into the clutch housing (43) by a retainer plate and snap ring. The three clutch plates are splined into the clutch housing, and the housing (43) is splined to the main input shaft (54).

The high driven gear (92) is splined to the countershaft (98) and is retained by a snap ring. The low driven gear (95) runs on a bush on the countershaft, next to the high driven gear (92). A spring loaded coupler (94) is fitted between the driven gears and operates on a helical spline on the countershaft (98). The coupler is spring loaded towards the low driven gear (95), and the teeth on the rear face of the coupler engage similar teeth on the front face of the low driven gear (95).

The oil pump supplies oil to the control valve for operation of the clutch (43). The control valve is fitted to the main drive retainer (34) and directs oil to the clutch or returns oil into the transmission housing. When the shift lever is in the high position, oil is directed from the control valve through drillings in the retainer (34), input shafts and clutch housing to the clutch piston. When the shift lever is in the low position, oil is returned from the control valve into the transmission housing. The Multi-Power shift lever is fitted to the instrument panel and mechanical linkage connects the shift lever to the oil control valve. Multi-Power high or low can be selected whilst the tractor is moving and in any gear. The gear levers and reduction unit are identical to those used for the eight speed transmission.

OPERATION

Shift Lever in Low
Oil is pumped through the control valve and back into the transmission housing. The drive is transmitted to the countershaft (98) through the low constant mesh gears (57, 95), and the free wheel coupler (94). The coupler is forced into engagement with the low driven gear (95) by its spring and the thrust exerted by the helical splines. When the coupler is in this engaged (low) position, no engine braking is available. If engine braking is required, move the Multi-Power shift lever to high.

Shift Lever in High
Oil is pumped to the control valve and is then directed through drillings to the clutch (43) which engages the high driving gear (52). The higher ratio of the high gears increases the speed of the countershaft (98). This speed increase exerts an opposite thrust on the helical splines of the coupler (94), which overcomes spring pressure and disengages the coupler from the low driven gear (95), so allowing the low driven gear to free-wheel.

SHIFTER RAIL MECHANISM

Removal and Refitment 4B-01-02
Special Tools Required: 270 Rail Trolley.

Removal
1. Split the tractor between the gearbox and centre housing as stated in Part 3.
2. Remove the gearbox top cover, in unit with the instrument panel, as stated in Part 3.
3. Fig 3. Release the locking wire from the 1st/rev. and 2nd/3rd shift rails (8, 10), and from the rear end of the HIGH/LOW shift rail (5).
4. Fig 4. Remove the locking peg (3) from the HIGH/LOW shift fork (6), detach the fork and coupler (77).
5. Remove the gear lever stop plate (11) and interlock pin (14), secured by two bolts (13) and spring washers (12).
6. Lift out the three shift rail springs (1), and plungers (2).
7. Remove the locking pegs (3) from the 1st/rev. and 2nd/3rd shift forks (7, 9).
8. Slide the 1st/rev. and 2nd/3rd shift rails (8, 10), rearwards out of the transmission housing. Lift out the 1st/rev. and 2nd/3rd shift forks (7, 9).
9. Release the locking wire and remove the locking peg (3) from the HIGH/LOW shift selector (4).
10. Slide the HIGH/LOW shift rail (5), rearwards out of the transmission housing. Lift out the HIGH/LOW shift selector (4).

Refitment
1. Fit the HIGH/LOW shift rail (5), sliding the HIGH/LOW shift selector (4), onto the rail and secure to the rail with locking peg (3). Wire lock the peg to the rail.
2. Locate the 1st/rev. and 2nd/3rd shift forks (7, 9), to their respective grooves in the mainshaft gears. The two forks are identical.
3. Assemble the 1st/rev. and 2nd/3rd shift rails (8, 10), with interlock pin grooves facing each other, to the forks, and secure each fork with a locking peg (3). Wire lock the pegs to the rails. The shorter, 2nd/3rd shift rail (8) is fitted to the L.H. side.
4. Locate the HIGH/LOW shift fork (6), to the groove in the coupler (77). Assemble the coupler into the planet pinion carrier assembly (69), simultaneously slIding the fork (6), onto the HIGH/LOW shift rail (5).
5. Secure the HIGH/LOW shift fork (6), to its rail withthe locking peg (3).
6. Wire lock the peg to the rail.
7. Fit the interlock pin (14), to the stop plate (11), and secure the stop plate with two bolts (13), and spring washers (12).
8. Fit the three plungers (2), pointed end downwards, and the three springs (1).
9. Refit the gearbox top cover and instrument panel assembly as stated in Part 3.

NOTE – BOTH GEAR LEVERS AND THE GEAR SELECTOR DOGS MUST BE PLACED IN NEUTRAL.

10 Reconnect the transmission to the centre housing, as stated in Part 3.

TRANSMISSION EPICYCLIC

Removal and Refitment 4B-02-02

Figure 4
Special Tools Required: 270 Rail Trolley

Removal
1. Split the tractor between the transmission and the centre housing.
2. Remove the locking wire and peg from the HIGH/LOW shifter fork, then remove the fork and coupler.

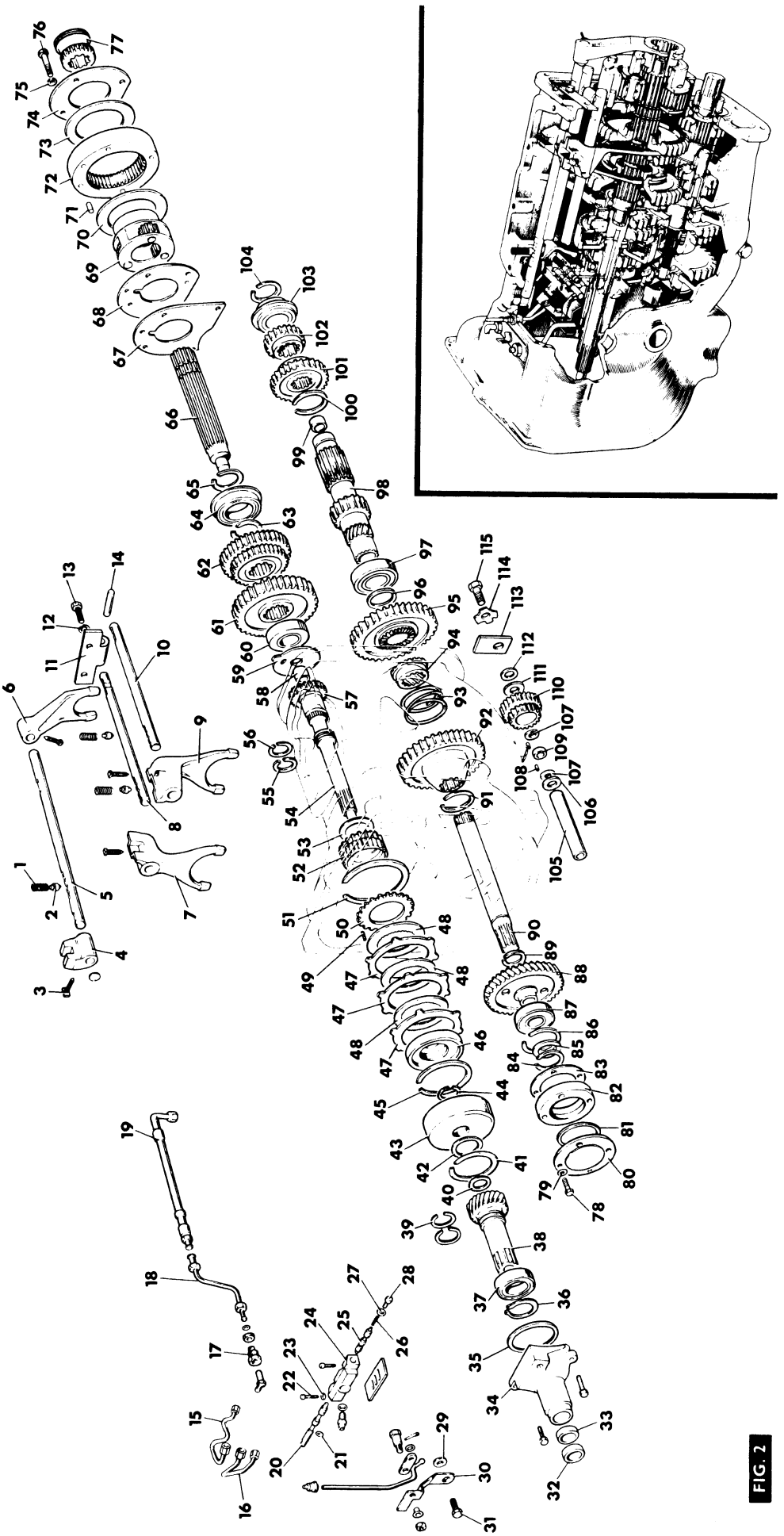

FIG. 2

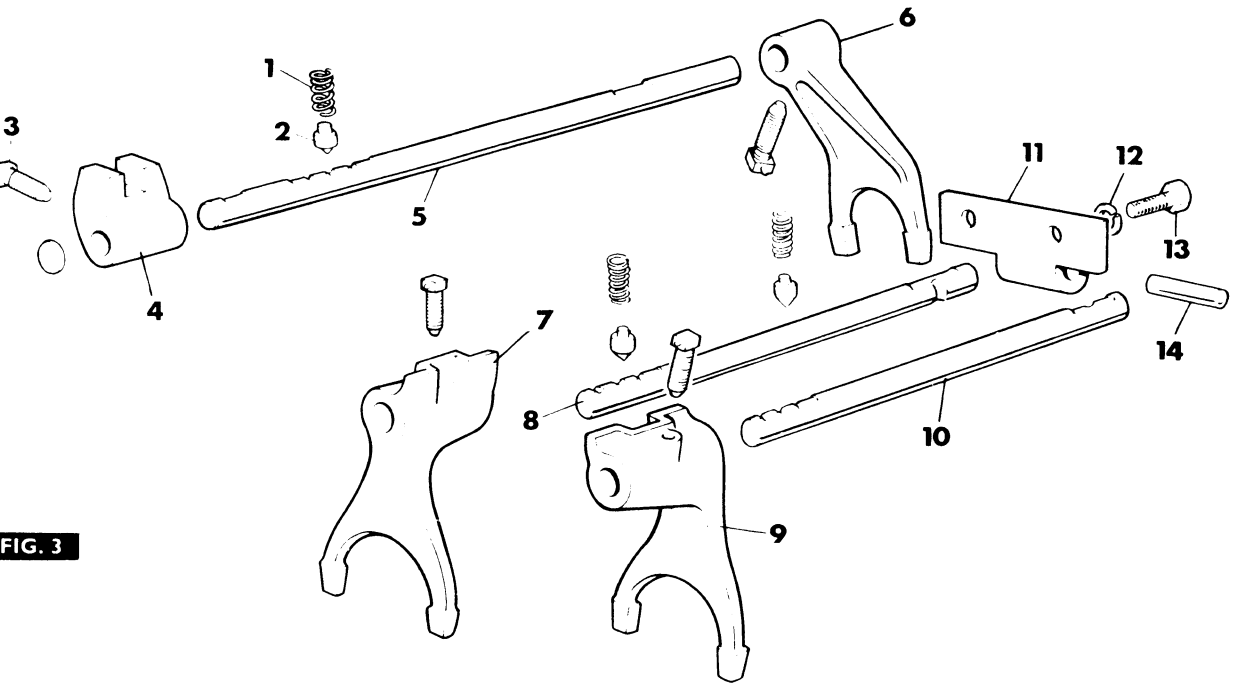
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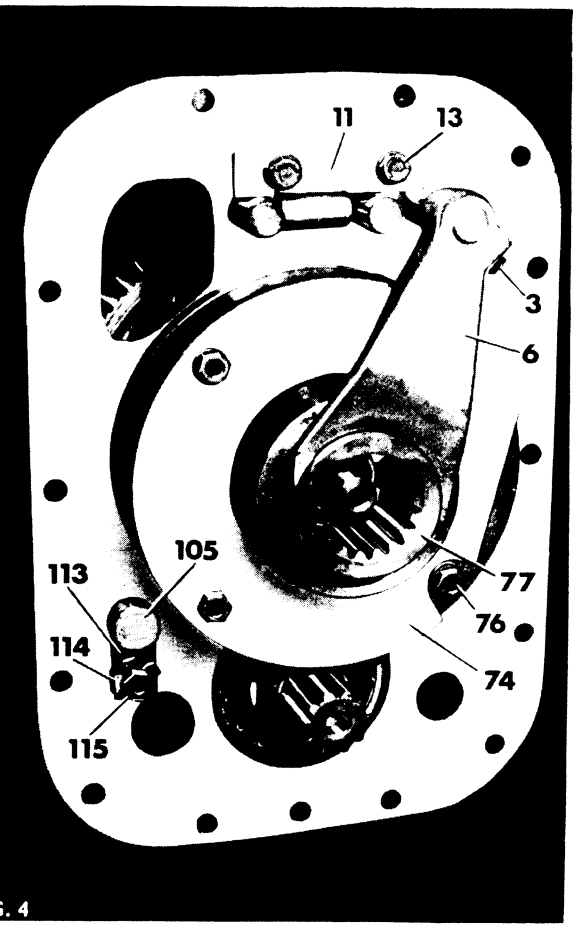
FIG. 3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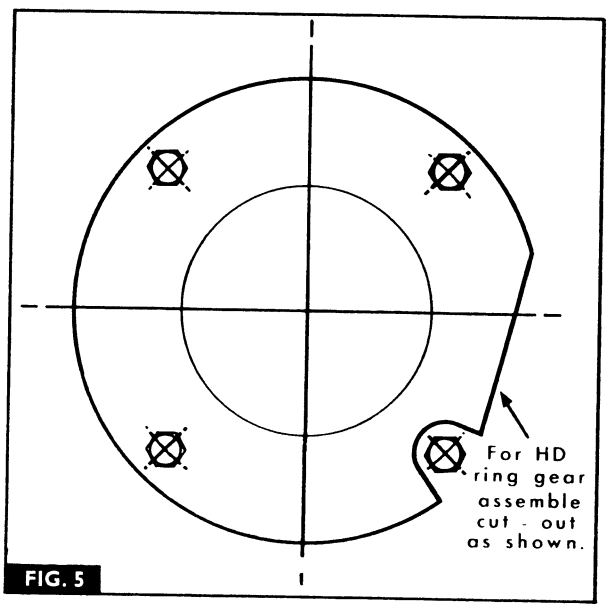
G. 4


For HD
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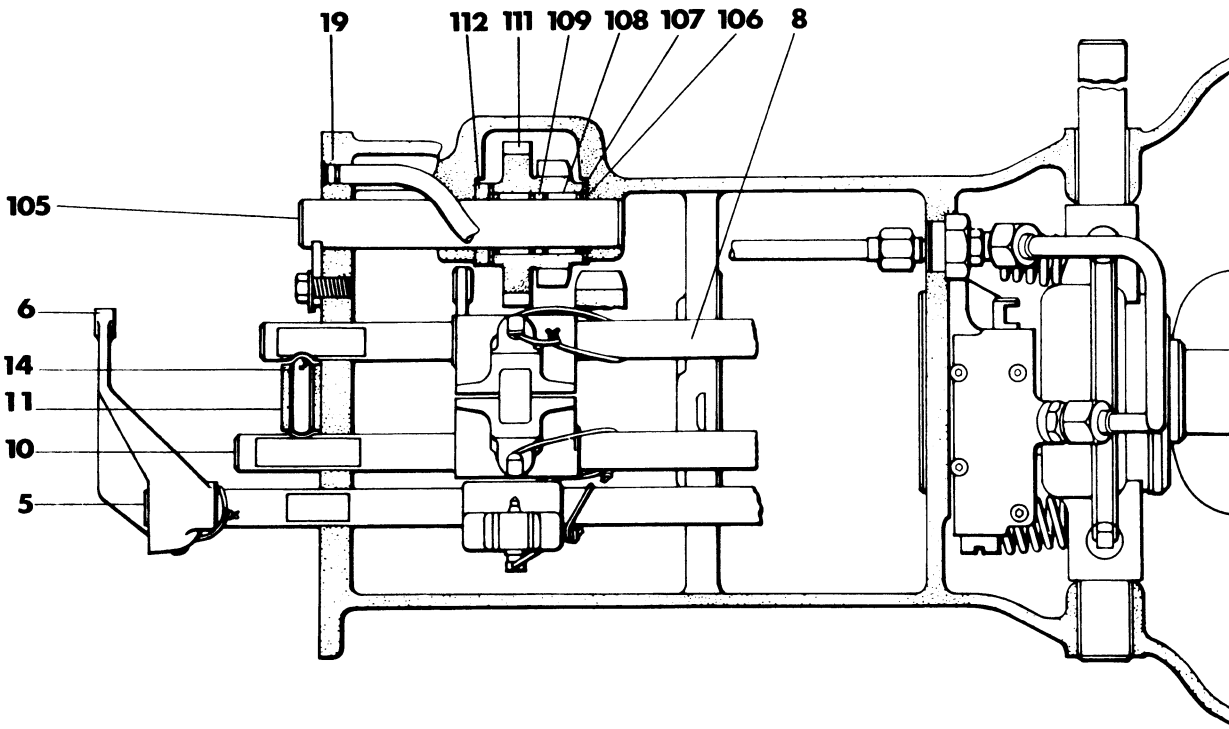
cut - out
as shown.

FIG. 5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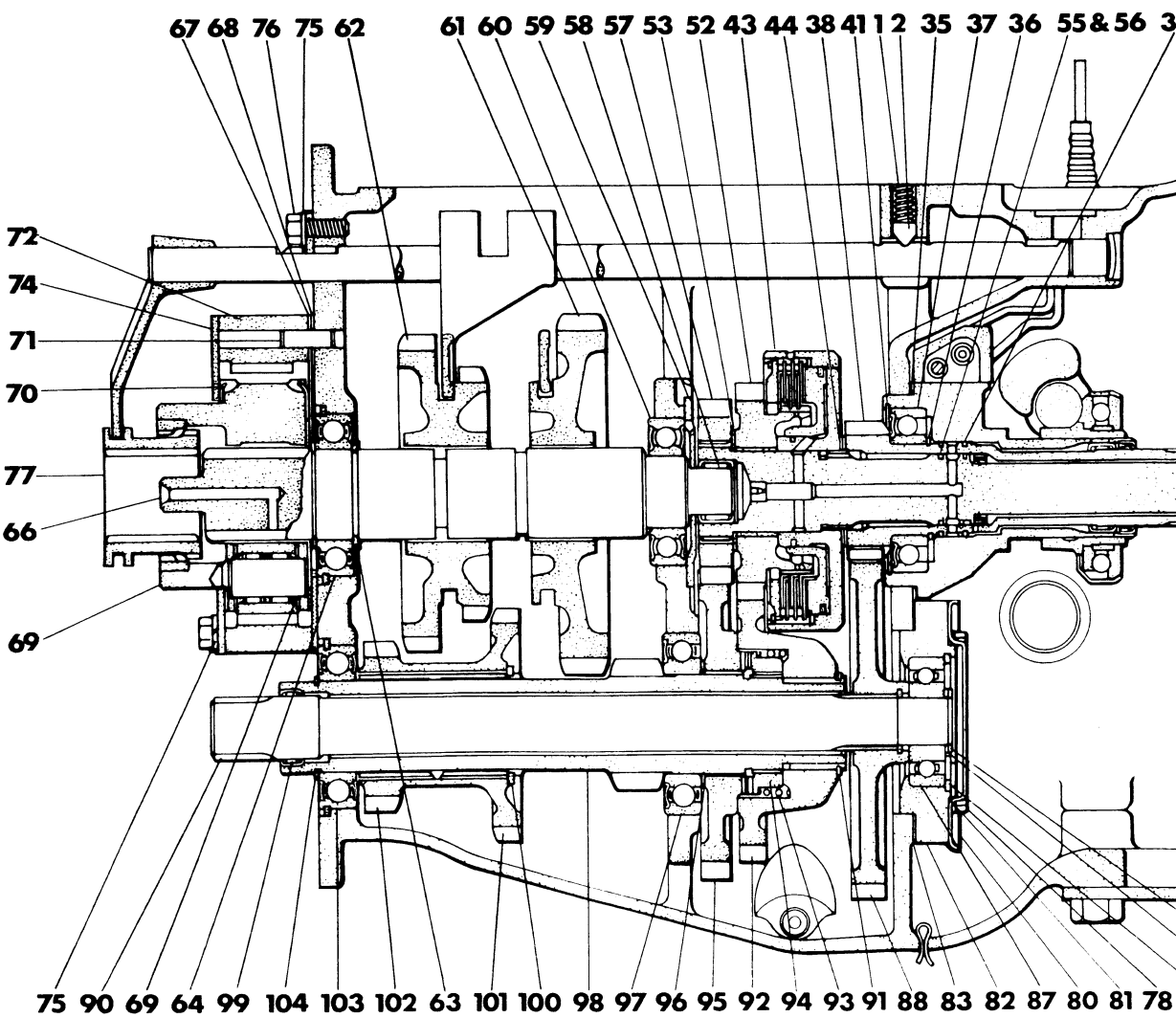
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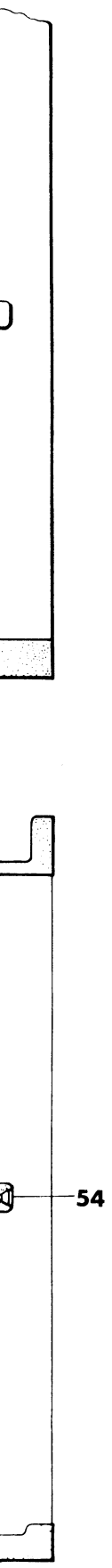


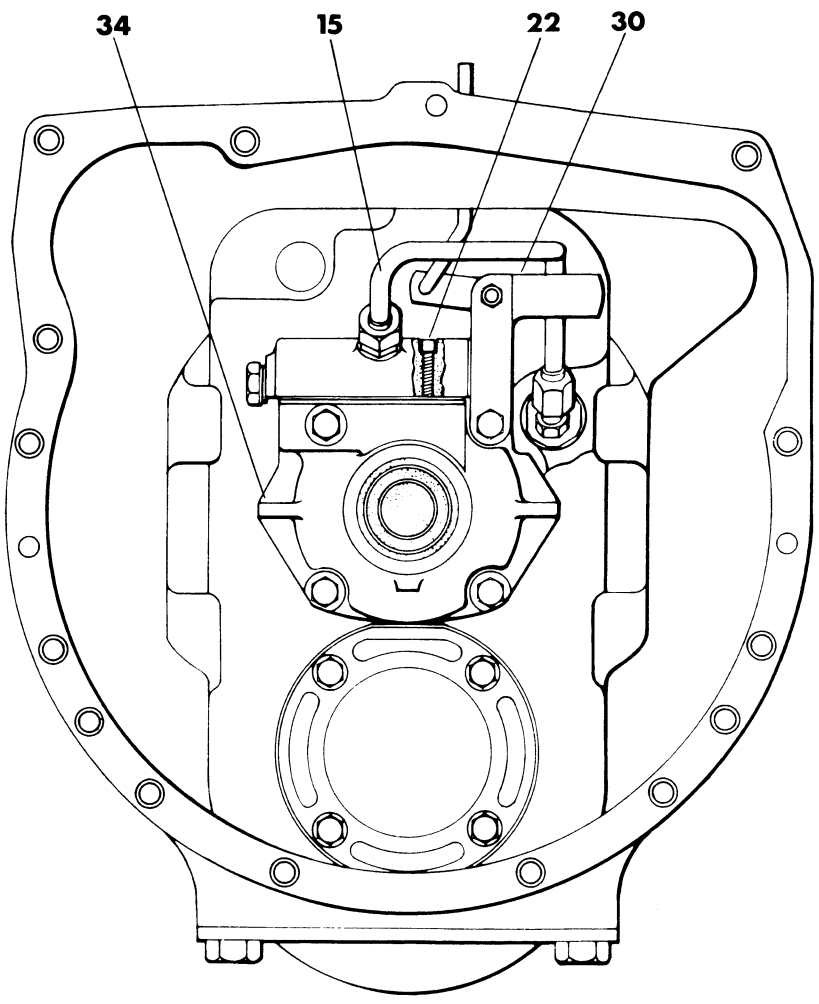


FIG. 1

3. Figure 4. Remove the four bolts (76) securing the transmission epicyclic unit, then remove the complete assembly.

Refitment

1. Figure 4. Refit the backplate (67) and the shims (68) to the dowels (71) on the ring gear (72), then locate the dowels in the holes in the transmission case. Fit the thrust washers (70 and 73) to the planetary pinion carrier (69) and locate the carrier in the ring gear. Refit the cover plate (74), as shown in Fig 5. Fit the four bolts (76) and tighten them progressively and evenly to a torque of 4,9 kg-m (35 lb ft).

NOTE – OMIT LOCKWASHER FROM LOWER LEFT HAND BOLT.

2. Refit the coupler and HIGH/LOW shifter fork, then refit the locking peg and locking wire.
3. Reconnect the transmission to the centre housing.

INPUT SHAFT HOUSING AND P.T.O. INPUT SHAFT

Removal and Refitment 4B-03-05

Special Tools Required: 270 Rail Trolley
MF 177 Seal Protector
MF 255B Oil Seal Replacer
MF 256A Oil Seal Replacer
MF 315 Needle Roller Bearing Removal and Refitting Tool.

Removal.

1. Remove the clutch release mechanism, as stated in operation 4A-03-05.
2. Fig 6. Remove the R.H. upper bolt (31) securing the Multi-Power shift linkage bracket (30) to the input housing, then remove the linkage by pulling the shifter rod downwards through the rubber bung in the top of the transmission case.
3. Disconnect the pipe (15) from the spool valve.

NOTE – IF THE TRACTOR IS FITTED WITH A LOW CAPACITY PUMP, THE COMPLETE PIPE MUST BE REMOVED (15 AND 16, FIG 6).

4. Remove the three remaining bolts (31) securing the input housing to the transmission case.
5. Fig 7. Withdraw the input housing (34), complete with the p.t.o. input shaft (38) from the transmission case.
6. Remove the four Allen screws (22) securing the spool valve (24) to the input housing.
7. Fig 8. Remove the large internal circlip (41) from the rear end of the input housing, then push the p.t.o. input shaft (38) out of the housing, complete with its bearing (37).
8. Lever the inner seal (40) out of the input shaft.
9. Carefully lever the front oil seal (32) from the front of the input housing with a screwdriver.
10. Fig 9A. Drive the needle roller bearing (33) out of the housing using special tool MF 315, as shown.
11. If the rear bearing (37) needs servicing remove the two rings (39) and the circlip (36) then press off the bearing.
12. Remove the 'O' ring (35) from the input housing.

Examine the bearings (33 and 37), the rings (39) and the input shaft gear teeth for signs of wear or damage and replace any defective components.

Always fit new seals (32 and 40) a new 'O' ring (35); also if possible, fit new circlip and snap ring (36 and 41).

Refitment

1. If necessary, press the bearing (37) on to the input shaft (38) (with the shield towards the gear teeth) and secure it with the circlip (36).
2. Fig 9B. Using special tool MF 315 drive the needle roller bearing (33) into the input housing.
3. Fig 10. Fit the new inner oil seal (40) to special tool MF 256A, then drive the seal fully into place.
4. Fig 11. Assemble special tool MF 255B, then slide the oil seal (32) (metal face first) on to the tool.
5. Remove the cone from the front of tool MF 255B.
6. Refit the two rings (39) to the input shaft (38), ensuring that the interlocking ends of the rings are properly engaged.
7. Slide the p.t.o. input shaft (38) into the housing, securing it with the large snap ring (41).
8. Carefully slide the special tool MF 255B on to the p.t.o. input shaft, then drive the seal (32) fully into place.
9. Refit the spool valve (24) to the input housing with the four Allen screws (22) and lockwashers.
10. Fit a new 'O' ring (35) to the rear spigot of the input housing.
11. Fit the seal protector MF 177 on the fron of the main input shaft (54), then carefully slide the input housing assembly into place.
12. Fig 6. Refit three bolts (31), but not the R.H. upper bolt.

NOTE – THE BOLT THREADS MUST BE COATED WITH HYLOMAR SQ32M SEALING COMPOUND.

13. Reconnect the pipe (15) to the spool value; OR, if the tractor is fitted with a low capacity pump, refit the complete pipe (15 and 16).
14. Push the Multi-Power shifter rod upwards through the rubber boot in the top of the transmission case, then locate and secure the shift linkage bracket (30) to the input housing, with the R.H. upper bolt.

NOTE – COAT THE BOLT THREAD WITH HYLOMAR SQ32M SEALING COMPOUND.

15. Refit the clutch release mechanism, as stated in operation 4A-03-05.

P.T.O. DRIVESHAFT FRONT BEARING

Removal and Refitment 4B-04-05

Special Tools Required:

270 Rail Trolley
MF 218A P.t.o. Driveshaft puller
Two ⅜ UNC x 75 mm (3 in) Bolts

MULTI-POWER TRANSMISSION

Removal
1. Split the tractor between the engine and gearbox.
2. Figure 12. Remove the bolt, nut and lockwasher (A) securing the left brake cross shaft lever. Remove the lever and key (B) from the shaft.
3. Withdraw the shaft, complete with pedals from the right hand side of the transmission housing.
4. Remove the four bolts (78) securing the cover plate (80).
5. Figure 13. Remove the circlip (84) and the thrust washer (85).
6. Screw two ⅜ UNC x 75 mm (3 in) bolts into the tapped holes in the bearing housing (82). Progressively and evenly tighten the bolts until the housing is extracted.
7. Remove the 'O' ring (81) from the bearing housing.
8. If the bearing (87) needs servicing, remove the circlip (86) and press out the bearing (87).

When refitting, always fit a new 'O' ring (81) and gasket (83), also fitting new circlips (84 and 86), if possible.

Refitment
1. Refit the p.t.o. driveshaft front bearing (87) to its housing (82) and secure it with the circlip (86).
2. Refit the housing (82) together with a new gasket (83) into the transmission case.
3. Pull the p.t.o. driveshaft (90) into its bearing (87) by using special tool MF 218A.
4. Figure 13. Secure the p.t.o. driveshaft with the thrust washer (84) and the circlip (85).
5. Using a new 'O' ring (81) refit the front cover plate (80).

NOTE – WHEN REFITTING THE COVER PLATE AND THE BOLTS (78) USE SEALING COMPOUND 'HYLOMAR COMPOUND SQ 32M' TO SEAL THE PLATE AND BOLT THREADS.

6. Refit the brake pedal and cross shaft assembly to the transmission case, from the right hand side.
7. Figure 12. Refit the lever and key to the brake cross shaft, then re-tighten the nut and bolt.
8. Reconnect the gearbox.

MAIN INPUT SHAFT

Removal and Refitment 4B-05-06

Removal
1. Remove the mainshaft, as stated in operation 4B-06-06.
2. Fig 14. Remove the tab located spacer (59), from the rear of the main input shaft.
3. Drive the main input shaft (54) rearwards out of the gearbox, removing the thrust washer (42) Multi-Power clutch (43) centre thrust washer (53) and the main drive pinion (57) as the shaft is withdrawn through them.
4. Remove the input overdrive pinion (52) from the Multi-Power clutch.
5. Remove the two rings (55 and 56) from the main input shaft.
6. If necessary, remove the needle roller bearing (58) from the rear end of the main input shaft.

Examination.
Check the condition of all components for wear, scoring, chipping, or any other damage. Any defective components must be replaced.
On reassembly, always fit new thrust washers (42 and 53) and new sealing rings (55 and 56).

Reassembly.
1. Fig 14. If necessary, fit a new needle roller bearing (58) to the rear of the main input shaft.
2. Fit the two new sealing rings (55 and 56) to their grooves in the main input shaft.
3. Refit the input overdrive gear (52) to the Multi-Power clutch.
4. Fit the main input shaft (54) into the gearbox from the rear, locating the main input gear (57) and thrust washer (53), then the clutch and overdrive assembly, locating the main input gear and the clutch on their relevant splines.
5. Refit the front thrust washer (42) on the splines, with the steel face towards the clutch.
6. Refit the tab located spacer (59) with its convex face towards the main input shaft and locating the tab in the centre web of the gear box.
7. Refit the mainshaft, as stated in operation 4B-06-06.

FIRST/REVERSE GEAR, SECOND/THIRD GEAR AND MAINSHAFT

Removal and Refitment 4B-06-06
Special Tools Required: MF200 Hand Press
MF200-25 Adapter.

Removal.
1. Remove the shifter rail mechanism, as stated in operation 4B-01-02.
2. Remove the transmission epicylic unit, as stated in operation 4B-02-02.
3. Fig 15. Pull the mainshaft (66) rearwards to release the mainshaft fron bearing (60) from the centre web in the gearbox.
4. Tilt the mainshaft upwards and drive off the bearing.
5. Withdraw the mainshaft rearwards and slide off the first/reverse gear (61) and the second/third gear (62).
6. Fig 16. Remove the circlip (63) from the mainshaft, then press off the bearing (64) using hand press MF 200 with the MF 200-25 adapter. Remove the rear circlip (65).

WARNING – DO NOT ATTEMPT TO PRESS THE BEARING OFF THE REAR END OF THE MAINSHAFT. AS THE GEAR TEETH ARE OF A LARGER DIAMETER THAN THE SHAFT SPLINES.

Refitment.
1. Refit the rear snap ring (65) to the mainshaft (66), then press on the bearing (64) using Hand Press MF 200 and adapter MF 200-25. Refit the second snap ring (63).
2. Refit the mainshaft front bearing (60) to its web in the gearbox.
3. Slide the mainshaft into the gearbox from the rear, locating the second/third gear (62) and the first/reverse gear (61) on the splines.

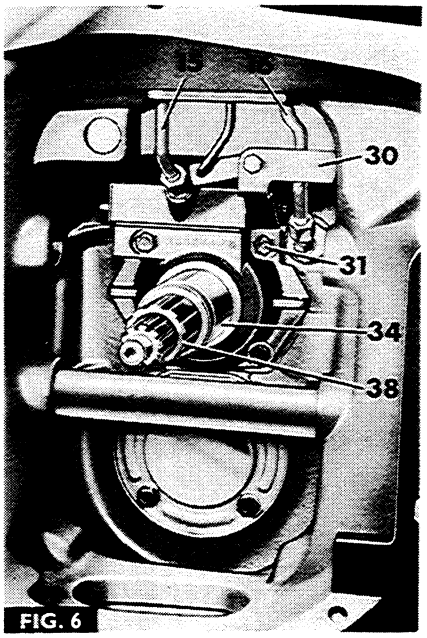


FIG. 6

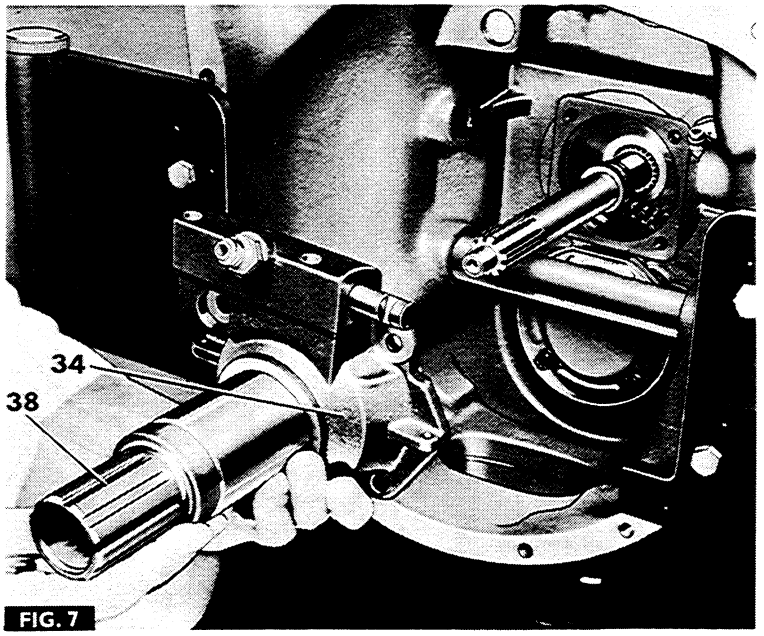


FIG. 7

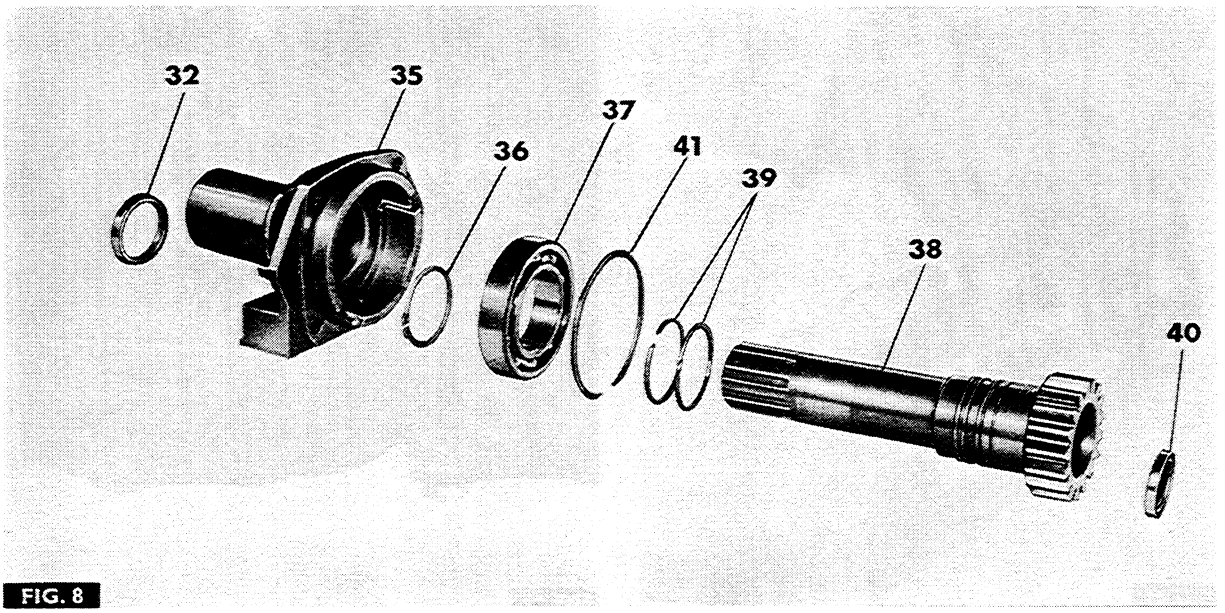


FIG. 8

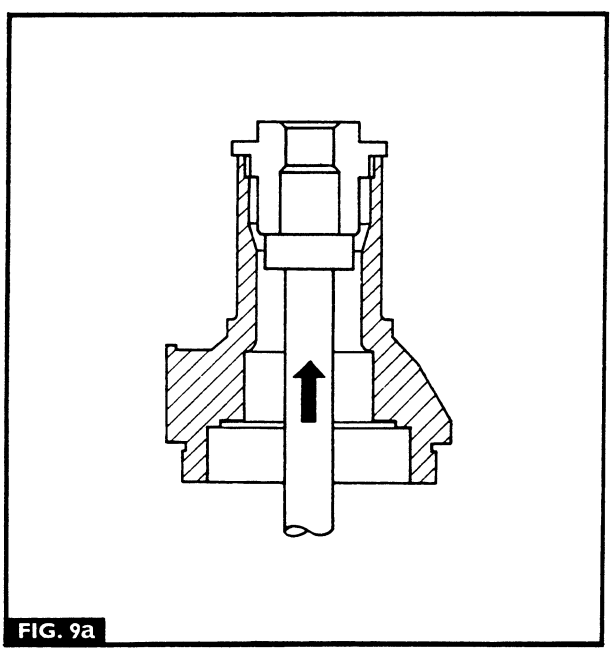


FIG. 9a

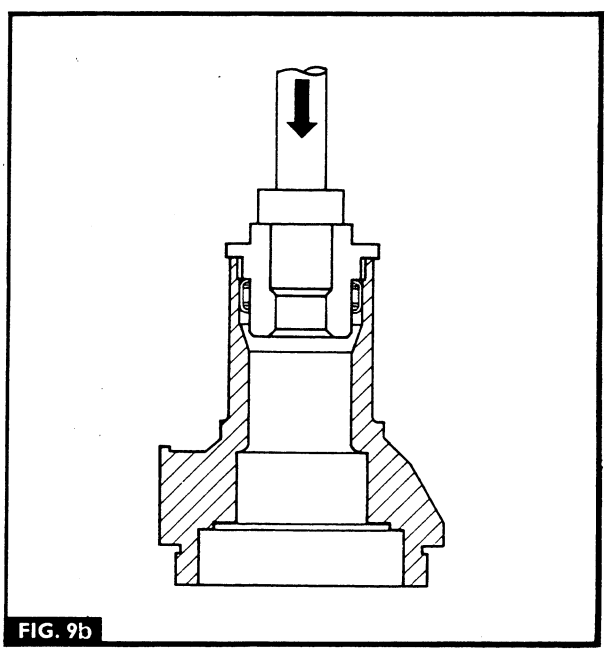


FIG. 9b

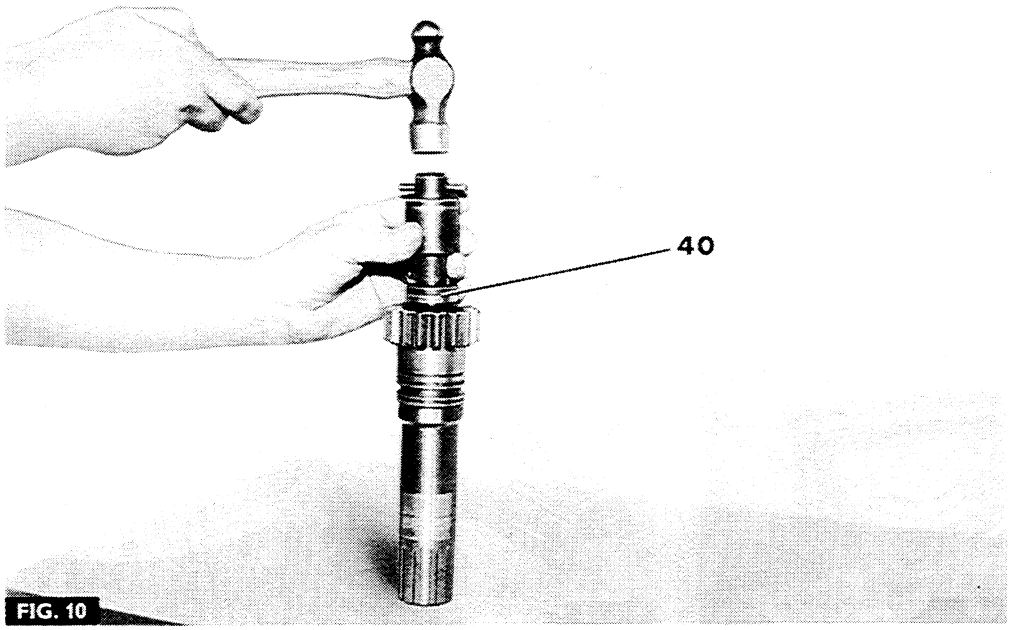


FIG. 10


FIG. 11

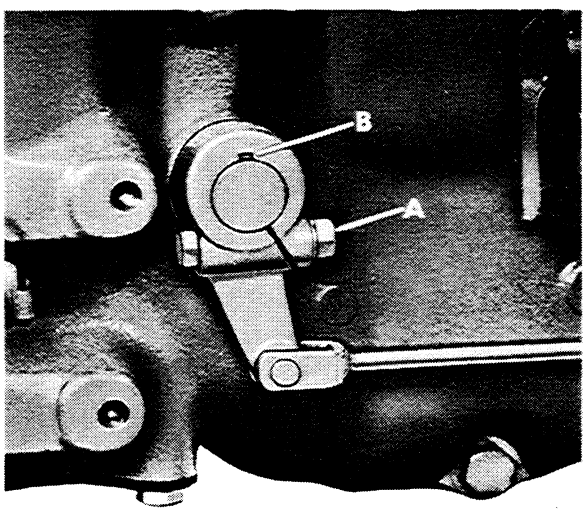


FIG. 12

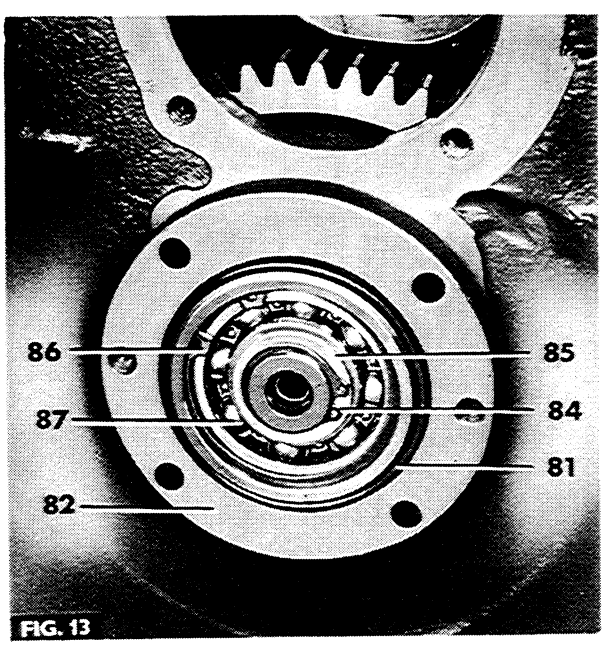


FIG. 13

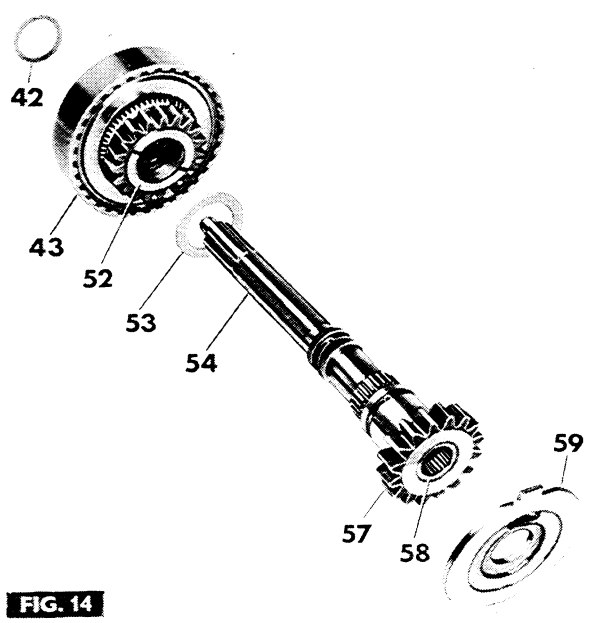


FIG. 14

4. Drive the mainshaft forwards, fully locating it in the front bearing (60) and the needle roller bearing in the rear end of the main input shaft.
5. Refit the transmission epicyclic unit, as stated in operation 4B-02-02.
6. Refit the shifter rail mechanism, as stated in operation 4B-01-02.

LAYSHAFT AND LAYSHAFT GEAR

Removal and Refitment. 4B-07-09

Removal.

1. Remove the main input shaft, as stated in operation 4B-05-06
2. Remove the p.t.o. driveshaft front bearing, as stated in operation 4B-04-05.
3. Remove the p.t.o. Driveshaft (90) by withdrawing it rearwards, then lift out the p.t.o. constant mesh gear (88).
4. Remove the rear snap ring (104) from the rear end of the layshaft.
5. Fig 17. Drive the layshaft forwards, as shown, then move the snap ring (100) on to the unsplined portion of the layshaft.
6. Remove the snap ring (91) from the front end of the layshaft.
7. Fig 18. Drive the layshaft forwards, removing the overdrive layshaft gear (92), spring (93) coupler (94) main drive layshaft gear (95) and thrust washer (96).
8. Locating the layshaft rear bearing (103) in the gearbox, drive the layshaft forwards out of the gearbox, complete with the centre bearing (97).
9. Remove the second (102) and third speed (101) layshaft fears from the transmission case.
10. If necessary, remove the circlip (100) from the layshaft, press off the bearing (97), using Hand Press MF 200 and adapter MF 200-25, and remove the layshaft rear bearing (103) from the gearbox case.

Examination.

Check the condition of all components for wear, scoring, chipping or other damage, particularly the following:

All gear teeth

The coupler splines and teeth

The main input gear coupler teeth.

The coupler spring.

The coupler spring should have a free length of 47,5 mm (1.87 in), a compressed length of 16,5 mm (0.65 in) and a maximum load of 10,2 kg (22.5 lb) when compressed. Any defective components must be replaced. When reassembling, if possible, always use new snap rings (91, 100 and 104) and a new thrust washer (96).

