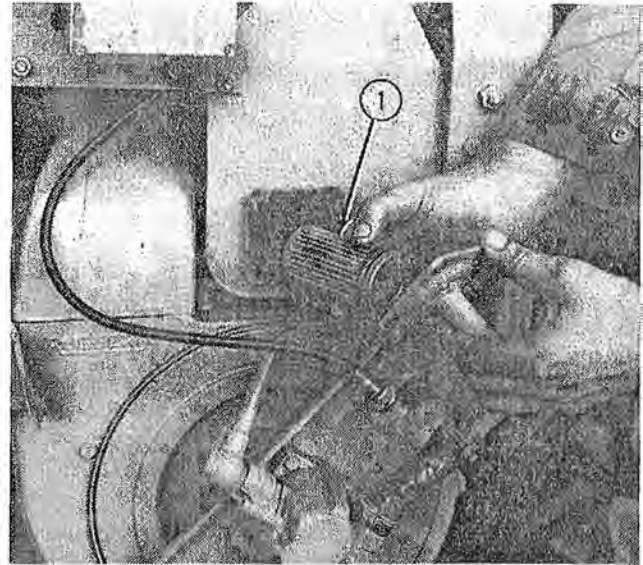


FIG. 2

The pump can be removed by disconnecting the banjo fittings from the pressure and suction ports and removing the (4) 6 mm. bolts and nuts. Figure 3 shows the drive hub on the pump (1, Fig. 3) and its matching drive adapter (2, Fig. 3) bolted to the engine flywheel.



FIG. 3

Figure 4 shows the drive hub removed from the pump shaft with related parts.

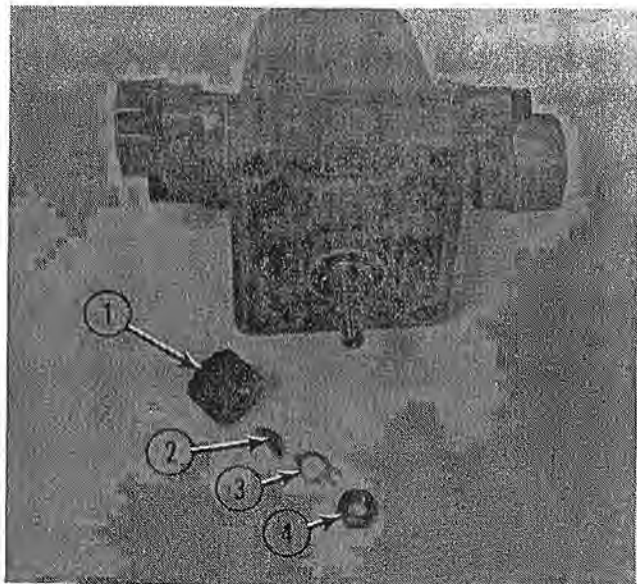


FIG. 4

- (1, Fig. 4) Drive Hub
- (2, Fig. 4) Woodruff Key
- (3, Fig. 4) Locking Washer
- (4, Fig. 4) 6 mm. Hex Nut

Inspect all parts, replace those that are defective and re-assemble in reverse order of disassembly.

Note: When re-assembling the drive hub to the pump shaft, you must be careful not to over-torque the 6 mm. nut, (4, Fig. 4)
This nut should not be torqued more than 25 - 30 ft./lbs.

After the 6 mm. nut is properly torqued, bend up the locking tabs on the locking washer. (3, Fig. 4)

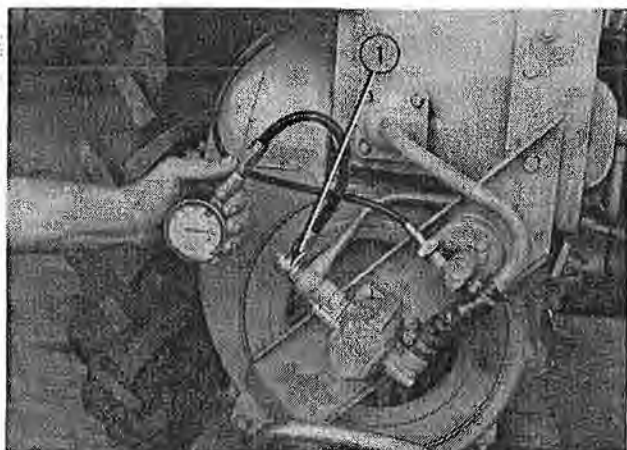
Refill the hydraulic reservoir with No. 20 weight SAE non-detergent oil.