Refitment

1. Fig 18. If necessary, press the centre bearing (97) on to the layshaft.
2. Fit a new snap ring (100) on to the layshaft, temporarily placing it on the unsplined portion of the shaft, adjacent to the first gear teeth.
3. Slide the layshaft into the gearbox from the front, locating the third (101) and second speed (102) gears on the splines.
4. Push the layshaft rearwards sufficiently far to permit fitment of the new thrust washer (96) the main input gear (95), the coupler (94), spring (93) and overdrive gear (92), then refit the front snap ring (91).
5. Pull the layshaft forwards to permit fitment of the snap ring (100) in the groove adjacent to the third speed gear (101).
6. Refit the layshaft rear bearing (103) then drive the layshaft fully rearwards and refit the rear snap ring (104). Ensure that the rear bearing is fully located. The layshaft is shown fully assembled in Fig 19.
7. Refit the p.t.o. constant mesh gear (88) into the transmission case, then refit the p.t.o. driveshaft (90).
8. Refit the p.t.o. driveshaft front bearing, as stated in operation 4B-04-05.
9. Refit the main input shaft as stated in operation 4B-05-06.

REVERSE GEAR

Removal and Refitment. 4B-08-09

Removal

1. Remove the mainshaft as stated in operation 4B-06-06.
2. Figure 4 Release the tabwasher (114), then remove the bolt (115) and plate (113).
3. Using a dummy shaft to prevent the needle rollers from falling into the transmission case remove the reverse gear cluster (110) thrust washers (106 and 111) and distance piece (112).

Refitment

1. Using petroleum jelly refit the two sets of needle rollers 108) with a spacer (109) between the rows and a retaining ring (107) at each end. A smear of petroleum jelly can be used to make the thrust washers (106 and 111) and the distance piece (112) adhere to the end face of the gear cluster.
2. Insert the dummy shaft to the reverse gear cluster.
3. Figure 19. Refit the gear cluster assembly to the transmission case, then insert the shaft (105) from the rear and push out the dummy shaft.
4. Figure 4. Refit the plate (113) a new tabwasher (114) and the bolt (115) Bend up the tabwasher. The assembled dear cluster is shown in Fig 19.
5. Refit main shaft as stated in operation 4B-06-06.

MULTI-POWER CLUTCH UNIT SERVICING.

Removal. 4B-09-09

1. Remove the clutch unit, by removing the main input shaft, as stated in operation 4B-05-06.
2. Fig 20. Place the clutch assembly on a flat surface, push down the retainer plate (50) and remove the snap ring (51).
3. Remove the retainer plate (50), three friction discs (48), three interplates (47) and the six return springs (49).
4. Slide the piston (46) out of the clutch housing (43).
5. If necessary, remove the piston ring (45) from the piston.

Examination.
Check the condition of all components for signs of wear, scoring, damage, distortion or overheating. Check the friction plates (48) for the following dimensional tolerances:

Thickness 2,41 to 2,59 mm (0.095 to 0.102 in)
Maximum Height (permissible distortion) 2,92 mm (0.115 in)
Groove Depth 0,38, to 0,63 mm (0.015 to 0.025 in)

Check the interplates (47) as follows:

Thickness 1,67 to 1,75 mm (0.66 to 0.69 in)
Maximum Dish 0,25 mm (0.010 in)

Maximum Height (permissible distortion) 2,21 mm (0.0875 in)
Check the six coil springs (49) as follows:

Free Length 17,8 mm (0.70 in)
Working Length 12,7 mm (0.50 in)

Load at Working Length 2,98 to 3,64 kg (6.57 to 8.03 lb).

Replace any worn or damaged components, as required.

Reassembly.
1. If necessary, refit the piston ring (45) to the piston.
2. Fig 21. Compressing the piston rings, as shown, refit the piston to the housing
3. Fig 22. Fit one interplate (47) to the clutch housing, with the lugs on the interplate located in the housing splines immediately to the right of the six holes in the housing.
4. Fig 22. Fit the six springs (49) as shown, placing them on the interplate lugs.
5. Fig 23. Refit the three friction plates and the remaining two interplates alternately, locating the lugs on each interplate one spline further to the right of one previously fitted.

NOTE: – THE SPRINGS MUST ONLY CONTACT THE FIRST INTERPLATE.

6. Fig 24. Refit the retainer plate (50) and the snap ring (51).
7. Refit the Multi-Power clutch and refit the main input shaft, as stated in operation 4B-05-06.
8. Test the assembled Multi-Power system, as stated in Part 7B.

MULTI-POWER SPOOL VALVE SERVICING.

Removal. 4B-10-10
1. Remove the input housing and p.t.o. input shaft, as stated in items 1 to 6 of operation 4B-03-05.
2. Remove the four Allen screws (22) securing the spool valve (24) to the input housing.
3. Remove the old gasket from the top face of the input housing, or the underside of the spool valve block.
4. Fig 25. Withdraw the actuating spool (20) from the spool block (24).
5. Remove the screw (28) from the end of the spool block, then withdraw the spring (26) and the spool (25).

Examine the spools (20 and 25) and the spool block (24) for scoring, pitting and wear and replace if necessary.

Refitment.
1. Place the spool (25) into the spool block (24), then the spring (26) and secure with a new washer (27) and screw (28).
2. Place the adjusting spool (20) with a new seal (21) into the spool block.
3. Fit a new gasket into position on the spool block and refit the block to the input housing.
4. Secure the spool block with the four Allen screws (22).
5. Refit the input housing as stated in operation 4B-03-05.

TRANSMISSION CASE

Removal and Refitment or Complete Gearbox Overhaul 4B-11-10
Special Tools Required:

MF 177 Seal Protector
MF 200 Hand Press
MF 200-25 Adapter
MF 218A P.t.o. Driveshaft Puller
MF 255B Oil Seal Protector
No. 270 Rail Trolley
2 ⅜ UNC x 75 mm (3 in) Bolts

Disassembly
1. Remove the clutch release mechanism, as stated in operation 4A-03-05.
2. Split the tractor between the gearbox and centre housing as stated in Part 3.
3. Remove the gearbox top cover, in unit with the instrument panel, as stated in Part 3.
4. Fig 3. Release the locking wire from the 1st/rev. and 2nd/3rd shift rails (8, 10), and from the rear end of the HIGH/LOW shift rail (5).
5. Fig 4. Remove the locking peg (3) from the HIGH/LOW shift fork (6), detach the fork (6) and coupler (77).
6. Remove the gear lever stop plate (11) and interlock pin (14), secured by two bolts (13) and spring washers (12).
7. Lift out the three shift rail springs (1), and plungers (2).
8. Remove the locking pegs (3) from the 1st/rev. and 2nd/3rd shift forks (8, 10).
9. Slide the 1st/rev. and 2nd/3rd shift rails (8, 10), rearwards out of the transmission housing. Lift Lift out the 1st/rev. and 2nd/3rd shift forks (7, 9).
11. Release the locking wire and remove the locking peg (3) from the HIGH/LOW shift selector (4).
12. Slide the HIGH/LOW shift rail (5), rearwards out of the transmission housing. Lift out the HIGH/LOW SHIFT SELECTOR (4).

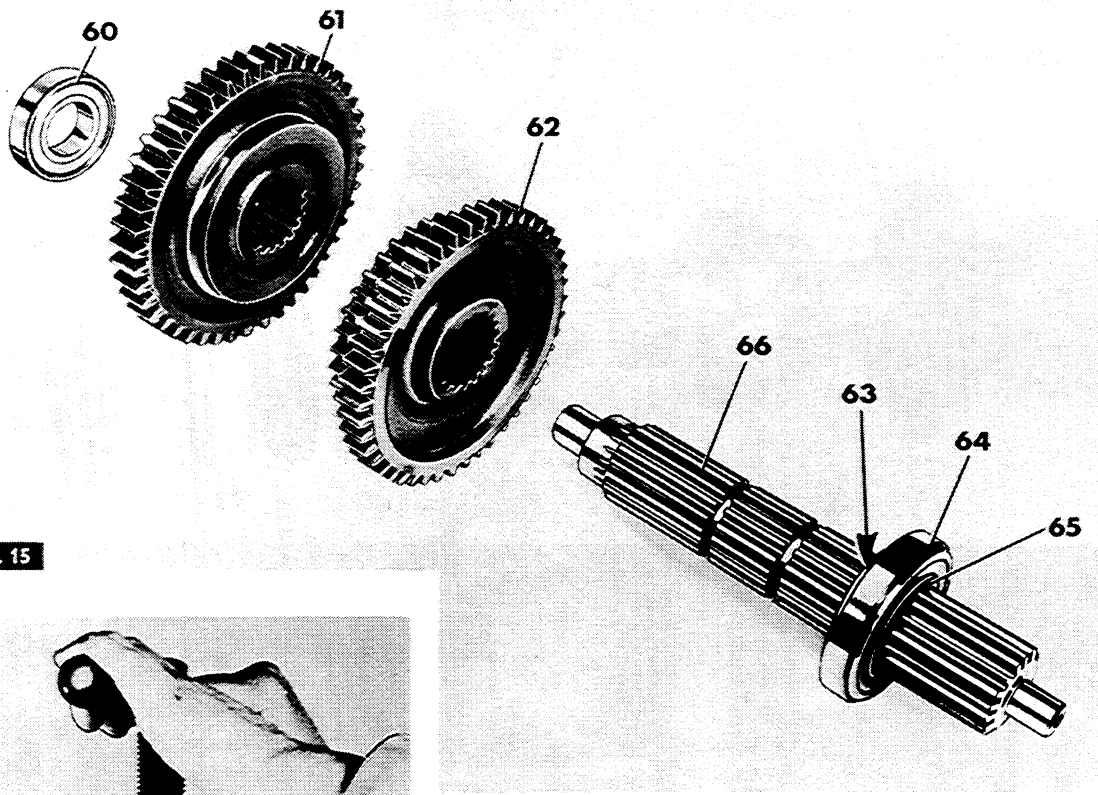


FIG. 15

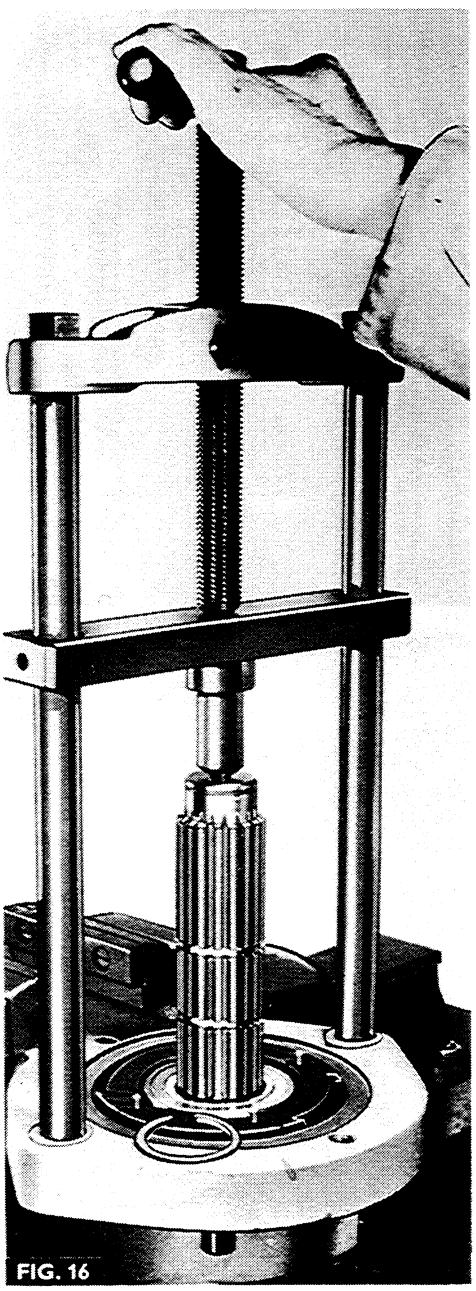


FIG. 16

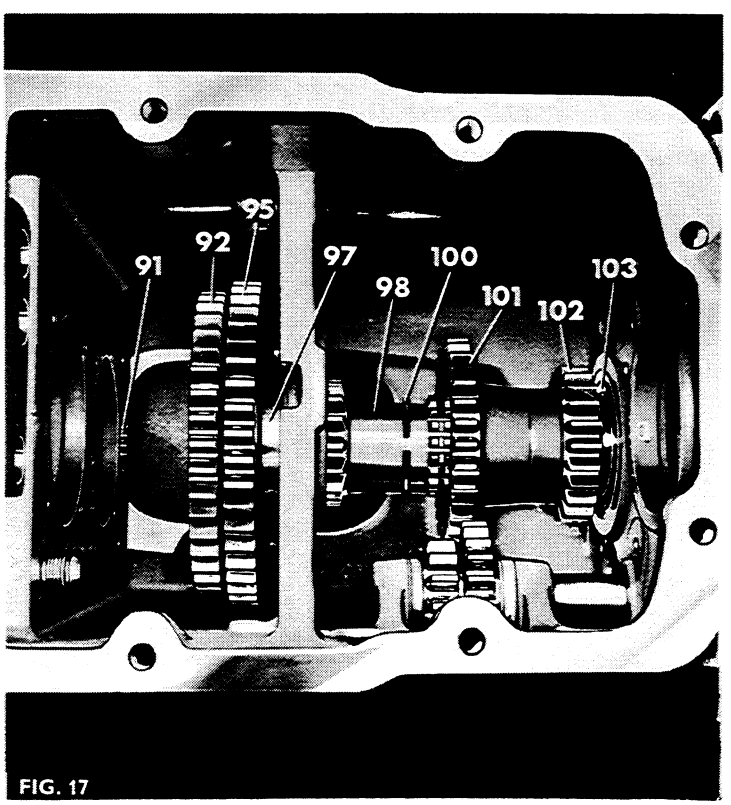


FIG. 17

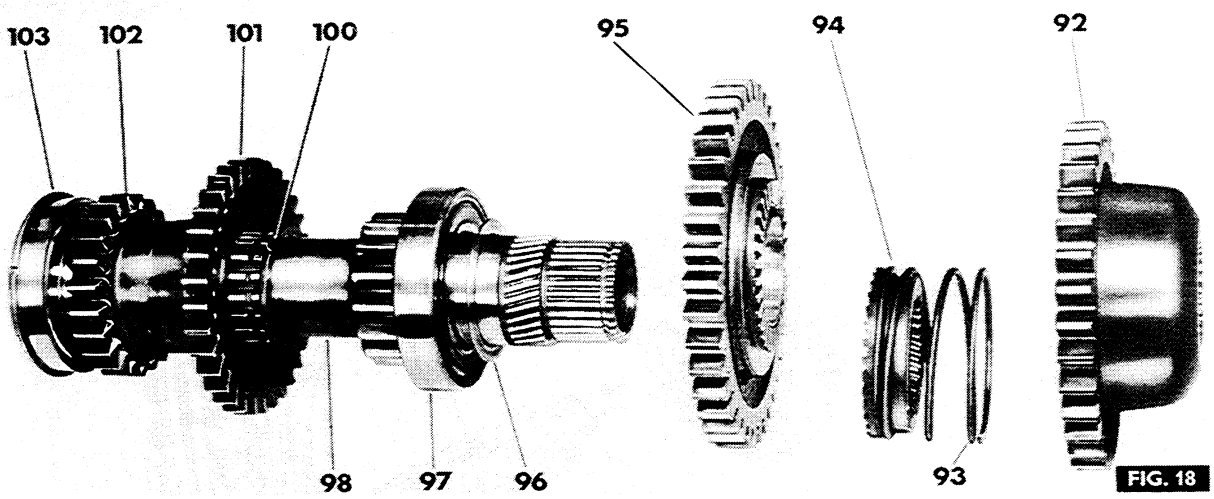


FIG. 18

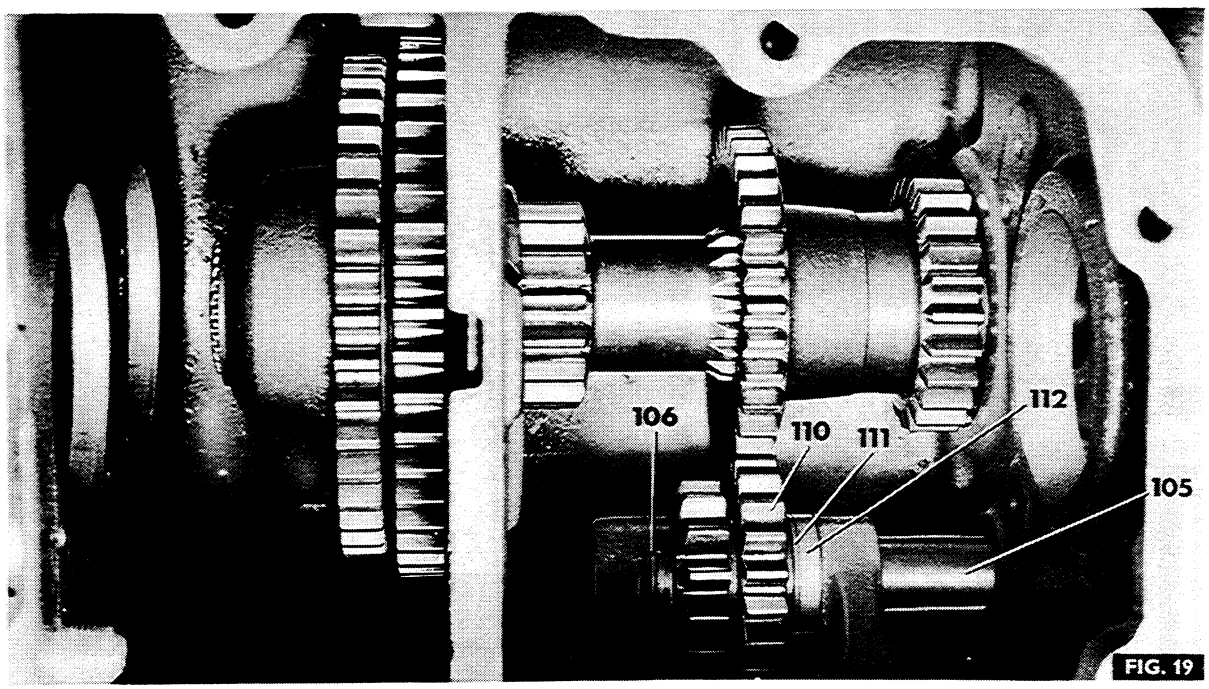


FIG. 19

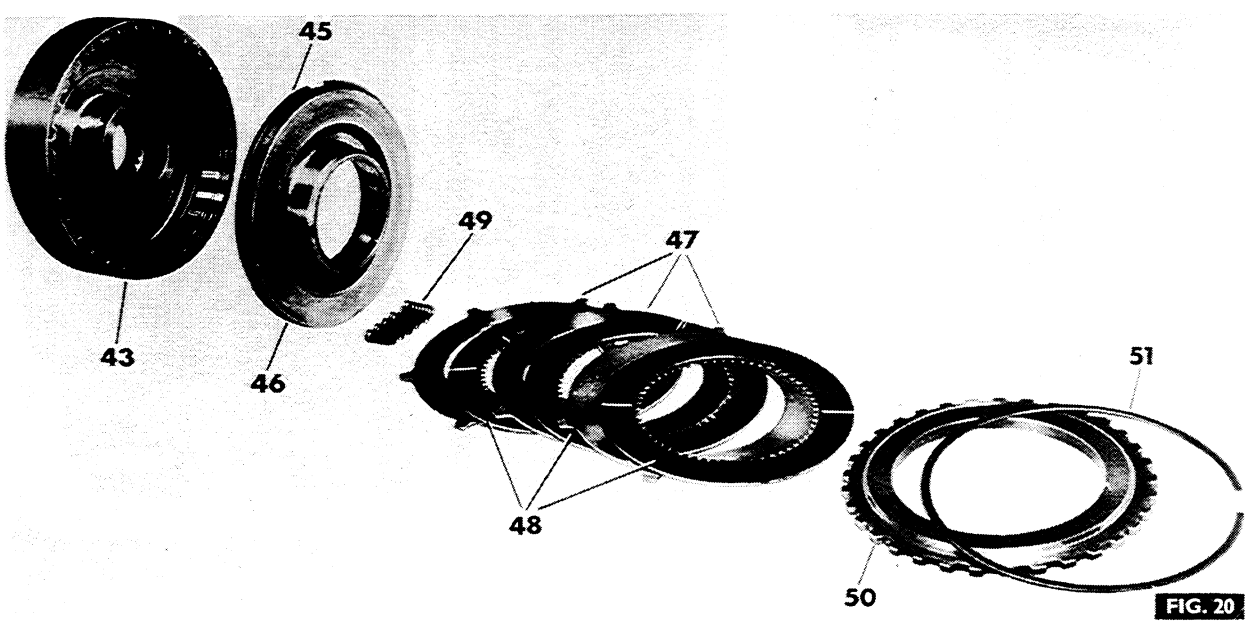


FIG. 20

13. Figure 4. Remove the four bolts (76) securing the transmission epicyclic unit, then remove the complete assembly.
14. Fig 6. Remove the R.H. upper bolt (31) securing the Multi-Power shift linkage bracket (30) to the input housing, then remove the linkage by pulling the shifter rod downwards through the rubber bung in the top of the transmission case.
15. Disconnect the pipe (15) from the spool valve.

NOTE – IF THE TRACTOR IS FITTED WITH A LOW CAPACITY PUMP, THE COMPLETE PIPE MUST BE REMOVED (15 AND 16, FIG 6).

16. Remove the three remaining bolts (31) securing the input housing to the transmission case.
17. Fig 7. Withdraw the input housing (34), complete with the p.t.o. input shaft (38) from the transmission case.
18. Remove the four Allen screws (22) securing the spool valve (24) to the input housing.
19. Fig 8. Remove the large internal circlip (41) from the rear end of the input housing, then push the p.t.o. input shaft (38) out of the housing, complete with its bearing (37).
20. Lever the inner seal (40) out of the input shaft.
21. Carefully lever the front oil seal (32) from the front of the input housing with a screwdriver.
22. Fig 9A. Drive the needle roller bearing (33) out of the housing using special tool MF 315, as shown.
23. If the rear bearing (37) needs servicing remove the two rings (39) and the circlip (36) then press off the bearing.
24. Remove the 'O' ring (35) from the input housing.
25. Figure 12. Remove the bolt, nut and lockwasher (A) securing the left brake cross shaft lever. Remove the lever and key (B) from the shaft.
26. Withdraw the shaft, complete with pedals from the right hand side of the transmission housing.
27. Remove the four bolts (78) securing the cover plate (80).
28. Figure 13. Remove the circlip (84) and the thrust washer (85).
29. Screw two ⅜ UNC x 75 mm (3 in) bolts into the tapped holes in the bearing housing (82).
30. Progressively and evenly tighten the bolts until the housing is extracted.
31. Remove the 'O' ring (81) from the bearing housing.
32. If the bearing (87) needs servicing, remove the circlip (86) and press out the bearing (87).
33. Fig 15. Pull the mainshaft (66) rearwards to release the mainshaft front bearing (60) from the centre web in the gearbox.
34. Tilt the mainshaft upwards and drive off the bearing.
35. Withdraw the mainshaft rearwards and slide off the first/reverse gear (61) and the second/third gear (62).
36. Fig 16. Remove the circlip (63) from the mainshaft, then press off the bearing (64) using hand press MF 200 with the MF 200-25 adapter. Remove the rear circlip (65).

WARNING – DO NOT ATTEMPT TO PRESS THE BEARING OFF THE REAR END OF THE MAINSHAFT. AS THE GEAR TEETH ARE OF A LARGER DIAMETER THAN THE SHAFT SPLINES.

37. Fig 14. Remove the tab located spacer (59), from the rear of the main input shaft.
38. Drive the main input shaft (54) rearwards out of the gearbox, removing the thrust washer (42) Multi-Power clutch (43) centre thrust washer (53) and the main drive pinion (57) as the shaft is withdrawn through them.
39. Remove the input overdrive pinion (52) from the Multi-Power clutch.
40. Remove the two rings (55 and 56) from the main input shaft.
41. If necessary, remove the needle roller bearing (58) from the rear end of the main input shaft.
42. Remove the p.t.o. Driveshaft (90) by withdrawing it rearwards, then lift out the p.t.o. constant mesh gear (88).
43. Remove the rear snap ring (104) from the rear end of the layshaft.
44. Fig 17. Drive the layshaft forwards, as shown, then move the snap ring (100) on to the unsplined portion of the layshaft.
45. Remove the snap ring (91) from the front end of the layshaft.
46. Fig 18. Drive the layshaft forwards, removing the overdrive layshaft gear (92), spring (93) coupler (94) main drive layshaft gear (95) and thrust washer (96).
47. Locating the layshaft rear bearing (103) in the gearbox, drive the layshaft forwards out of the gearbox, complete with the centre bearing (97).
48. Remove the second (102) and third speed (101) layshaft fears from the transmission case.
49. If necessary, remove the circlip (100) from the layshaft, press off the bearing (97), using Hand Press MF 200 and adapter MF 200-25, and remove the layshaft rear bearing (103) from the gearbox case.
50. Fig 20. Place the clutch assembly on a flat surface, push down the retainer plate (50) and remove the snap ring (51).
51. Remove the retainer plate (50), three friction discs (48), three interplates (47) and the six return springs (49).
52. Slide the piston (46) out of the clutch housing (43).
53. If necessary, remove the piston ring (45) from the piston.
54. Figure 4 Release the tabwasher (114), then remove the bolt (115) and plate (113).
55. Using a dummy shaft to prevent the needle rollers from falling into the transmission case, remove the reverse gear cluster (110) thrust washers (106 and 111) and distance piece (73).
56. Remove the old gasket from the top face of the input housing, or the underside of the spool valve block.
57. Fig 25. Withdraw the actuating spool (20) from the spool block (24).
58. Remove the screw (28) from the end of the spool block, then withdraw the spring (26) and the spool (25).

Examination.

Check the condition of all components for signs of wear, scoring, damage, distortion or overheating.

The coupler spring should have a free length of 47,5 mm (1.87 in), a compressed length of 16,5 mm (0.65 in) and a maximum load of 10,2 kg (22.5 lb) when compressed. Any defective components must be replaced. When reassembling, if possible, always use new snap rings (91, 100 and 104) and a new thrust washer (96).

Check the friction plates (48) for the following dimensional tolerances:

Thickness 2,41 to 2,59 mm (0.095 to 0.102 in)
Maximum Height (permissible distortion) 2,92 mm (0.115 in)
Groove Depth 0,38, to 0,63 mm (0.015 to 0.025 in)

Check the interplates (47) as follows:

Thickness 1,67 to 1,75 mm (0.66 to 0.69 in)
Maximum Dish 0,25 mm (0.010 in)
Maximum Height (permissible distortion) 2,21 mm (0.0875 in)

Check the six coil springs (49) as follows:

Free Length 17,8 mm (0.70 in)
Working Length 12,7 mm (0.50 in)
Load at Working Length 2,98 to 3,64 kg (6.57 to 8.03 lb).

Replace any worn or damaged components, as required.

On reassembly, always fit new thrust washers (42 and 53) and new sealing rings (55 and 56).

Examine the bearings (33 and 37), the rings (39) and the input shaft gear teeth for signs of wear or damage and replace any defective components.

Always fit new seals (32 and 40) a new 'O' ring (35); also if possible, fit new circlip and snap ring (36 and 41).

Before fitting, lubricate all seals with petroleum jelly.

When refitting, always fit a new 'O' ring (81) and gasket (83), also fitting new circlips (84 and 86), if possible.

Examine the spools (20 and 25) and the spool block (24) for scoring, pitting and wear and replace if necessary.

Refitment

1. Using petroleum jelly refit the two sets of needle rollers 108) with a spacer (109) between the rows and a retaining ring (107) at each end. A smear of petroleum jelly can be used to make the thrust washers (106 and 111) and the distance piece (112) adhere to the end face of the gear cluster (110).
2. Insert the dummy shaft in the reverse gear cluster.
3. Figure 19. Refit the gear cluster assembly to the transmission case, then insert the shaft (105) from the rear and push out the dummy shaft.
4. Figure 4. Refit the plate (113) a new tabwasher (114) and the bolt (115). Bend up the tabwasher. The assembled gear cluster is shown in Fig 19.
5. Fig 18. If necessary, press the centre bearing (97) on to the layshaft (98).
6. Fit a new snap ring (100) on to the layshaft, temporarily placing it on the unsplined portion of the shaft, adjacent to the first gear teeth.
7. Slide the layshaft into the gearbox from the front, locating the third (101) and second speed (102) gears on the splines.
8. Push the layshaft rearwards sufficiently far to permit fitment of the new thrust washer (96) the main input gear (95), the coupler (94), spring (93) and overdrive gear (92), then refit the front snap ring (91).
9. Pull the layshaft forwards to permit fitment of the snap ring (100) in the groove adjacent to the third speed gear (101).
10. Refit the layshaft rear bearing (103) then drive the layshaft fully rearwards and refit the rear snap ring (104). Ensure that the rear bearing is fully located. The layshaft is shown fully assembled in Fig 19.
11. Refit the p.t.o. constant mesh gear (88) into the transmission case, then refit the p.t.o. driveshaft (90).
12. If necessary, refit the piston ring (45) to the piston (46).
13. Fig 21. Compressing the piston rings, as shown, refit the piston to the housing (43).
14. Fig 22. Fit one interplate (47) to the clutch housing, with the lugs on the interplate located in the housing splines immediately to the right of the six holes in the housing.
15. Fig 22. Fit the six springs (49) as shown, placing them on the interplate lugs.
16. Fig. 23. Refit the three friction plates (48) and the remaining two interplates alternately, locating the lugs on each interplate one spline further to the right of one previously fitted.

NOTE: – THE SPRINGS MUST ONLY CONTACT THE FIRST INTERPLATE.

17. Fig 24. Refit the retainer plate (50) and the snap ring (51).
18. Fig 14. If necessary, fit a new needle roller bearing (58) to the rear the main input shaft.
19. Fit the two new sealing rings (55 and 56) to their grooves in the main input shaft (54).
20. Refit the input overdrive gear (52) to the Multi-Power clutch.
21. Fit the main input shaft (54) into the gearbox from the rear, locating the main input gear (57) and thrust washer (53), then the clutch and overdrive assembly, locating the main input gear and the clutch on their relevant splines.
22. Refit the front thrust washer (42) on the splines, with the steel face towards the clutch.
23. Refit the tab located spacer (59) with its convex face towards the main input shaft and locating the tab in the centre web of the gear box.
24. Refit the rear snap ring (65) to the mainshaft (66), then press on the bearing (64) using Hand Press MF 200 and adapter MF 200-25. Refit the second snap ring (63).
25. Refit the mainshaft front bearing (60) to its web in the gearbox.

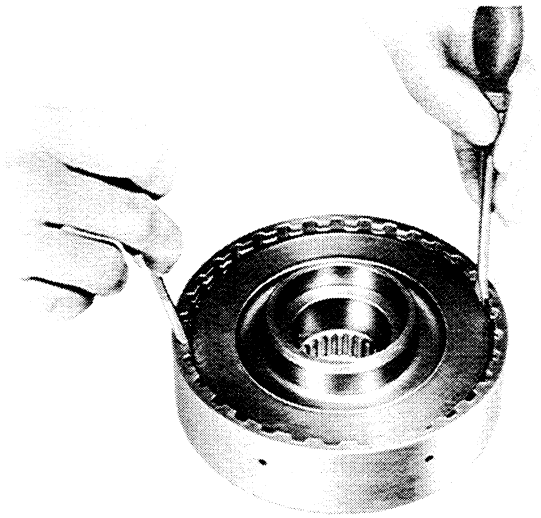


FIG. 21

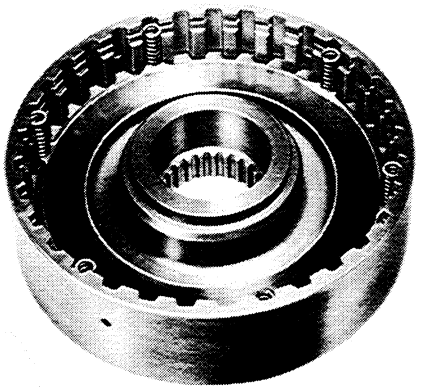


FIG. 22

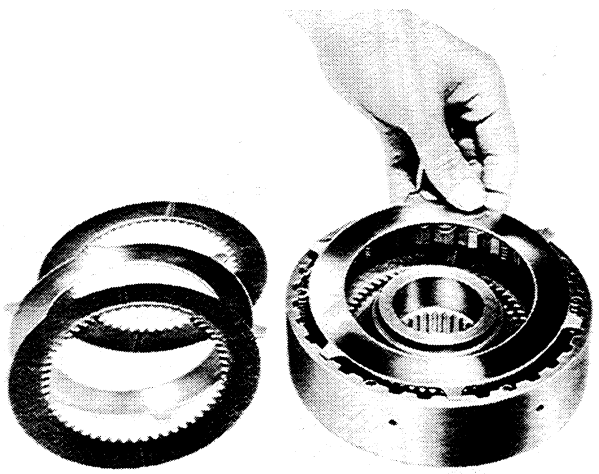


FIG. 23

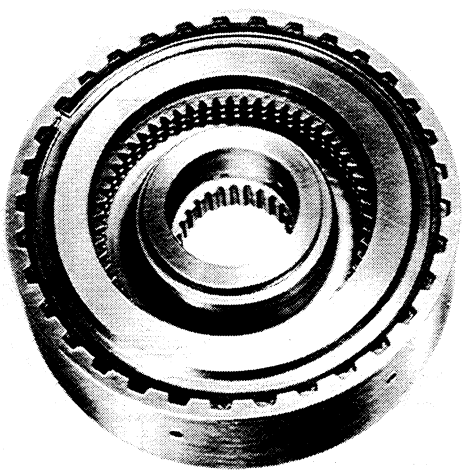


FIG. 24

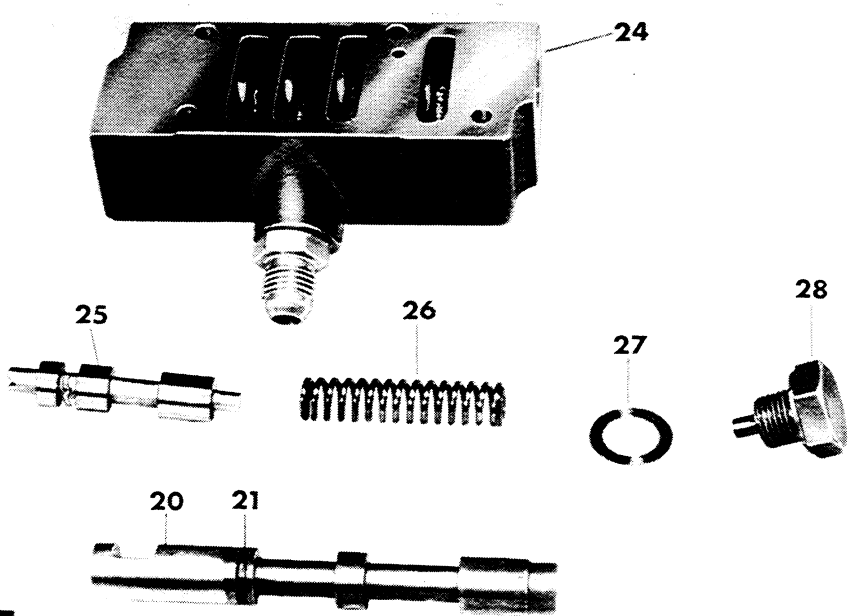


FIG. 25

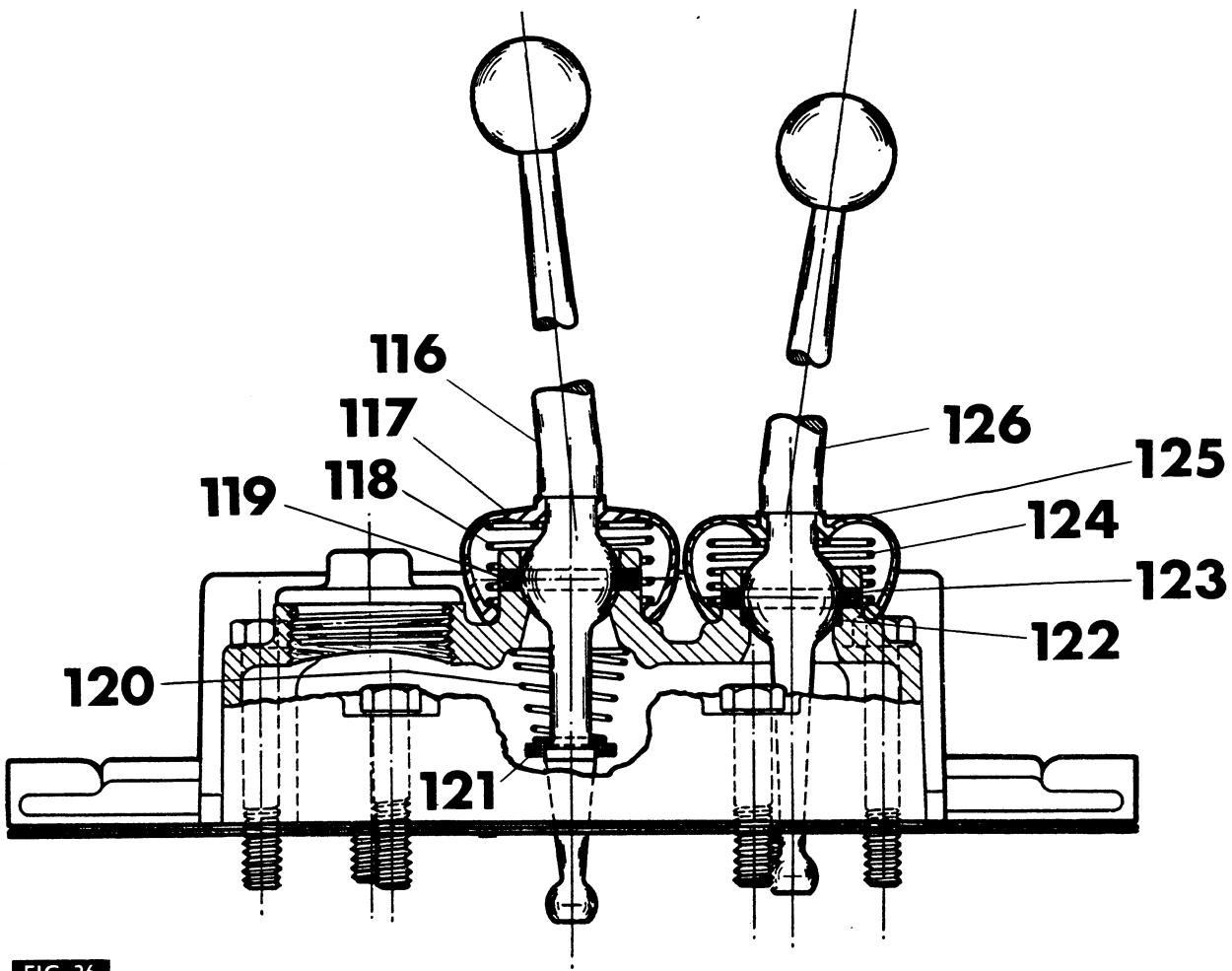


FIG. 26

26. Slide the mainshaft into the gearbox from the rear, locating the second/third gear (62) and the first/reverse gear (61) on the splines.
27. Drive the mainshaft forwards, fully locating it in the front bearing (60) and the needle roller bearing in the rear end of the main input shaft.
28. Refit the p.t.o. driveshaft front bearing (87) to its housing (82) and secure it with the circlip (86).
29. Refit the housing (82) together with a new gasket (83) into the transmission case.
30. Pull the p.t.o. driveshaft (90) into its bearing (87) by using special tool MF 218A.
31. Figure 13. Secure the p.t.o. driveshaft with the thrust washer (84) and the circlip (85).
32. Using a new 'O' ring (81) refit the front cover plate (80).

NOTE – WHEN REFITTING THE COVER PLATE AND THE BOLTS (78) USE SEALING COMPOUND 'HYLOMAR COMPOUND SQ 32M' TO SEAL THE PLATE AND BOLT THREADS.

33. Refit the brake pedal and cross shaft assembly to the transmission case, from the right hand side.
34. Figure 12. Refit the lever and key to the brake cross shaft, then re-tighten the nut and bolt.
35. Place the spool (25) in the spool block (24), then the spring (26) and secure with a new washer (27) and screw (28).
36. Place the adjusting spool (20) with a new seal (21) into the spool block.
37. Fit a new gasket into position on the spool block and refit the block to the input housing.
38. Secure the spool block with the four Allen screws (22) and spring washers (23).
39. If necessary, press the bearing (37) on to the input shaft (38) (with the shield towards the gear teeth) and secure it with the circlip (36).
40. Fig 9B. Using special tool MF 315 drive the needle roller bearing (33) into the input housing.
41. Fig 10. Fit the new inner oil seal (40) to special tool MF 256A, then drive the seal fully into place.
42. Fig 11. Assemble special tool MF 255B, then slide the oil seal (32) (metal face first) on to the tool.
43. Remove the cone from the front of tool MF 255B.
44. Refit the two rings (39) to the input shaft (38), ensuring that the interlocking ends of the rings are properly engaged.
45. Slide the p.t.o. input shaft (38) into the housing, securing it with the large snap ring (41).
46. Carefully slide the special tool MF 255B on to the p.t.o. input shaft, then drive the seal (32) fully into place.
47. Fit a new 'O' ring (35) to the rear spigot of the input housing.
48. Fit the seal protector MF 177 on the front of the main input shaft (54), then carefully slide the input housing assembly into place.
49. Fig 6. Refit three bolts (31), but not the R.H. upper bolt.

NOTE – THE BOLT THREADS MUST BE COATED WITH HYLOMAR SQ32M SEALING COMPOUND.

50. Reconnect the pipe (15) to the spool value; OR, if the tractor is fitted with a low capacity pump, refit the complete pipe (15 and 16).
51. Push the Multi-Power shifter rod upwards through the rubber boot in the top of the transmission case, then locate and secure the shift linkage bracket (30) to the input housing, with the R.H. upper bolt.

NOTE – COAT THE BOLT THREAD WITH HYLOMAR SQ32M SEALING COMPOUND.

52. Figure 4. Refit the backplate (67) and the shims (68) to the dowels (71) on the ring gear (72), then locate the dowels in the holes in the transmission case. Fit the thrust washers (70 and 73) to the planetary pinion carrier (69) and locate the carrier in the ring gear. Refit the cover plate (74), as shown in Fig 5. Fit the four bolts (76) and tighten them progressively and evenly to a torque of 4,9 kg-m (35 lb ft).

NOTE – OMIT LOCKWASHER (75) FROM LOWER LEFT HAND BOLT.

53. Fit the HIGH/LOW shift rail (5), sliding the HIGH/LOW shift selector (4), onto the rail and secure to the rail with locking peg (3). Wire lock the peg to the rail.
54. Locate the 1st/rev. and 2nd/3rd shift forks (7, 9), to their respective grooves in the mainshaft gears. The two forks are identical.
55. Assemble the 1st/rev. and 2nd/3rd shift rails (8, 10), with interlock pin grooves facing each other, to the forks, and secure each fork with a locking peg (3). Wire lock the pegs to the rails. The shorter, 2nd/3rd shift rail (10) is fitted to the L.H. side.
56. Locate the HIGH/LOW shift fork (6), to the groove in the coupler (77). Assemble the coupler into the planet pinion carrier assembly (69), simultaneously sliding the fork (6), onto the HIGH/LOW shift rail (5).
57. Secure the HIGH/LOW shift fork (6), to its rail withthe locking peg (3).
58. Wire lock the peg to the rail.
59. Fit the interlock pin (14), to the stop plate (11) and secure the stop plate with two bolts (13), and spring washers (12).
60. Fit the three plungers (2), pointed end downwards, and the three springs (1).
61. Refit the gearbox top cover and instrument panel assembly as stated in Part 3.

NOTE – BOTH GEAR LEVERS AND THE GEAR SELECTOR DOGS MUST BE PLACED IN NEUTRAL.

62. Reconnect the transmission to the centre housing, as stated in Part 3.

GEAR SHIFT LEVER

Removal and Refitment 4B-12-18

Figure 26.

1. Remove the steering box.
2. Remove the eight bolts securing the shift lever support and battery platform to the transmission housing. Lift the support and platform up off the transmission housing.
3. Release the spring retaining seat (120) from the lower end of the gear lever (116), and detach the seat and spring (120).
4. Remove the gear lever rubber cover (117) and spring (118) fitted under the cover.
5. Drive out the pin (119) securing the gear lever (116) to its housing.
6. Lift out the gear lever (116).
7. Refitment is a reversal of the removing procedure.

HIGH/LOW SHIFT LEVER

Removal and Refitment 4B-13-18

Figure 26

1. Remove the rubber cover (125) and spring (124), fitted under the cover.
2. Drive out the pin (123) securing the lever (126) to its housing.
3. Lift out the lever (126) and 'O' ring (122).
4. Refitment is a reversal of the removing procedure.

8 SPEED TRANSMISSION

Part 4 Section C

GENERAL

The transmission has four forward gears and one reverse gear which are doubled by a planetary reduction unit to give eight forward and two reverse gears.

All gear teeth are of involute, straight cut spur type. Where movement of the gears is required, to change ratio, the gears slide on a splined shaft.

8 SPEED TRANSMISSION

PRINCIPLE OF OPERATION

Figure 1 and 2

The Gearbox

The tractor engine drives a clutch with divided drive. Each plate is splined on to a separate gearbox shaft. Drive is transmitted to:

(a) The p.t.o. input shaft (15), which is hollow and has gear teeth on its rear end.

(b) The main drive input shaft (18) which runs inside the p.t.o input shaft has gear teeth on its rear end and is spigot located in the front end of the mainshaft (25).

Layshaft and P.T.O. Shaft

Rotation of the p.t.o. input shaft (15), drives the p.t.o. constant mesh gear (52) which is splined on to the p.t.o. drive shaft (53). When the main input shaft (18) rotates, the drive is transmitted to the constant mesh gear (55) which is splined on to the layshaft (58). The layshaft, which is hollow and externally splined, has 15 gear teeth machined on its outside diameter to provide the first gear layshaft pinion. It is supported on two ball races located in the centre web and rear wall of the transmission case. Mounted on the layshaft are three other gears, (56, 61 and 62) with 28, 33 and 23 teeth, which are third, fourth and second gears respectively. None of the layshaft gears are free to move along the shaft, being retained, either by abutment with other gears, bearings or snap rings.

Mainshaft

The mainshaft (25) is externally splined, has gear teeth at its rear end and has a bore at its front end to accept the spigot on the main input shaft and its needle roller bearing (24). Mounted on the mainshaft are three gears (one being a compound gear having two sets of teeth): When viewed from the front of the gearbox, these gears have 41 teeth (20); 45 teeth (26) and 36/46 teeth (27) to mesh with the layshaft gears and give third, first, fourth and second gears respectively. The mainshaft gears are moved into and out of mesh by selector forks (86, 88 and 92), the gears sliding on the mainshaft splines.

The engine speed is reduced by the selected gear ratio (variable reduction) and by the input constant mesh gears (fixed reduction).

Reverse Gear Cluster

Reverse gear is achieved by the engagement of a compound gear cluster (71) with 13/21 teeth. The 21 tooth half of the gear is in constant mesh with the fourth gear pinion (33 teeth) on the layshaft. The 45 tooth first gear pinion on the mainshaft is moved into, or out of mesh with the 13 tooth portion of the reverse gear cluster.

The reverse gear, by acting as an idler gear between the layshaft and the mainshaft drive, reverses the rotation of the mainshaft, epicyclic unit and the final drive.

Epicyclic Unit

The basic four forward and one reverse gears are doubled by the epicyclic unit mounted on the rear end of the transmission case. The epicyclic unit comprises a ring gear (34), inside which run three planetary pinions mounted in a carrier (36). The planetary pinions are driven by gear teeth on the end of the mainshaft (25) which acts as the sun gear. When the mainshaft rotates, the planetary pinions also rotate, but being meshed with the teeth on the inside of the ring gear the rotational speed of the carrier is reduced by a ratio of 4 : 1.

To transmit the drive from the epicyclic unit to the rear axle, a driveshaft is connected by the coupler (39), either directly to the gearbox mainshaft (HIGH range), or to the planetary pinion carrier (36) (LOW range).

Movement of the dual range selector lever actuates the rod attached to the selector fork (95) which moves the coupler (39) into, or out of mesh with either the end of the mainshaft (25) or the planetary pinion carrier (36). Between the two engaged (HIGH or LOW range) positions, there is a neutral position, where the coupler splines are disengaged from both the mainshaft and the planetary pinion carrier.

SHIFTER RAIL MECHANISM

Removal and Refitment 4C-01-02

Figure 3

Special Tools Required: 270 Rail Trolley

Removal

1. Split the tractor between the gearbox and the centre housing.
2. Remove the gearbox top cover, in unit with the instrument panel.
3. Figure 5. Remove the two bolts (78) securing the interlock mechanism. Lift off the locking ball carrier (80) and the two plates (83 and 84). Store the balls carefully.
4. Cut the locking wire and remove the shifter rails.

Refitment

1. Refit the third speed selector rod (89), fitting first the engagement dog (90), then the selector fork (88), engaging the selector fork in the third speed sliding gear (20).
2. Rotate the rod until the engagement dog locking pin can be fitted. Tighten the locking pin and secure it with locking wire.
3. Rotate the rod to bring the engagement dog to the top, then fit the locking pin and locking wire to the selector fork (88).
4. Slide the interlock cross peg (81) into the third speed selector rod.
5. Refit the first/reverse and the second/fourth gear selector rods and forks (86, 87, 91 and 92), engaging the forks in the gears. Refit the locking pegs (85) and the locking wires.
6. Figure 4. Refit the HIGH/LOW selector rod assembly (92 and 95) engaging the selector fork (95) in the coupler (39) and locating the coupler in the end of the planetary pinion carrier (36).
7. Figure 3. Refit the locking peg and locking wire to the HIGH/LOW engagement dog (94).
8. Refit the stop plate (84), the plain plate (83), the locking ball carrier (80) and the locking balls (82), securing them with the two bolts and spring washers (78 and 79), tightened to a torque of 4.9 kg/m (35 lb ft).

8 SPEED TRANSMISSION

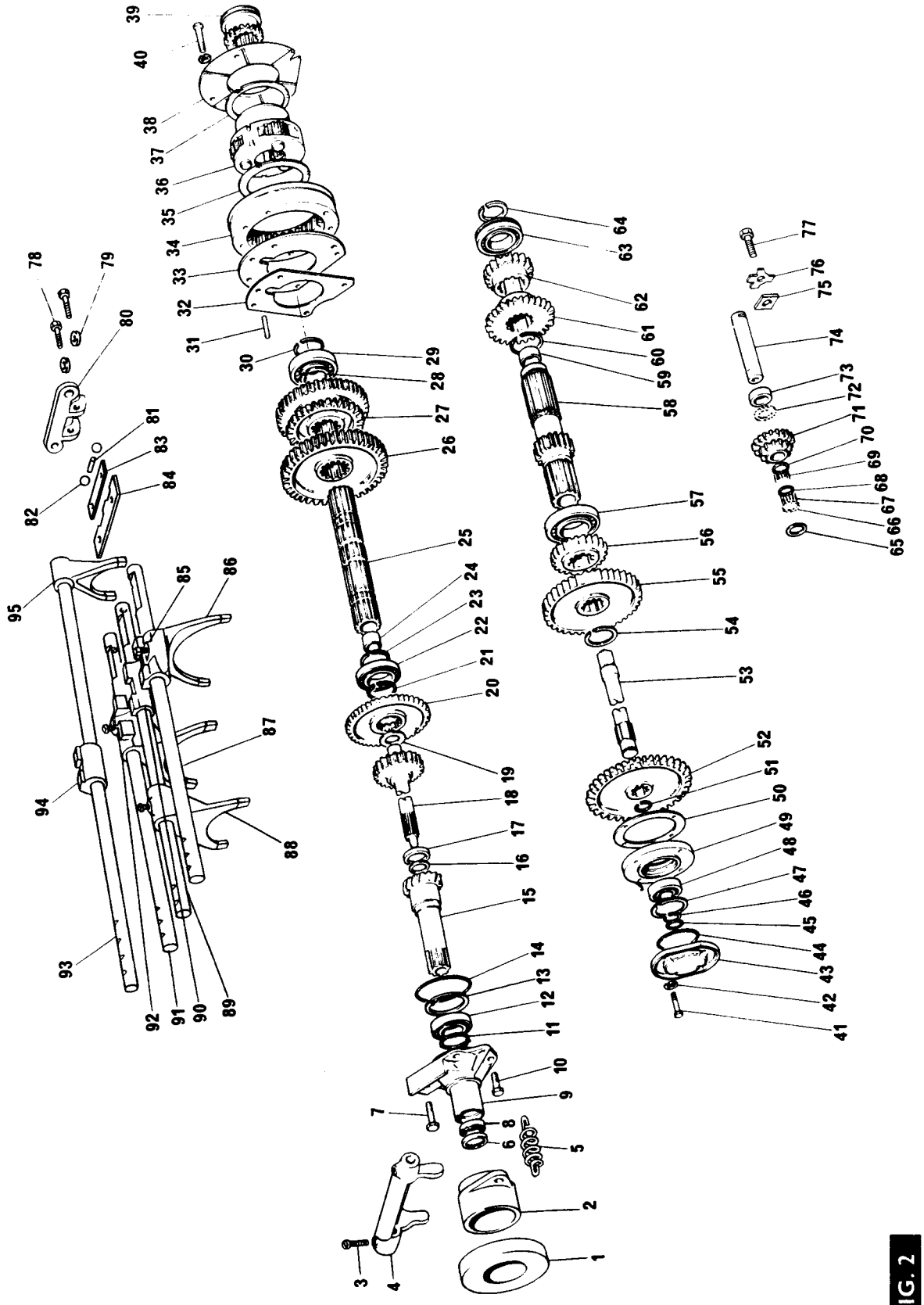
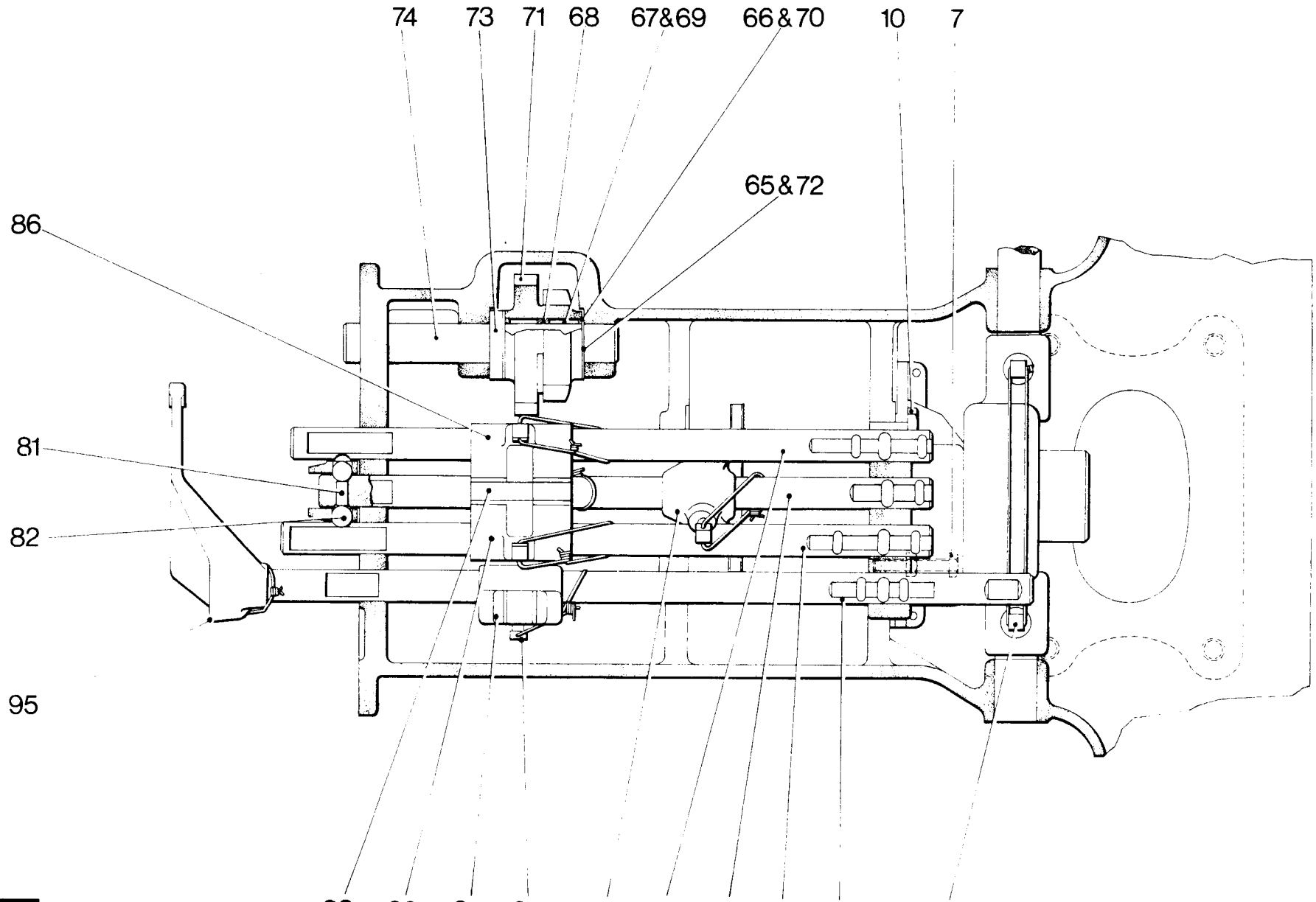


FIG. 2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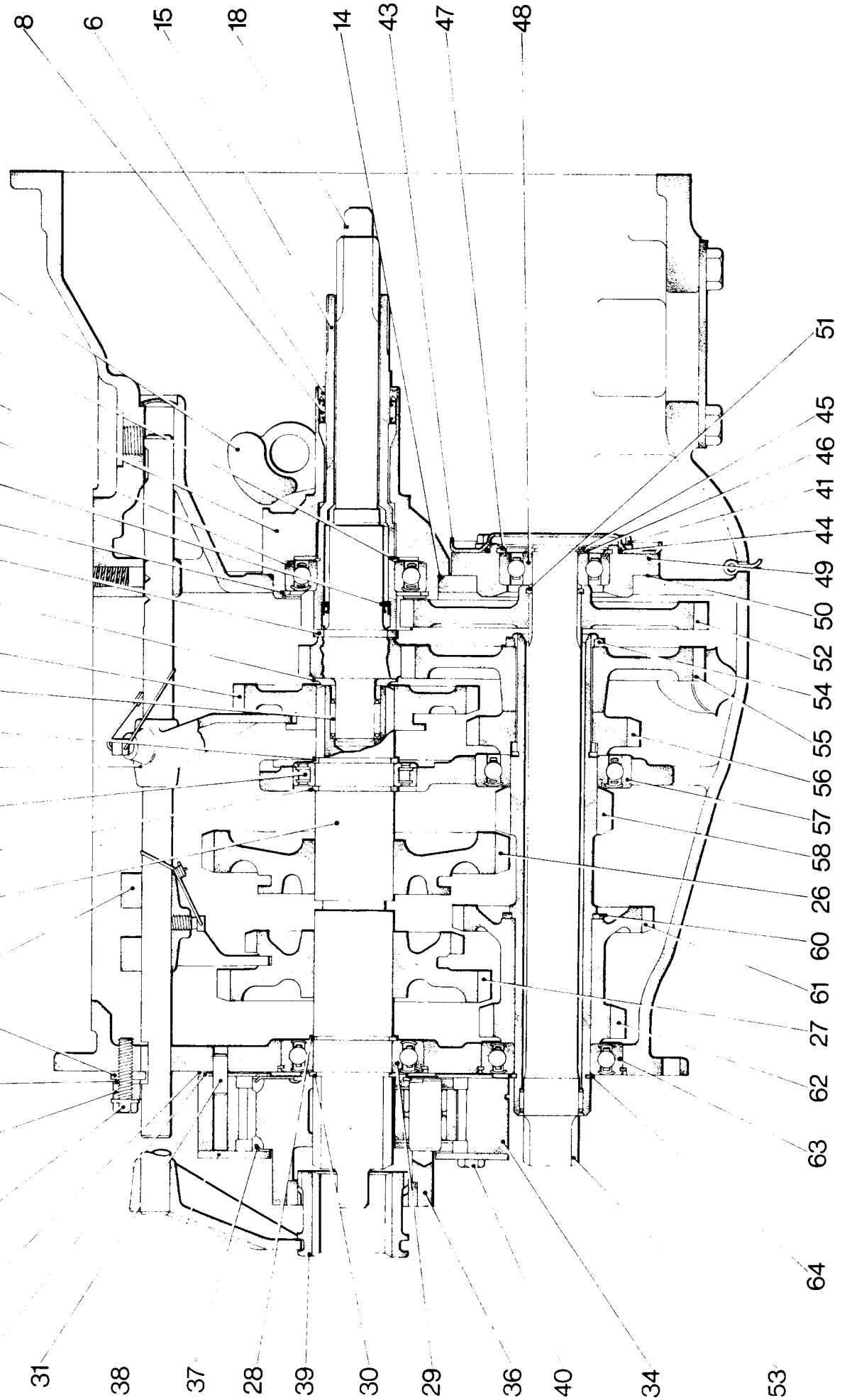
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FIG. 1

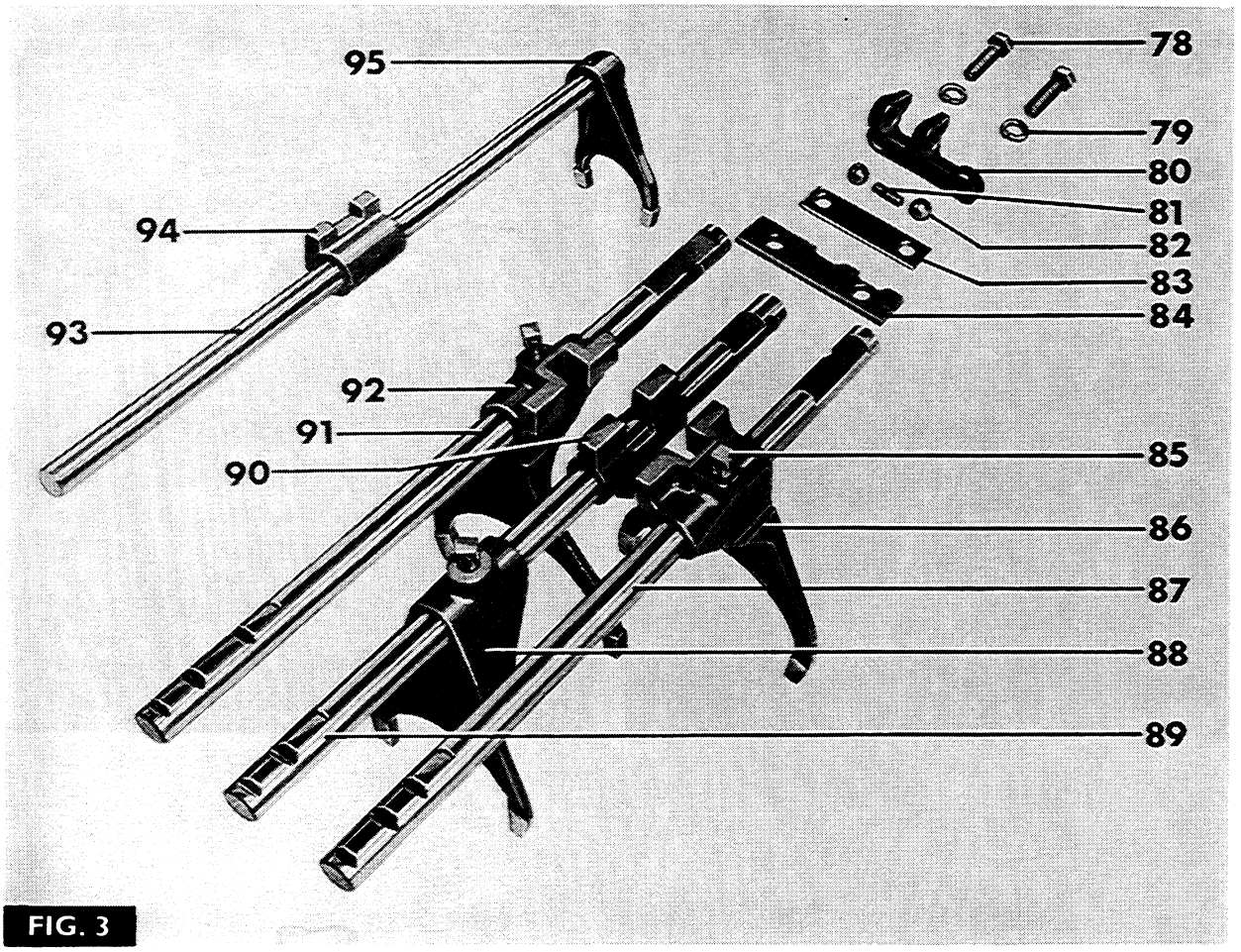

FIG. 3

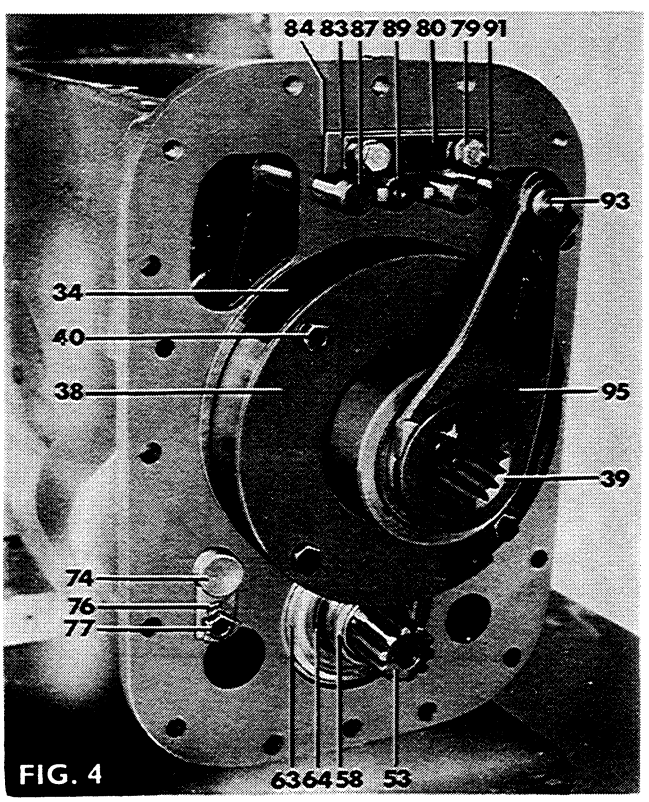

FIG. 4

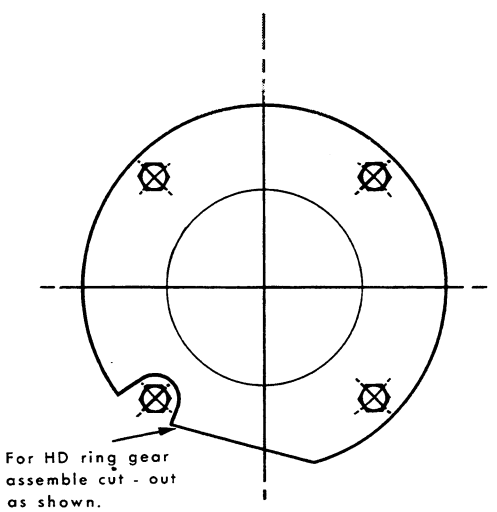

FIG. 5

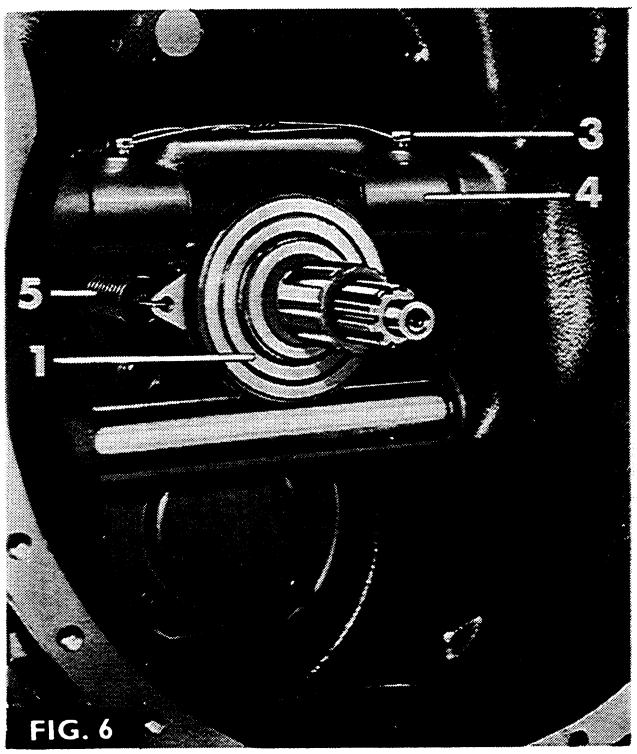

FIG. 6

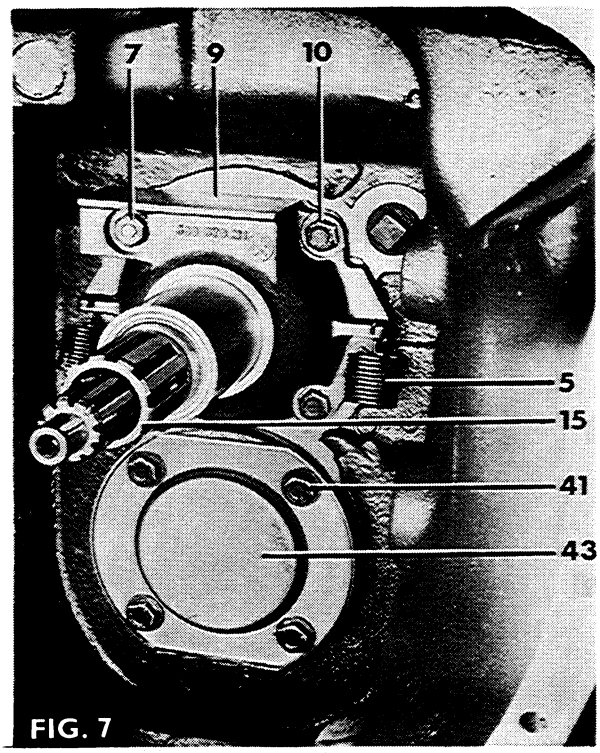

FIG. 7

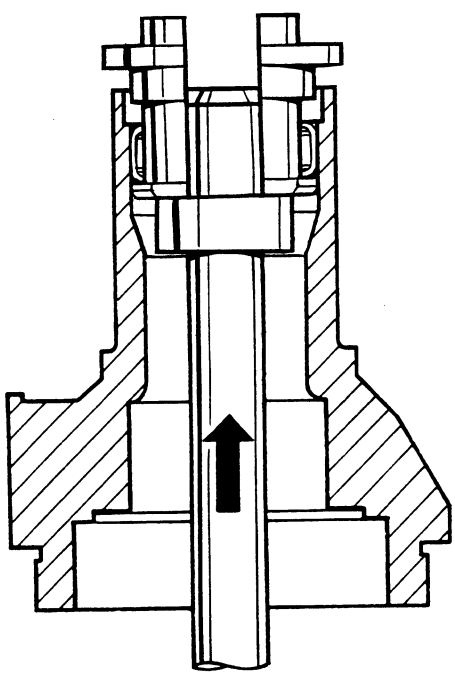
FIG. 8a

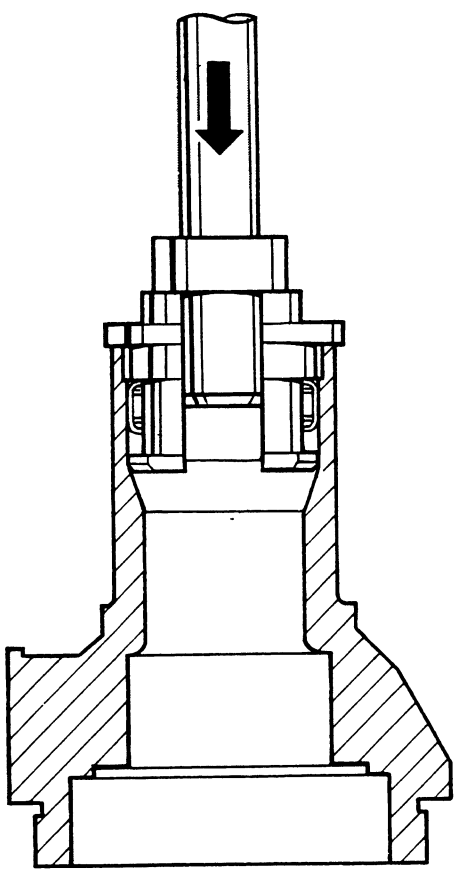
FIG. 8b

9. Refit the gearbox top cover and instrument panel assembly.

NOTE – BOTH GEAR LEVERS, AND THE GEAR SELECTOR DOGS SHOULD BE PLACED IN NEUTRAL.

10. Reconnect the centre housing to the gearbox.

TRANSMISSION EPICYCLIC

Removal and Refitment 4C-02-07

Figure 4

Special Tools Required: 270 Rail Trolley

Removal

1. Split the tractor between the transmission and the centre housing.
2. Remove the locking wire and peg from the HIGH/LOW shifter fork, then remove the fork and coupler.
3. Figure 4. Remove the four bolts (40) securing the transmission epicyclic unit, then remove the complete assembly.

Refitment

1. Figure 4. Refit the backplate (33) and the shims (32) to the dowels (31) on the ring gear (34), then locate the dowels in the holes in the transmission case. Fit the thrust washers (35 and 37) to the planetary pinion carrier (36) and locate the carrier in the ring gear. Refit the cover plate (38), as shown in Fig. 5. Fit the four bolts (40) and tighten them progressively and evenly to a torque of 4.9 kg/m (35 lb ft).

NOTE – OMIT LOCKWASHER FROM LOWER LEFT HAND BOLT.

2. Refit the coupler and HIGH/LOW shifter fork, then refit the locking peg and locking wire.
3. Reconnect the transmission to the centre housing.

CLUTCH RELEASE MECHANISM

Removal and Refitment 4C-03-07

Figure 6

Special Tools Required: 270 Rail Trolley

Removal

1. Split the tractor between the engine and transmission.
2. Figure 6. Remove the two springs (5) securing the release bearing carrier, then slide the carrier and release bearing (1) off the input shaft retainer housing.
3. Cut the locking wire and remove the two locking pegs (3) from the clutch release fork (4). Remove the clutch release shafts and fork.

Refitment

1. Figure 3. Refit the clutch release shafts and the clutch release fork (4) refitting the locking pegs (3) and the locking wire.
2. Lubricate the splines of the input shafts and the clutch release bearing carrier bore with special grease Mobilgrease Super.
3. Slide the clutch release bearing (1) and carrier (2) on to the input housing, and refit the two return springs (5).
4. Ensure that all gears are in neutral, then reconnect the engine to the transmission.

INPUT SHAFT AND P.T.O. INPUT SHAFT

Removal and Refitment 4C-04-07

Figures 7, 8A & 8B

Special Tools Required: 270 Rail Trolley
MF 177 Seal Protector
MF 255B Oil Seal Replacer
MF 256A Oil Seal Replacer
MF 315 Needle Roller Bearing Removal and Refitting Tool

Removal

1. Remove the clutch release mechanism as stated in operation 4C-03-07
2. Figure 7. Remove the four bolts (7 and 10) and withdraw the input shaft retainer housing (9), complete with the p.t.o. input shaft (15).
3. Remove the large internal circlip (13) from the rear end of the input housing (9), then push the p.t.o. input housing (15) out of the housing, complete with its bearing (12).
4. Lever the inner seal (16) from the input shaft.
5. Carefully lever the front oil seal (6) from the front of the input housing (9) with a screwdriver.
6. Figure 8A. Using special tool MF 315, drive the needle roller bearing (8) out of the input housing.
7. If the bearing needs servicing, remove the external circlip (11) from the input shaft, then press off the bearing (12).

Refitment

1. If necessary, press the bearing (12) on to the front of the p.t.o. input shaft (15) and secure it with the circlip (11).
2. Figure 8B. Refit the needle roller bearing (8) to the input housing (9) using special tool MF 315 as shown.
3. Fit a new front oil seal (6) to the input housing, using special tool MF 255B. Lubricate the oil seal and the needle roller bearing with petroleum jelly.
4. Fit a new oil seal (16) to the p.t.o. input shaft (15), using special tool MF 256A. Lubricate the seal with petroleum jelly.
5. Carefully insert the p.t.o. input shaft (15) into the housing (9). Push the bearing (12) fully into place and secure it with the large internal circlip (13).
6. Place the seal protector MF 177 on the front of the main input shaft (18).
7. Fit a new 'O' ring (14) on to the rear spigot of the input retainer housing (9), then carefully feed the input housing (9) over the seal protector and locate the input housing in the front of the transmission case.
8. Figure 7. Refit the four bolts (7 and 10) using 'Hylomar Compound SQ 32M' to seal the threads.

P.T.O. DRIVESHAFT FRONT BEARING

Removal and Refitment 4C-05-08

Special Tools Required: 270 Rail Trolley
Two ⅜ UNC x 75 mm (3 in) Bolts.
MF 218A P.t.o. Drive shaft Puller.

Removal

1. Split the tractor between the engine and gearbox.
2. Figure 9. Remove the bolt, nut and lockwasher (A) securing the left brake cross shaft lever. Remove the lever and key (B) from the shaft.
3. Withdraw the shaft, complete with pedals from the right hand side of the transmission housing.
4. Remove the four bolts (41) securing the cover plate (43).

NOTE – IF THE 'O' RING (44) IS CAUSING LEAKAGE, PROCEDE NO FURTHER.

5. Figure 10. Remove the circlip (45) and the thrust washer (46).
6. Screw two ⅜ UNC x 75 mm (3 in) bolts into the tapped holes in the bearing housing (49). Progressively and evenly tighten the bolts until the housing is extracted.
7. Remove the 'O' ring (44) from the bearing housing.
8. If the bearing (48) needs servicing, remove the circlip (47) and press out the bearing (48).

Refitment

1. Refit the p.t.o. driveshaft front bearing (48) to its housing (49) and secure it with the circlip (47).
2. Figure 10. Refit the housing (49) together with a new gasket (50) into the transmission case as shown.
3. Pull the p.t.o. driveshaft into its bearing (48) by using special tool MF 218A.
4. Figure 10. Secure the p.t.o. driveshaft with the thrust washer (46) and the circlip (45).
5. Using a new 'O' ring (44), refit the front cover plate (43) as shown in Fig. 7.

NOTE – WHEN REFITTING THE COVER PLATE AND THE BOLTS (41) USE SEALING COMPOUND 'HYLOMAR COMPOUND SQ 32M' TO SEAL THE PLATE AND BOLT THREADS.

6. Refit the brake pedal and cross shaft assembly to the transmission case, from the right hand side.
7. Figure 9. Refit the lever and key to the brake cross shaft, then re-tighten the nut and bolt.
8. Reconnect the gearbox.

MAIN INPUT SHAFT

Removal and Refitment 4C-06-08

Special Tools Required: MF 218A P.t.o. Driveshaft Puller

Removal

1. Remove the clutch release mechanism as stated in operation 4C-03-07
2. Remove the input housing and p.t.o. input shaft as stated in operation 4C-04-07
3. Remove the shifter rail mechanism as stated in operation 4C-01-02
4. Remove the p.t.o. driveshaft front bearing cover (43) as stated in operations 1 to 4 of operation 4C-05-08
5. Figure 4. Withdraw the p.t.o. drive shaft (53) from the rear end of the layshaft, thus allowing the p.t.o. constant mesh gear to drop into the transmission case.
6. Remove the main input shaft (18) complete with the thrust washers (17 and 19) and lift the p.t.o. constant mesh gear (52) from the transmission case. Remove the lockring (51) from the constant mesh gear only if necessary.

Refitment

1. Lower the p.t.o. constant mesh gear (52) into the transmission case but do not yet fit the p.t.o. driveshaft (53).
2. Insert the main input shaft (18), complete with its thrust washers (17 and 19) into the transmission case, locating the shaft spigot in the needle roller bearing (24) located in the end of the mainshaft. Engage the input shaft gear teeth with those of the constant mesh gear (55).
3. Refit the p.t.o. driveshaft (53) from the rear, locating the p.t.o. constant mesh gear on the splines and then pull the end of the shaft through the bearing (48) using special tool M F 218A.
4. Figure 4. Secure the p.t.o. driveshaft with the thrust washer (46) and the circlip (45).
5. Using a new 'O' ring (44), refit the front cover plate (43) as shown in Fig. 10.

NOTE – WHEN REFITTING THE COV ER PLATE AND THE BOLTS (41) USE SEALING COMPOUND 'HYLOMAR COMPOUND SQ 32M' TO SEAL THE PLATE AND THE BOLT THREADS.

6. Refit the brake pedal and cross shaft assembly to the transmission case, from the right-hand side.
7. Figure 4. Refit the lever and key to the brake cross shaft, then re-tighten the nut and bolt.
8. Refit the shifter rail mechanism as stated in operation 4C-01-02
9. Refit the input housing and p.t.o. input shaft assembly as stated in operation 4C-04-07
10. Refit the clutch release mechanism as stated in operation 4C-03-07

THIRD GEAR (MAINSHAFT)

Removal and Refitment 4C-07-08

Removal

1. Remove the shifter rail mechanism as stated in operation 4C-01-02
2. Remove the transmission epicyclic unit as stated in operation 4C-02-07
3. Remove the clutch release mechanism as stated in operation 4C-03-07
4. Remove the input housing as stated in operation 4C-04-07
5. Remove the main input shaft as stated in operation 4C-06-08
6. Using a soft faced drift, drive the mainshaft (25) rearwards to permit removal of the third gear pinion (20).

Refitment

1. Drive the mainshaft forwards through the centre bearing, locating the third gear pinion (20) on the splines as the shaft emerges.
2. Refit the main input shaft as stated in operation 4C-06-08
3. Refit the input housing as stated in operation 4C-04-07
4. Refit the clutch release mechanism as stated in operation 4C-03-07
5. Refit the transmission epicyclic unit as stated in operation 4C-02-07
6. Refit the clutch release mechanism as stated in operation 4C-01-02

FIRST, SECOND OR FOURTH GEAR OR MAINSHAFT

Removal and Refitment 4C-08-09

Special Tools Required: MF 200 Hand Press
MF 200-25 Adapter

Removal

1. Remove the third gear pinion as stated in operation 4C-07-08
2. Remove the snap ring (21), then drive the mainshaft through the centre bearing (22).
3. Remove the snap ring (23) and withdraw the main shaft rearwards, progressively removing the first/reverse pinion (26) and the second/fourth pinion (27).
4. Figure 11. Remove the circlip (28) from the mainshaft, then press off the bearing (29) using hand press MF 200 with the MF 200-25 adapter, then remove the circlip (30).

WARNING – DO NOT ATTEMPT TO PRESS THE BEARING OFF THE REAR END OF THE MAINSHAFT, AS THE GEAR TEETH ARE OF A LARGER DIAMETER THAN THE SHAFT SPLINES.

Refitment

1. Refit the mainshaft rear snap ring (30) from the front end, then press the bearing (29) on to the mainshaft (25) using press MF 200 (see figure 9). Refit the second snap ring (28).
2. Refit the mainshaft centre bearing (22) to the web in the transmission case.
3. Figure 12. Feed the mainshaft into the transmission case from the rear, progressively fitting the fourth/second compound sliding gear (27), the first/reverse sliding gear (26) and the snap ring (23). Insert the mainshaft through the centre bearing.
4. Refit the third gear pinion as stated in operation 4C-07-08

LAYSHAFT AND LAYSHAFT GEAR

Removal and Refitment 4C-09-09

Special Tools Required: MF 200 Hand Press
MF 200-25 Adapter

Removal

1. Remove the mainshaft and gears as stated in operation 4C-07-08
2. Figure 4. Remove the snap ring (64) from the rear of the layshaft.
3. Figure 13. Tap the layshaft forwards to expose the snap ring (60), forward of the fourth gear pinion (61). Move the snap ring (60) forwards on to the unsplined portion of the layshaft.
4. Remove the snap ring (54) from the front of the layshaft, then tap the layshaft backwards until the constant mesh gear (55) and the third speed gear (56) can be removed.
5. Drive the layshaft forward out of the case, progressively removing the second and fourth gear pinions (62 and 61) from the transmission case.
6. Using the hand press MF 200 and the adapter MF 200-25, press the centre bearing (57) from the layshaft (58).

Refitment

1. Press the layshaft centre bearing (57) on to the layshaft (58) using MF 200 and MF 200-25.
2. Refit the snap ring (60) on to the layshaft (58) placing it temporarily on the unsplined portion of the shaft to the rear of the first gear teeth.
3. Feed the layshaft into the transmission case, from the front, progressively fitting the fourth gear pinion (61) and the second gear pinion (62). Push the layshaft rearwards to permit fitment of the third gear pinion (56) and the constant mesh gear (55).
4. Refit the snap ring (54) to secure the constant mesh gear (55) the third gear pinion (56) and the bearing (57).
5. Tap the layshaft forwards slightly to allow the snap ring (60) to be fitted to its groove adjacent to the second gear pinion (61).
6. Carefully drive the layshaft rearwards and fit the rear snap ring (64).
7. Refit the mainshaft as stated in operation 4C-07-08

REVERSE GEAR CLUSTER

Removal and Refitment 4C-10-09

Removal

1. Remove the mainshaft as stated in operation 4C-07-08
2. Figure 4. Release the tabwasher (76), then remove the bolt (77).
3. Using a dummy shaft to prevent the needle rollers from falling into the transmission case, remove the reverse gear cluster (71) thrust washers (65 and 72) and distance piece (73).

Refitment

1. Using petroleum jelly refit the two sets of needle rollers (67 and 69), with a spacer (68) between the rows and a retaining ring (66 and 70) at each end. A smear of petroleum jelly can be used to make the thrust washers (65 and 72) and the distance piece (73) adhere to the end face of the gear cluster.
2. Insert the dummy shaft to the reverse gear cluster.
3. Figure 12. Refit the gear cluster assembly to the transmission case, then insert the shaft (74) from the rear and push out the dummy shaft.
4. Figure 4. Refit the plate (75), a new tabwasher (76) and the bolt (77). Bend up the tabwasher. The assembled gear cluster is shown in Fig. 13.

TRANSMISSION CASE REMOVAL AND REFITMENT OR COMPLETE GEARBOX OVERHAUL

Removal and Refitment 4C-11-10

Special Tools Required: MF 177 Seal Protector
MF 200 Hand Press
MF 200-25 Adapter
MF 218A P.T.O. Shaft Puller
MF 255B Oil Seal Replacer
MF 256A O il Seal Replacer
MF 315 Needle Roller Bearing Remover/Refitting Tool V.L. Churchill 50 ton Hydraulic Press.
(Alternative to MF 200)

Disassembly

1. Drain the transmission oil.
2. Split the tractor at the engine.
3. Remove the steering box and instrument panel as an assembly.
4. Split the tractor at the centre housing.
5. Figure 6. Remove the two springs (5) securing the release bearing carrier, then slide the carrier and release bearing (1) off the input shaft retainer housing.
6. Cut the locking wire and remove the two locking pegs (3) from the clutch release fork (4). Remove the clutch release shafts and fork.
7. Figure 8. Remove the bolt, nut and lockwasher (A) securing the left brake cross shaft lever. Remove the lever and key (B) from the shaft.
8. Withdraw the shaft, complete with pedals from the right hand side of the transmission housing.
9. Figure 4. Remove the two bolts (78) securing the interlock mechanism. Lift off the locking ball carrier (80) and the two plates (83 and 84). Store the balls carefully.
10. Cut the locking wire and remove the shifter rails.
11. Figure 4. Remove the four bolts (40) securing the transmission epicyclic unit, then remove the complete assembly.
12. Figure 7. Remove the four bolts (7 and 10) and withdraw the input shaft retainer housing (9), complete with the p.t.o. input shaft (15).
13. Remove the four bolts (41) securing the cover plate (43).
14. Figure 9. Remove the circlip (45) and the thrust washer (46).
15. Screw two ⅜ UNC x 75 mm (3 in) bolts into the tapered holes in the bearing housing (49). Progressively and evenly tighten the bolts until the housing is extracted.
16. Remove the 'O' ring (44) from the bearing housing then remove the circlip (47) and press out the bearing (48).
17. Figure 4. Withdraw the p.t.o. drive shaft (53) from the rear end of the layshaft, thus allowing the p.t.o. constant mesh gear to drop into the transmission case.
18. Remove the main input shaft (18) complete with the thrust washers (17 and 19) and lift the p.t.o. constant mesh gear (52) from the transmission case. Remove the lockring (51) from the constant mesh gear.
19. Using a soft faced drift, drive the mainshaft (25) rearwards to permit removal of the third gear pinion (20).
20. Remove the snap ring (21), then drive the mainshaft through the centre bearing (22).
21. Remove the snap ring (23) and withdraw the main shaft rearwards, progressively removing the first/reverse pinion (26) and the second/fourth pinion (27).
22. Figure 4. Remove the snap ring (64) from the rear of the layshaft.
23. Figure 12. Tap the layshaft forwards to expose the snap ring (60), forward of the fourth gear pinion (61). Move the snap ring (60) forwards on to the unsplined portion of the layshaft.
24. Remove the snap ring (54) from the front of the layshaft, then tap the layshaft backwards until the constant mesh gear (55) and the third speed gear (56) can be removed.
25. Drive the layshaft forward out of the case, progressively removing the second and fourth gear pinions (62 and 61) from the transmission case.
26. Figure 4. Release the tabwasher (76), then remove the bolt (77).
27. Using a dummy shaft to prevent the needle rollers from falling into the transmission case, remove the reverse gear cluster, (71), thrust washers, (65 and 72) and distance piece (73).
28. Figure 10. Remove the circlip (28) from the mainshaft, then press off the bearing (29) using hand press MF 200 with the MF 200-25 adapter, then remove the circlip (30).

WARNING – DO NOT ATTEMPT TO PRESS THE BEARING OFF THE REAR END OF THE MAINSHAFT, AS THE GEAR TEETH ARE OF A LARGER DIAMETER THAN THE SHAFT SPLINES.

29. Using the hand press MF 200 and the adapter MF 200-25, press the centre bearing (57) from the layshaft (58).
30. Remove the large internal circlip (13) from the rear end of the input housing (9), then push the p.t.o. input housing (15) out of the housing, complete with its bearing (12).
31. Remove the external circlip (11) from the input shaft, then press off the bearing (12).
32. Lever the inner seal (16) from the input shaft.
33. Carefully lever the front oil seal (6) from the front of the input housing (9) with a screwdriver.
34. Figure 7A. Using special tool MF 315, drive the needle roller bearing (8) out of the input housing.
35. Tap the bearing (63) rearwards from the transmission case.

Examination

After disassembly of the transmission, examine all the components for scoring, wear or chipping. Pay particular attention to the gear teeth, bearings needle rollers, gear selector forks, also shaft splines which are subject to wear from the sliding action of the gears.

All bearings should be washed in clean paraffin, blown dry, inspected for wear or scoring on the outer circumference and measured for fit in transmission case webbs. Maximum acceptable clearance is 0,033 mm (0.0013 in). Where clearance between bearing and bore exceeds this figure, Loctite Grade A or grade AV may be used to refit bearings into transmission case. After inspection, lubricate bearings with transmission oil.

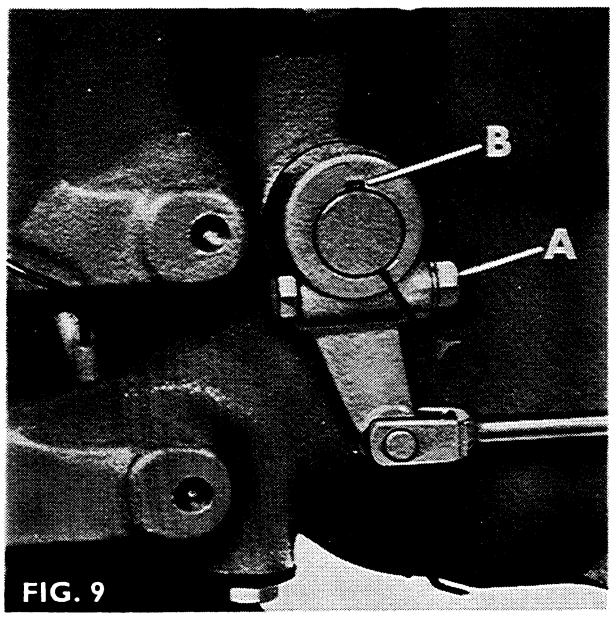

FIG. 9

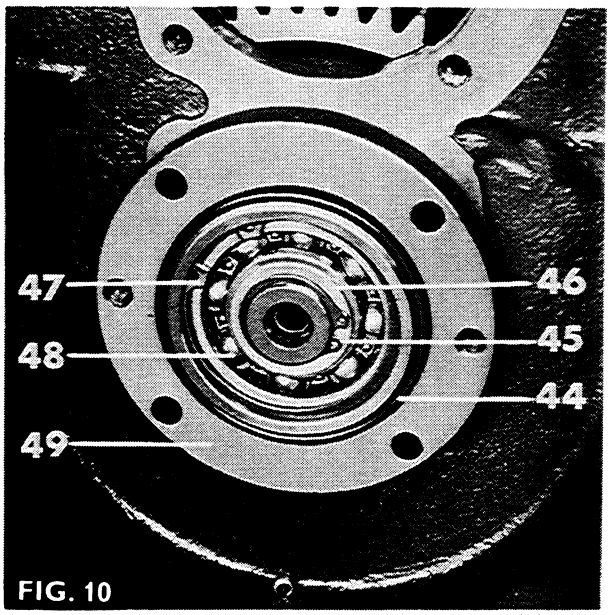

FIG. 10

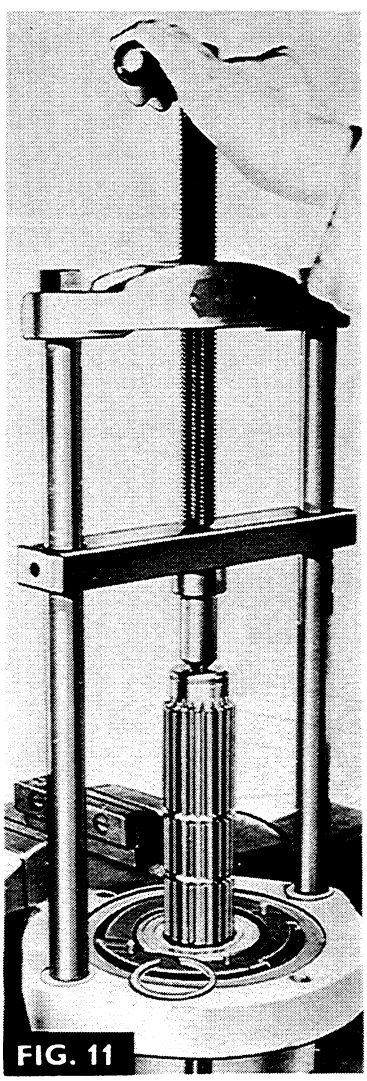
FIG. 11

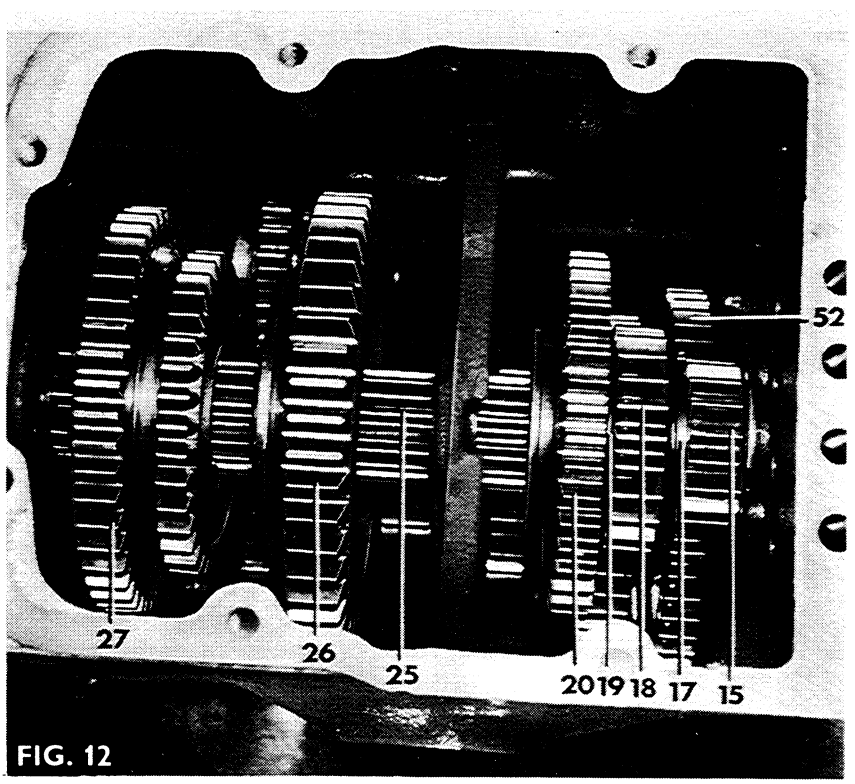

FIG. 12

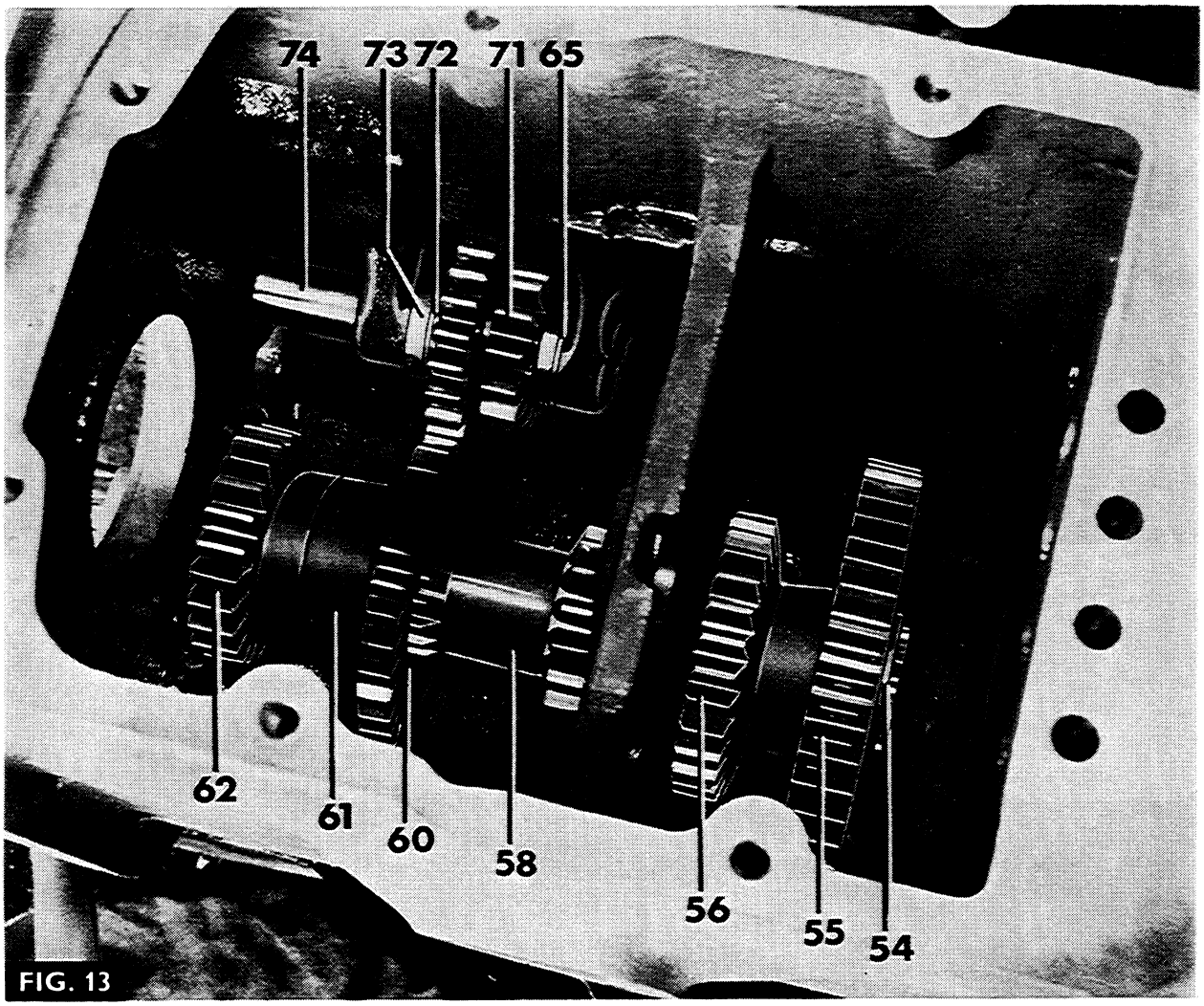
74
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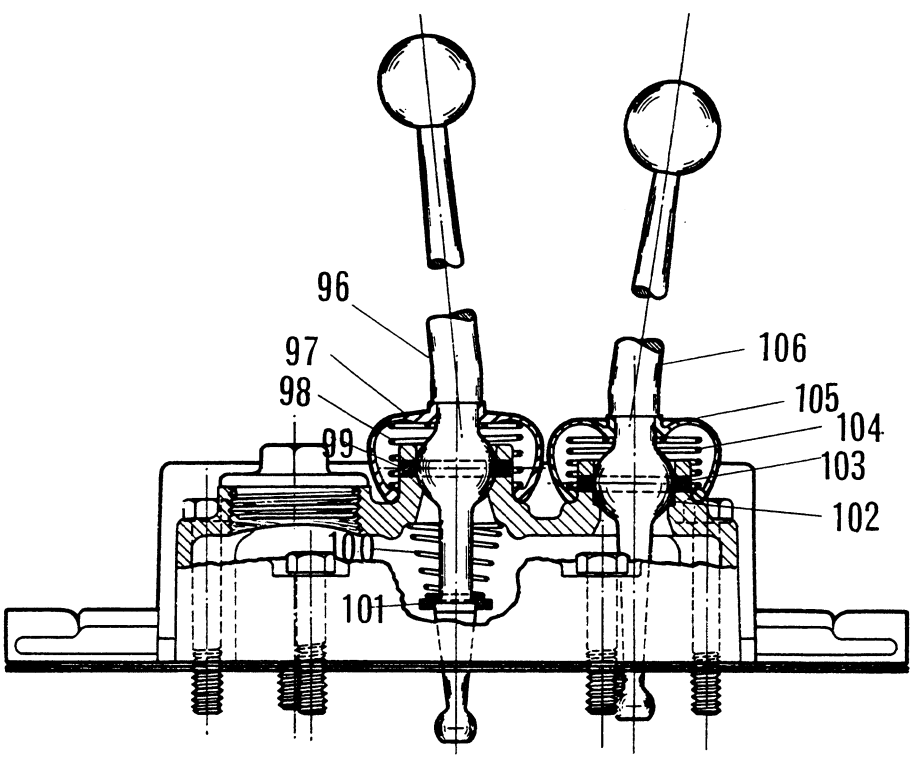
FIG. 13


96
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98
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100
101
106
105
104
103
102

FIG. 14

Any worn or damaged components should be replaced; also, a complete set of new gaskets, 'O' rings and a new tabwasher should be fitted.