Start the tractor, and cycle all of the hydraulically operated functions.

- 1. Rear lift
- 2. Power steering
- 3. Dozer, loader, etc.

Refill the reservoir to be 2 to 3 inches down from the filler tube.

You may now install a pressure gauge into the system to verify that the pump is providing adequate pressure. With the engine running at 2200 - 2400 RPM's, the pressure relief should dump back to tank at approximately 1500 psi.



REMOVE THE REAR LIFT CYLINDER & DIS-ASSEMBLE ROCK SHAFT

Remove the seat and fenders for easy access.

The lift cylinder may be removed by pulling the forward and rear support pins.

Note: The rear support pin must be removed through a cut-out in the right hand side of the frame. (1, Fig. 1)

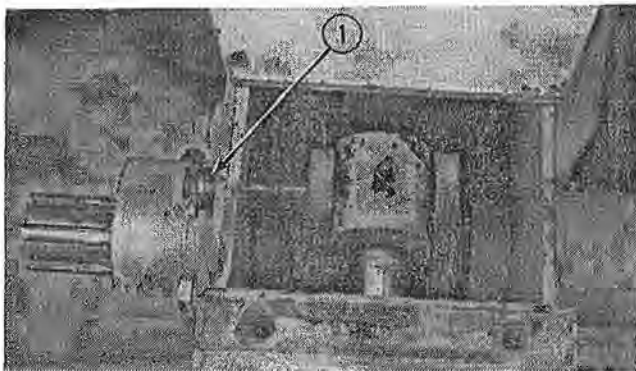


FIG. 1

Disconnect the hydraulic line from the lift cylinder. Watch for the restrictor installed between the banjo fitting and the hose fitting. This restrictor is designed to control the "drop" in the lift assembly by limiting the rate oil can return to tank.

The hydraulic lift cylinder may now be removed for overhaul or replacement.

REMOVE THE REAR ROCK SHAFT

Remove the snap rings and slide off the two rock shaft arms. (1, Fig 2)

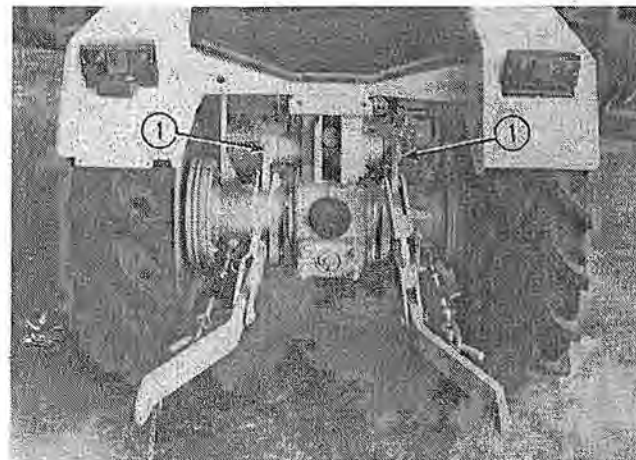


FIG. 2

Remove the (4) 10 mm. bolts that secure the bushing carrier to the main support frame. (1, Fig. 3)

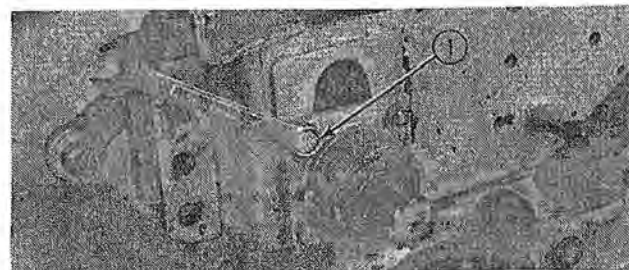


FIG. 3

Pull the pin securing the rock shaft to the end of the cylinder, slide the cylinder rod forward and pull the rock shaft out through the cut-out in the support frame.
(1, Fig. 4)



FIG. 4

Inspect all parts carefully, replace those that are defective and re-assemble in reverse order of disassembly.