Reassembly

NOTE – USE ONLY PETROLEUM JELLY FOR REASSEMBLY PURPOSES – **NEVER** GREASE.

1. Figure 7B. Refit the needle roller bearing (8) to the input housing (9) using special tool MF 315 as shown.
2. Fit a new front oil seal (6) to the input housing, using special tool MF 255B. Lubricate the oil seal and the needle roller bearing with petroleum jelly.
3. Fit a new oil seal (16) to the p.t.o input shaft (15), using special tool MF 256A. Lubricate the seal with petroleum jelly.
4. Press the bearing (12) on to the front of the p.t.o. input shaft (15) and secure it with the circlip (11).
5. Carefully insert the p.t.o. input shaft (15) into the housing (9). Push the bearing (12) fully into place and secure it with the large internal circlip (13).
6. Reassemble the reverse gear cluster as follows: Using petroleum jelly refit the two sets of needle rollers (67 and 69), with a spacer (68) between the rows and a retaining ring (66 and 70) at each end. A smear of petroleum jelly can be used to make the thrust washers (65 and 72) and the distance piece (73) adhere to the end face of the gear cluster.
7. Insert the dummy shaft to the reverse gear cluster.
8. Figure 12. Refit the gear cluster assembly to the transmission case, then insert the shaft (74) from the rear and push out the dummy shaft.
9. Figure 4. Refit the plate (75), a new tabwasher (76) and the bolt (77). Bend up the tabwasher. The assembled gear cluster is shown in Fig. 12.
10. Refit the layshaft rear bearing (63) to the transmission case.
11. Press the layshaft centre bearing (57) on to the layshaft (58) using MF 200 and MF 200-25.
12. Refit the snap ring (60) on to the layshaft (58) placing it temporarily on the unsplined portion of the shaft to the rear of the first gear teeth.
13. Feed the layshaft into the transmission case, from the front, progressively fitting the fourth gear pinion (61) and the second gear pinion (62). Push the layshaft rearwards to permit fitment of the third gear pinion (56) and the constant mesh gear (55).
14. Refit the snap ring (54) to secure the constant mesh gear (55) the third gear pinion (56) and the bearing (57).
15. Tap the layshaft forwards slightly to allow the snap ring (60) to be fitted to its groove adjacent to the second gear pinion (61).
16. Carefully drive the layshaft rearwards and fit the rear snap ring (64).
17. Refit the p.t.o. driveshaft front bearing (48) to its housing (49) and secure it with the circlip (47).
18. Figure 9. Refit the housing (49) together with a new gasket (50) into the transmission case as shown.
19. Refit the mainshaft rear snap ring (30) from the front end, then press the bearing (29) on to the mainshaft (25) using press MF 200 (see figure 10). Refit the second snap ring (28).
20. Refit the mainshaft centre bearing (22) to the web in the transmission case.
21. Figure 11. Feed the mainshaft into the transmission case from the rear, progressively fitting the fourth/second compound sliding gear (27), the first/reverse sliding gear (26) and the snap ring (23). Insert the mainshaft through the centre bearing.
22. As the mainshaft emerges through the bearing, refit the snap ring (21) and the third speed sliding gear (20).

NOTE – ENSURE THAT THE SNAP RINGS (21 AND 23) ARE CORRECTLY LOCATED IN THEIR GROOVES.

23. Lower the p.t.o. constant mesh gear (52) into the transmission case but do not yet fit the p.t.o. driveshaft (53).
24. Insert the main input shaft (18), complete with its thrust washers (17 and 19) into the transmission case, locating the shaft spigot in the needle roller bearing (24) located in the end of the mainshaft. Engage the input shaft gear teeth with those of the constant mesh gear (55).
25. Refit the p.t.o. driveshaft (53) from the rear, locating the p.t.o. constant mesh gear on the splines and then pull the end of the shaft through the bearing (48) using special tool MF 218A.
26. Figure 9. Secure the p.t.o. driveshaft with the thrust washer (46) and the circlip (45).
27. Using a new 'O' ring (44), refit the front cover plate (43) as shown in Fig. 7.

NOTE – WHEN REFITTING THE COVER PLATE AND THE BOLTS (41) USE SEALING COMPOUND 'HYLOMAR COMPOUND SQ 32M' TO SEAL THE PLATE AND THE BOLT THREADS.

28. Place the seal protector MF 177 on the front of the main input shaft (18).
29. Fit a new 'O' ring (14) on to the rear spigot of the input retainer housing (9), then carefully feed the input housing (9) over the seal protector and locate the input housing in the front of the transmission case.
30. Figure 7. Refit the four bolts (7 and 10) using 'Hylomar Compound SQ 32M' to seal the threads.
31. Figure 4. Refit the transmission epicyclic unit as follows:
    Refit the backplate (33) and the shims (32) to the dowels (31) on the ring gear (34), then locate the dowels in the holes in the transmission case. Fit the thrust washers (35 and 37) to the planetary pinion carrier (36) and locate the carrier in the ring gear. Refit the cover plate (38), as shown in figure 5A. Fit the four bolts (40) and tighten them progressively and evenly to a torque of 4.9 kg.m (35 lb ft).

NOTE – OMIT LOCKWASHER FROM LOWER LEFT HAND BOLT IRRESPECTIVE OF ITS ALIGNMENT WITH THE CUT–OUT IN COVER PLATE.

32. Figure 3. Refit the third speed selector rod (89), fitting first the engagement dog (90), then the selector fork (88), engaging the selector fork in the third speed sliding gear (20).
33. Rotate the rod until the engagement dog locking pin can be fitted. Tighten the locking pin and secure it with locking wire.
34. Rotate the rod to bring the engagement dog to the top, then fit the locking pin and locking wire to the selector fork (88).
35. Slide the interlock cross peg (81) into the third speed selector rod.
36. Refit the first/reverse and the second/fourth gear selector rods and forks (86, 87, 91 and 92), engaging the forks in the gears. Refit the locking pegs (85) and the locking wires.
37. Figure 4. Refit the HIGH/LOW selector rod assembly (93 and 95) engaging the selector fork (95) in the coupler (39) and locating the coupler in the end of the planetary pinion carrier (36).
38. Figure 3. Refit the locking peg and locking wire to the HIGH/LOW engagement dog (94).
39. Refit the stop plate (84), the plain plate (83), the locking ball carrier (80) and the locking balls (82), securing them with the two bolts and spring washers (78 and 79), tightened to a torque of 4.9 kg/m (35 lb ft).
40. Refit the brake pedal and cross shaft assembly to the transmission case, from the right-hand side.
41. Figure 8. Refit the lever and key to the brake cross shaft, then re-tighten the nut and bolt.
42. Figure 6. Refit the clutch release shafts and the clutch release fork (4) refitting the locking pegs (3) and the locking wire.
43. Lubricate the splines of the input shafts and the clutch release bearing carrier bore with special grease Mobilgrease Super. Slide the clutch release bearing (1) and carrier (2) on to the input housing, and refit the two return springs (5).
44. Reconnect the transmission to the centre housing.
45. Ensure that all gears are in neutral, then reconnect the engine to the transmission.
46. Refill the transmission with a recommended oil to the correct level.
47. Test run the tractor in all gears, checking for quiet operation and ease of selection.

GEAR SHIFT LEVER

Removal and Refitment 4C-12-14

Figure 14

1. Remove the steering box.
2. Remove the eight bolts securing the shift lever support and battery platform to the transmission housing. Lift the support and platform up off the transmission housing.
3. Release the spring retaining seat (101) from the lower end of the gear lever (96), and detach the seat and spring (100).
4. Remove the gear lever rubber cover (97) and spring (98) fitted under the cover.
5. Drive out the pin (99) securing the gear lever (96) to its housing.
6. Lift out the gear lever (96).
7. Refitment is a reversal of the removing procedure.

HIGH/LOW SHIFT LEVER

Removal and Refitment 4C-13-14

Figure 14

1. Remove the rubber cover (105) and spring (104), fitted under the cover.
2. Drive out the pin (103) securing the lever (106) to its housing.
3. Lift out the lever (106) and 'O' ring (102).
4. Refitment is a reversal of the removing procedure.

6 SPEED TRANSMISSION

Part 4 Section D

GENERAL

The transmission has three forward gears and one reverse gear which are doubled by a planetary reduction unit to give six forward and two reverse gears.

All gear teeth except those of the main constant mesh gears are of involute, straight cut spur type. Where movement of the gears is required, to change ratio, the gears slide on a splined shaft.

PRINCIPLE OF OPERATION

Figure 1

The Gearbox

The tractor engine drives a clutch with divided drive. Each plate is splined on to a separate gearbox shaft. Drive is transmitted to:

a) The p.t.o. input shaft (24), which is hollow and has gear teeth on its rear end.

b) The main drive input shaft (31) which runs inside the p.t.o. input shaft has gear teeth on its rear end and abuts against the front end of the mainshaft (39).

Layshaft and P.t.o. Shaft

Rotation of the p.t.o. input shaft (24), drives the p.t.o. constant mesh gear (63) which is splined on to the p.t.o. drive shaft (65). When the main input shaft (31) rotates, the drive is transmitted to the constant mesh gear (67) which splined on the layshaft (70). The layshaft, which is hollow and externally splined, has 15 gear teeth machined on its outside diameter to provide the first gear layshaft pinion. It is supported on two ball races located in the centre web and rear wall of the transmission case. Mounted on the layshaft are other gears, (73 and 74) with 33 and 23 teeth, which are third, and second gears respectively. None of the layshaft gears are free to move along the shaft, being retained, either by abutment with other gears, bearings or snap rings.

Mainshaft

The mainshaft (39) is externally splined, and has gear teeth at its rear end. Mounted on the mainshaft are two gears (one being a compound gear having two sets of teeth): When viewed from the front of the gearbox, these gears have 45 teeth (34) and 36/46 teeth (35) to mesh with the layshaft gears and give first, third and second gears respectively. The mainshaft gears are moved into and out of mesh by selector forks (10 and 13), the gears sliding on the mainshaft splines.

The engine speed is reduced by the selected gear ratio (variable reduction) and by the input constant mesh gears (fixed reduction).

Reverse Gear Cluster

Reverse gear is achieved by the engagement of a compound gear cluster (83) with 13/21 teeth. The 21 tooth half of the gear is in constant mesh with the third gear pinion (33 teeth) on the layshaft. The 45 tooth first gear pinion on the mainshaft is moved into, or out of mesh with the 13 tooth portion of the reverse gear cluster.

The reverse gear, by acting as an idler gear between the layshaft and the mainshaft drive, reverses the rotation of the mainshaft, epicyclic unit and the final drive.

Epicyclic Unit

The basic three forward and one reverse gears are doubled by the epicyclic unit mounted on the rear end of the transmission case. The epicyclic unit comprises a ring gear (43), inside which run three planetary pinions mounted in a carrier (45). The planetary pinions are driven by gear teeth on the end of the mainshaft (39) which acts as the sun gear. When the mainshaft rotates, the planetary pinions also rotate, but being meshed with the teeth on the inside of the ring gear the rotational speed of the carrier is reduced by a ratio of 4:1.

To transmit the drive from the epicyclic unit to the rear axle, a driveshaft is connected by the coupler (50), either directly to the gearbox mainshaft (HIGH range), or to the planetary pinion carrier (45) (LOW range).

Movement of the dual range selector lever actuates the rod attached to the selector fork (7) which moves the coupler (50) into, or out of mesh with either the end of the mainshaft (39) or the planetary pinion carrier (45). Between the two engaged (HIGH or LOW range) positions, there is a neutral position, where the coupler splines are disengaged from both the mainshaft and the planetary pinion carrier.

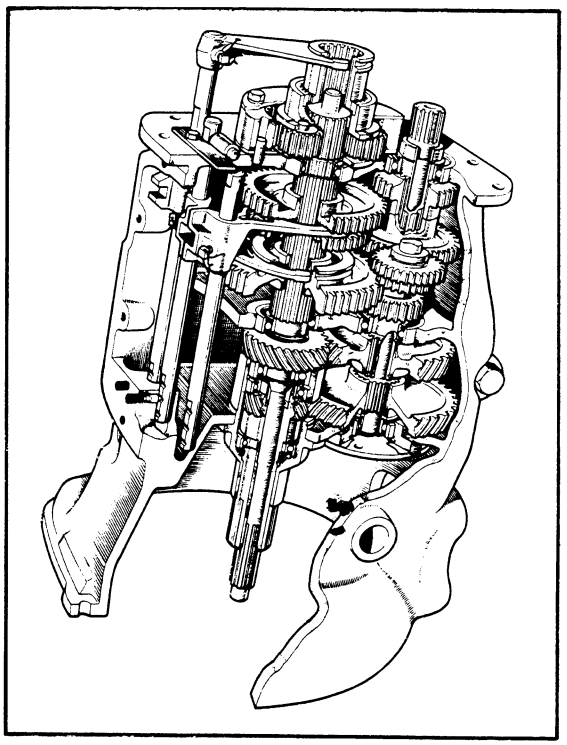
SHIFTER RAIL MECHANISM

Removal and Refitment 4D-01-02

Special Tools Required: 270 Rail Trolley.

Removal

1. Split the tractor between the gearbox and centre housing as stated in Part 3.
2. Remove the gearbox top cover, in unit with the instrument panel, as stated in Part 3.
3. Fig 2. Release the locking wire from the 1st/rev. and 2nd/3rd shift forks (10,13), and from the rear end of the HIGH/LOW shift rail (6).
4. Fig 3. Remove the locking peg (8) from the HIGH/LOW shift fork (7), detach the fork and coupler (50).
5. Remove the gear lever stop plate (15) and interlock pin (18), secured by two bolts (17) and spring washers (16).
6. Lift out the three shift rail springs (1), and plungers (2).
7. Remove the locking pegs (9 and 12) from the 1st/rev. and 2nd/3rd shift forks (10 and 13).
8. Slide the 1st/rev. and 2nd/3rd shift rails (11 and 14), rearwards out of the transmission housing. Lift out the 1st/rev. and 2nd/3rd shift forks (10 and 13).
9. Release the locking wire and remove the locking peg (3) from the HIGH/LOW shift selector (5).
10. Slide the HIGH/LOW shift rail (6), rearwards out of the transmission housing. Lift out the HIGH/LOW shift selector (5).



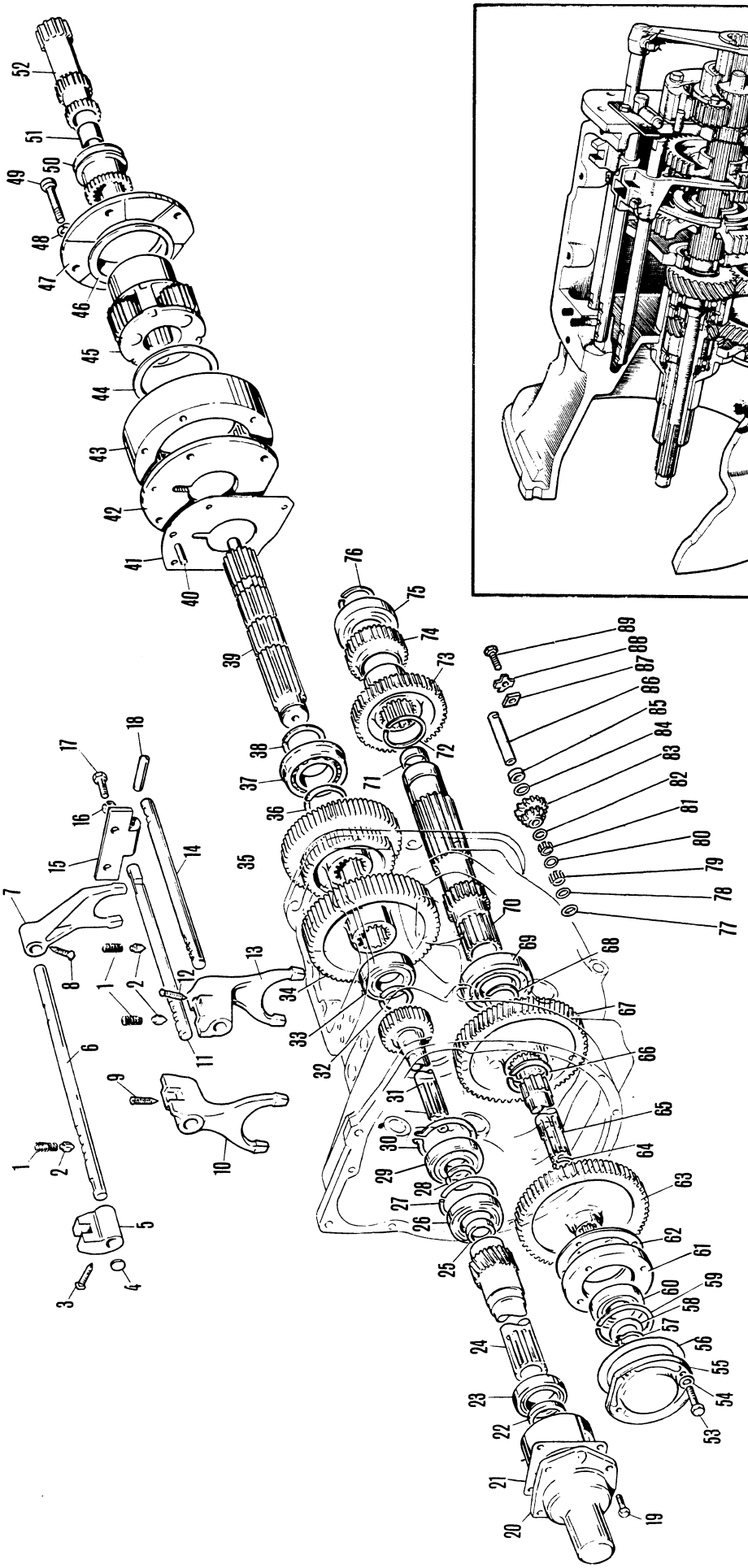


FIG. 1

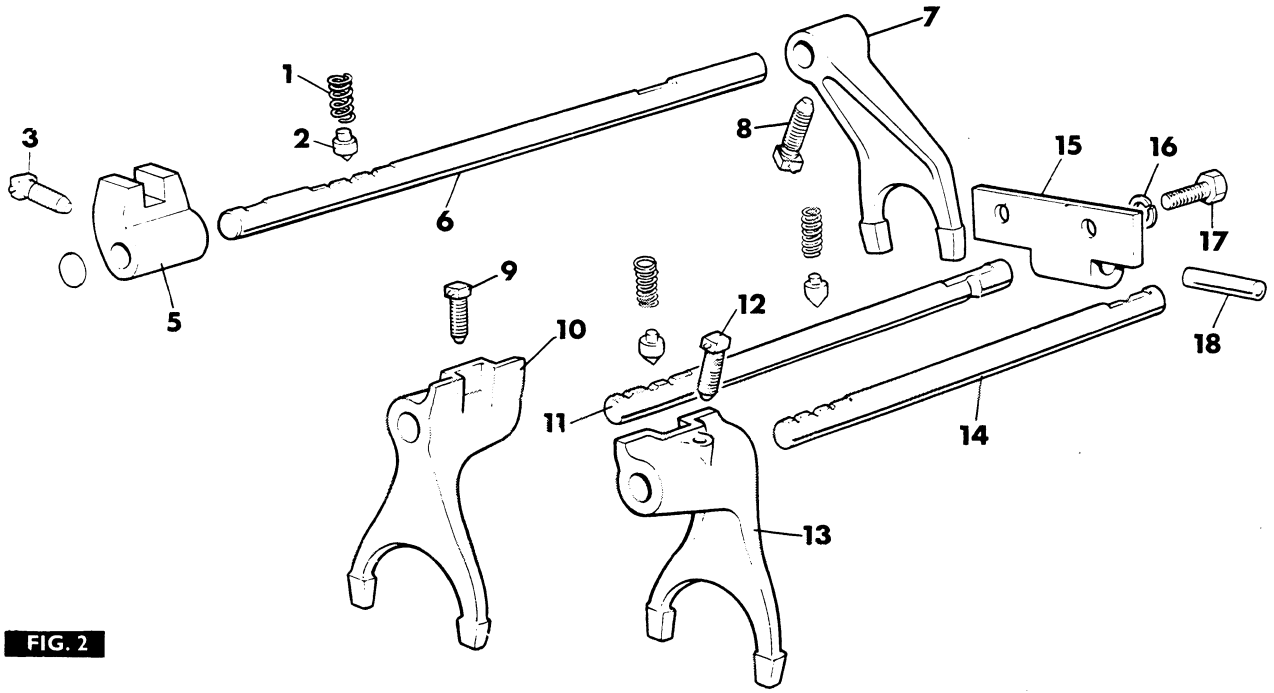


FIG. 2

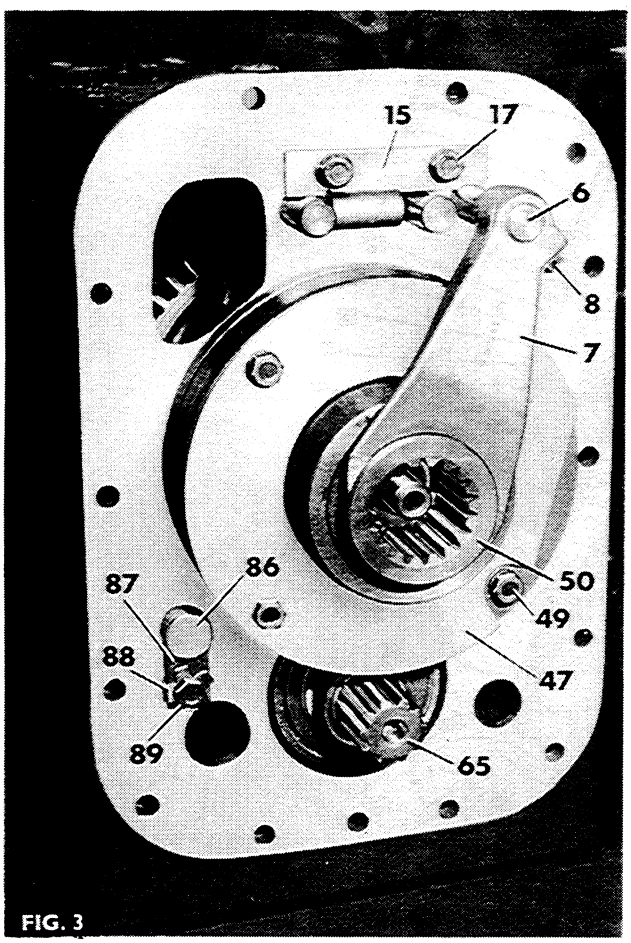


FIG. 3

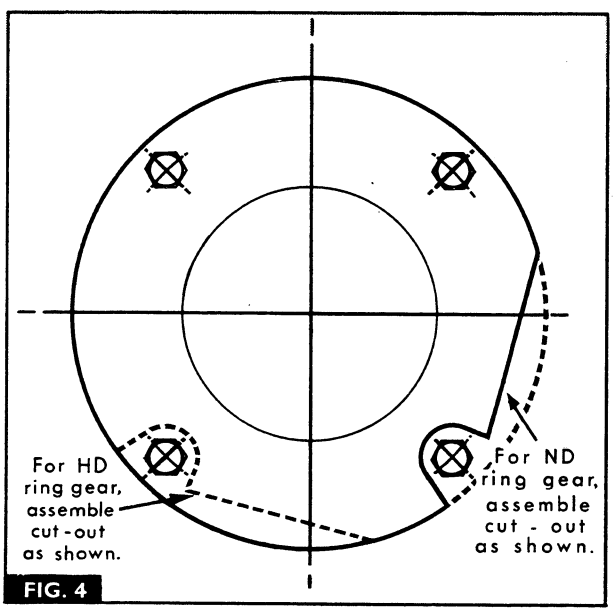


FIG. 4

Refitment

1. Fit the HIGH/LOW shift rail (6), sliding the HIGH/LOW shift selector (5), onto the rail and secure to the rail with a locking peg (3). Wire lock the peg to the rail.
2. Locate the 1st/rev. and 2nd/3rd shift forks (10 and 13), to their respective grooves in the mainshaft gears. The two forks are identical.
3. Assemble the 1st/rev. and 2nd/3rd shift rails (11 and 14), with the interlock pin grooves facing each other, to the forks, and secure each fork with a locking peg (9 and 12). Wire lock the pegs to the rails. The shorter, 2nd/3rd shift rail (14) is fitted to the L.H. side.
4. Locate the HIGH/LOW shift fork (7), to the groove in the coupler (50). Assemble the coupler into the planet pinion carrier assembly (45), simultaneously sliding the fork (7), onto the HIGH/LOW shift rail (6).
5. Secure the HIGH/LOW shift fork (7), to its rail with the locking peg(8).
6. Wire lock the peg to the rail.
7. Fit the interlock pin (18), to the stop plate (15), and secure the stop plate with two bolts (17), and spring washers (16).
8. Fit the three plungers (2), pointed end downwards, and the three springs (1).
9. Refit the gearbox top cover and instrument panel assembly as stated in Part 3.

NOTE – BOTH GEAR LEVERS AND THE GEAR SELECTOR DOGS MUST BE PLACED IN NEUTRAL.

10. Reconnect the transmission to the centre housing, as stated in Part 3.

TRANSMISSION EPICYCLIC

Removal and Refitment 4D-02-05

Figure 3

Special Tools Required: 270 Rail Trolley.

Removal

1. Split the tractor between the transmission and the centre housing.
2. Remove the locking wire and peg (8) from the HIGH/LOW shifter fork (7) then remove the fork and coupler (50).
3. Figure 3. Remove the four bolts (49) securing the transmission epicyclic unit, then remove the complete assembly.

Refitment

1. Refit the backplate (42) and the shims (41) to the dowels (40) on the ring gear (43), then locate the dowels in the holes in the transmission case. Fit the thrust washers (44 and 46) to the planetary pinion carrier (45) and locate the carrier in the ring gear. Refit the cover plate (47), as shown in Fig 4. Fit the four bolts (49), and tighten them progressively and evenly to a torque of 4,9 kg-m (35 lb-ft).

NOTE – OMIT LOCKWASHER FROM LOWER LEFT HAND BOLT.

2. Refit the coupler (50) and HIGH/LOW shifter fork (7), then refit the locking peg (8) and locking wire.
3. Reconnect the transmission to the centre housing.

P.T.O. DRIVESHAFT FRONT BEARING

Removal and Refitment 4D-03-05

Special Tools Required: 270 Rail Trolley
MF 218A P.t.o. Driveshaft puller
MF 218A-2 Adapter

Removal

1. Split the tractor between the engine and gearbox.
2. Fig 5. Remove the bo lt, nut and lockwasher (A) securing the left brake cross shaft lever. Remove the lever and key (B) from the shaft.
3. Withdraw the shaft, complete with pedals from the right hand side of the transmission housing.
4. Remove the four bolts (53) securing the cover plate (55).

NOTE – IF THE 'O' RING (56) IS CAUSING LEAKAGE, PROCEDE NO FURTHER.

5. Figure 6. Remove the circlip (57) and the thrust washer (58).
6. Screw two 3/8 UNC x 75 mm (3 in) bolts into the tapped holes in the bearing housing (61). Progressively and evenly tighten the bolts until the housing is extracted.
7. Remove the 'O' ring (56) from the bearing housing.
8. If the bearing (60) needs servicing, remove the circlip (59) and press out the bearing (60).

When refitting, always fit a new 'O' ring (56) and gasket (62), also fitting new circlips (57 and 59), if possible.

Refitment

1. Refit the p.t.o. driveshaft front bearing (60) to its housing (61) and secure it with the circlip (59).
2. Refit the housing (61) together with a new gasket (62) into the transmission case.
3. Fig 7. Pull the p.t.o. driveshaft (65) into its bearing (60) by using special tool MF 218A and adapter MF218-2.
4. Figure 6. Secure the p.t.o. driveshaft with the thrust washer (58) and the circlip (57).
5. Using a new 'O' ring (56) refit the front cover plate (55).

NOTE – WHEN REFITTING THE COVER PLATE AND THE BOLTS (53) USE SEALING COMPOUND 'HYLOMAR COMPOUND SQ 32M' TO SEAL THE PLATE AND BOLT THREADS.

6. Refit the brake pedal and cross shaft assembly to the transmission case, from the right hand side.
7. Figure 5. Refit the lever and key to the brake cross shaft, then re-tighten the nut and bolt.
8. Reconnect the gearbox.

INPUT SHAFT HOUSING AND INPUT SHAFTS

Removal and Refitment. 4D-04-06

Special Tools Required: 270 Rail Trolley
MF 177 Seal Protector
MF 178 Seal Protector
MF 179 Oil Seal Replacer
MF 200 Hand Press
MF 200-25 Adapter
550 Universal Handle

Removal

1. Remove the p.t.o. driveshaft front bearing, as stated in operation 4D-03-05.
2. Split the tractor between the gearbox and centre housing, as stated in Part 3A.
3. Remove the clutch release mechanism and stated in operation 4A-03-05.
4. Withdraw the p.t.o. driveshaft (65) rearwards to permit the p.t.o. constant mesh gear (63) to drop into the transmission case.
5. Remove the four bolts (19) securing the input shaft housing (20) to the gearbox, then withdraw the housing, complete with the shafts and gasket.
6. Fig 8. Compress the snap ring (30) then, drive the main input shaft (31) out of the housing (20).
7. Remove the snap ring (27), then drive the p.t.o. input shaft (24), complete with its bearings (23 and 26) and oil seal (25) out of the housing.
8. Carefully remove the oil seals (22 and 25) from the housing (20) and the p.t.o. input shaft (24).
9. If necessary, remove the snap ring (28), then press the main input shaft and p.t.o. input shaft bearings (29, 23 and 26) off their respective shafts using the hand press MF 200 and adapter MF 200-25.

Refitment

1. If necessary, press the p.t.o. input shaft and main input shaft bearings (23, 26 and 29) on to their respective shafts securing the main input shaft bearing (29) with a new snap ring(28).
2. Fig 9. Assemble the oil seal replacer MF 179 to the 550 handle, then slide the new oil seal (22), with its metal face towards the housing on to MF 179.
3. Drive the seal into the input housing (20).
4. Fig 10. Fit a new oil seal (25) on to MF 179, then drive the seal into the p.t.o. input shaft.
5. Fig 10. Fit the oil seal protector, MF 178 to the p.t.o. input shaft, then slide the p.t.o. input shaft into the housing (20).
6. Secure the p.t.o. input shaft with a new snap ring (27), then remove the oil seal proctector MF 178..
7. Thoroughly clean and degrease the outside diameter of the main input shaft bearing (29), using triclorethylene or a similar degreasing solvent.
8. Fig 12. Fit the seal protector MF 177 to the main input shaft.
9. Apply four drops of either 'Loctite Grade 'AV' (Red), or Casco Metalok LF5 to the outside diameter of the bearing (29), then press the bearing into the main input shaft until the bearing contacts the inner snap ring (27). Fit a new outer snap ring (30). Remove the seal protector.
10. Slide the input housing and shaft assembly into the transmission case, using a new gasket (21) and secure it with the four bolts (19).

NOTE – TO SEAL THE BOLT THREADS AND THE GASKET FACE, USE SEALING COMPOUND 'HYLOMAR SQ32M'.

11. Slide the p.t.o. driveshaft (65) into the layshaft from the rear engaging the constant mesh gear (63).
12. Refit the p.t.o. driveshaft front bearing, as stated in operation 4D-03-05.
13 Reconnect the gearbox to the centre housing, as stated in Part 3A.
14. Refit the clutch release mechanism, as stated in operation 4A-03-05.

FIRST, SECOND OR THIRD GEAR OR MAINSHAFT

Removal and Refitment 4D-05-06

Special Tools Required: MF 200 Hand Press
MF 200-25 Adapter

Removal

1. Remove the shifter rail mechanism, as stated in operation 4D-01-02.
2. Remove the transmission epicyclic unit, as stated in operation 4D-02-05.
3. Remove the input housing and input shafts as stated in operation 4D-04-06.
4. Fig 13. Remove the snap ring (32) from the front end of the mainshaft (39).
5. Drive the mainshaft rearwards to release the front bearing (33) from its web in the gearbox, then drive the bearing off the mainshaft.
6. The mainshaft can then be withdrawn rearwards, removing the 1st/rev. gear (34) and the 2nd/3rd gear (35).
7. Fig 14. If necessary, remove the snap ring (36) and press off the bearing (37), using the MF 200 hand press and the MF 200-25 adapter, then remove the snap ring (38).

WARNING – DO NOT ATTEMPT TO PRESS THE BEARING OFF THE REAR END OF THE MAINSHAFT, AS THE GEAR TEETH ARE OF A LARGER DIAMETER THAN THE SHAFT SPLINES.

Refitment

1. Fig 14. Refit the mainshaft rear snap ring (38) from the front end, then press the bearing (37) on to the mainshaft (39) using press MF 200 and adapter MF 200-25. Refit the second snap ring (36).
2. Refit the mainshaft centre bearing (33) to the web in the transmission case.

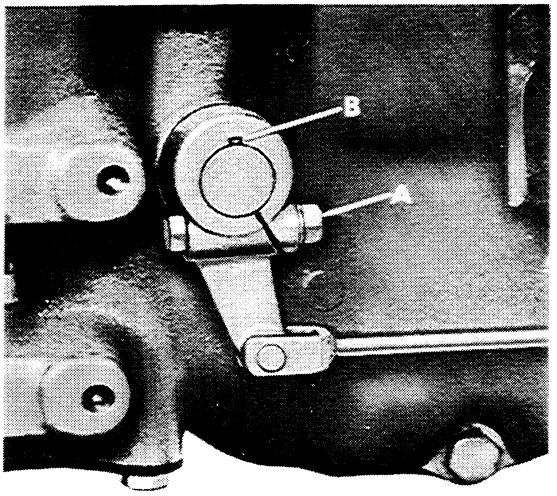


FIG. 5

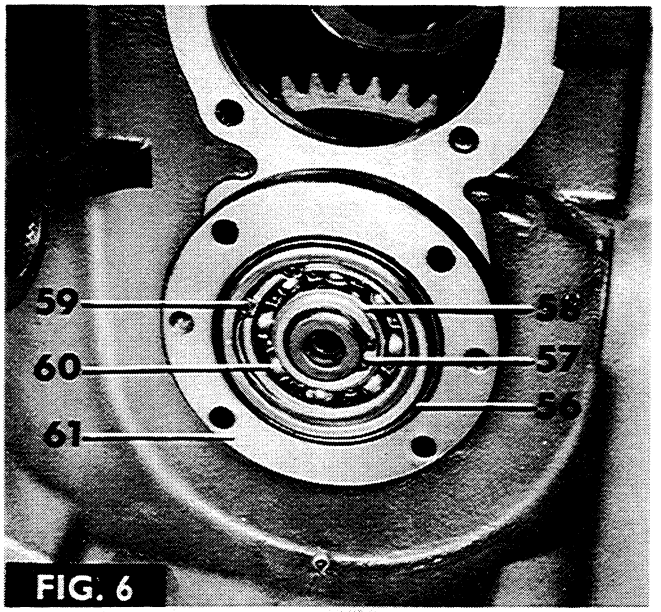


FIG. 6

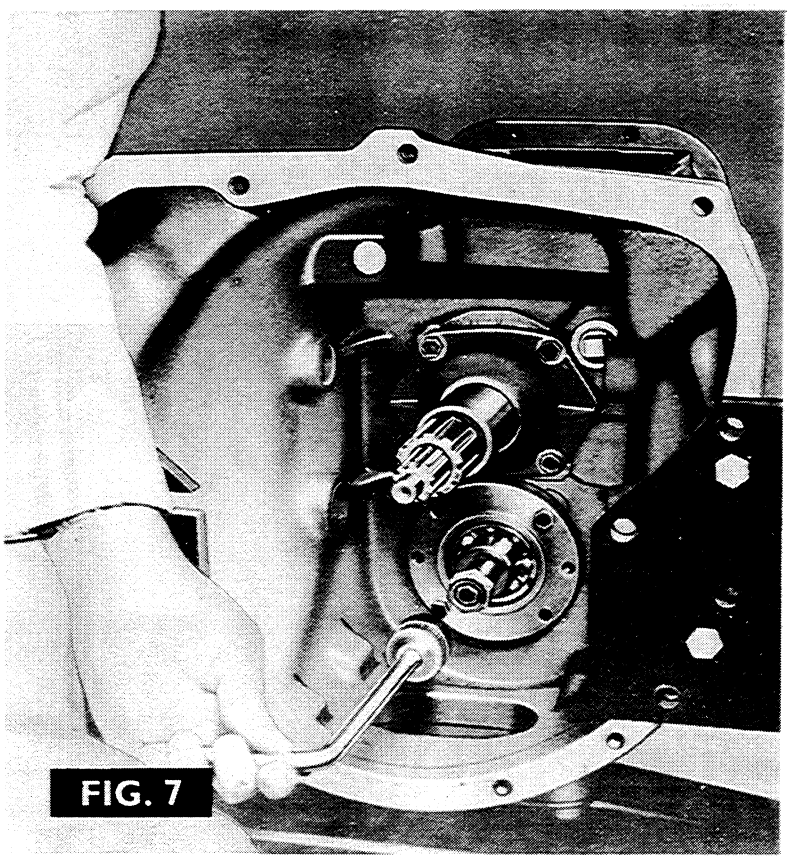


FIG. 7

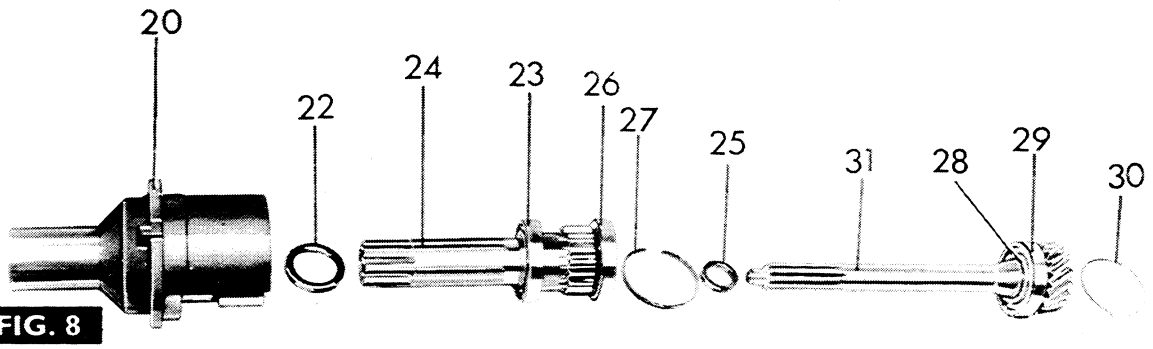


FIG. 8

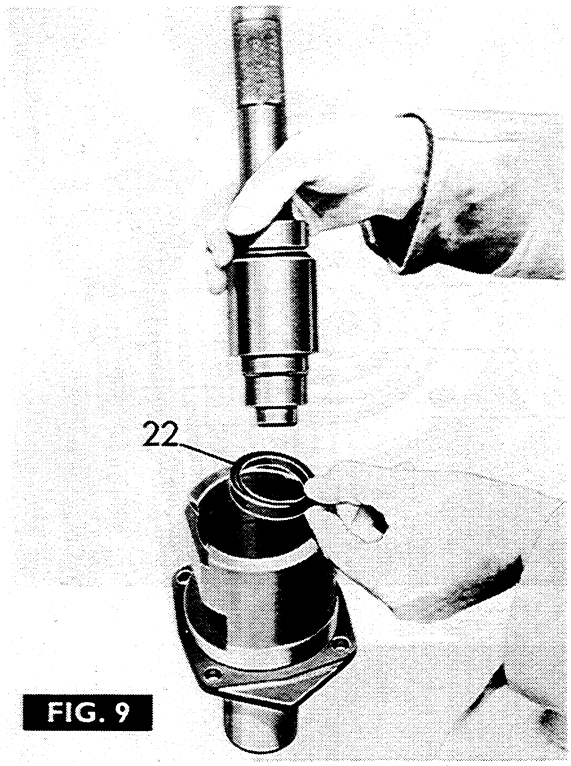


FIG. 9

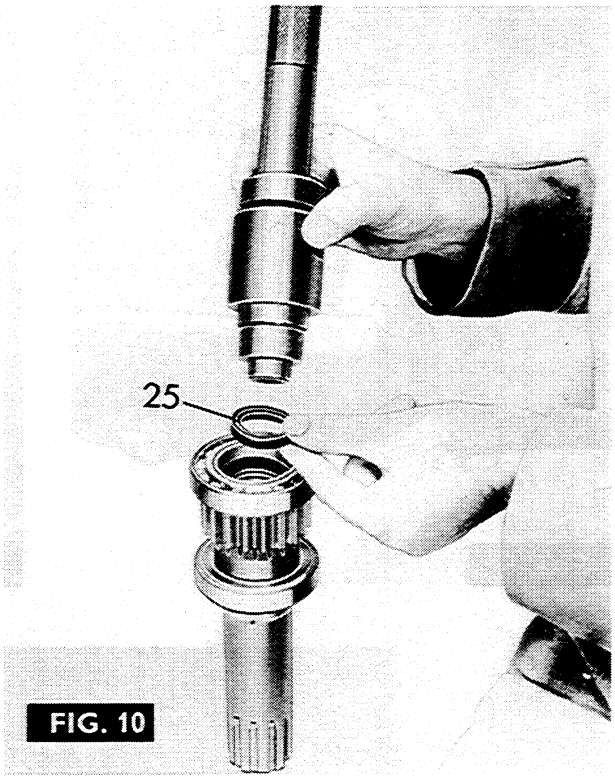


FIG. 10


FIG. 11

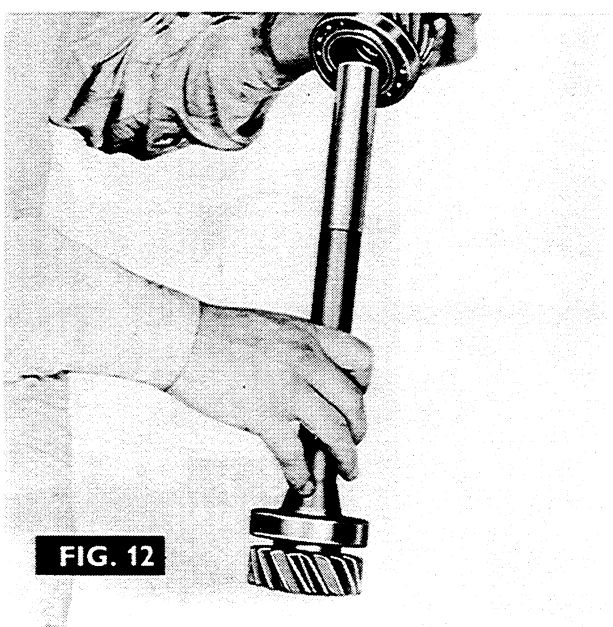


FIG. 12

3. Figure 13. Feed the mainshaft into the transmission case from the rear, progressively fitting the third/second compound sliding gear (35) and the first reverse sliding gear (34). Insert the mainshaft through the centre bearing.
4. Drive the mainshaft forwards into the front bearing then fit the snap ring (32).
5. Refit the input housing and input shafts, as stated in operation 4D-04-06.
6. Refit the transmission epicyclic unit, as stated in operation 4D-02-05.
7. Refit the shifter rail mechanism, as stated in operation 4D-01-02.

LAYSHAFT AND LAYSHAFT GEARS

Removal and Refitment 4D-06-09

Special Tools Required: MF 200 Hand Press
MF 200-25 Adapter

Removal
1. Remove the mainshaft and gears as stated in operation 4D-05-06.
2. Figure 15. Remove the snap ring (76) from the rear of the layshaft.
3. Figure 16. Tap the layshaft forwards to expose the snap ring (72), forward of the third gear pinion (73). Move the snap ring (72) forwards on to the unsplined portion of the layshaft.
4. Remove the snap ring (66) from the front of the layshaft, then tap the layshaft backwards until the constant mesh gear (67) can be removed.
5. Drive the layshaft forward out of the case, progressively removing the second and third gear pinions (74 and 73) from the transmission case.
6. Using the hand press MF 200 and the adaptor MF 200-25, press the centre bearing (69) from the layshaft (70).

Refitment
1. Fig 16. Press the layshaft centre bearing (69) on to the layshaft (70) using MF200 and MF200-25.
2. Refit the snap ring (72) on to the layshaft (70) placing it temporarily on the unsplined portion of the shaft to the rear of the first gear teeth.
3. Feed the layshaft into the transmission case, from the front, progressively fitting the third gear pinion (74) and the second gear pinion (74). Push the layshaft rearwards to permit fitment of the constant mesh gear (67).
4. Refit the snap ring (66) to secure the constant mesh gear (67) and the bearing (69).
5. Tap the layshaft forwards slightly to allow the snap ring (72) to be fitted to its groove adjacent to the third gear pinion (73).
6. Fig 15. Carefully drive the layshaft rearwards and fit the rear snap ring (76).
7. Refit the mainshaft as stated in operation 4D-05-06.

REVERSE GEAR CLUSTER

Removal and Refitment 4D-07-09

Removal
1. Remove the mainshaft as stated in operation 4D-05-06.
2. Figure 3. Release the tabwasher (88), then remove the bolt (89)
3. Fig 17. Using a dummy shaft to prevent the needle rollers from falling into the transmission case, remove the reverse gear cluster (83) thrust washers (77 and 84) and distance piece (85).

Refitment
1. Fig 17. Using petroleum jelly refit the two sets of needle rollers (79 and 81), with a spacer (80) between the rows and a retaining ring (78 and 82) at each end. A smear of petroleum jelly can be used to make the thrust washers (77 and 84) and the distance piece (85) adhere to the end face of the gear cluster.
2. Insert the dummy shaft to the reverse gear cluster.
3. Refit the gear cluster assembly to the transmission case, then insert the shaft (86) from the rear and push out the dummy shaft.
4. Figure 3. Refit the plate (87), a new tabwasher (88) and the bolt (89). Bend up the tabwasher.

TRANSMISSION CASE REMOVAL AND REPLACEMENT OR COMPLETE TRANSMISSION OVERHAUL

4D-08-09

Special Tools Required: MF 177 Seal Protector
MF 178 Seal Protector
MF 179 Oil Seal Replacer
MF 200 Hand Press
MF 200-25 Adapter
MF 218A P.t.o. Driveshaft Puller
MF 218A-2 Adapter
270 Rail Trolley
550 Universal Handle

Disassembly
1. Remove the clutch release mechanism, as stated in operation 4A-03-05
2. Split the tractor between the gearbox and centre housing as stated in Part 3
3. Remove the gearbox top cover, in unit with the instrument panel, as stated in Part 3.
4. Fig 2. Release the locking wire from the 1st/rev. and 2nd/3rd shift rails (11, 14), and from the rear end of the HIGH/LOW shift rail (6).
5. Fig 3. Remove the locking peg (8) from the HIGH/LOW shift fork (7), detach the fork (7) and coupler (50)
6. Remove the gear lever stop plate (15) and interlock pin (18), secured by two bolts (17) and spring washers (16)
7. Fig 2. Lift out the three shift rail springs (1), and plungers (2).
8. Remove the locking pegs (9 and 12) from the 1st/rev. and 2nd/3rd shift forks (10, 13)

9. Slide the 1st/rev. and 2nd/3rd shift rails (11, 14), rearwards out of the transmission housing. Lift out the 1st/rev. and 2nd/3rd shift forks (10, 13).
10. Release the locking wire and remove the locking peg (3) from the HIGH/LOW shift selector (5)
11. Slide the HIGH/LOW shift rail (6), rearwards out of the transmission housing. Lift out the HIGH/LOW shift selector (5).
12. Figure 3. Remove the four bolts (49) securing the transmission epicyclic unit, then remove the complete assembly.
13. Remove the four bolts (53) securing the cover plate (55).
14. Figure 6. Remove the circlip (57) and the thrust washer (58).
15. Screw two 3/8 UNC x 75 mm (3 in) bolts into the tapped holes in the bearing housing (61). Progressively and evenly tighten the bolts until the housing is extracted.
16. Remove the 'O' ring (56) from the bearing housing then remove the circlip (59) and press out the bearing (60).
17. Figure 3. Withdraw the p.t.o. drive shaft (65) from the rear end of the layshaft, thus allowing the p.t.o. constant mesh gear (63), to drop into the transmission case.
18. Remove the four bolts (19) and withdraw the input shaft retainer housing (20) complete with the input shafts.
19. Fig 8. Compress the snap ring (30) then, drive the main input shaft (31) out of the housing (20).
20. Remove the snap ring (27), then drive the p.t.o. input shaft (24), complete with its bearings (23 and 26) and oil seal (25) out of the housing.
21. Carefully remove the oil seals (22 and 25) from the housing (20) and the p.t.o. input shaft (24).
22. Remove the snap ring (28), then press the main input shaft and p.t.o. input shaft bearings (29, 23 and 26) off their respective shafts using the hand press MF200 and adapter MF 200-25.
23. Fig 13. Remove the snap ring (32) from the front end of the mainshaft (39).
24. Drive the mainshaft rearwards to release the front bearing (33) from its web in the gearbox, then drive the bearing off the mainshaft.
25. The mainshaft can then be withdrawn rearwards, removing the 1st/rev. gear (34) and the 2nd/3rd gear (35).
26. Fig 14. Remove the snap ring (36) and press off the bearing (37), using the MF200 hand press and the MF200-25 adapter, then remove the snap ring (38)

WARNING – DO NOT ATTEMPT TO PRESS THE BEARING OFF THE REAR END OF THE MAINSHAFT, AS THE GEAR TEETH ARE OF A LARGER DIAMETER THAN THE SHAFT SPLINES.

27. Figure 15. Remove the snap ring (76) from the rear of the layshaft.
28. Figure 16. Tap the layshaft forwards to expose the snap ring (72), forward of the third gear pinion (73). Move the snap ring (72) forwards on to the unsplined portion of the layshaft.
29. Remove the snap ring (66) from the front of the layshaft, then tap the layshaft backwards until the constant mesh gear (67) can be removed.
30. Drive the layshaft forward out of the case, progressively removing the second and third gear pinions (74 and 73) from the transmission case.
31. Using the hand press MF 200 and the adapter MF 200-25, press the centre bearing (69) from the layshaft (70).
32. Figure 3. Release the tabwasher (88), then remove the bolt (89).
33. Using a dummy shaft to prevent the needle rollers from falling into the transmission case, remove the reverse gear cluster (83) thrust washers (77 and 84) and distance piece (85).

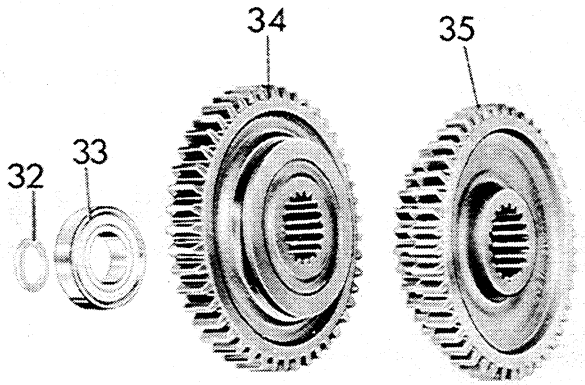
Examination

After disassembly of the transmission, examine all the components for scoring, wear or chipping. Pay particular attention to the gear teeth, bearings needle rollers, gear selector forks, also shaft splines which are subject to wear from the sliding action of the gears. All bearings should be washed in clean paraffin, blown dry, inspected for wear or scoring on the outer circumference and measured for fit in transmission case webbs. Maximum acceptable clearance is 0,33 mm (0.0013 in). Where clearance between bearing and bore exceeds this figure, Loctite Grade 'Bearing Fit' (Yellow) may be used to refit bearings into transmission case. After inspection, lubricate bearings with transmission oil.

Any worn or damaged components should be replaced; also, a complete set of new gaskets, 'O' rings and a new tabwasher should be fitted.

Reassembly

1. Fig 17. Using petroleum jelly refit the two sets of needle rollers (79 and 81), with a spacer (80 between the rows and a retaining ring (78 and 82) at each end. A smear of petroleum jelly can be used to make the thrust washers (77 and 84) and the distance piece (85) adhere to the end face of the gear cluster.
2. Insert the dummy shaft to the reverse gear cluster.
3. Refit the gear cluster assembly to the transmission case, then insert the shaft (86) from the rear and push out the dummy shaft.
4. Fig 3. Refit the plate (87), a new tabwasher (88) and the bolt (89). Bend up the tabwasher.
5. Fig 16. Press the layshaft centre bearing (69) on to the layshaft (70) using MF200 and MF200-25.
6. Refit the snap ring (72) on to the layshaft (70) placing it temporarily on the unsplined portion of the shaft to the rear of the first gear teeth.
7. Feed the layshaft into the transmission case, from the front, progressively fitting the third gear pinion (73) and the second gear pinion (74). Push the layshaft rearwards to permit fitment of the constant mesh gear (67).
8. Refit the snap ring (66) to secure the constant, mesh gear (67) and the bearing (69).
9. Tap the layshaft forwards slightly to allow the snap ring (72) to be fitted to its groove adjacent to the gear pinion (73).
10. Fig 15. Carefully drive the layshaft rearwards and fit the rear snap ring (76).



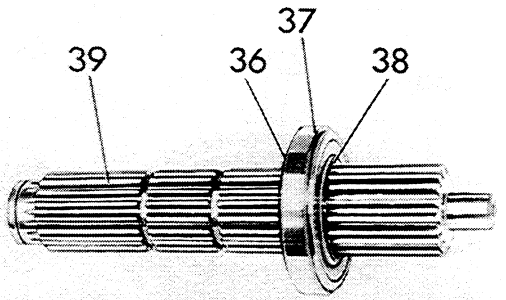


FIG. 13

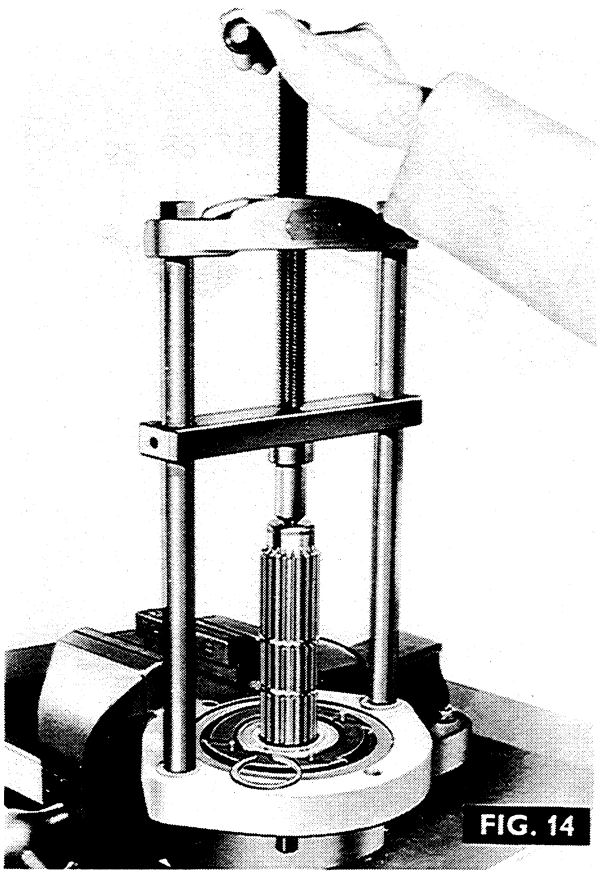


FIG. 14

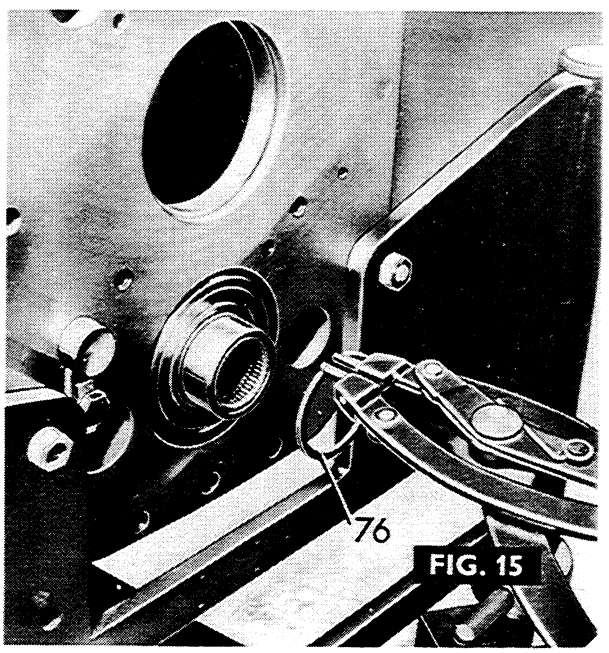


FIG. 15

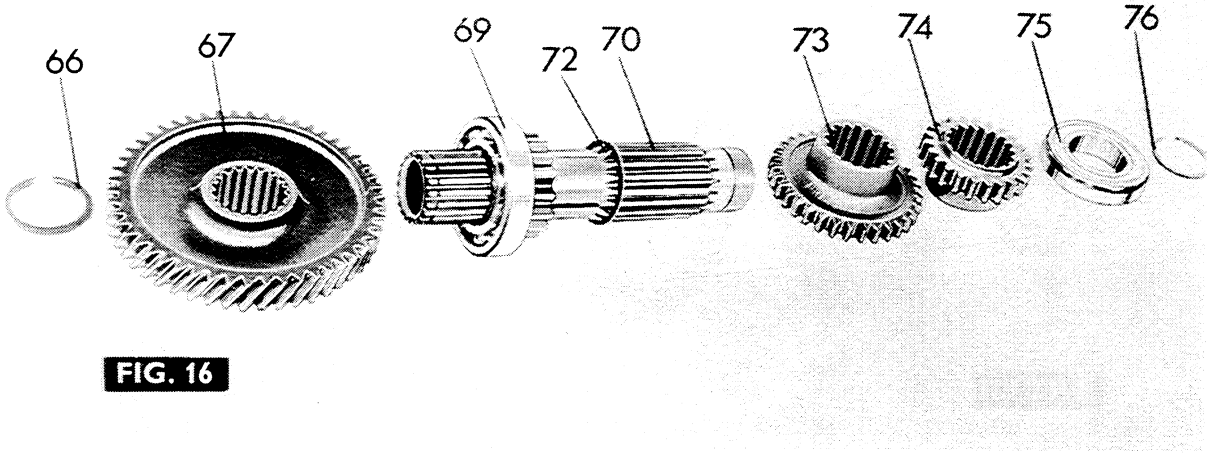


FIG. 16

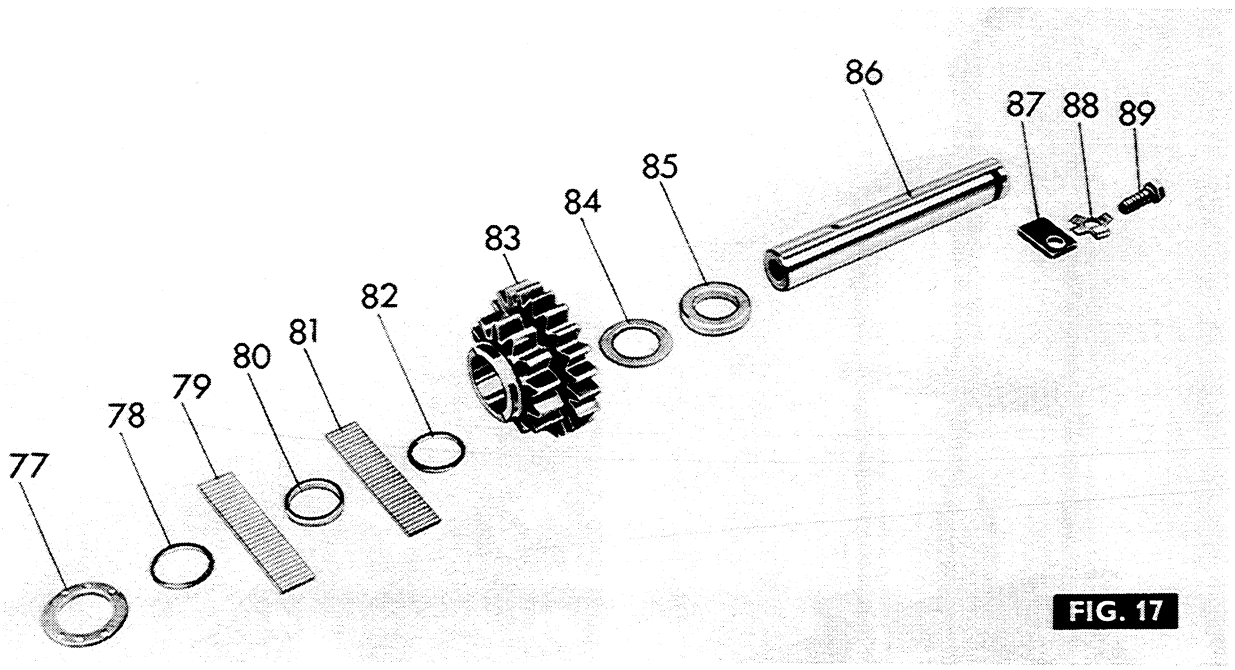


FIG. 17

11. Fig 14. Refit the mainshaft rear snap ring (38) from the front end, then press the bearing (37) on to the mainshaft (39) using press MF200 and adapter MF200-25. Refit the second snap ring (36).
12. Refit the mainshaft centre bearing (33) to the web in the transmission case.
13. Fig 13. Feed the mainshaft into the transmission case from the rear, progressively fitting the third/second compound sliding gear (35) and the first/reverse sliding gear (34). Insert the mainshaft through the front bearing.
14. Drive the mainshaft forwards into the front bearing then fit the snap ring (32).
15. Fig 8. Press the p.t.o. input shaft and main input shaft bearings (23, 26 and 29) on to their respective shafts securing the main input shaft bearing (29) with a new snap ring (28).
16. Fig 9. Assemble the oil seal replacer MF179 to the 550 handle, then slide the new oil seal (22), with its metal face towards the housing on to MF179.
17. Drive the seal into the input housing (20).
18. Fig 10. Fit a new oil seal (25) on to MF 179, then drive the seal into the p.t.o. input shaft.
19. Fig 11. Fit the oil seal protector, MF 178 to the p.t.o. input shaft, then slide the p.t.o. input shaft into the housing(20).
20. Secure the p.t.o. input shaft with a new snap ring (27), then remove the oil seal protector MF178.
21. Fig 8. Thoroughly clean and degrease the outside diameter of the main input shaft bearing (29), using triclorethylene or a similar degreasing solvent.
22. Fig 12. Fit the seal protector MF177 to the main input shaft.
23. Apply four drops of either 'Loctite Grade 'AV' (Red), or Casco Metalok LF5 to the outside diameter of the bearing (29), then press the bearing into the main input shaft until the bearing contacts the inner snap ring (27). Fit a new outer snap ring (30). Remove the seal protector.
24. Slide the input housing and shaft assembly into the transmission case, using a new gasket (21) and secure it with the four bolts (19).

NOTE – TO SEAL THE BOLT THREADS AND THE GASKET FACE, USE SEALING COMPOUND 'HYLOMAR SQ32M'.

25. Slide the p.t.o. driveshaft (65) into the layshaft from the rear, engaging the constant mesh gear (63).
26. Fig 6. Refit the p.t.o. driveshaft front bearing (60) to its housing (61) and secure it with the circlip (59).
27. Refit the housing (61) together with a new gasket (62) into the transmission case.
28. Fig 7. Pull the p.t.o. driveshaft (65) into its bearing (60) by using special tool MF218A and adapter MF218-2.
29. Fig 6. Secure the p.t.o. driveshaft with the thrust washer (58) and the circlip (57).
30. Using a new 'O' ring (56) refit the front cover plate (55).

NOTE – WHEN REFITTING THE COVER PLATE AND THE BOLTS (53) USE SEALING COMPOUND 'HYLOMAR COMPOUND SQ 32M' TO SEAL THE PLATE AND BOLT THREADS.

31. Refit the brake pedal and cross shaft assembly to the transmission case, from the right hand side.
32. Fig 5. Refit the lever and key to the brake cross shaft, then re-tighten the nut and bolt.
33. Refit the backplate (42) and the shims (41) to the dowels (40) on the ring gear (43), then locate the dowels in the holes in the transmission case. Fit the thrust washers (44 and 46) to the planetary pinion carrier (45) and locate the carrier in the ring gear. Refit the cover plate (47), as shown in Fig 4. Fit the four bolts (49) and tighten them progressively and evenly to a torque of 4,9 kg-m (35 lb-ft).

NOTE – OMIT LOCKWASHER FROM LOWER LEFT HAND BOLT

34. Fig 2. Fit the HIGH/LOW shift rail (6), sliding the HIGH/LOW shift selector (5), onto the rail and secure it to the rail with a locking peg (3). Wire lock the peg to the rail.
35. Locate the 1st/rev. and 2nd/3rd shift forks (10 and 13) to their respective grooves in the mainshaft gears. The two forks are identical.
36. Assemble the 1st/rev. and 2nd/3rd shift rails (11 and 14), with the interlock pin grooves facing each other, to the forks, and secure each fork with a locking peg (9 and 12). Wire lock the pegs to the rails. The shorter, 2nd/3rd shift rail (14) is fitted to the L.H. side.
37. Fig 3. Locate the HIGH/LOW shift fork (7), to the groove in the coupler (50). Assemble the coupler into the planet pinion carrier assembly (45), simultaneously sliding the fork (7), onto the HIGH/LOW shift rail (6).
38. Secure the HIGH/LOW shift fork (7), to its rail with the locking peg (8).
39. Wire lock the peg to the rail.
40. Fig 2. Fit the interlock pin (18), to the stop plate (15), and secure the stop plate with two bolts (17) and spring washers (16).
41. Fit the three plungers (2), pointed end downwards, and the three spings (1).
42. Refit the gearbox top cover and instrument panel assembly as stated in Part 3.

NOTE – BOTH GEAR LEVERS AND THE GEAR SELECTOR DOGS MUST BE PLACED IN NEUTRAL.

43. Reconnect the transmission to the centre housing, as stated in Part 3.
44. Refit the clutch release mechanism, as stated in operation 4A-03-05

GEAR SHIFT LEVER

(MF 135 tractor only)

Removal and Refitment 4D-09-14

1. Remove the steering box as stated in Part 6A.
2. Fig 18. Release the spring retaining seat (96) from the gear lever (90) and detach the seat (96) and spring (95).
3. Remove the gear lever rubber cover (91).
4. Unscrew the locking ring (93) securing the gear lever cup (94).
5. Drive out the pin (92) securing the gear lever (90) to the cup (94).
6. Lift out the gear lever (90).
7. Drive the cup (94) downwards out of the housing.
8. Refitment to a reversal of the removing procedure

HIGH/LOW SHIFT LEVER

(MF 135 tractor only)

Removal and Refitment 4D-10-14

1. Remove the steering box as stated in Part 6A.
2. Fig 18. Remove the rubber cover (100).
3. Unscrew the locking (98) securing the lever cup (97).
4. Turn the lever (101) and cup (97) until the pin (99), securing the lever to the cup, can be removed.
5. Lift out the lever (101).
6. Drive the cup (97) downwards out of the housing.
7. Refitment is a reversal of the removing procedure.

GEAR SHIFT LEVER

(MF 165 tractor only)

Removal and Refitment 4D-09-14

1. Remove the steering box as stated in Part 6A.
2. Fig 19. Remove the bolts securing the shift lever support and battery platform to the transmission housing. Lift the support and platform up off the transmission housing.
3. Release the spring retaining seat (107) from the lower end of the gear lever (102) and detach the seat and spring (106).
4. Remove the gear lever rubber cover (103) and spring (104) fitted under the cover.
5. Drive out the pin (105) securing the gear lever (102) to its housing.
6. Lift out the gear lever (102).
7. Refitment is a reversal of the removing procedure.

HIGH/LOW SHIFT LEVER

(MF 165 tractor only)

Removal and Refitment 4D-10-14

1. Fig 19. Remove the rubber cover (111) and spring (110) fitted under the cover.
2. Drive out the pin (109) securing the lever (112) to its housing.
3. Lift out the lever (112) and 'O' ring (108).
4. Refitment is a reversal of the removing procedure.

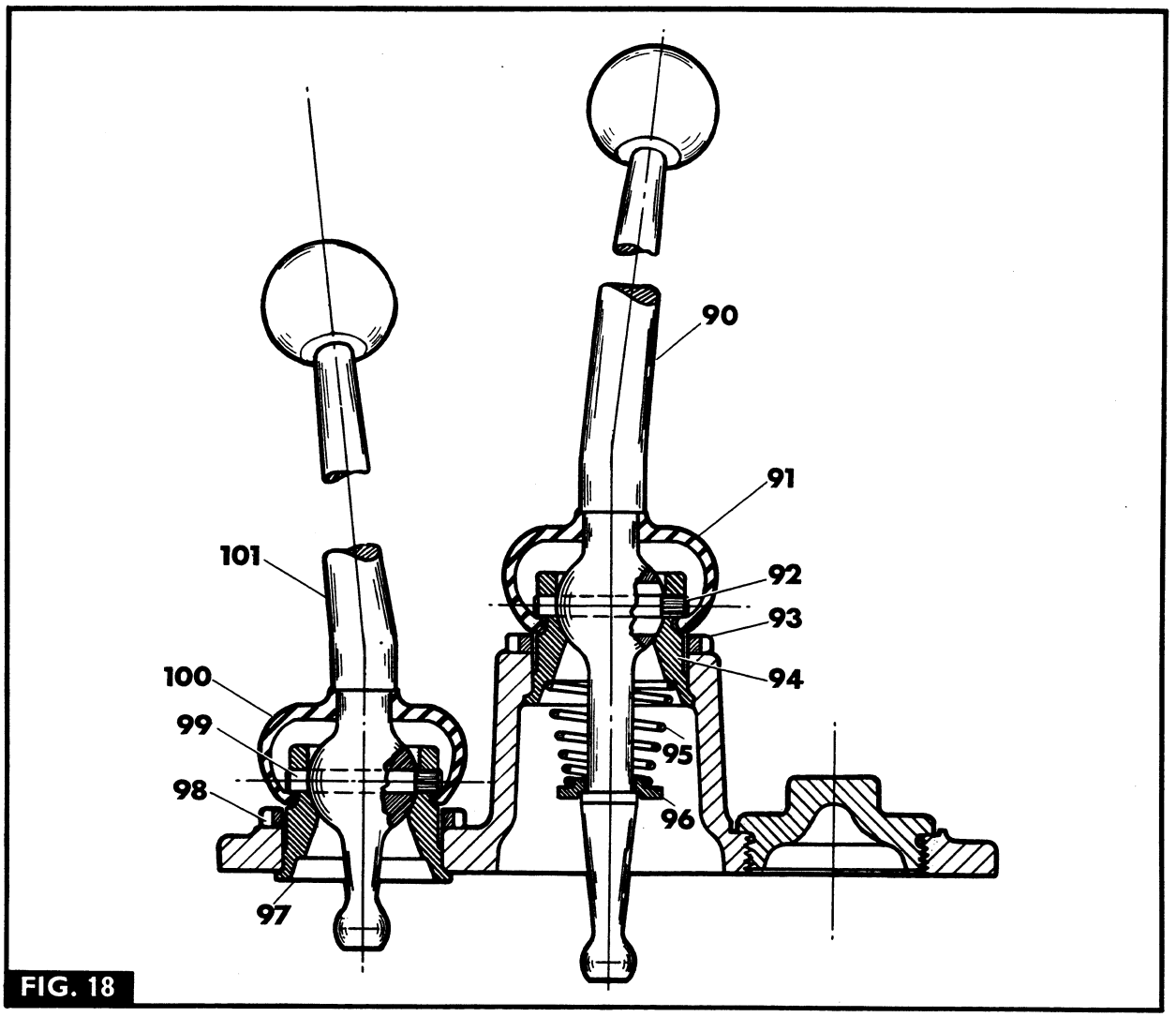

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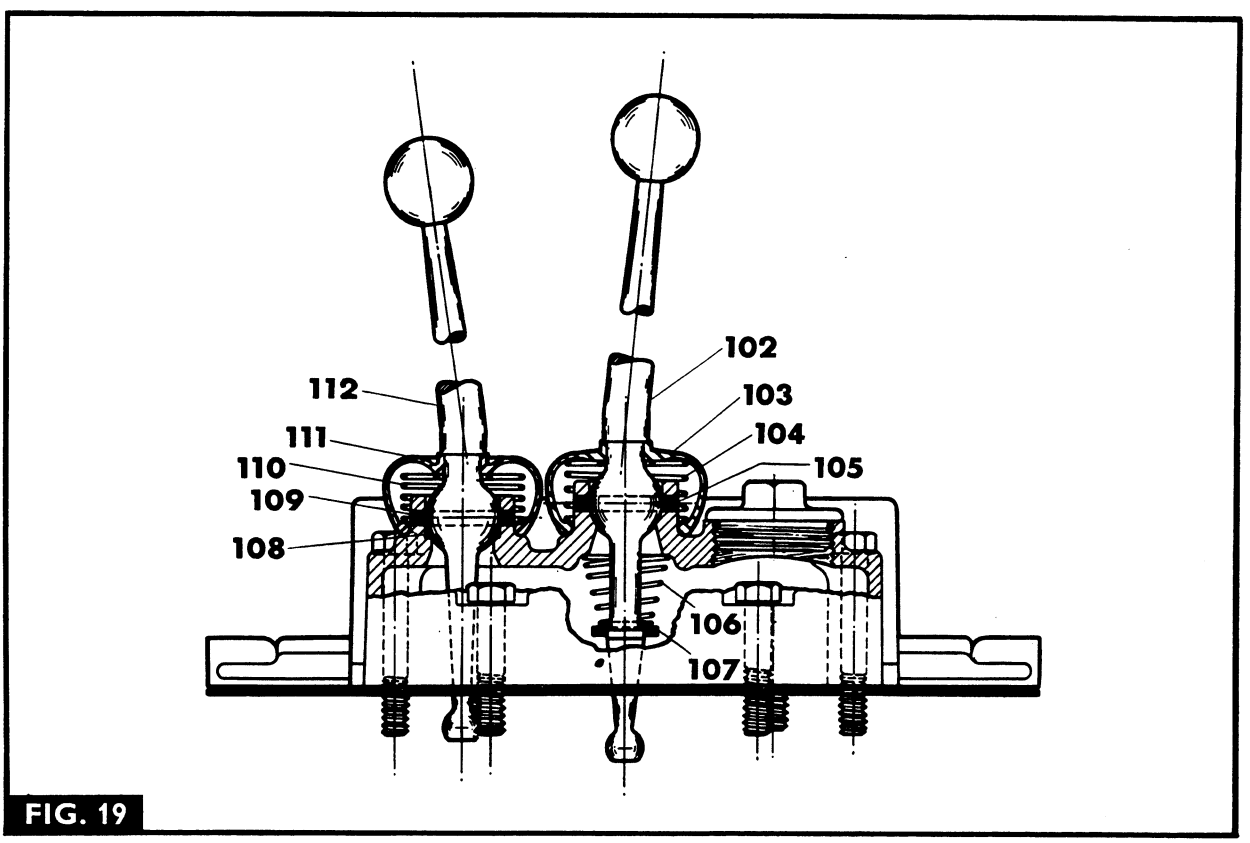
FIG. 18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112

FIG. 19

REAR AXLE AND BRAKES

Part 5 Section A

REAR AXLE AND BRAKES

GENERAL

The drive from the transmission mainshaft is transmitted through the rear drive shaft and shear tube to a spiral bevel driving pinion and crown wheel, then through the axle shafts to the rear wheels.

The driving pinion is supported in the centre housing by a straight roller pilot bearing and a pre-loaded housing assembly carrying two tapered roller bearings.

The crown wheel is attached to the split differential case, which is supported each side by a tapered roller bearing. The differential pinions run on a cross joint and thrust is taken by thrust washers behind the pinions.

The axle shaft inner ends are splined into the differential gears, and the outer ends run on tapered roller bearings in the hubs. The hub bearings are retained by collars shrunk onto the axle shafts.

A differential lock is fitted to the R.H. axle housing. When the spring loaded pedal is depressed, a cam engages a coupler with a coupling cap on the differential case, and locks the differential.

This tractor is fitted with Girling double acting, floating cam type brakes which operate on the rear wheels only. They are internally expanding 356 mm x 51 mm (14 in x 2 in) drum brakes fitted with bonded linings in production but the shoes are drilled to receive riveted linings in service.

Each brake consists of a backplate on which is mounted the double anchor pin assembly securing one end of each shoe. The other end of each shoe fits into slots in the adjuster assembly and is held in position by a spring.

Between the shoe webs at the anchor pin end is the operating camshaft which is connected by linkage to the pedal. A shoe to anchor pin spring is connected between the anchor pin and shoe web of each shoe. The shoes are kept square in relation to the backplate by steady posts and shoe hold down pins. The backplate is secured to the rear axle housing and is enclosed within a drum which is fitted to the rear axle shaft assembly.

The brakes are operated by two independent brake pedals situated on the right hand side of the transmission case. Each pedal can be operated independently to assist turning during field work or locked together by means of the combining brake lock pivoting on the right hand pedal.

REAR WHEEL STUD

Removal and Replacement 5A-01-02

Removal

1. Jack up the tractor under the trumpet housing adjacent to the wheel being serviced.
2. Remove the rear wheel.
3. Remove the two screws (3) securing the brake drum (2) to the axle shaft (4) and remove the drum.
4. Drive out the stud (5) to be replaced, using a suitable drift and hammer.

Replacement

1. Fit a new stud to the hole in the axle and tap the stud gently to locate the splines.
2. Fit a new wheel nut, with the flat side against the axle, to the stud and pull the stud through the axle to its correct position. Remove the nut.
3. Refit the brake drum (2) and secure it with the two screws (3).
4. Refit the rear wheel and nuts, then torque the nuts progressively and evenly to 27,5 kg-m (200 lb-ft).
5. Adjust the brakes as stated in operation 5A-07-06.

AXLE SHAFT ASSEMBLY

Removal and Refitment 5A-02-02

Special Tools Required: MF 278 Dial Indicator

Removal

1. Jack up the tractor under the trumpet housing to be serviced.
2. Drain the transmission oil.
3. Remove the rear wheel.
4. Remove the two screws (3) securing the brake drum (2) to the axle shaft (4) and remove the drum.
5. Release the brake pull rods from the brake camshaft lever.
6. Remove the 12 nuts (11) and spring washers securing the hub (7) to the trumpet housing (12).
7. Withdraw the axle shaft (4), complete with shims (10), hub and bearing assembly (7) and brake assembly (1) from the trumpet housing, then remove the shims and the brake assembly from the shaft.

Refitment

1. Place the brake assembly (1) and more shims (10) than will be necessary on the axle shaft, then taking care not to damage the oil seal (9), place the axle shaft in the trumpet housing, simultaneously locating the brake camshaft, and secure with three of the nuts (11) and spring washers, equi-spaced and tightened to a torque of 7,0 kg-m (55 lb-ft).
2. Fig. 2. Check the axle shaft end float, using the dial indicator MF 278 as shown. Remove shims as necessary to give an end float of 0,05 to 0,2 mm (0.002 to 0.008 in).
3. Refit the remaining nuts (11) and spring washers and tighten to a torque of 7,0 kg-m (55 lb-ft)
4. Reconnect the brake pull rods to the brake camshaft lever.
5. Refit the brake drum (2) and secure it with the two screws (3).
6. Refit the rear wheel and nuts, then torque the nuts progressively and evenly to 27,5 kg-m (200 lb-ft).
7. Refill the transmission with a recommended oil to the correct level.
8. Adjust the brakes as stated in operation 5A-07-06.

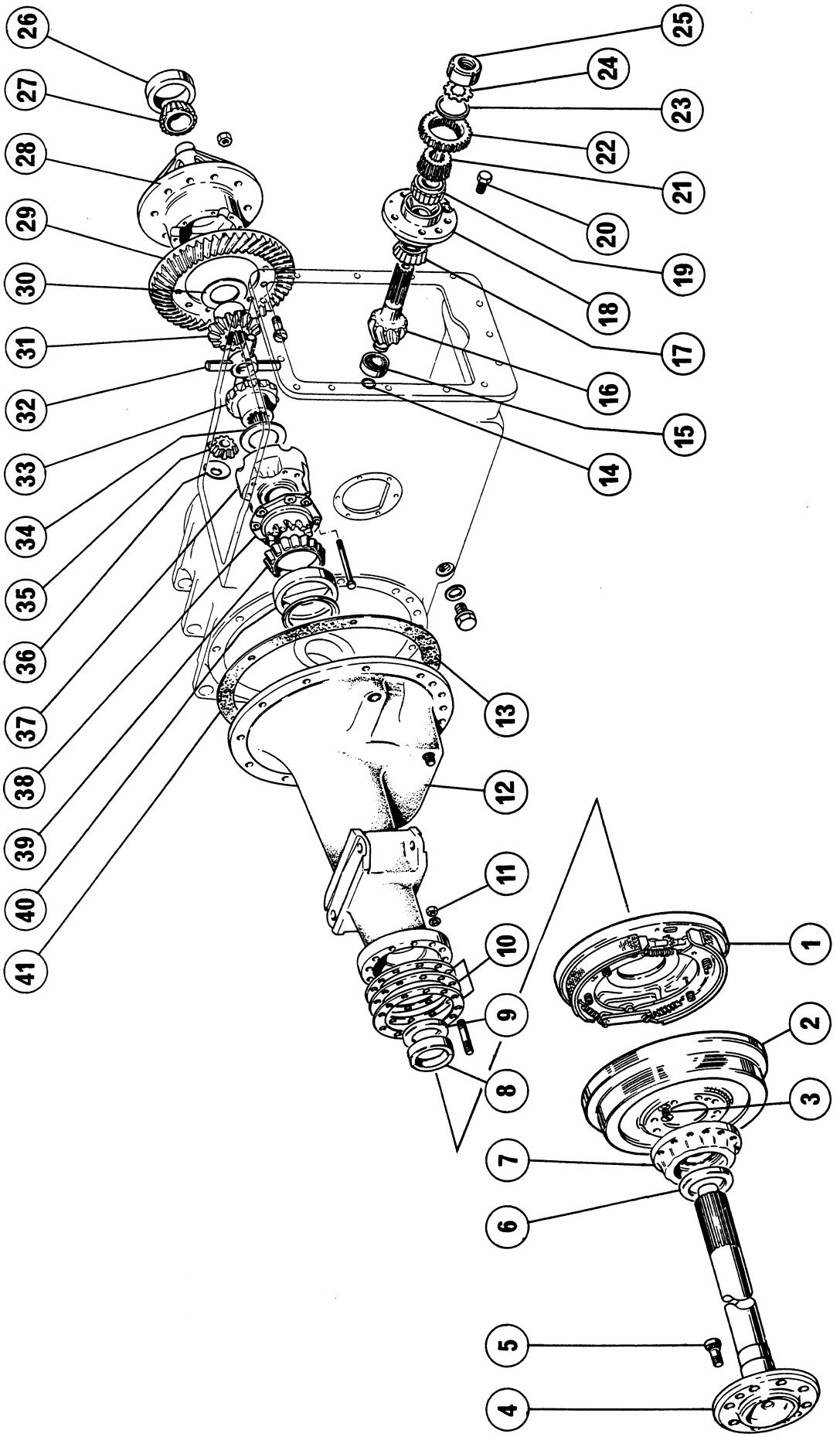
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FIG. 1

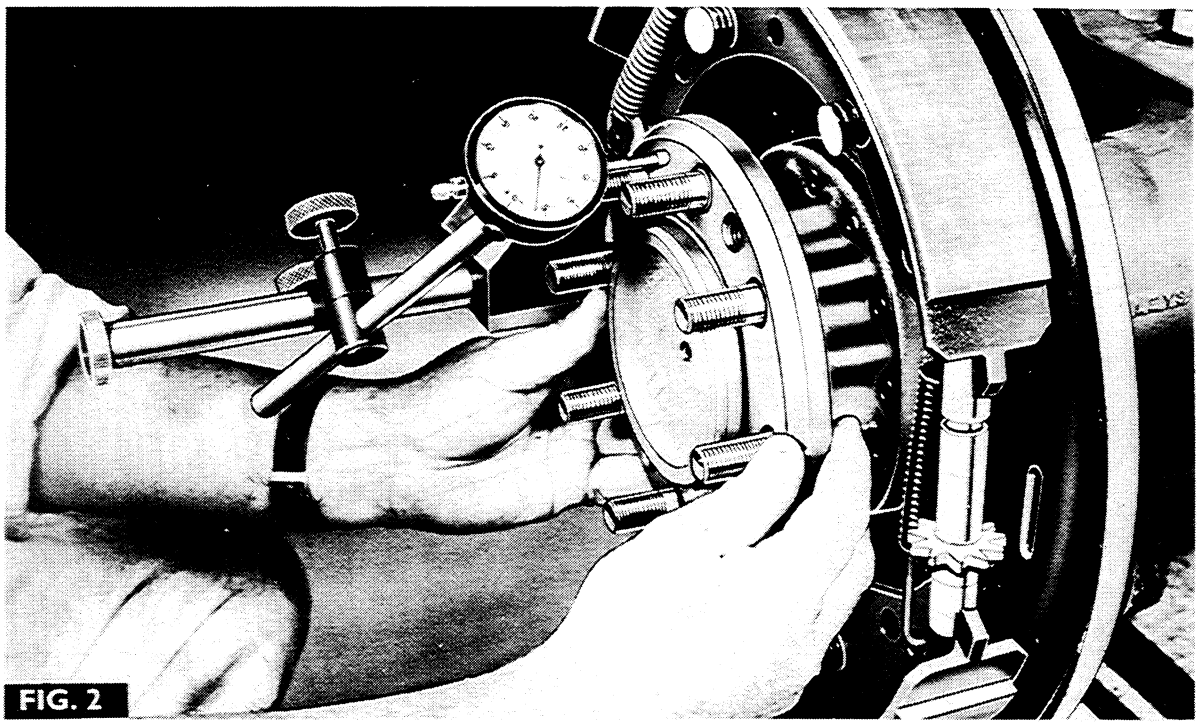

FIG. 2

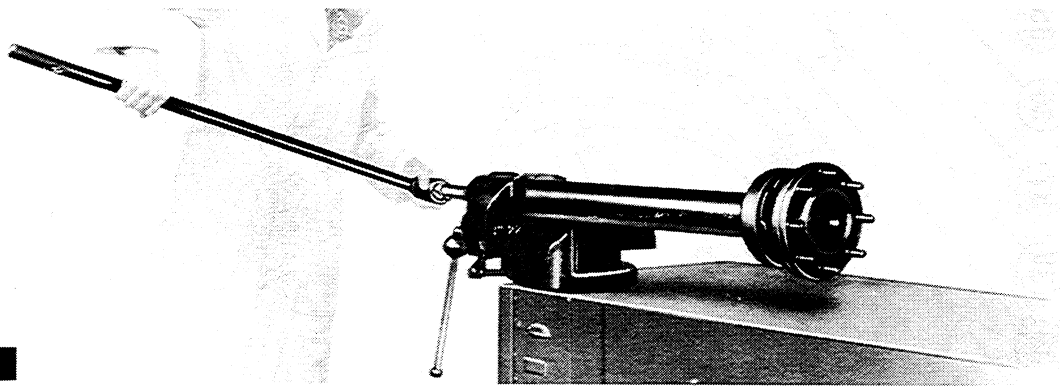

FIG. 3

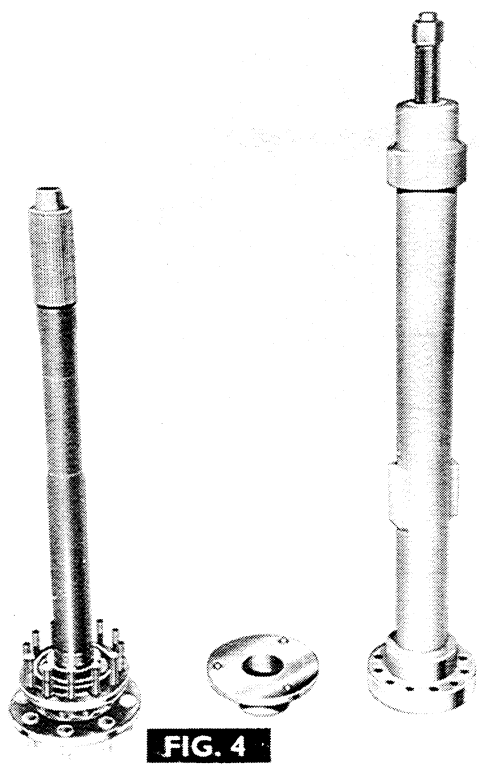

FIG. 4

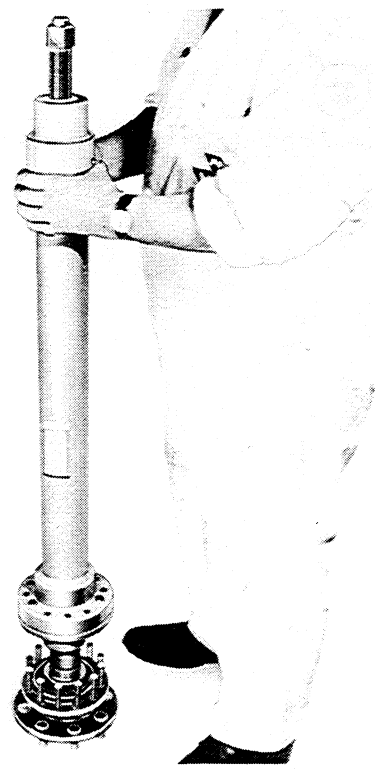

FIG. 5

AXLE SHAFT ASSEMBLY

Servicing 5A-03-05

Special Tools Required: MF 26A Wrench
MF 26B Bearing Remover
MF 26B-1 Adapter
MF 278 Dial Indicator

Disassembly

1. Remove the axle shaft assembly as stated in operation 5A-02-02
2. Drill into the side of the bearing retaining collar (8).
3. Fig. 3. Assemble the bearing remover tool MF 26B over the axle shaft and secure the tool to the hub studs. Using the MF 26A Wrench force the axle shaft out of the hub and bearing assembly (7) and collar (8) as shown.
4. Remove the special tools MF 26A and MF 26B, then remove the collar, hub and bearing assembly, and oil seal (6) from the axle shaft.

Reassembly

1. Figs. 4 and 5. Fit a new oil seal (6) to the hub and bearing assembly (7) and postion the hub and bearing assembly, new collar (8) and adapter MF 26B-1 onto the axle shaft, and then using the MF 26B tool as shown, drive the hub and bearing assembly and collar onto the axle shaft.
2. Refit the axle shaft assembly as stated in operation 5A-02-02.

BRAKE ASSEMBLY

Brake Shoes

Removal and Replacement 5A-04-05

Removal

1. Jack up the tractor.
2. Remove the rear wheel.
3. Fig. 6. Remove the two screws (3) securing the brake drum (2) to the axle shaft and remove the drum.
4. Release the brake pull rods from the brake camshaft lever.
5. Remove the brake shoes hold down springs (43) by gripping each pin (53) in turn with pliers and pressing and turning the dished washer (42) until released.
6. Remove the four sets of washers (42), springs (43), washers (44) and pins (53).
7. Force apart the brake shoes (47) at the adjuster end to allow the adjuster (59) to drop out of position, then remove the spring (60).
8. Remove the two springs (46), by levering, with a screwdriver, between the springs and the anchor pin plate (45).
9. Remove the plate (45), then lift off the two brake shoes (47) and the two spacer washers (49).

Replacement

1. Lightly smear both ends of the new brake shoes and the flat end of the camshaft with Girling White Brake Grease.
2. Refit the two spacer washers (49) to the anchor pins (60), then place the new brake shoes (47) into position over the pins (60).
3. Refit the anchor pin plate (45), then the two springs (46).

NOTE – TO FACILITATE THE FITMENT OF THE SPRINGS, USE A LENGTH OF WIRE LOOPED AROUND THE HOOK OF THE SPRING AND PULL THE SPRING OVER THE ANCHOR PIN.

4. Refit the spring (60), then pull the brake shoes apart and refit the adjuster (59).

NOTE – ENSURE THAT THE ADJUSTER IS FITTED WITH THE STAR WHEEL ADJACENT TO THE ADJUSTING HOLE IN THE BACK PLATE (51).

5. Refit the four pins (53), washers (44), springs (43), and dished washers (42), by gripping each pin (53) in turn with pliers and pressing and turning the dished washer (42) until secured.
6. Slacken the steady post nuts (57) and screw the steady posts (58) well back into the back plate (51).
7. Turn the adjuster (59) to the fully OFF position, then refit the drum (2) and secure it with the two screws (3).
8. Slacken the anchor pin nuts (52).
9. Using the adjuster, expand the brake shoes in the drum, then tap the anchor pin nuts (52), with a soft faced hammer, to ensure that the brake shoes are seated correctly.
10. Repeat the tightening and tapping procedure until the adjuster can not be tightened any more, then torque the anchor pin nuts (52) to 20 kg-m (150 lb-ft).
11. Remove the two screws (3) securing the brake drum to the axle shaft, then slacken off the brake shoes until the drum can be removed.
12. Screw in the steady posts (58) until they are in contact with the brake shoe webs, then secure the posts (58) with the nuts (57).
13. Refit the brake drum and secure it with the two screws (3).
14. Reconnect the brake pull rods to the brake camshaft lever.
15. Refit the rear wheel and nuts, then torque the nuts progressively and evenly to 27,5 kg-m (200 lb-ft).
16. Adjust the brakes as stated in operation 5A-07-06.

BRAKE ASSEMBLY

Brake Shoes Re-lining 5A-05-05

Special Tools Required: Brake Re-lining Equipment
or
Brake Riveting Anvil, Clamps and Punch.

It is permissible to reline brake shoes when genuine reconditioned shoes are not available, but it must be stressed that it is advisable to use factory reconditioned brake shoes where ever possible.

Disassembly

1. Remove the brake shoes as stated in operation 5A-04-05.
2. Place the brake shoes in an oven and heat to 700°C (1300°F) until the lining material turns white.
3. Remove the brake shoes from the oven and peel off the old lining.

NOTE – IF NO OVEN IS AVAILABLE PLACE THE BRAKE SHOES IN BOILING WATER UNTIL THE LINING CAN BE PEELED OFF.

4. Thoroughly clean the brake shoes, paying particular attention to the lining contact surface. Ensure that all the drillings are clear.

Reassembly

1. Offer up the lining to the brake shoe and align the holes.
2. Locate the lining to the brake shoes by inserting two rivets at the centre of the lining.
3. Place clamps in position and tighten securely.
4. Using brake riveting anvil and the appropriate punch or brake re-lining equipment, secure the centre rivets in position.
5. Working alternately from the centre of the brake shoe, move the clamps, insert rivets and secure in position.

NOTE – THE GAP BETWEEN THE BRAKE SHOE AND THE LINING MUST NOT EXCEED 0,1 mm (0.004 in).

6. Refit the brake shoes as stated in operation 5A-04-05.

BRAKE ASSEMBLY

Servicing 5A-06-06

Special Tools Required: MF 278 Dial Indicator

Disassembly

1. Remove the brake shoes as stated in operation 5A-04-05.
2. Fig. 6. Remove the steady posts (58) and nuts (57).
3. Remove the anchor pins (50), spring washers and nuts (52).
4. Release the wiring cable and clips from the camshaft.
5. Remove the setscrew securing the brake lever to the camshaft (48) and remove the camshaft, spring (54) and washer (55) from the back plate (51).
6. Fig. 1. Remove the 12 nuts (11) and spring washers securing the hub (7) to the trumpet housing.
7. Withdraw the axle shaft (4) complete with shims (10), hub and bearing assembly (7) and the back plate (51) from the trumpet housing, then remove the shims and back plate.

Examination

Check all components for signs of wear or damage and replace if necessary.

Reassembly

1. Place the back plate and more shims (10) than will be necessary on the axle shaft, then taking care not to damage the oil seal (9) place the axle shaft in the trumpet housing and secure with three of the nuts (11) and spring washers, equi-spaced and tightened to a torque of 7,0 kg-m (55 lb-ft).
2. Fig. 2. Check the axle shaft end float, using the dial indicator MF 278 as shown. Remove shims as necessary to give an end float of 0,05 to 0,2 mm (0.002 to 0.008 in).
3. Refit the remaining nuts (11) and spring washers and tighten to a torque of 7,0 kg-m (55 lb-ft).
4. Fig. 6. Place the camshaft (48) through the back plate (51) and refit the washer (55) and spring (54), then refit the brake lever, with a new key, and secure it to the camshaft with a new setscrew.
5. Locate the camshaft in the trumpet housing and drive the spring (54), until it is half compressed, against the back plate to load the camshaft.
6. Refit the wiring cable and clips onto the camshaft.
7. Refit the anchor pins (50), spring washers and nuts (52), but do not fully tighten the nuts at this stage.
8. Refit the steady posts (58) and nuts (57), but do not fully tighten the steady posts or nuts at this stage.
9. Refit the brake shoes as stated in operation 5A-04-05.

BRAKE ADJUSTMENT AND BALANCING

5A-07-06

Procedure is as follows:

1. Jack up the tractor until both rear wheels are clear of the ground.
2. Ensure that all shafts and pins work freely and that the brake pedals and parking brake are against their stops when the brakes are OFF.
3. Figs 7A and 7B. Move the cover plate (56) to one side and lever the star wheel adjuster (59) clockwise until the wheel is locked. Tap the drum lightly with a soft faced hammer and again attempt to tighten the brake shoes.
4. Slacken off the adjuster (59) six to eight clicks and check that the wheel is free to rotate.
5. Remove the jack, then road test the tractor, with the pedals locked together, checking for binding or pulling to one side. Any tendency to pull to one side should be counteracted by slackening off the adjuster on the side which the pulling takes place.

TRUMPET HOUSING

Removal and Refitment 5A-08-06

Special Tools Required: 270 Rail Trolley

Removal

1. Drain the transmission oil.
2. Fig. 8. Remove the two bolts (61) securing the lower link adapter bracket (62) to the swinging drawbar, then remove the split pin, nut (63) and washer securing the bracket (62) to the trumpet housing pin, and release the bracket.
3. Jack up the tractor under the trumpet housing being serviced.
4. Remove the rear wheel.
5. Support the tractor on the 270 rail trolley.
6. Release the brake pull rods from the brake camshaft lever.
7. Remove the three nuts, bolts and spring washers securing the fender to the footplate.
8. Release the fender light wiring from the camshaft and at the fender.
9. Place a trolley jack under the centre of the trumpet housing being serviced, just supporting the housing.
10. Remove all of the nuts and bolts securing the trumpet housing to the centre housing.
11. Withdraw the trumpet housing on the trolley jack, complete with the fender.

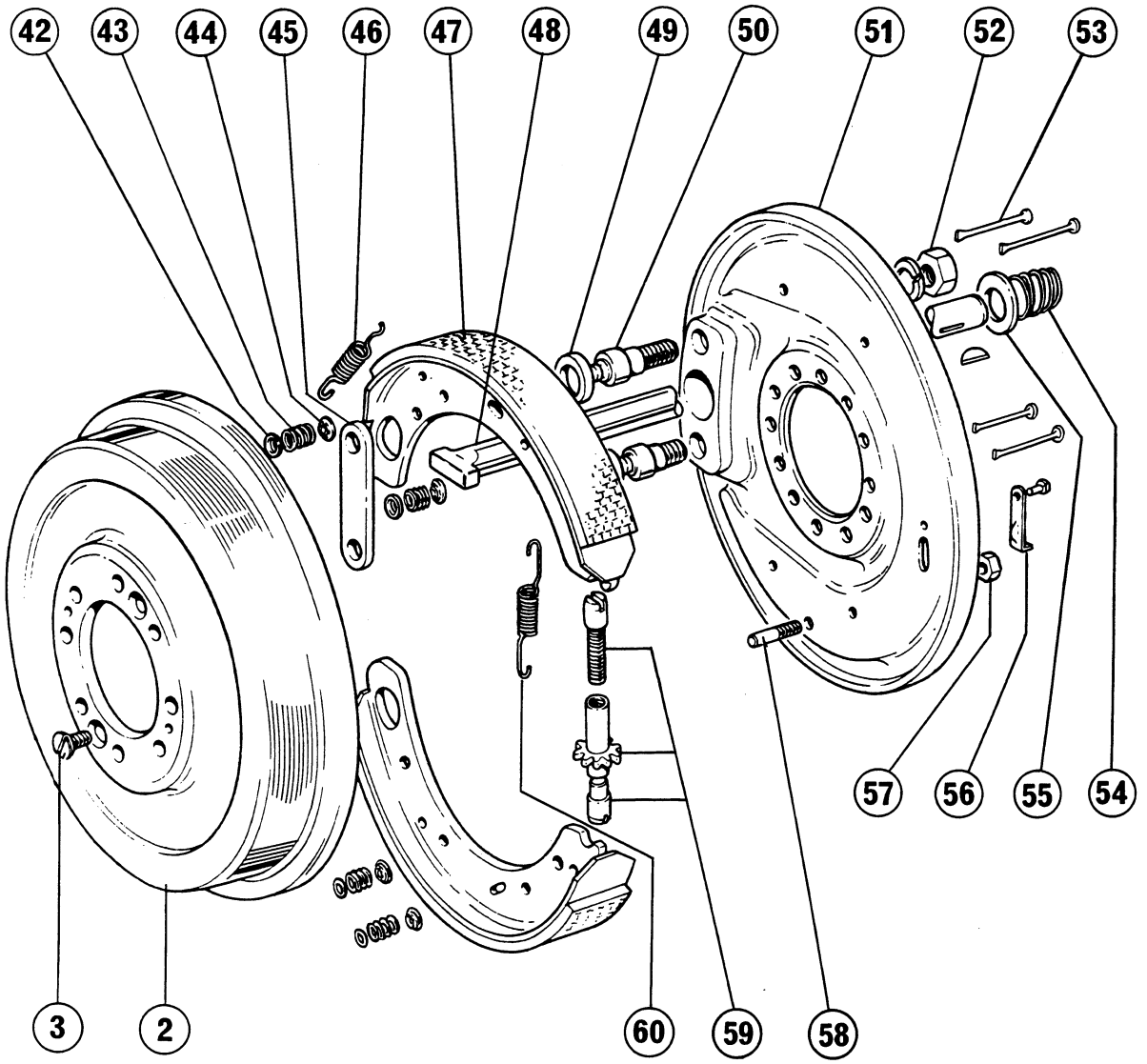

FIG. 6

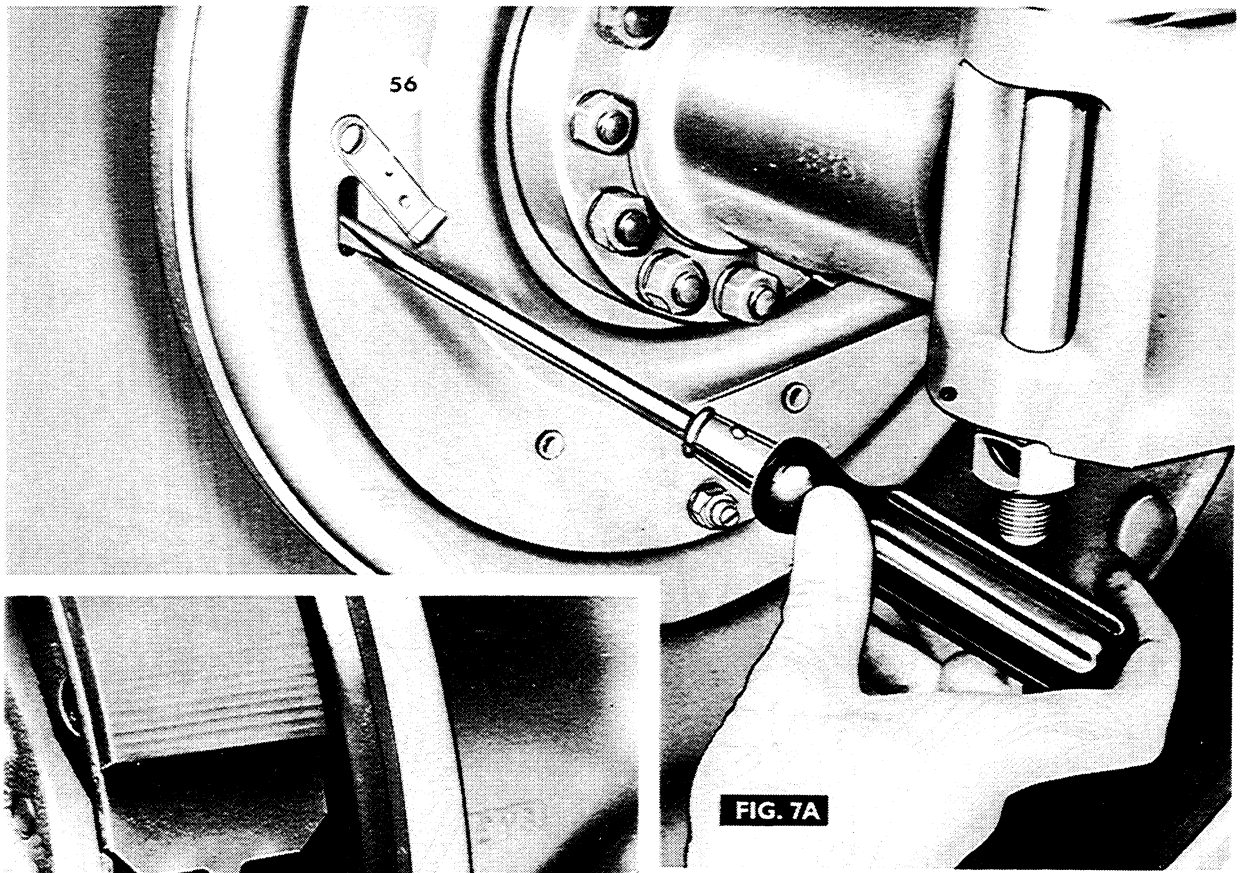

FIG. 7A

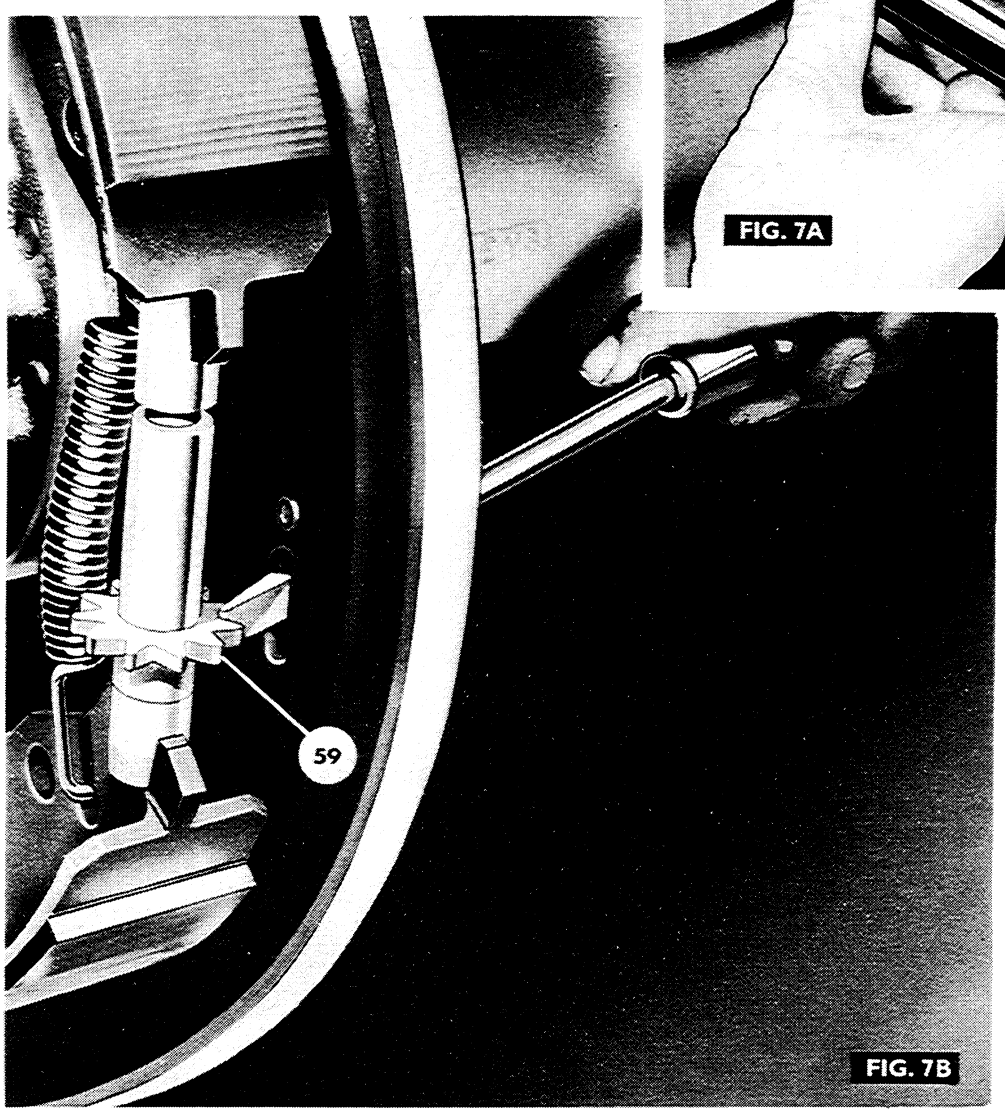

FIG. 7B

NOTE – WHEN REMOVING THE L.H. TRUMPET HOUSING THE DIFFERENTIAL UNIT MUST BE SUPPORTED.

12. Remove the gasket (13) from the centre housing or trumpet housing.

Refitment

1. Fit a new gasket (13) to the centre housing using petroleum jelly.
2. Supporting the trumpet housing and fender on the trolley jack, manoeuvre the trumpet housing into position, locating the axle shaft splines in the differential unit and the studs through their holes in the trumpet housing.
3. Refit the nuts and bolts securing the trumpet housing to the centre housing.

NOTE – WHEN REFITTING THE R.H. TRUMPET HOUSING DO NOT FORGET TO REFIT THE DIFFERENTIAL LOCK RETURN SPRING AND ATTACHMENT PLATE.

4. Remove the 270 rail trolley.
5. Refit the three bolts, nuts and spring washers securing the fender to the footplate.
6. Refit the wiring to the brake camshaft and the fender.
7. Reconnect the brake pull rods to the brake camshaft lever.
8. Refit the rear wheel and nuts, then torque the nuts progressively and evenly to 27,5 kg-m (200 lb-ft).
9. Remove the trolley jack.
10. Fig. 8. Refit the lower link adapter bracket (62) to the trumpet housing pin, and secure with the washer, nuts (63) and a new split pin, then refit the two bolts (61) securing the bracket to the swinging drawbar.
11. Refill the transmission with a recommended oil.

LOWER LINK ADAPTER BRACKET PIN

Removal and Replacement 5A-09-09

Special Tools Required: 270 Rail Trolley

Removal

1. Remove the trumpet housing as stated in operation 5A-08-06.
2. Remove the nut and washer securing the pin and remove the pin.

Replacement

1. Place a new pin in the trumpet housing and refit the washer and nut.
2. Tighten the nut to a torque of 16,5 kg-m (120 lb-ft).
3. Refit the trumpet housing as stated in operation 5A-08-06.

DIFFERENTIAL LOCK MECHANISM

Removal and Refitment 5A-10-09

Special Tools Required: 270 Rail Trolley
MF 259A Bush and Oil Seal Remover/Replacer.

Removal

1. Remove the R.H. trumpet housing as stated in operation 5A-08-06.
2. Fig. 9. Remove the bolt (64), nut and spring washer securing the arm (65) to the actuating shaft (67).
3. Fig. 10. Withdraw the cam (71) and shaft (67) as shown.
4. Remove the two bolts (72) securing the shifter fork (68) to the trumpet housing.
5. Manoeuvre the shifter fork, with the two guide shoes (70) out of the trumpet housing.
6. Slide the coupler (69) off the axle shaft splines.
7. Remove the seal (73) from the trumpet housing.

Refitment

1. Fig. 11. Fit a new oil seal (73) into the trumpet housing using tool MF 259A as shown.
2. Clean and degrease the threads of the shifter fork securing bolts (72) and their locating holes in the trumpet housing.
3. Fig. 10. Slide the coupler (69) on to the axle shaft splines, with the teeth facing outwards as shown.
4. Position the shifter fork (68) together with the two guide shoes (70) in the trumpet housing, making sure the guide shoes locate properly on the coupler.
5. Apply a small quantity of either Loctite grade A.V. or Casco LF5 to the threads of the bolts (72) and secure the shifter fork to the trumpet housing, then torque the bolts to 5,5 kg-m (40 lb-ft).
6. Fig. 10. Taking care not to damage the oil seal, slide the cam (71) and shaft (67) into the trumpet housing simultaneously refitting the arm (65) to the shaft (67), and locating the dowel on the shifter fork (68) in the cam (71).
7. Fig. 9. Secure the arm (65) to the shaft (67) with the bolt (64), spring washer and nut.
8. Refit the R.H. trumpet housing as stated in operation 5A-08-06.
9. Adjust the differential lock pedal as stated in operation 5A-12-10.

DIFFERENTIAL LOCK SHAFT BUSH

Removal and Replacement 5A-11-09

Special Tools Required: 270 Rail Trolley
MF 259A Bush and Oil Seal Remover/Replacer
MF 278 Dial Indicator.

Removal

1. Remove the differential lock mechanism as stated in operation 5A-10-09.
2. Fig. 1. Remove the 12 nuts (11) and spring washers securing the hub (7) to the trumpet housing. (12).
3. Withdraw the axle shaft (4), complete with shims (10), hub and bearing assembly (7) and brake assembly (1) from the trumpet housing.
4. Fig. 12. Using tool MF 259A, cut a thread into the bush (74), then drive out the tool and bush as shown.

Replacement

1. Fig. 13. Fit a new bush, using tool MF 259A as shown.
2. Place the axle shaft, brake assembly and more shims than will be necessary in the trumpet housing, simultaneously locating the brake camshaft, and secure with three of the nuts (11) and spring washers, equi-spaced and tightened to a torque of 7,0 kg-m (55 lb-ft).
3. Replace the differential lock mechanism as stated in operation 5A-10-09, but do not refit the wheel at this point.
4. Remove the two screws (3) securing the brake drum (2) to the axle shaft (4) and remove the drum.
5. Fig. 2. Check the axle end float, using the dial indicator MF 278 as shown. Remove shims as necessary to give an end float of 0,05 to 0,2 mm (0.002 to 0.008 in).
6. Refit the brake drum and secure with the two screws (3).
7. Refit the rear wheels and nuts, then torque the nuts progressively and evenly to 27,5 kg-m (200 lb-ft).
8. Remove the jack.
9. Fig. 8. Refit the lower link adapter bracket (62) to the trumpet housing pin, and secure with the washer, nut (63), and a new split pin, then refit the two bolts (61), securing the bracket to the swinging drawbar.
10. Refill the transmission with a recommended oil.
11. Adjust the brakes as stated in operation 5A-07-06.
12. Adjust the differential lock as stated in operation 5A-12-10.

DIFFERENTIAL LOCK ADJUSTMENT 5A-12-10

Procedure is as follows:

1. Engage the differential lock.
2. Fig. 14. Slacken the nut (A) and adjust the pedal so that the clearance between the pedal and footplate is 6,5 to 12,5 mm (¼ to ½ in).
3. Tighten the nut to a torque of 11,7 kg-m (85 lb-ft) and check the clearance.

DIFFERENTIAL LOCK COUPLER CAP

Removal and Replacement 5A-13-10

Special Tools Required: 555 Universal Puller
MF 555-2A/1 Puller Adapter.
MF 257 Bearing Driver.

Removal

1. Remove the R.H. trumpet housing as stated in operation 5A-08-06.
2. Fig. 15. Fit puller 555 and adapter MF 555-2A/1 to the differential bearing cone (39) then pull off the case.
3. Remove the eight bolts securing the cap (38) to the differential case (37) then carefully prise the cap off the case, taking care not to release the case which will allow the differential components to fall out of the case.

Refitment

1. Fit the new differential coupler cap (38) in place then refit the eight bolts loosely.
2. Progressively and evenly tighten the bolts, using diagonal selection to a final torque of 11,5 kg-m (80 lb-ft).
3. Drive the bearing cone (39) on to the coupler cap using special tool MF 257.
4. Refit the trumpet housing as stated in operation 5A-08-06.

DIFFERENTIAL

Pre-Load Checking and Adjustment 5A-14-10

Special Tools Required: 270 Rail Trolley
MF 254D Pre-Load Gauge
MF 254D-1 Straight Edge
MF 1105 Bearing Remover/Replacer
MF 1105-7A/1 and 2 Adapters.
550 Driver Handle
MF 278 Dial Indicator.

NOTE – THIS CHECK MUST BE CARRIED OUT WHENEVER THE DIFFERENTIAL UNIT IS DISASSEMBLED, OR IF THE BEARINGS HAVE BEEN REPLACED.

Procedure is as follows:

1. Remove the R.H. trumpet housing as stated in operation 5A-08-06.
2. Remove the axle shaft assembly as stated in operation 5A-02-02.
3. Remove the differential lock mechanism as stated in operation 5A-10-09.
4. Remove the bearing cup (40) from the trumpet housing using special tool MF 1105 and adapters MF 1105-7A/1 and MF 1105-7A/2, then remove the chip shield (41).
5. Fig. 16. Screw the two setting blocks (A) on to two centre housing studs as shown. Remove one stud from an adjacent location to permit fitment of the upper block.
6. Remove another stud from the centre housing and refit it in the tapped hole adjacent to the long pin.
7. Place the bearing cup on the bearing cone, fit the centralisers (B) and then place the clamp bar (C) in position, securing it with the two tube nuts (D).
8. Torque the clamp bar nut (E) to 2,7 kg-m (20 lb-ft) turning the differential unit, by use of a lever, but keeping the bearing cup and cone stationary, to fully centralise the end seat of both bearings.
9. Fig. 17. Place the straight edge in position as shown, then measure the gap between the straight edge and the end of the centraliser pin, using feeler gauges to determine the thickness of chip shield required. The gap measured, directly indicates the required shield which should be selected from the table shown below:

FEELER GAP (Equals Shield Thickness)		MEANS OF IDENTIFICATION	PART No.
mm	ins		
0,74 to 0,79	0.29 to 0.31	No Dots	187 689 M1
0,86 to 0,91	0.34 to 0.36	One Dot	892 173 M1
0,99 to 1,04	0.39 to 0.41	Two Dots	892 172 M1
1,12 to 1,17	0.44 to 0.46	Three Dots	892 171 M1
1,25 to 1,30	0.49 to 0.51	Four Dots	892 170 M1
1,37 to 1,42	0.54 to 0.56	No Dots	191 124 M1

10. Remove the tube nuts (D), clamp bar (C), centraliser (B) and the setting blocks (A), then refit the two studs to their original holes.
11. Place the new chip shield (41) in the trumpet housing, with the 'dished' face towards the differential, then refit the bearing cup (40) using tool MF 1105-7A/1 and the 550 handle.
12. Refit the differential lock mechanism as stated in operation 5A-10-09.
13. Refit the trumpet housing as stated in operation 5A-08-06.
14. Refit the axle shaft assembly as stated in operation 5A-02-02.

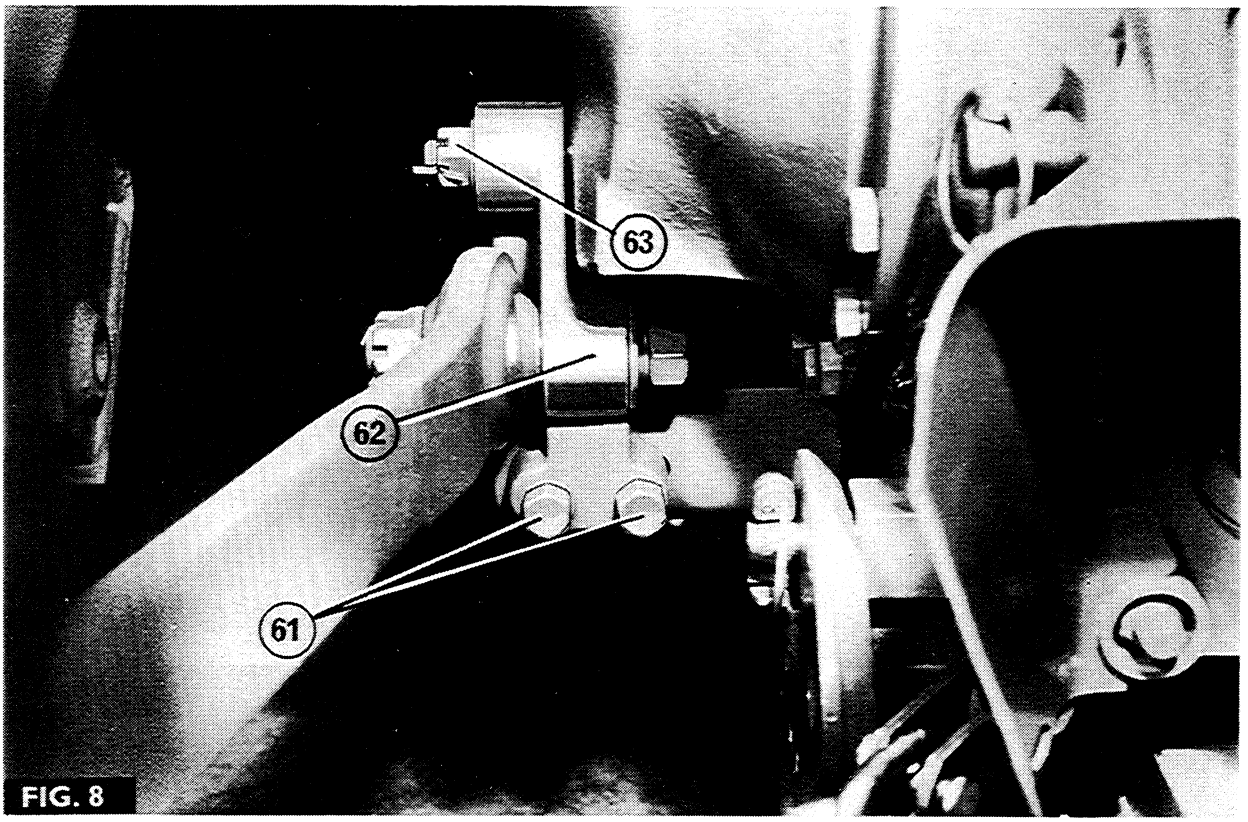

FIG. 8

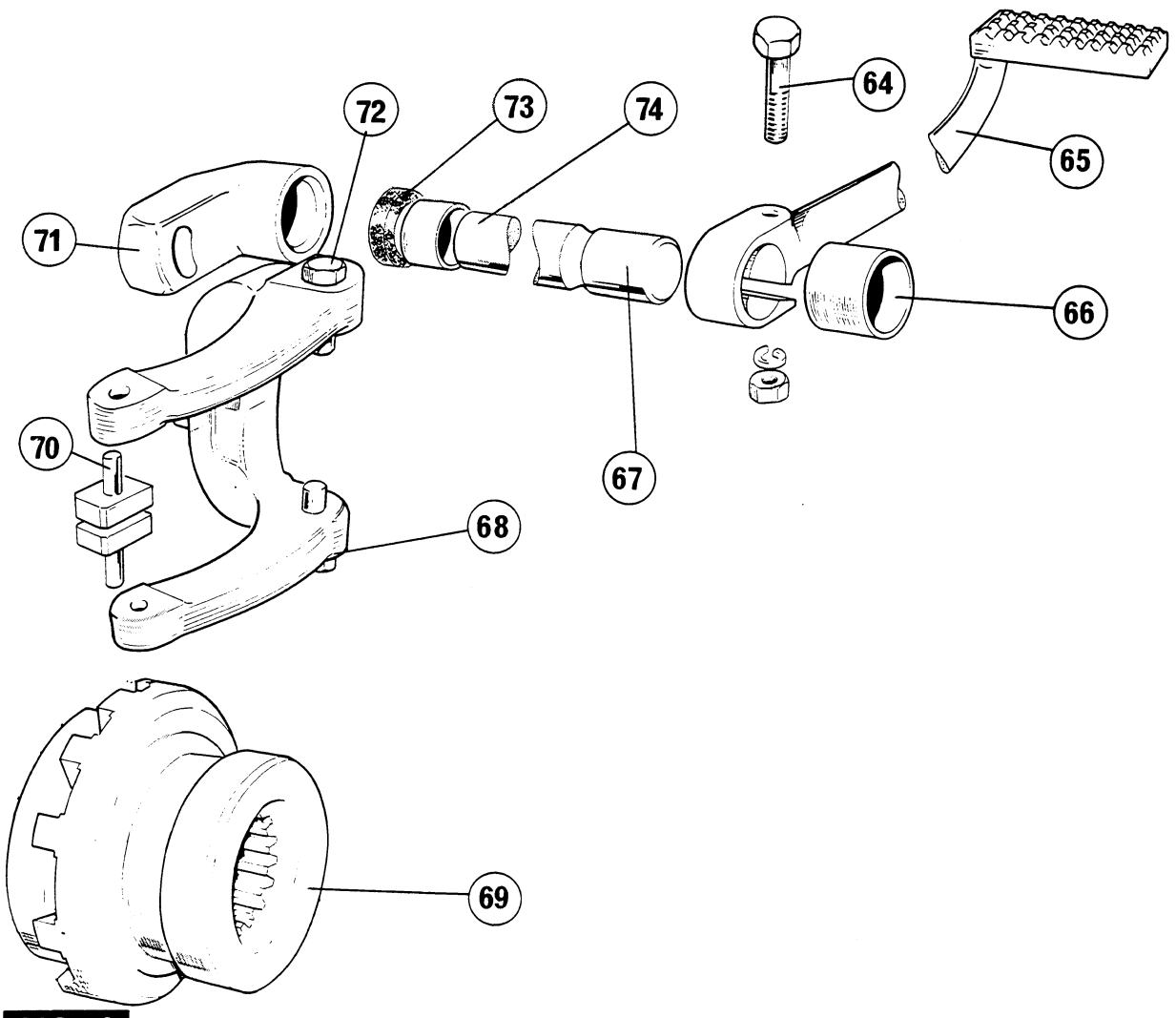

FIG. 9

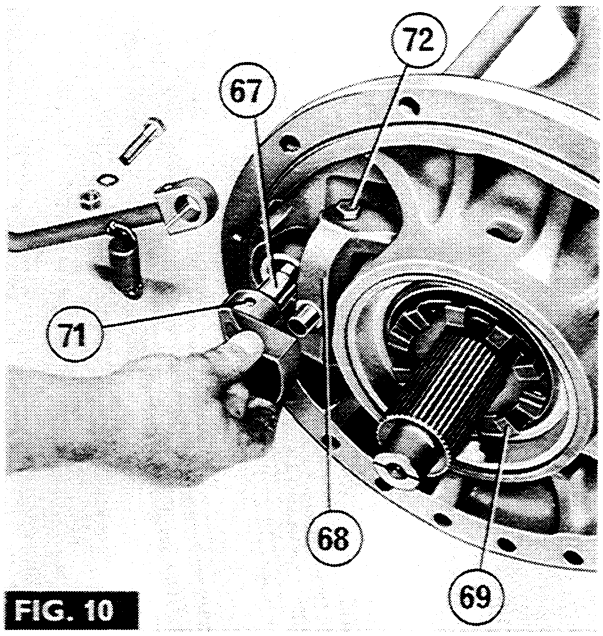

FIG. 10

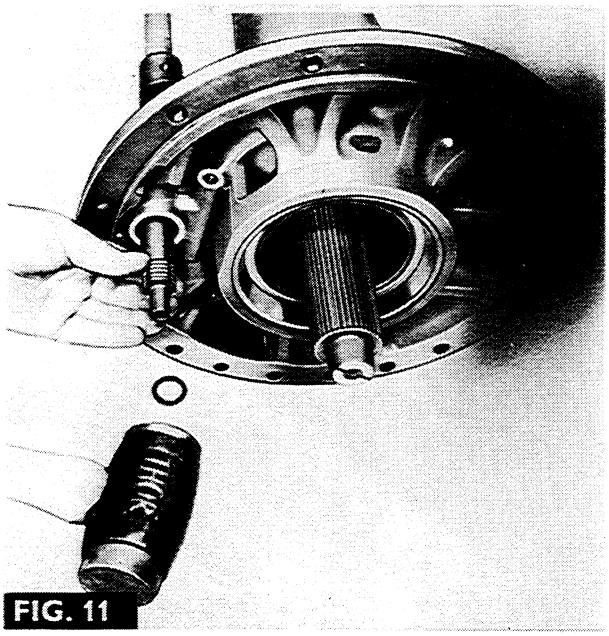

FIG. 11

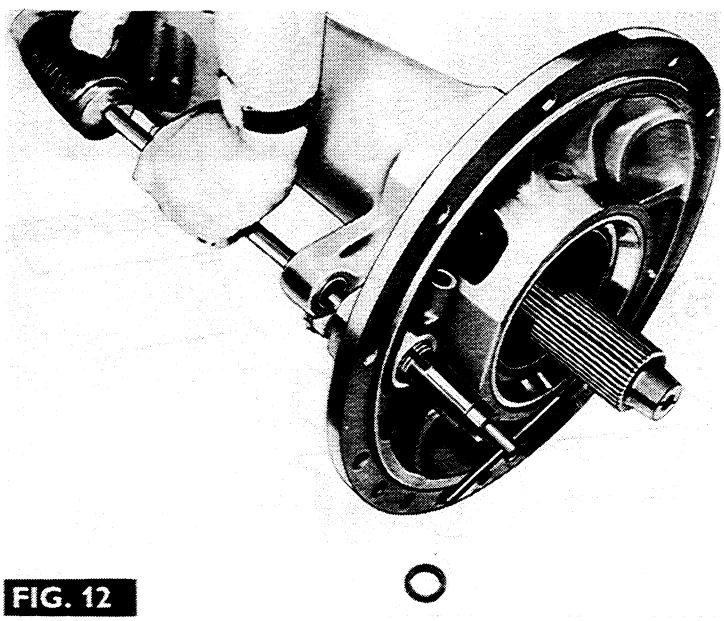

FIG. 12

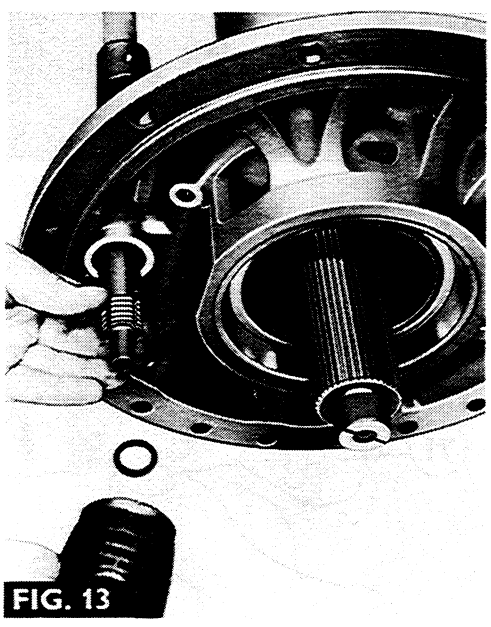

FIG. 13

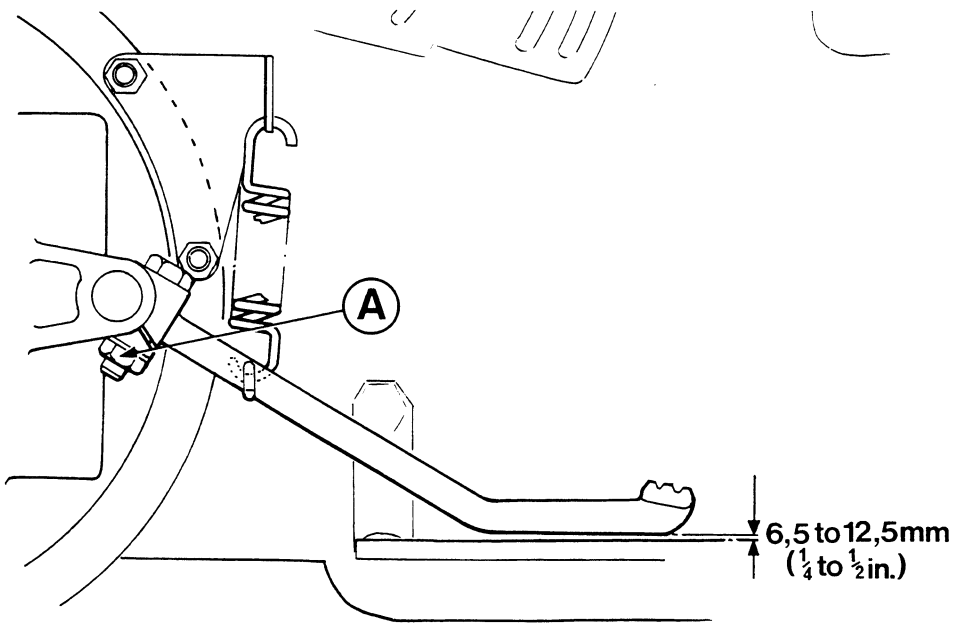

FIG. 14

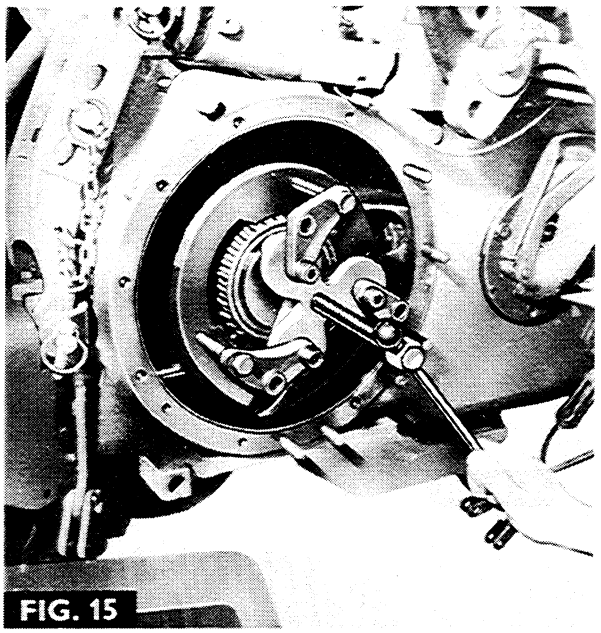
FIG. 15

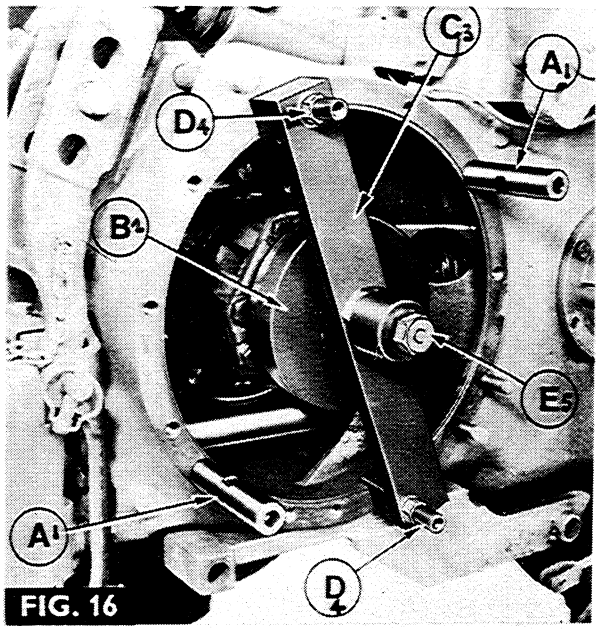

FIG. 16

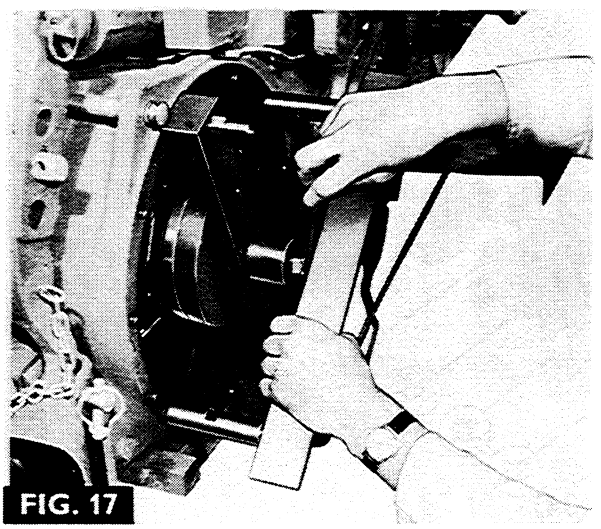
FIG. 17

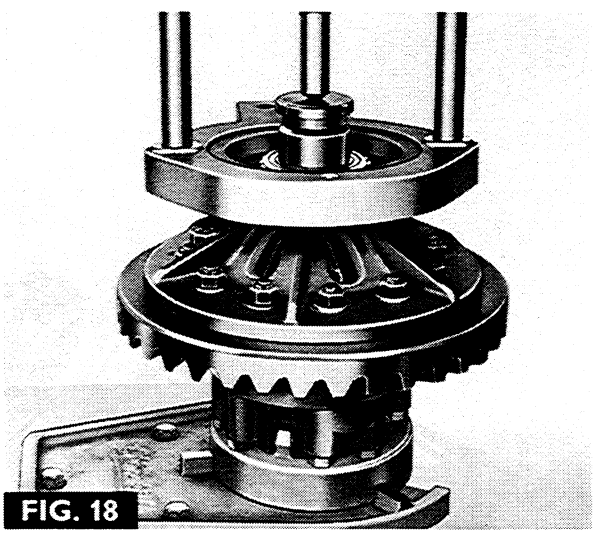
FIG. 18

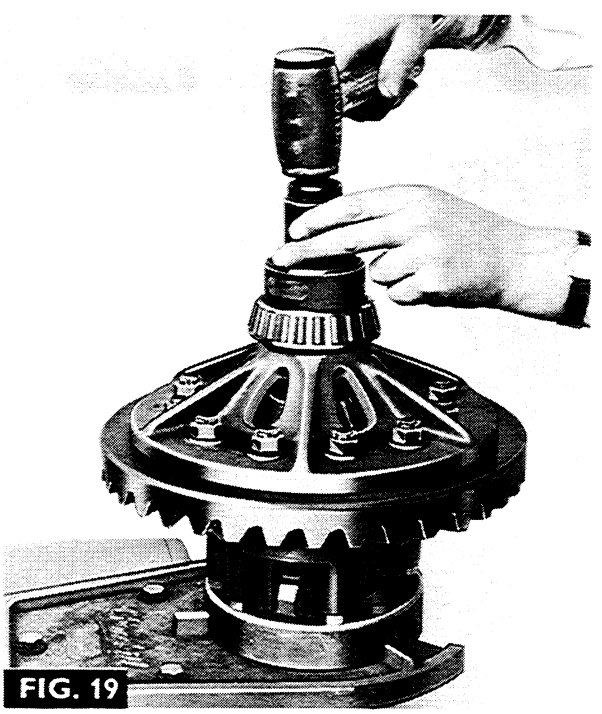
FIG. 19

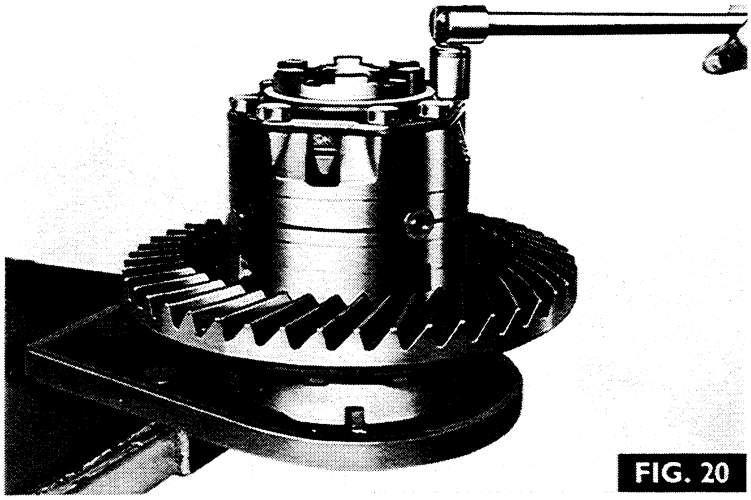

FIG. 20

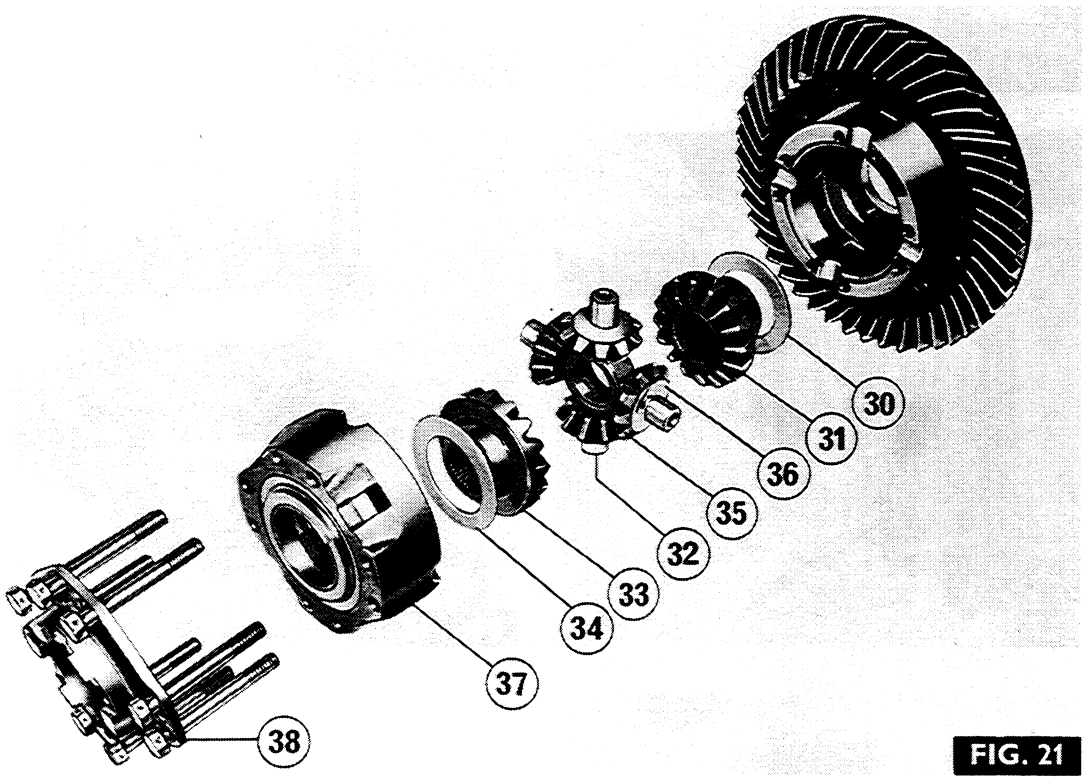

FIG. 21

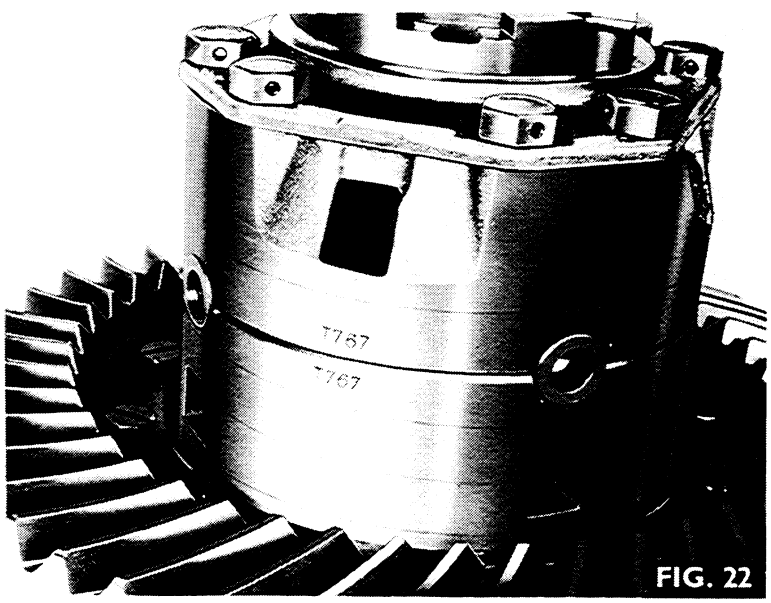

FIG. 22

R.H. DIFFERENTIAL

Bearing Removal and Replacement 5A-15-15
Special Tools Required: See operation 5A-14-10 and
555 Universal Puller
MF 555-2A/1 Puller Adapter
MF 257 Bearing Driver.

Removal
1. Remove the R.H. trumpet housing as stated in operation 5A-08-06.
2. Fig. 15. Fit puller 555 and adapter MF 555-2A/1 to the differential as shown, then pull off the bearing cone (39).
3. Remove the axle shaft assembly as stated in operation 5A-02-02.
4. Remove the differential lock mechanism as stated in operation 5A-10-09.
5. Remove the bearing cup (40) from the trumpet housing using tool MF 1105 and adapters MF 1105-7A/1 and MF 1105-7A/2, then remove the chip shield.

Replacement
1. Drive a new bearing cone (39) on to the differential lock cap (38) using tool MF 257.
2. Check the bearing pre-load as stated in items 5 to 14 of operation 5A-14-10.

DIFFERENTIAL UNIT

Removal and Refitment 5A-16-15
Special Tools Required: 270 Rail Trolley

Removal
1. Remove the L.H. trumpet housing as stated in operation 5A-08-06
2. Insert a suitable bar into the differential case assembly, then manoeuvre the differential assembly out of the centre housing.

Warning
The differential unit is heavy and awkward to handle. Take care when both removing and refitting.

Refitment
1. Manoeuvre the differential assembly back into the centre housing, engaging the splines of the differential unit in those of the R.H. axle shaft.
2. Refit the L.H. trumpet housing as stated in operation 5A-08-06.
3. If for any reason, any of the components of the differential unit have been replaced, check the differential pre-load, as stated in operation 5A-14-10.

L.H. DIFFERENTIAL BEARING

Removal and Replacement 5A-17-15
Special Tools Required: See operation 5A-14-10 and
MF 200 Hand Press
MF 200-22 Adapter
MF 10 Bench Adapter
MF 258 Holder
MF 257 Bearing Driver
MF 1105-2A Adapter

Removal
1. Remove the differential assembly as stated in operation 5A-16-15.
2. Fig. 18. Fit the bench adapter MF 10 to the bench, then fit the holder MF 258 to the bench adapter.
3. Place the differential on the adapter, then assemble the hand press MF 200 with the MF 200-22 adapter as shown, then pull off the bearing cone (27).
4. Remove the axle shaft assembly as stated in operation 5A-02-02.
5. Remove the bearing cup (26) from the trumpet housing, using puller MF 1105 and adapter MF 1105-2A.

Replacement
1. Fig. 19. Drive the new bearing cone (27) on to the differential using tool MF 257 as shown.
2. Fit the new bearing cup (26) in the trumpet housing using a suitable punch and hammer.
3. Refit the differential assembly as stated in operation 5A-16-15.
4. Refit the axle shaft assembly as stated in operation 5A-02-02.
5. Check the differential pre-load as stated in operation 5A-14-10.

DIFFERENTIAL UNIT

Servicing 5A-18-15
Special Tools Required: See operation 5A-14-10 and
MF 10 Bench Adapter
MF 258 Holder
MF 257 Bearing Driver
555 Universal Puller
MF 555-2A/1 Adapter

Disassembly
1. Remove the differential unit, as stated in operation 5A-16-15.
2. Fit puller 555 and adapter MF 555-2A/1 to the differential bearing cone (39) then pull off the cone.
3. Fit the bench adapter MF 10 to the bench, then fit the holder MF 258 to the bench adapter.
4. Fig. 20. Place the differential on the adapter as shown, then remove the eight bolts securing the R.H. case (37) and the differential lock coupler cap (38).
5. Remove the coupler cap from the R.H. case, and remove the case.
6. Fig. 21. Lift out the R.H. differential gear (33) with its thrust washer (34), cross joint (32) and gears (35) with their thrust washers (36), then finally remove the remaining differential gear (31) and thrust washer (30).

Examination
Examine all differential components, particularly gears, thrust washers and shafts, for scoring, chipping or wear. Any component showing signs of wear should be renewed.

NOTE – IF ANY OF THE SPRIDER GEARS IS WORN, A FULL SET OF FOUR NEW GEARS SHOULD BE FITTED. IN SUCH CIRCUMSTANCES, DIFFERENTIAL GEARS MAY ALSO NEED REPLACING.

Reassembly

1. Fig. 21. Refit the L.H. differential gear (31) and thrust washer (30) into the differential case followed by the cross joint (32) and pinion assembly (35) with thrust washers (36), then finally the remaining differential gear (33) and thrust washer (34).
2. Fig. 22. Refit the R.H. differential case (37) with the markings aligned, as shown, then fit the differential lock coupler (38).
3. Refit the eight bolts and torque them to 11,5 kg-m (80 lb-ft).
4. Drive the bearing cone (39) on to the coupler cap using special tool MF 257.
5. Refit the differential unit as stated in operation 5A-16-15.

CROWNWHEEL

Removal and Replacement 5A-19-16

Special Tools Required: See operation 5A-14-10 and 5A-18-15 and Epoxy Resin Bonding Kit 1852 913M91.

Removal

1. Remove the differential gears as stated in operation 5A-18-15
2. Place the differential unit on the bench with teeth facing downwards, then carefully centre punch the head of each rivet centrally.
3. Using a 13 mm (½ in) diameter drill, very carefully drill through each rivet head until the rivet heads become detached from the shanks.
4. Drive the rivets out of the differential case and the crownwheel, then drive off the crownwheel.

NOTE – IF THE CROWNWHEEL IS DAMAGED, THE PINION MUST ALSO BE REPLACED AS THESE ARE ONLY SUPPLIED IN MATCHED SETS.

Replacement

1. Inspect the mating faces of the differential case and the new crownwheel, ensuring that they are perfectly flat.
2. Place the L.H. differential case on the MF 258 holder, with the crownwheel mating faces upwards.
3. Thoroughly degrease the crownwheel, L.H. differential case, differential bolts and nuts with trichlorethylene, before attempting assembly.
4. Before attempting assembly, have all the bolts and nuts, a torque wrench, a correct size socket and either Loctite Grade AV or Casco ML15 ready for use immediately the crownwheel and differential case are joined..
5. Open the epoxy resin kit 1852 913 M91. Its contents are:
   One jar containing 10 ml of resin. This jar is also used as a mixing vessel.
   One jar containing 5 ml of hardener.
   One glass stirring rod.
   One brush.
6. Pour the hardener into the resin jar then mix the two elements thoroughly with the glass rod.
7. Apply an even coating of adhesive to both mating faces.
8. Carefully fit the crownwheel to the differential case.

NOTE – THESE TWO COMPONENTS ARE AN INTERFERENCE FIT AND MUST, THEREFORE, HAVE THEIR BOLT HOLES ACCURATELY ALIGNED BEFORE FITTING THE TWO COMPONENTS.

9. Fit the twelve bolts with their heads nearest the crownwheel teeth, then apply two drops of either Loctite Grade AV or Casco ML15 to the first thread of each bolt.
10. Fit the nuts and torque them progressively and evenly to 15,5 kg-m (120 lb-ft).

NOTE– OPERATION 7 TO 10 MUST BE COMPLETED WITHIN 30 MINUTES OF MIXING THE RESIN AND HARDENER.

11. Finally cure the resin bonding by subjecting the crownwheel and differential case to uniform heating at one of the temperatures listed below, for the required length of time:
    120°C (245°F) for a minimum of 1 hour
    40°C (105°F) for a minimum of 12 hours
    30°C (85°F) for a minimum of 16 hours
    20°C (68°F) for a minimum of 24 hours
12. Refit the differential components as stated in operation 5A-18-15.

PINION ASSEMBLY

Removal and Refitment 5A-20-16

Special Tools Required: See operation 7A-14-31.

Removal

1. Remove the hydraulic lift cover and the hydraulic pump(s), as stated in operation 7A-14-31.
2. Fig. 23. Release the snap ring (23), securing the ground speed gear (22) to the splined hub, then slide off the gear.
3. Remove the six bolts (20) and spring washers securing the pinion housing (18).
4. Screw two of the bolts into the two tapped holes in the housing, then extract the pinion assembly.

Refitment

1. Fit the pinion assembly into the centre housing, aligning the locating pin, before pressing the housing in place.
2. Secure the housing with the six bolts and spring washers tightened to a torque of 11 kg-m (80 lb-ft).
3. Locate the ground speed gear (22), with the boss at the rear, then fit a new snap ring (23).
4. Refit the ground speed gear to the front of the p.t.o. shaft.
5. Refit the hydraulic pump(s) and the hydraulic lift cover as stated in operation 7A-14-31.

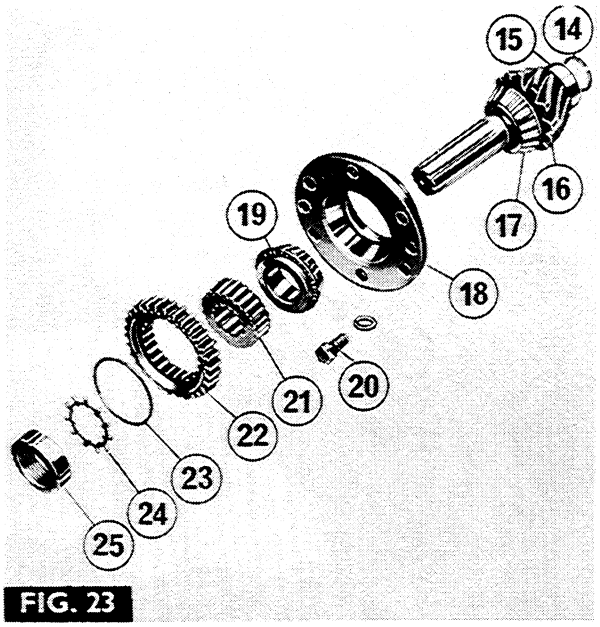

FIG. 23

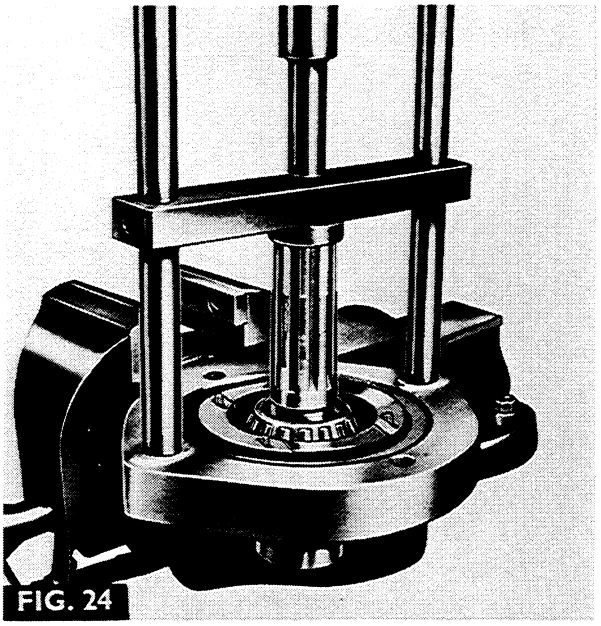
FIG. 24

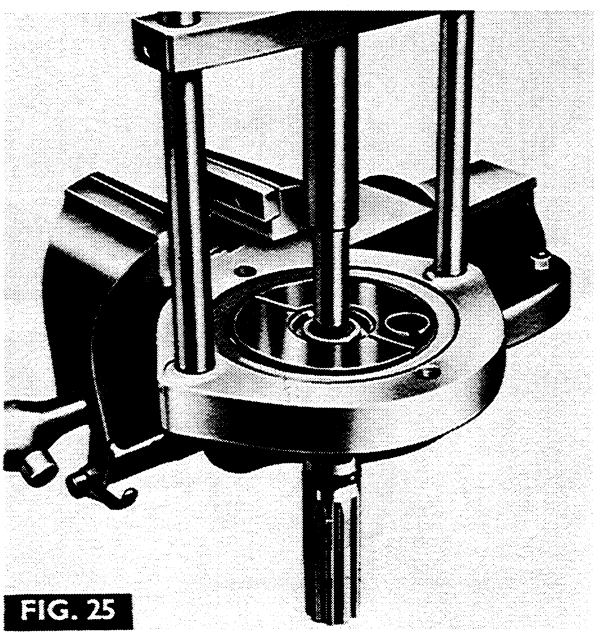
FIG. 25

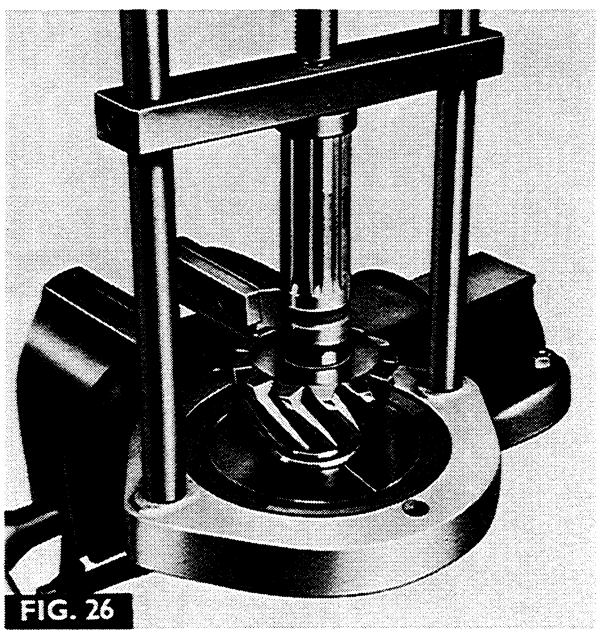
FIG. 26

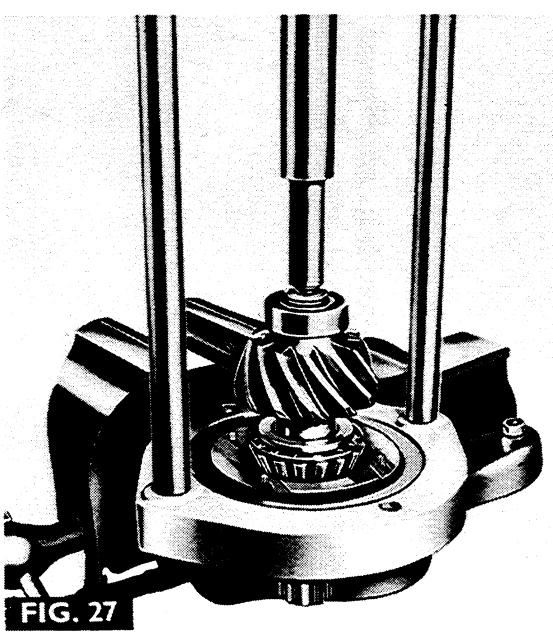
FIG. 27

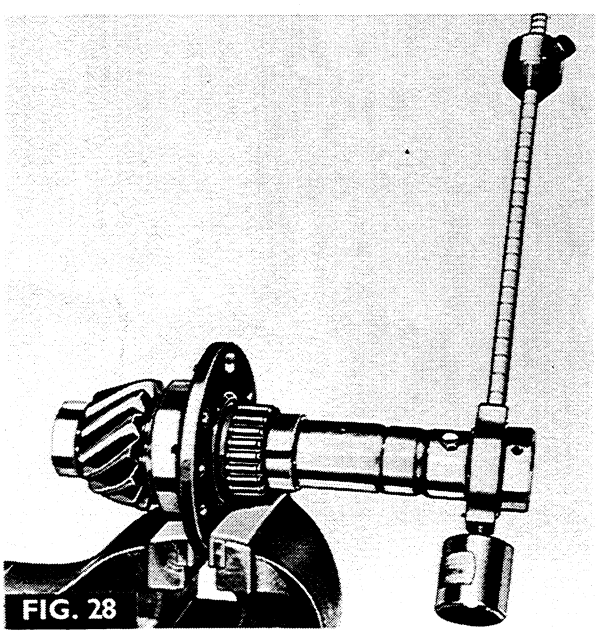
FIG. 28

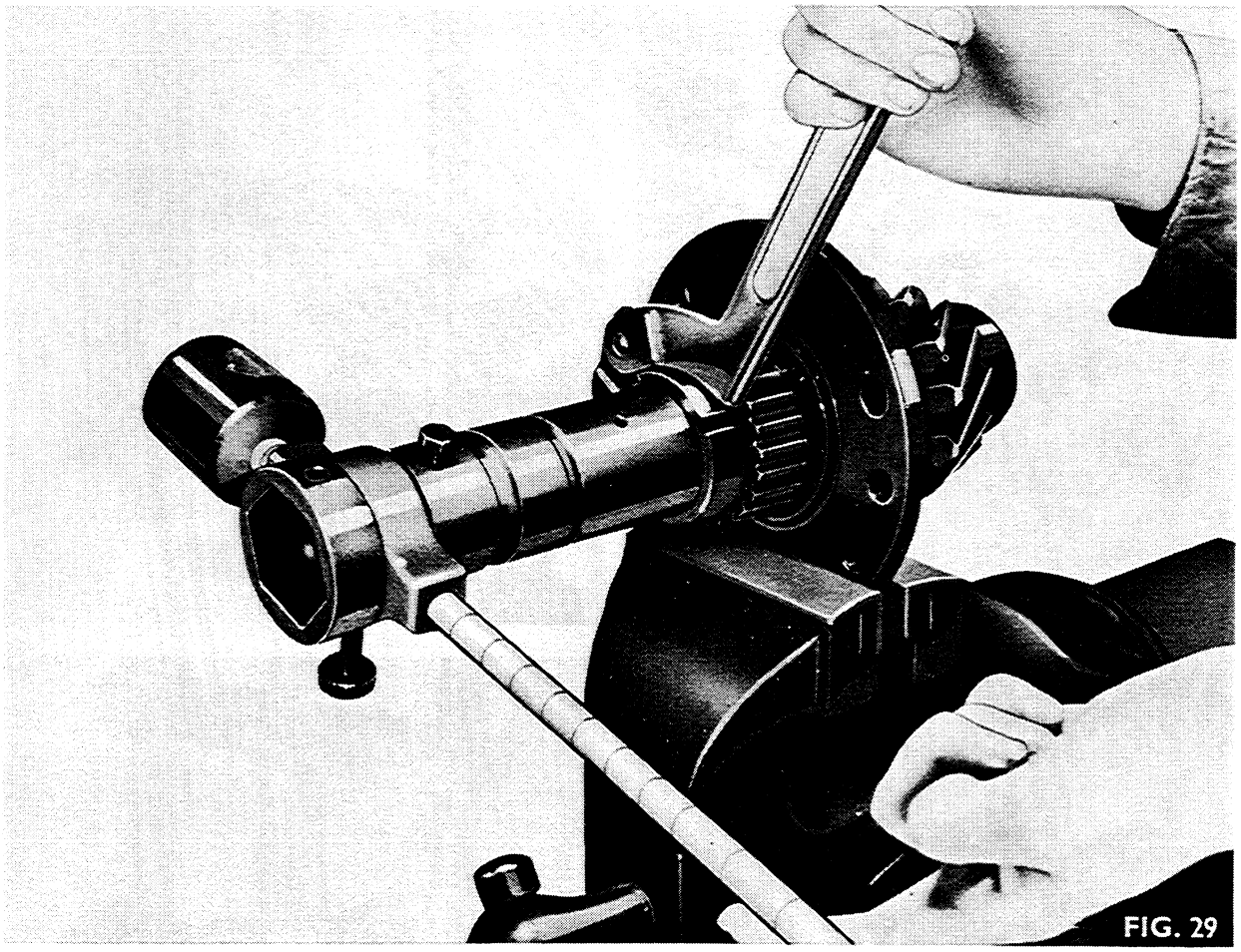
FIG. 29

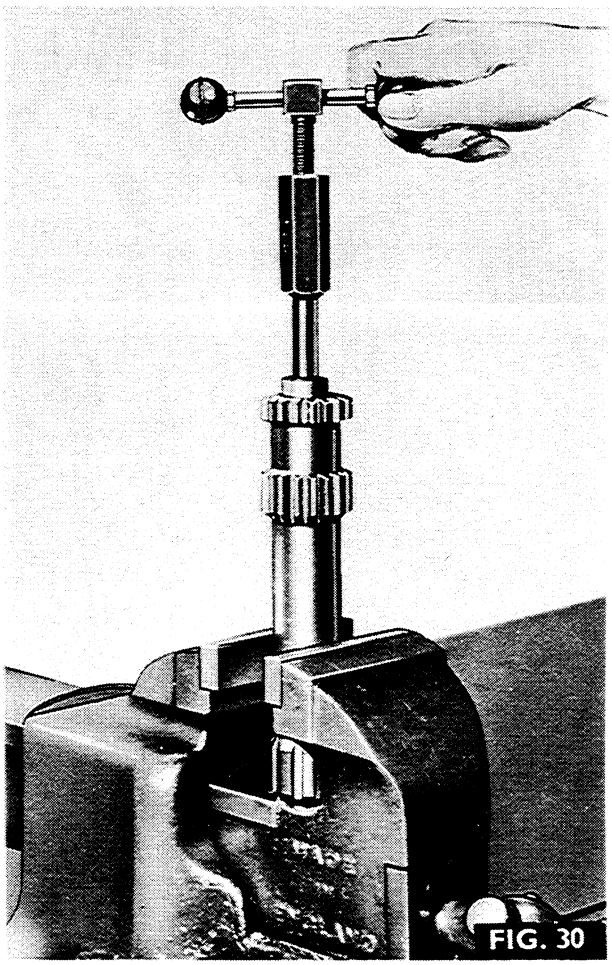
FIG. 30

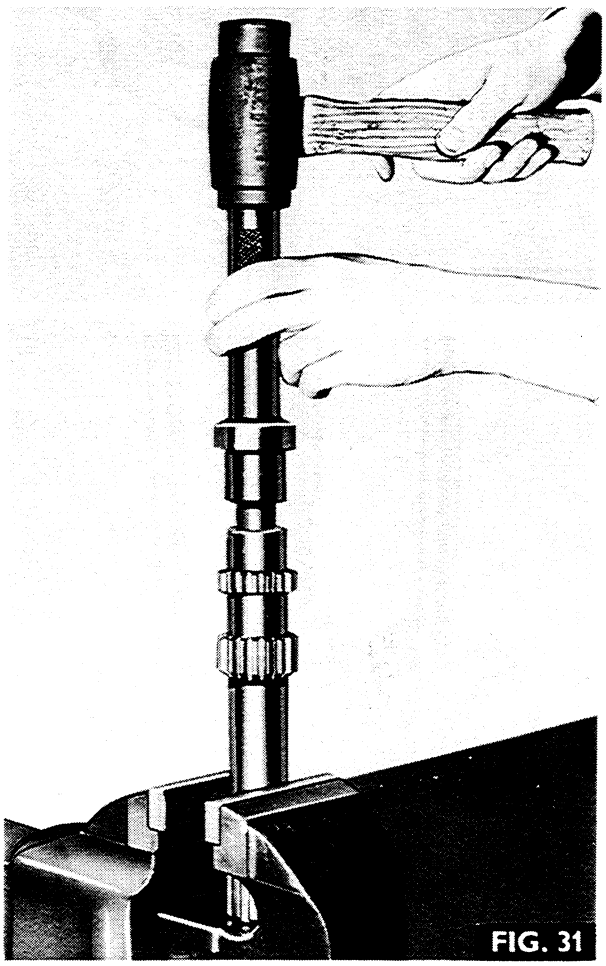
FIG. 31

PINION ASSEMBLY

Servicing 5A-21-19

Special Tools Required: See operation 7A-14-31 and
3150 'C' Spanner
CP 4030 Pre-Load Gauge
MF 200 Hand Press
MF 200-23 Adapter
MF 200-25 Adapter

Disassembly

1. Remove the pinion assembly as stated in operation 5A-20-16.
2. Fig. 23. Hold the pinion in a soft faced vice, release the tab washer (24), then unscrew the locking ring (25) using the 3150 'C' spanner. Remove the splined hub (21) and pull off the housing (18) complete with the front bearing cone (19).
3. Fig. 24. Fit the pinion to the MF 200 hand press with adapters MF 200-23 and MF 200-25 as shown, then press off the bearing (17).
4. Remove the snap ring (14) securing the pilot bearing (15) to the pinion.
5. Fig. 25. Fit the pinion to the MF 200 hand press, using adapter MF 200-23 as shown, then press off the pilot bearing (15).

Examination

Examine the following:
Pinion teeth and splines
All bearings and cones
Gear teeth

All of the above components must be checked for wearing, chipping or scoring.

Any component which shows signs of wear must be replaced (i.e. both the cup and cone for taper roller bearings).

NOTE

1. IF THE PINION IS DAMAGED, THE CROWN-WHEEL MUST ALSO BE REPLACED AS THESE ARE ONLY SUPPLIED IN MATCHED SETS.
2. THE TAPER ROLLER BEARINGS (17 AND 19) ARE SERVICED AS A PAIR, ASSEMBLED WITH THE HOUSING (18). NEW SNAP RINGS AND A NEW TAB WASHER SHOULD ALWAYS BE FITTED.

Reassembly

1. Fig. 26. Using the MF 200 hand press and adapter MF 200-23 as shown, press the pilot bearing (16) on to the pinion.
2. Secure the pilot bearing with a new snap ring (14).
3. Fig. 27. Using the MF 200 hand press and adapters MF 200-23 and MF 200-25, press the bearing (17) on to the pinion.
4. Locate the pinion in its housing (18), then fit the front bearing cone (19), the splined hub (21), a new tab washer (24) and the locking ring (25).
5. Fig. 28. Hold the housing in a soft faced vice, then assemble the CP 4030 pre-load gauge as shown. Adjust the pre-load gauge to 0,23 kg-m (1.67 lb-ft, 20 lb-in).
6. Fig. 29. Tighten the locking ring (25) using the 3150 'C' spanner, simultaneously tapping the pinion to centralise the bearing. When the pre-load is correctly set, the weight on the gauge should just fall freely under its own weight.
7. Secure the locking ring with the tab washer (24).
8. Refit the pinion assembly as stated in operation 5A-20-16.

REAR DRIVE SHAFT

Servicing 5A-22-19

Special Tools Required: See operation 7A-03-16 and
MF 202A Bearing Puller
MF 203A Bearing Driver
550 Universal Handle

Disassembly

1. Remove the lift cover as stated in operation 7A-03-16.
2. Remove the split pin from the shear tube, then remove the shear tube.
3. Remove the rear drive shaft.
4. Fig. 30. Locate the end of the bearing remover tool MF 202A underneath the bearing cage, inside the bore of the rear drive shaft as shown, then extract the bearing.

Examine the rear drive shaft for wear or damage and fit a new needle roller bearing.

Reassembly

1. Fig. 31. Position the new needle roller bearing squarely over its bore in the rear drive shaft.
2. Place the bearing depth control collar (part of MF 203A) on the end of the driveshaft, over the bearing.
3. Drive in the needle roller bearing using MF 203A and the 550 handle, as shown, until the tool contacts the depth control collar.
4. Refit the rear drive shaft.
5. Refit the shear tube, then fit a new split pin to give 0,40 to 2,50 mm (0.015 to 0.100 in) end float.
6. Refit the lift cover as stated in operation 7A-03-16.

FOOTBRAKE LINKAGE AND PEDALS

Removal and Refitment 5A-23-19

Removal

1. Fig. 32. Remove the split pin (77) and the clevis pin (76) securing the brake rod to the R.H. pedal (83).
2. Remove the split pin and clevis pin securing the L.H. brake rod to the cross shaft arm (91).
3. Remove the split pin (81) and the clevis pin (82) securing the brake rod (90) to the R.H. brake camshaft lever.
4. Repeat item 3 for the L.H. brake camshaft lever pull rod.
5. Remove the snap ring (94), and the washer (93), then slide the R.H. brake pedal off the cross shaft (95).
6. Slacken the pinch bolt (92) securing the L.H. cross shaft arm (91), then pull off the arm.
7. Remove the Woodruff Key from the cross shaft, then push the cross shaft through the centre housing and remove it, complete with the L.H. brake pedal.
8. Remove the pinch bolt (97), nut and spring washer, securing the L.H. brake pedal (85) then slide the pedal off the shaft. Remove the Woodruff Key.
9. To remove the locking latch (99), remove the screw (100) and lift off the latch (99) and plate (98). To service the parking latch see operation 5A-24-20.

Examine the cross shaft (95), and the R.H. pedal bush (75) for wear and replace if necessary.
When reassembling, fit new Woodruff Keys, a new snap ring (94) and new split pins (77 and 81).

Refitment

1. If necessary, press a new bush (75) into the R.H. brake pedal (83).
2. Fit a new Woodruff Key to the R.H. end of the cross shaft (95), then refit the L.H. brake pedal (85) and secure with the pinch bolt (97), nut and spring washer.
3. Slide the cross shaft through the transmission case. Fit a new Woodruff Key, then refit the cross shaft arm (91) and secure it with the pinch bolt (92), nut and spring washer.
4. Re-assemble the locking latch (99) and plate (98) to the R.H. brake pedal (83), refitting the screw (100) and a new self-locking nut.
5. Slide the R.H. brake pedal on to the cross shaft, refit the washer (93) and secure the pedal with a new snap ring (94).
6. Refit the L.H. brake rod and secure it to the brake cross shaft lever (91) and the brake camshaft lever with the clevis pins (76 and 81) and new split pins (77 and 81).
7. With the brake shoes fully extended in the drums, adjust the L.H. brake rod until the pedal is depressed three or four teeth on the parking brake sector.
8. Refit the R.H. brake rod and secure it with the clevis pins and new split pins, then adjust the rod until the locking latch can be engaged freely.
9. Adjust and balance the brakes as stated in operation 5A-07-06.

PARKING LATCH

Servicing 5A-24-20

Fig. 32. The parking latch is secured to the L.H. brake pedal by a clevis pin (84) and split pin (87). To disassemble the latch, remove the split pin and clevis pin. This then frees the latch (89), pawl (88) and spring (86). The sector (90) is secured to the transmission case by three bolts.

Examine the pawl, pin and sector teeth for wear and replace as necessary.
When reassembling the latch, retension the spring and fit a new split pin (87).

PARKING BRAKE AND LINKAGE

Removal and Refitment 5A-25-20

Removal

1. Fig. 33. Remove the split pin (101), washer and clevis pin (117) securing the brake rod clevis (103) to the lever (110), then remove the split pin (105), washer and clevis pin (106) securing the brake rod (104) to the brake camshaft lever and lift off the rod and clevis assembly.
2. Repeat item one for the other side of the tractor, if necessary.
3. Remove the two bolts (107) securing the lever assembly to the tractor.
4. To disassemble the lever assembly, withdraw the taper pin (109), then pull the cross shaft (118) and lift off the lever (110).
5. To remove the pawl (112), remove the split pin (116), washer and clevis pin (111), then disengage the pawl from the actuator (113).
6. Pull the actuator (113), spring (114) and stop (115) from the lever.

Examine the pawl and teeth for wear and replace if necessary. Replace any worn clevis pins and always fit new split pins and a new taper pin (109) on assembly.

Refitment

1. Fit the spring (114) and stop (115) to the actuator (113), then feed the actuator into the lever (110) from the top.
2. Engage the pawl (112) in the end of the actuator rod, then refit the clevis pin (111), washer and a new split pin (116).
3. Slide the cross shaft (118) into the bracket (108), then fit the lever assembly and secure them with a new taper pin (109).
4. Refit the bracket assembly to the tractor and secure it with the two bolts (107).
5. Adjust the footbrakes as stated in operation 5A-07-06.
6. Refit the brake rod and clevis assembly to the brake camshaft lever securing it with the clevis pin (106), washer and a new split pin (105).
7. With the parking brake lever in the fully lowered position, adjust the clevis adapter (103) until the clevis pin (117) can be just fitted without movement of the brake lever, then secure the clevis pin with a washer and new split pin (101).
8. Repeat items six and seven for the opposite side of the tractor.

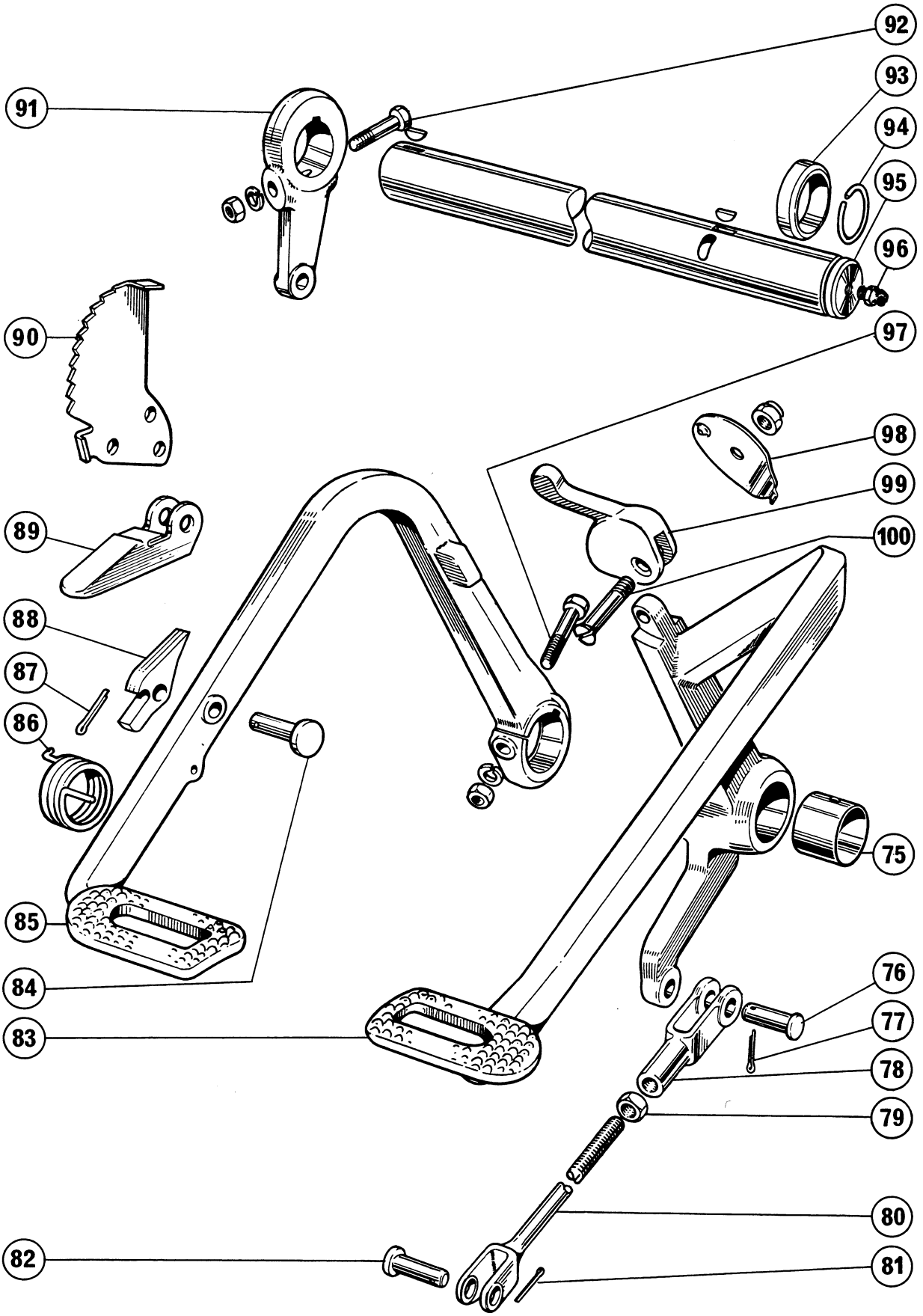
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FIG. 32

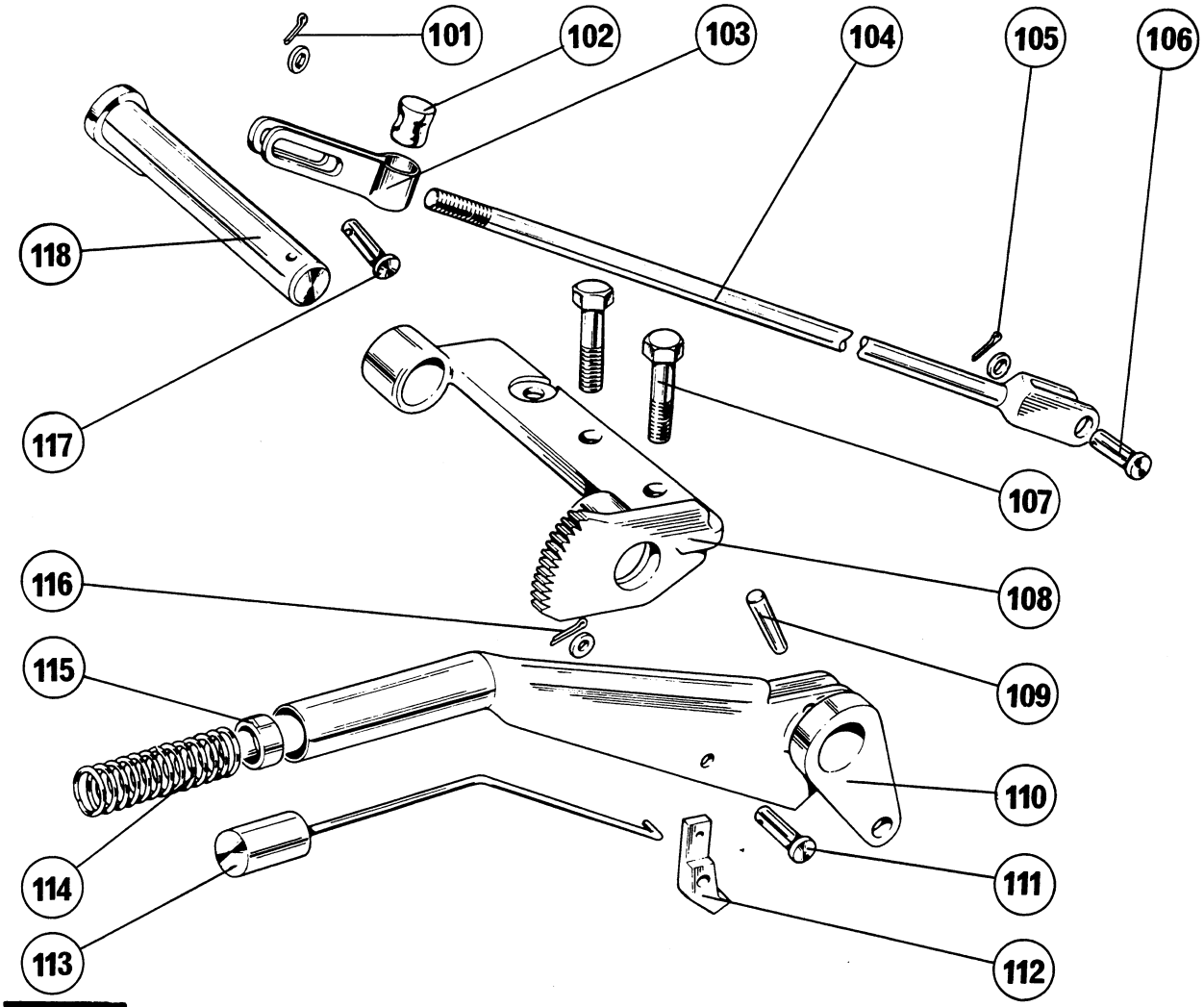
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FIG. 33

POWER TAKE–OFF

Part 5 Section B

GENERAL

Figures 1, 2, 3, 4, 5 & 6

The power take-off shaft projects from the rear of the tractor centre housing and has a 34.9 mm (1 3/8 in) (British Standard) spline with an annular groove for positive fixing of implement couplings.

A removable cap (16) protects the splines when the shaft (9) is not in use. The shaft itself is supported at the rear by a ball race (10) and at the front by a needle roller bearing (8). Double seals (12 & 14) exclude dirt from the bearing and retain lubricant in the centre housing. The power take-off is engaged by a lever (1) located on the Left Hand side of the centre housing, which selects either proportional engine speed or proportional ground speed.

Placing the lever in the neutral position (A, Figure 2), disconnects the p.t.o. drive. Proportional engine speed (B. Figure 2) is selected by pulling the lever rearwards to engage the internal splines of the ground speed p.t.o. driven gear with the splines on the rear end of the hydraulic pump drive shaft. The p.t.o. shaft is then driven at 17/53 of the engine speed. The p.t.o. shaft is coupled behind the hydraulic pump shaft; the pump is therefore constant running and continues to operate even when the p.t.o. is disengaged. Proportional ground speed (C, Figure 2) is engaged by pushing the p.t.o. lever forwards towards the ground – thereby shifting the ground speed p.t.o. driven gear into mesh with the gear splined onto the rear axle driving pinion. The p.t.o. shaft speed is then directly related to the ground speed of the tractor, and the shaft revolves once for approximately every 483 mm (19 in) of travel by the rear wheels. If the tractor is reversed, the direction of rotation will also be reversed, and this must be remembered as the implement mechanism may be damaged if driven in reverse.

POWER TAKE-OFF

Key to Fig. 1

1. Roll Pin
2. Oil Seal
3. Shift Lever
4. Side Cover
5. Spring
6. Detent
7. Selector
8. Ground Speed Gear
9. Bush
10. Needle Roller Bearing
11. P.T.O. Shaft
12. Ball Race
13. Circlip
14. Seal
15. Housing
16. 'O' Ring
17. Cover
18. Cap
19. P.T.O. Shield

P.T.O. SHAFT OIL SEAL

Removal and Replacement 5B-01-01

Special Tools Required: MF 167 Seal Protector
MF 168 Seal Remover/ Replacer
550 Universal Handle

Removal

1. Drain the centre housing of oil.
2. Remove the p.t.o. shield, cap, check chain mounting bracket and oil seal housing retainer plate.
3. Slide the oil seal and housing assembly off the p.t.o. shaft.
4. Remove the oil seal using tool MF 168 and 550 handle as shown in Figure 3.

Replacement

1. Replace the oil seal using tool MF 168 and 550 handle as shown in Figure 4.
2. Fit oil seal protector MF 167 over the rear end of the p.t.o. shaft and slide the oil seal assembly onto the shaft as shown in Figure 5. Remove the oil seal protector.
3. Replace the oil seal housing retainer plate (with cut-out facing downwards) and locate onto the two flats on the oil seal housing. Secure the plate.
4. Refit the check chain mounting bracket, p.t.o. cap and shield.
5. Refill the centre housing with recommended oil.

P.T.O. SHAFT

Removal and Refitment 5B-02-02

Special Tools Required: MF 167 Seal Protector

Removal

1. Drain the centre housing of oil.
2. Remove the p.t.o. shield secured by one bolt and spring washer.
3. Remove the p.t.o. cap.
4. Remove four nuts and spring washers securing the check chain mounting bracket, and release the bracket from the centre housing.
5. Remove the p.t.o. shaft oil seal housing retainer plate, secured by two screws.
6. Withdraw the p.t.o. shaft from the centre housing, complete with oil seal assembly and bearing.

Refitment

1. Fit a new seal to the housing before reassembly.
2. Enter the p.t.o. shaft with its bearing into the centre housing and align the splines on the front end of the shaft into the ground speed p.t.o. driven gear.
3. Fit oil seal protector MF 167 over the rear end of the p.t.o. shaft and slide the oil seal assembly onto the shaft as shown in Figure 5. Remove the oil seal protector.
4. Replace the oil seal housing retainer plate (with cut-out facing downwards) and locate onto the two flats on the oil seal housing. Secure the plate with two screws.
5. Replace the check chain mounting bracket, p.t.o. cap and shield.
6. Refill the centre housing with recommended oil.

P.T.O. SHAFT REAR BEARING

Removal and Replacement 5B-03-02

Special Tools Required: MF 167 Seal Protector
MF 200 Hand Press
MF 200-25 Adaptor

Removal

1. Remove the p.t.o. shaft as stated in operation 5B-02-02
2. Slide the oil seal assembly off the p.t.o. shaft.
3. Remove the bearing retaining snap ring from the collar on the p.t.o. shaft.
4. Press off the bearing using multi-purpose bearing remover MF 200-25 as shown in Figure 6.
5. Examine the bearing and replace it if necessary.

Replacement

1. Press the bearing onto the p.t.o. shaft.
2. Refit the snap ring.
3. Refit the p.t.o. shaft and seal, as stated in operations 5B-01-02 and 5B-02-02, not forgetting to fit a new 'O' ring.

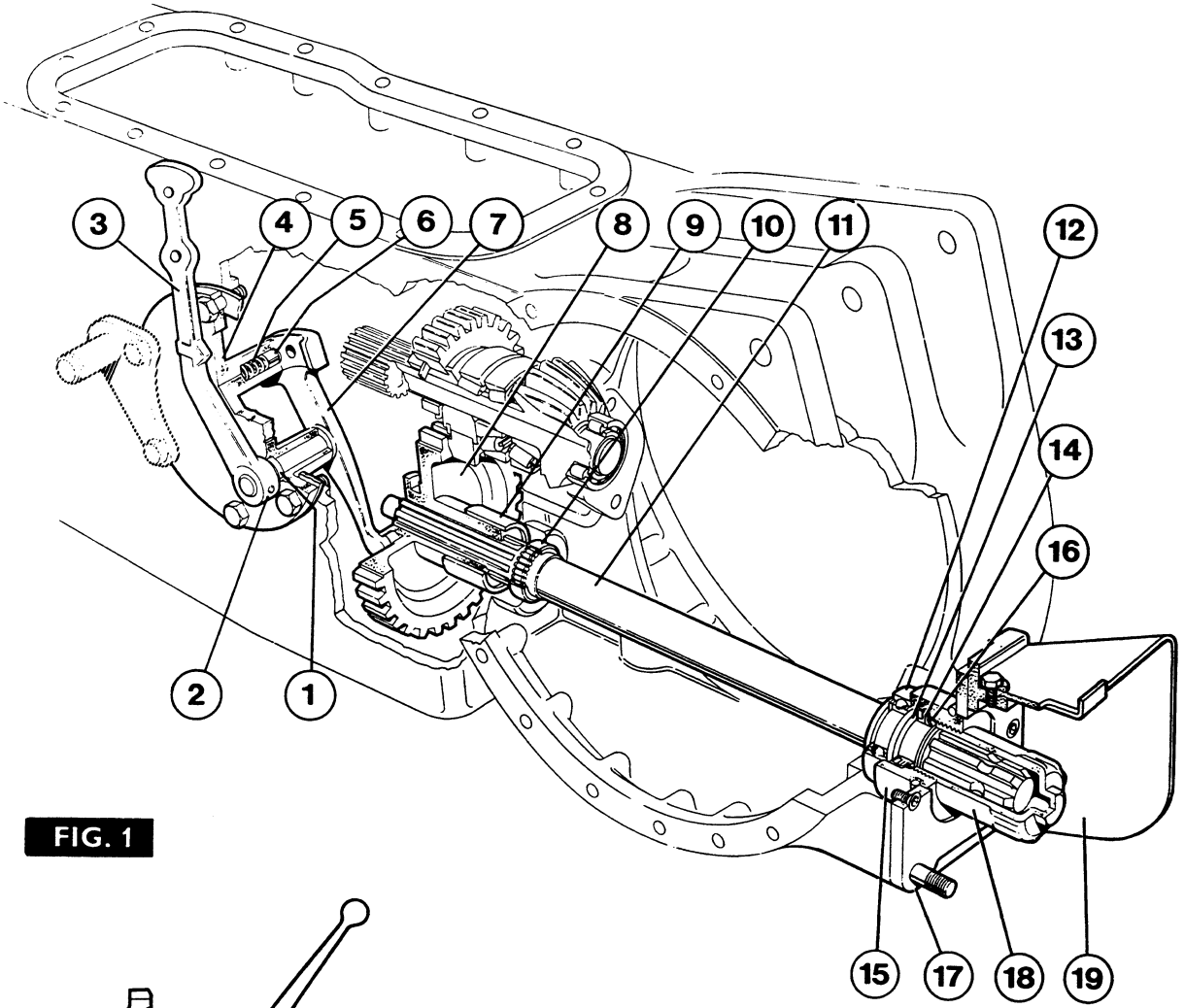


FIG. 1

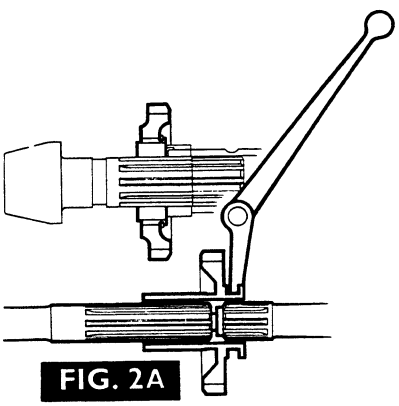


FIG. 2A

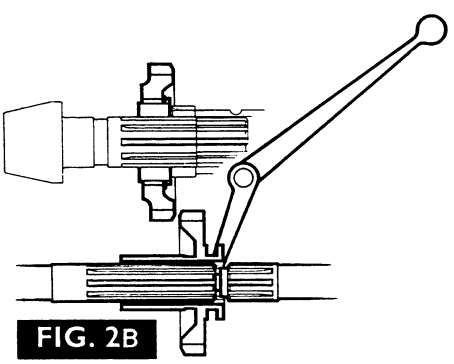


FIG. 2B

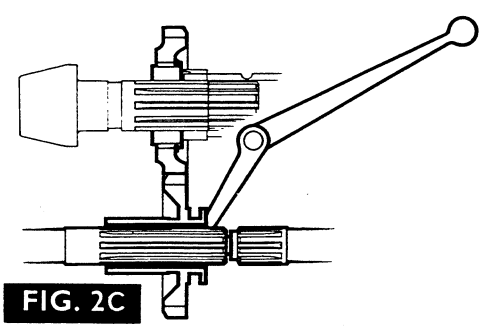


FIG. 2C

POWER TAKE-OFF

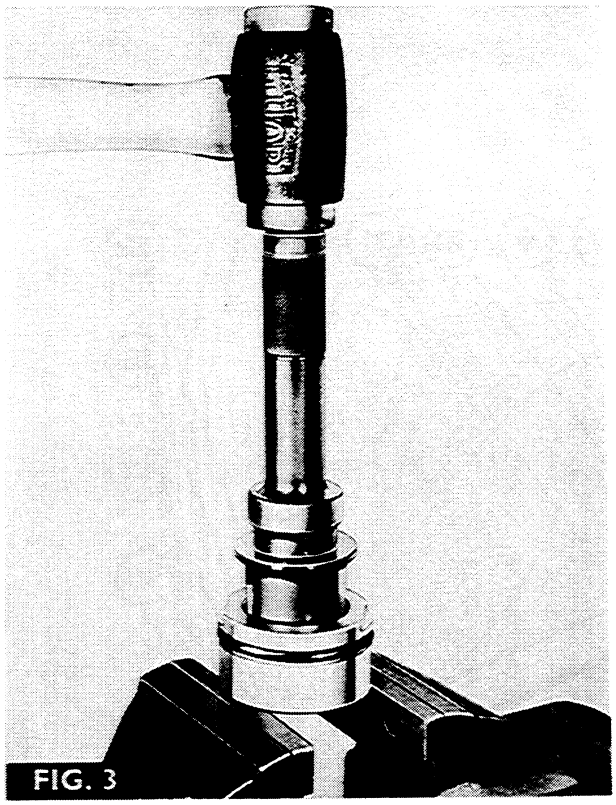


FIG. 3

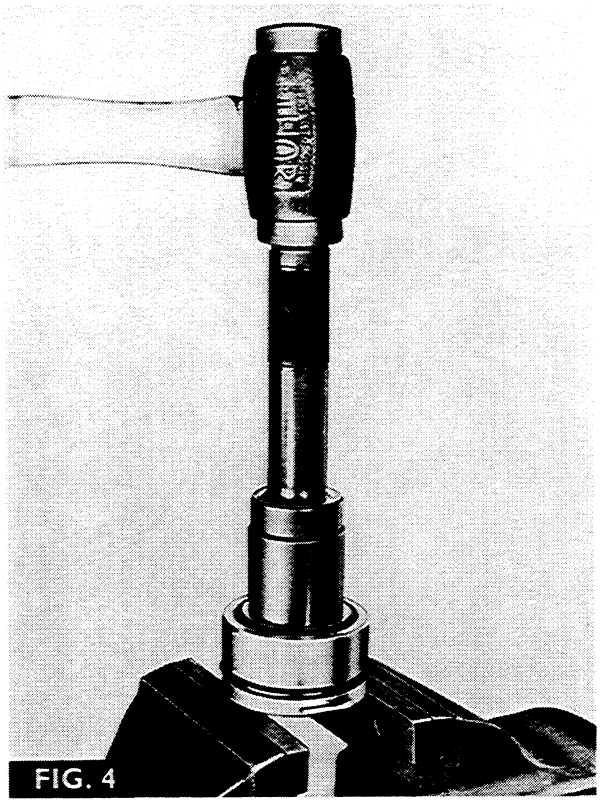


FIG. 4

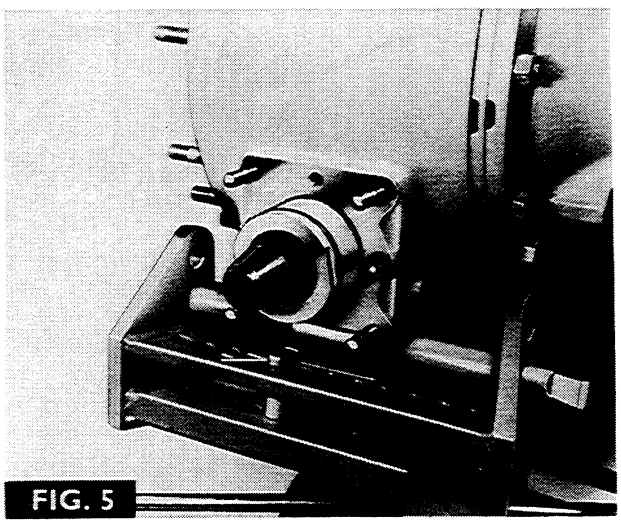


FIG. 5

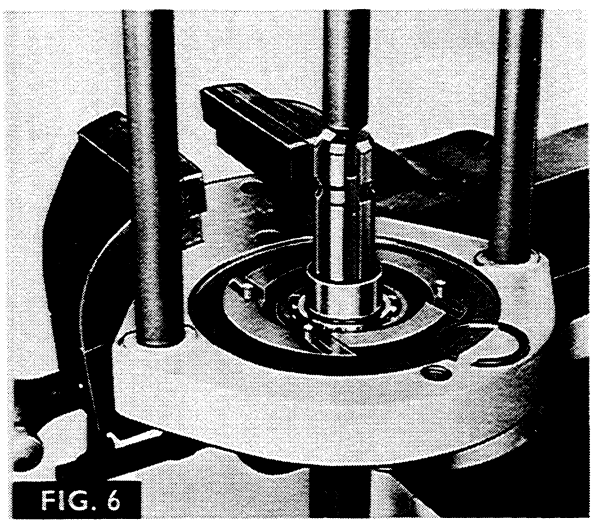


FIG. 6

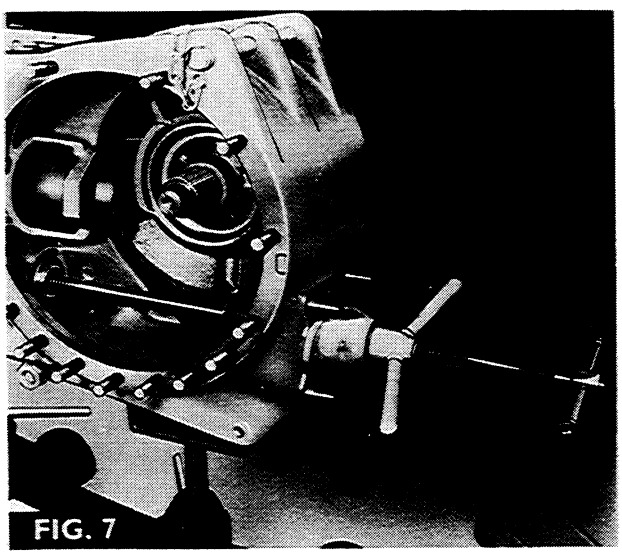


FIG. 7

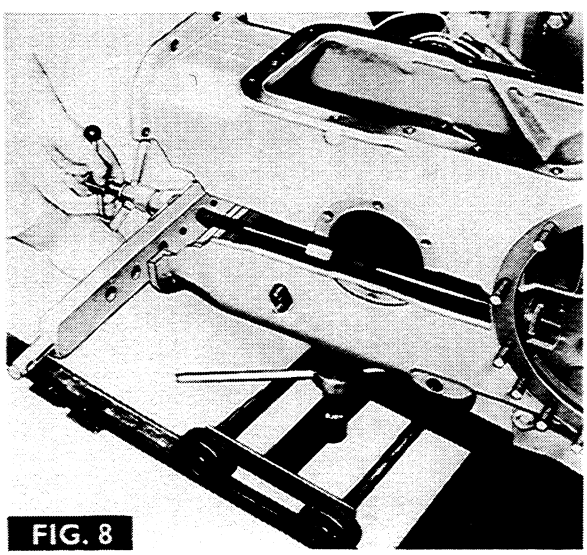


FIG. 8

P.T.O. NEEDLE ROLLER BEARING

Removal and Replacement 5B-04-05

Special Tools Required: MF 195-5/1 Adapters
MF 195-5/2 Bar
MF 195 Puller

Removal

1. Drain the centre housing of oil.
2. Remove the hydraulic lift cover as stated in Part 7, Section A.
3. Split the tractor at the centre housing.
4. Remove the hydraulic pumps as stated in Part 7, Section A.
5. Remove the p.t.o. side cover, then the ground speed p.t.o. driven gear.
6. Remove the Left Hand axle shaft housing assembly and the differential assembly.
7. Remove the p.t.o. shaft as stated in operation 5B-02-02
8. Assemble tool MF 195-5/1 to the needle roller bearing from the front. Fit tool MF 195 and bar MF 195-5/2 to the centre housing as shown in Figure 7, screw the bar into tool MF 195-5/1 and remove the bearing.
9. Examine the bearing and replace it if necessary.

Replacement

1. Position the new bearing squarely over its bore in the centre housing from the rear. Fit tool MF 195-5/1 into the bearing from the rear. Screw the bar tool MF 195-5/2 into tool MF 195-5/1 from the front and, using a suitable support for main tool MF 195, pull the bearing into its bore in the centre housing as shown in Figure 8.
2. Refit the p.t.o. shaft as stated in operation 5B-02-02
3. Refit the differential case assembly, and Left Hand axle shaft housing assembly.
4. Refit the ground speed p.t.o. driven gear and the p.t.o. cover plate and lever, locating the lever into its groove in the gear.
5. Refit the hydraulic pumps.
6. Refit the centre housing to the transmission.
7. Refit the hydraulic lift cover.
8. Refill the centre housing with recommended oil.

GROUND SPEED GEAR BUSH

Removal and Replacement 5B-05-05

Special Tools Required: MF 195-4/1 Adapter
MF 195-5/2 Bar
MF 195 Puller

Removal

1. Drain the oil from the centre housing.
2. Remove the hydraulic lift cover as stated in Part 7. Section A.
3. Split the tractor at the centre housing.
4. Remove the hydraulic pump(s) as stated in Part 7. Section A.
5. Remove the p.t.o. side cover and lever, then remove the ground speed p.t.o. driven gear.
6. Remove the Left Hand axle shaft housing assembly and the differential assembly.
7. Remove the p.t.o. shaft, as stated in operation 5B-02-02
8. Assemble the two adapters MF 195-4/1 into the bush.
9. Screw the tool bar portion MF 195-5/2 into the adapter MF 195-4/1 then, using a suitable support bar for MF 195, pull the bush out of the centre housing, as shown in Figure 9.

Replacement

1. Position the new bush squarely over its bore in the centre housing.
2. Assemble the adapter MF195-4/1 into the bush.
3. Screw the tool bar portion MF 195-5/2 into the adapter MF 195-4/1 from the rear and pull the bush into the centre housing using puller MF 195 as shown in Fig. 10.
4. Refit the p.t.o. shaft, as stated in operation 5B-02-02.
5. Refit the differential assembly and the Left Hand axle housing.
6. Refit the ground speed p.t.o. driven gear and the p.t.o. side cover assembly, locating the lever in its groove in the gear.
7. Refit the hydraulic pumps.
8. Re-attach the centre housing to the transmission.
9. Refit the hydraulic lift cover.
10. Refill the centre housing with a recommended oil.

P.T.O. SIDE COVER

Removal and Refitment 5B-06-05

Special Tools Required: Torque Wrench

Removal

1. Drain about 9 litres (2 gallons) of oil from the centre housing.
2. Disconnect the two hoses from the side cover to the spool valve manifold at the two unions on the side cover (Multi-Power auxiliary hydraulic tractors only).
3. Remove the three socket head screws securing the internal manifold to the side cover (Multi-Power auxiliary hydraulic tractors only).
4. Remove the six bolts securing the side cover to the centre housing.
5. Manoeuvre the side cover, complete with its lever and selector out of the centre housing.

Refitment

1. Fit the side cover assembly into the centre housing, locating the selector in the groove in the ground speed driven gear.
2. Fit the six side cover securing bolts loosely, to permit alignment with the internal manifold (Multi-Power auxiliary hydraulic tractors only).
3. Fit the three socket head screws and secure the internal manifold (Multi-Power auxiliary hydraulic tractors only).
4. Tighten the six side cover bolts to a torque of 7,6 kg/m (55 lb ft).
5. Reconnect the hose from the tee-piece union on the spool valve to the rear union on the side cover (Multi-Power tractors only).
6. Reconnect the hose from right-angle union on the spool valve union to the front union on the side cover (Multi-Power auxiliary hydraulic tractors only).
7. Replenish the transmission with oil.

NOTE – THE ABOVE PROCEDURE ASSUMES THAT FOR MULTI–POWER TRACTORS THE LIFT COVER WILL HAVE BEEN REMOVED FOR OTHER WORK TO BE CARRIED OUT, AS THE INTERNAL MANIFOLD CANNOT EASILY BE ALIGNED WITH THE SIDE COVER, EVEN WHEN THE BOLTS ARE LEFT SLACK.

P.T.O. SIDE COVER UNIT

Disassembly and Reassembly 5B-07-06

Figure 11

Disassembly

1. Remove the p.t.o. side cover unit as stated in operation 5B-06-05
2. Drive out the roll pin (2) securing the shift lever (3) to the selector shaft (7).
3. Withdraw the selector shaft from the side cover (4) and remove the detent (6) and spring (5).
4. Remove the oil seal (1) from the side cover (4).

Reassembly

1. Fit a new oil seal (1) to the side cover (4).
2. Examine the detent spring (5) and replace it if necessary, then fit the spring and the detent (6) to the side cover.
3. Refit the selector shaft to the side cover taking care not to damage the oil seal.
4. Refit the flat washer, then the shift lever and secure the lever with a new roll pin.
5. Refit the side cover unit as stated in operation 5B-06-05

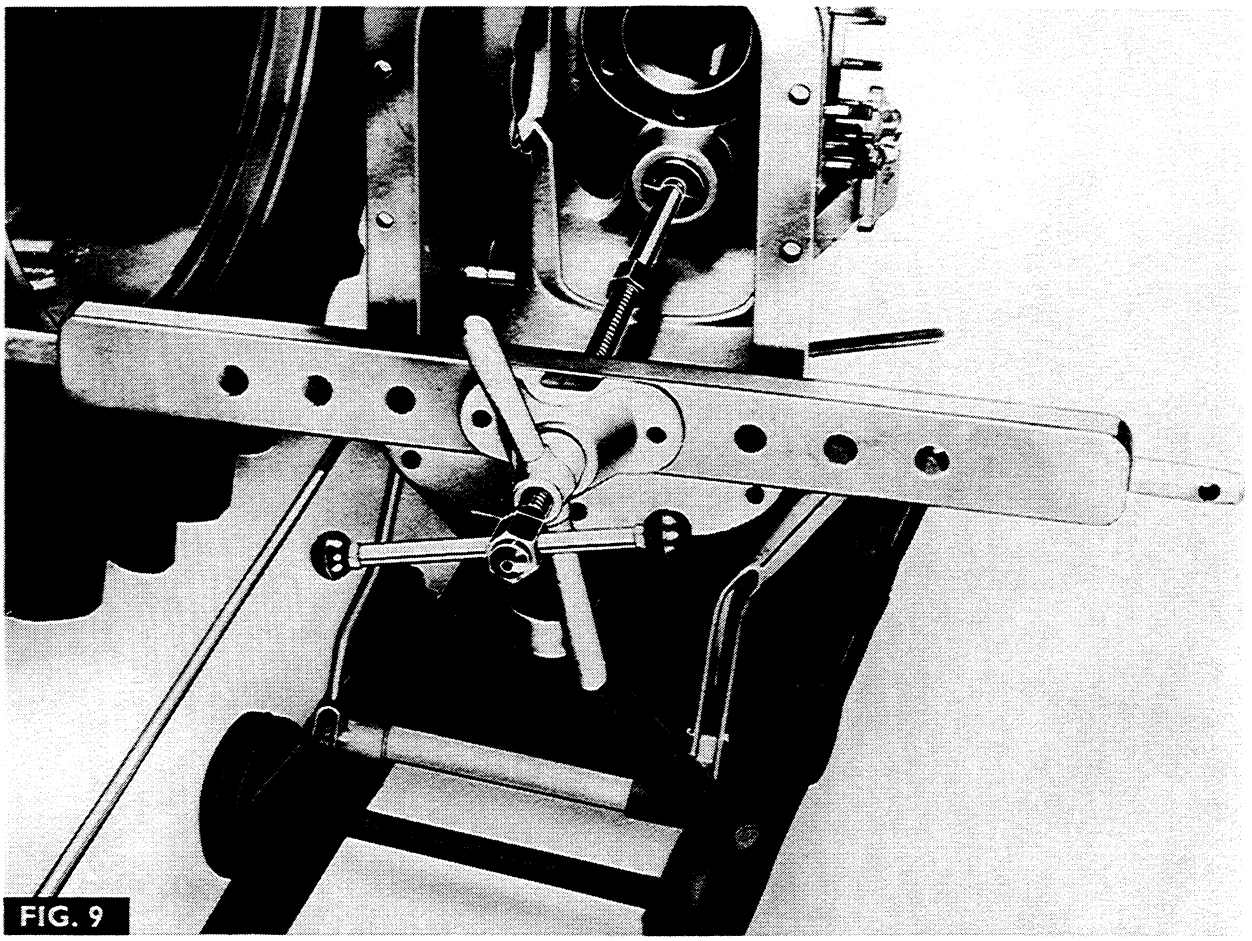


FIG. 9

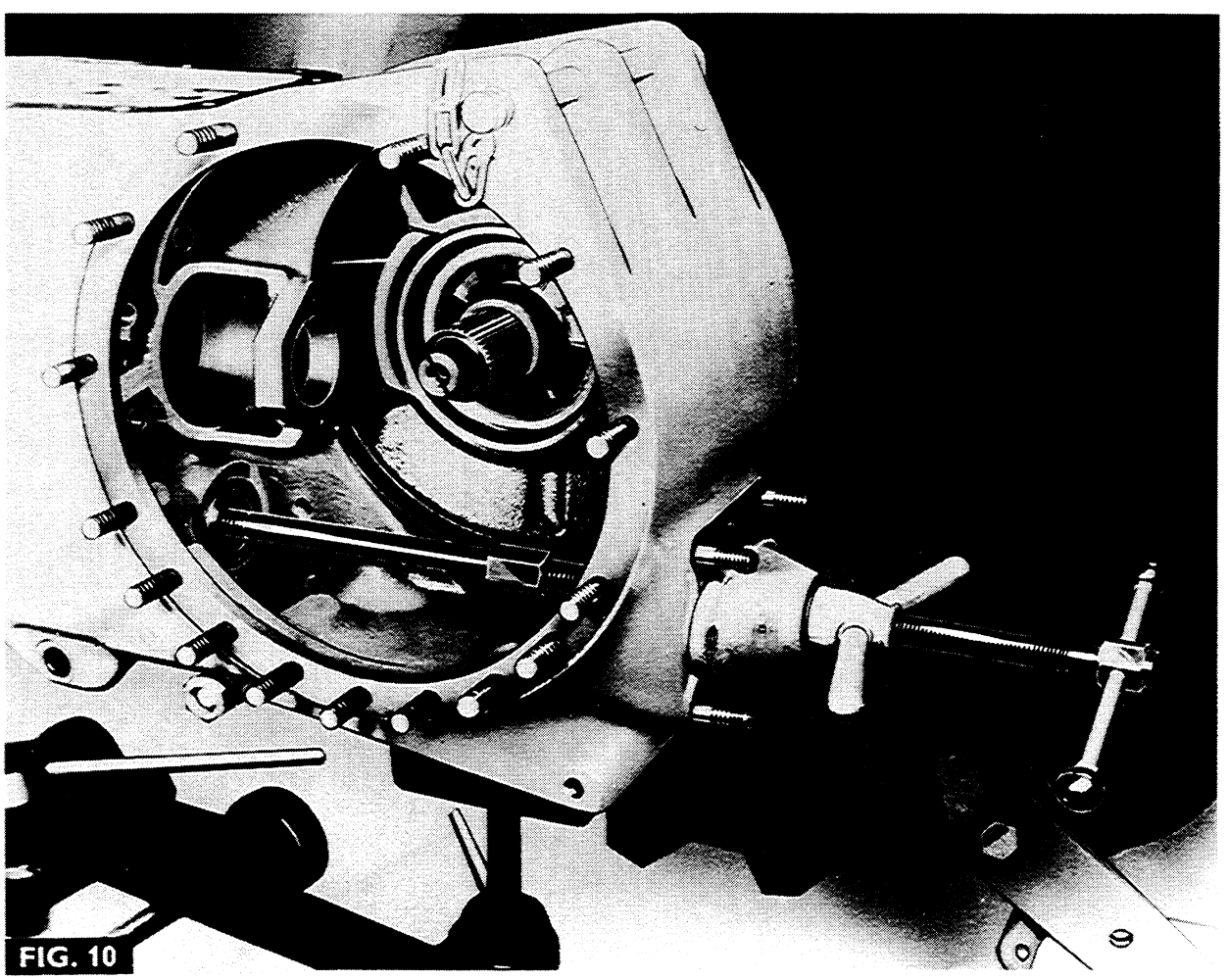


FIG. 10

POWER TAKE-OFF

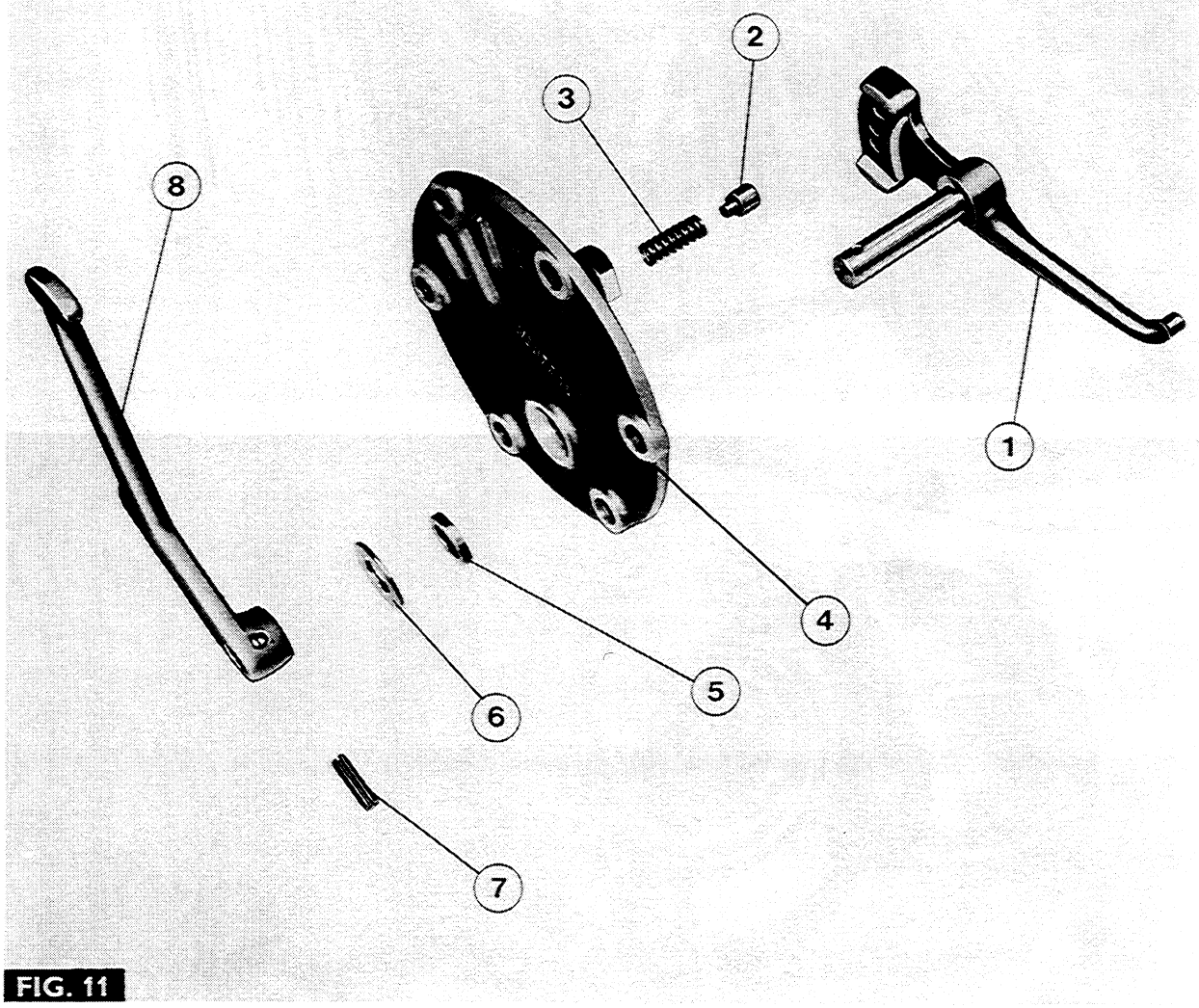


FIG. 11

INDEPENDENT POWER TAKE-OFF

Part 5 Section C

GENERAL

The independent power take off system consists of a hydraulically actuated clutch whose engagement, or disengagement is controlled by a three position spool valve. The clutch drum is splined on to the rear end of the hydraulic lift pump camshaft and the friction plate hub is splined on to the front end of the p.t.o. shaft.

Hydraulic pressure is supplied by one of the low pressure outlet ports on the Multi-Power or Auxiliary pump at a minimum of 17,5 Kg/cm^2 (250 lb/in^2). To maintain this minimum pressure, a special valve is incorporated in the outlet flow pipe in the Multi-Power circuit.

The clutch valve is operated by a hand lever on the left side of the centre housing.

INDEPENDENT POWER TAKE-OFF

I.P.T.O. UNIT

Removal and Refitment 5B-08-12
Special Tools Required: See operation 7A-03-16 and 3A-05-03

Removal

1. Drain the transmission oil to the low mark on the dipstick.
2. Disconnect the two hoses (if fitted), from the unions on the side cover to the spool valve manifold, at the side cover.
3. Remove the lift cover as stated in operation 7A-03-16.
4. Split the tractor between the centre housing and the transmission as stated in operation 3A-05-03.
5. Remove the two banjo bolts and manifold (auxiliary hydraulic tractors without spool valves) or the two unions and nuts (auxiliary hydraulic tractors with spool valves) from the side cover.
6. Fig.12.Remove the pipe (1) (auxiliary hydraulic tractors only) by removing the snap ring securing the pipe to the side cover (6) and releasing the pipe at the auxiliary pump.
7. Remove the pipe (2) from the auxiliary pump and the i.p.t.o. spool valve (5).
8. Remove the return pipe (3) (auxiliary hydraulic tractors only) by removing the snap ring securing the pipe to the side cover.
9. Disconnect the pressure test pipe (4) at the spool valve (5).
10. Remove the six bolts securing the side cover to the centre housing.
11. Manoeuvre the side cover, complete with the lever (7), selector (8) and pipe (4) out of the centre housing.
12. Move the auxiliary pump, hydraulic pump and the i.p.t.o. unit forwards.
13. Withdraw the auxiliary pump and hydraulic pump as a complete assembly, then remove the i.p.t.o. unit.

Refitment

1. Place the i.p.t.o. unit in the centre housing and locate it on the p.t.o. shaft splines.
2. Position the auxiliary pump and hydraulic pump in the centre housing, locating the camshaft splines in the i.p.t.o. unit.
3. Refit the hydraulic pump securing dowels, with new 'O' rings, then locate the dowels in the hydraulic pump and secure with two nuts each side.
4. Position the side cover, with a new gasket, on the centre housing, locating the selector (8) in the spool (9) and the dowel pin in the spool valve (5).
5. Secure the side cover, rear footplate bracket and clutch pedal (if removed) with six bolts, tightened to a torque of 7,6 Kg-m (55 lb-ft).
6. Reconnect the pressure test pipe (4) to the spool valve (5).
7. Refit the return pipe (3) (auxiliary hydraulic tractors only), with a new sealing ring, to the side cover and secure with a new snap ring.
8. Refit the pipe (2) to the auxiliary pump and the i.p.t.o. spool valve (5).
9. Refit the pipe (1) (auxiliary hydraulic tractors only), with a new sealing ring, to the side cover and secure with a new snap ring, then fit the pipe to the auxiliary pump.
10. Refit the manifold (auxiliary hydraulic tractors without spool valves), with a new gasket, and secure with the two banjo bolts and new sealing rings. Tighten the banjo bolts to a torque of 5,5 kg-m (40 lb-ft).
11. Refit the two nuts and unions (auxiliary hydraulic tractors with spool valves) to the side cover. The right angle union must be fitted to the rear hole in the side cover.
12. Reconnect the centre housing to the transmission as stated in operation 3A-05-03.
13. Refit the lift cover as stated in operation 7A-03-16.
14. Reconnect the hose (if fitted), from the tee-piece union on the spool valve manifold, to the rear union on the side cover.
15. Reconnect the hose (if fitted), from the right angle union on the spool valve manifold, to the front union on the side cover.

Clutch Assembly Servicing 5B-09-12
Special Tools Required: See operations 7A-03-16 and 3A-05-03

Disassembly

1. Remove the i.p.t.o. unit as stated in operation 5B-08-12
2. Fig. 13. Remove the snap ring (10), thrust washer (11) and then the spool valve (5) from the clutch assembly.
3. Fig.14. Remove the snap ring (19) and then lift out the clutch cover plate (18).
4. Remove the centre hub (13).
5. Remove the seven friction discs (17), springs (16) and pressure plates (15).
6. Invert the housing (12) and tap out the piston (14). If necessary remove the piston ring.

Examine all parts for scoring, wear or damage and replace if necessary. Always fit new snap rings.

Reassembly

1. If necessary, fit a new piston ring to the piston (14), then place the piston, boss uppermost, in the clutch housing (12).
2. Refit the centre hub (13) in the housing.
3. Fig.15. Alternately assemble the seven pressure plates (15), friction discs (17) and springs (16) in the housing. To facilitate the refitting of all the discs, place suitable pins to compress the springs as shown.
4. Refit the cover plate (18) and secure with a new snap ring (19).
5. Remove the spring compressing pins.
6. Fig.13. Refit the spool valve (5) to the clutch, then the thrustwasher (11) and secure with a new snap ring (10).
7. Refit the i.p.t.o. unit as stated in operation 5B-08-12.

Spool Valve Servicing 5B-10-12
Special Tools Required: See operations 7A-03-16 and 3A-05-03

Disassembly

1. Remove the i.p.t.o. unit as stated in operation 5B-08-12.

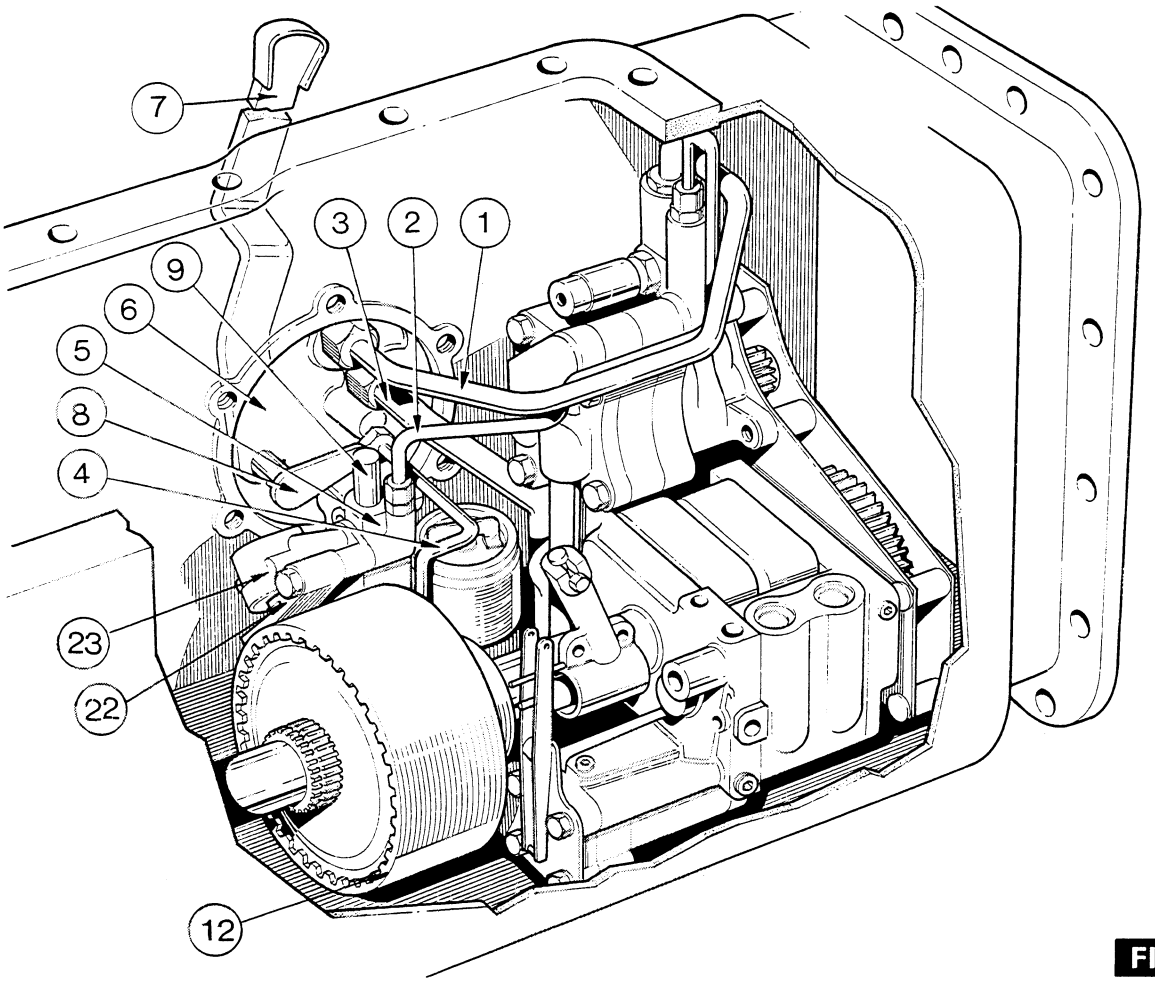


FIG. 12

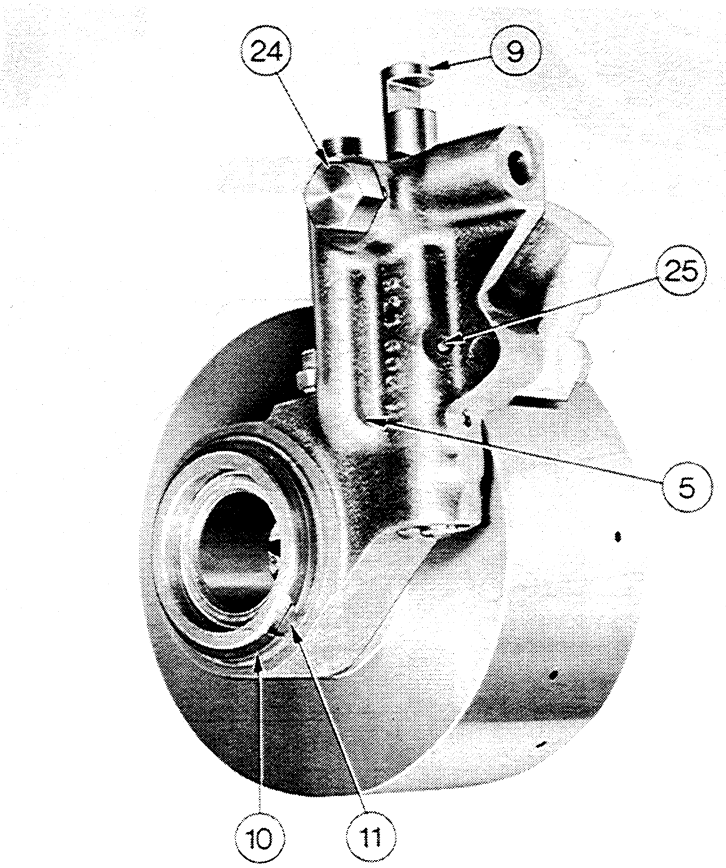


FIG. 13

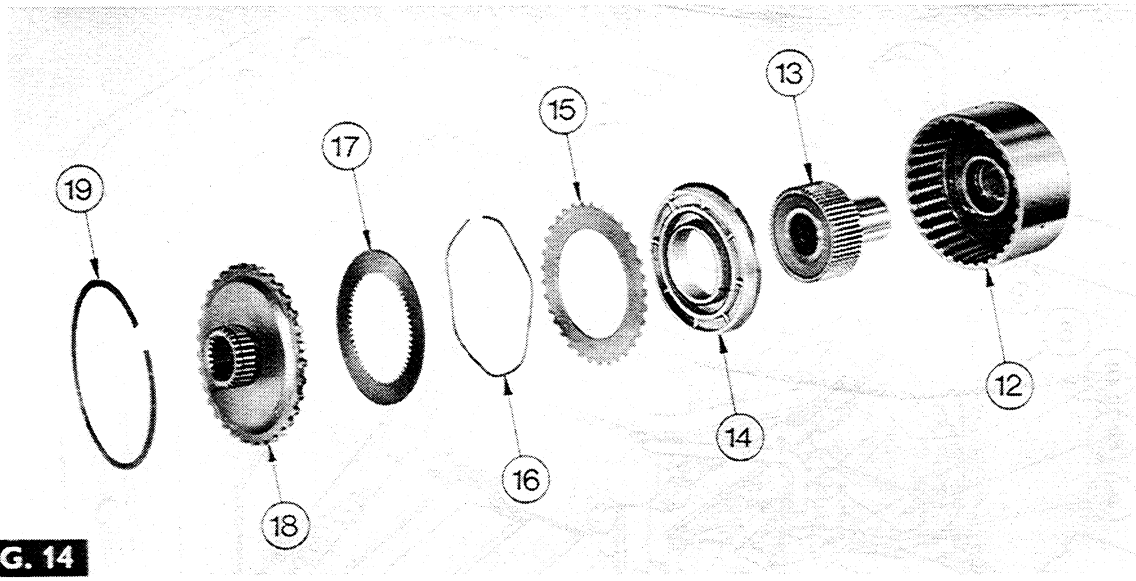


FIG. 14

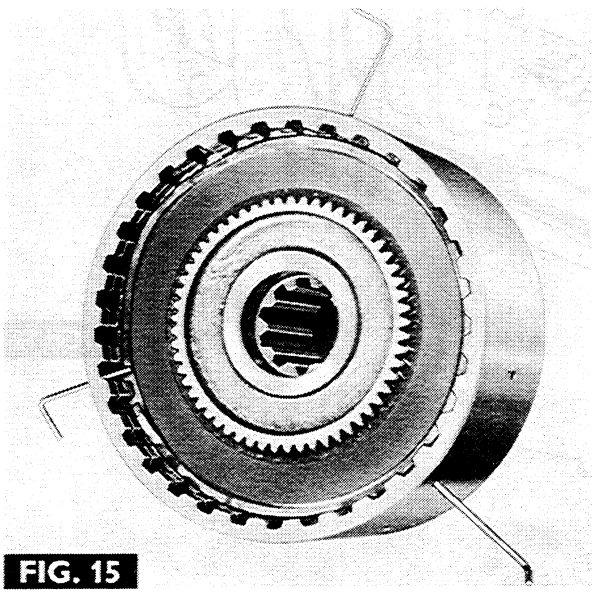


FIG. 15

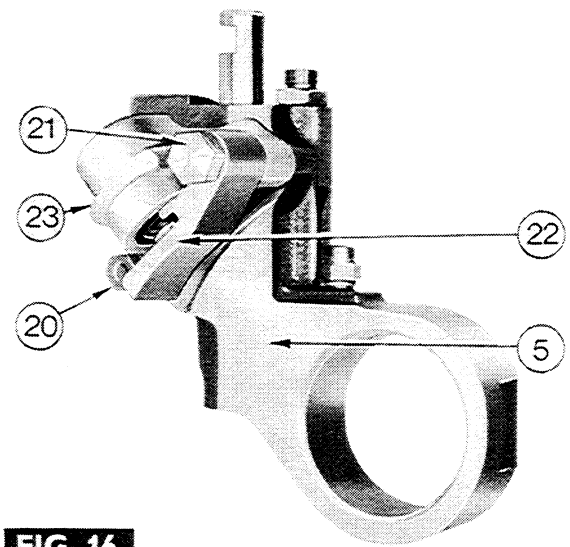


FIG. 16

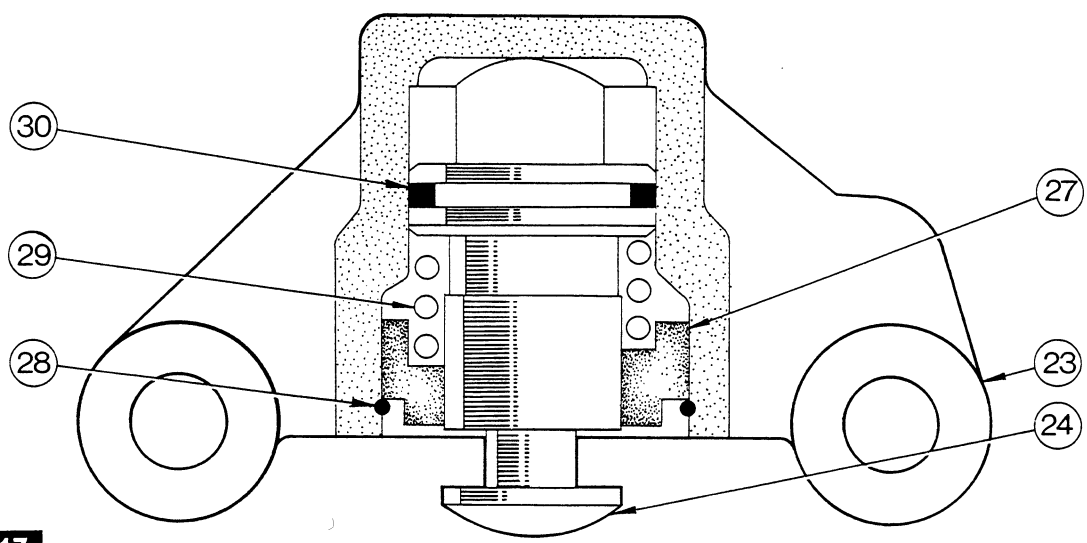


FIG. 17

2. Fig.13. Remove the snap ring (10), thrust washer (11) and then the spool valve (5) from the clutch housing.
3. Fig.16. Remove the two bolts (20 and 21) securing the brake (22) and the brake housing (23) to the spool valve (5).
4. Fig.13. Remove the plug (24), spring and ball, then drive out the securing pin (25) and withdraw the spool (9) from the spool valve (5).
5. Fig.17. To service the brake assembly, remove the snap ring (28), guide (26), spring (29) and piston (27). Remove the 'O' ring (30) from the piston.

Examine all parts for scoring, wear or damage and replace if necessary. Always fit new 'O' rings and snap rings.

Reassembly

1. Fig.17.To reassemble the brake assembly, fit a new 'O' ring (30) on the piston (27) then refit the piston, spring (29), and guide (26) in the brake housing (23) and secure with a new snap ring (28).
2. Fig.13. Slide the spool (9) into the valve (5), then align the flat on the spool with the hole in the valve and fit a new securing pin (25).
3. Refit the ball, spring and plug (24).
4. Fig.16.Engage the brake (22) into the slot at the end of the piston (27 Fig. 6) then refit the brake and the brake housing (23) to the spool valve and secure with the two bolts (20 and 21).

   NOTE – BEFORE FULLY TIGHTENING THE BOLTS (20 and 21) ENSURE THAT THE BRAKE (22) IS FLUSH AGAINST THE BRAKE HOUSING (23).

5. Fig.13.Refit the spool valve (5) to the clutch, then the thrust washer (11) and secure with a new snap ring (10).
6. Refit the i.p.t.o. unit as stated in operation 5B-08-12.

P.T.O. SIDE COVER

Removal and Refitment 5B-11-15

Special Tools Required: See operation 7A-03-16

Removal

1. Drain the transmission oil to the low mark on the dipstick.
2. Disconnect the two hoses (if fitted), from the unions on the side cover to the spool valve manifold, at the side cover.
3. Remove the lift cover as stated in operation 7A-03-16.
4. Remove the two banjo bolts and manifold (auxiliary hydraulic tractors without spool valves) or the two unions and nuts (auxiliary hydraulics with spool valves) from the side cover.
5. Fig.12.Remove the two snap rings securing the two pipes (1 and 3) (auxiliary hydraulic tractors only) to the side cover and lift out the return pipe (3).
6. Disconnect the pressure test pipe (4) at the spool valve (5).
7. Remove the six bolts securing the side cover to the centre housing.
8. Manoeuvre the side cover, complete with the lever (7), selector (8) and pipe (4) out of the centre housing.

Refitment

1. Position the side cover, with a new gasket, on the centre housing, locating the selector (8) in the spool (9) and the dowel pin in the spool valve (5).
2. Secure the side cover, rear footplate bracket and clutch pedal (if removed) with six bolts, tightened to a torque of 7,6 Kg-m (55 lb-ft).
3. Reconnect the pressure test pipe (4) to the spool valve.
4. Refit the return pipe (3), then the delivery pipe (1) (auxiliary hydraulic tractors only), with new sealing rings, to the side cover and secure them with new snap rings.
5. Refit the manifold (auxiliary hydraulic tractors without spool valves), with a new gasket, and secure with two banjo bolts and new sealing rings. Tighten the banjo bolts to a torque of 5,5 Kg-m (40 lb-ft).
6. Refit the two nuts and unions (auxiliary hydraulic tractors with spool valves) to the side cover. The right angle union must be fitted to the rear hole in the side cover.
7. Refit the lift cover as stated in operation 7A-03-16.
8. Reconnect the hose (if fitted), from the tee-piece union on the spool valve manifold, to the rear union on the side cover.
9. Reconnect the hose (if fitted), from the right angle union on the spool valve manifold, to the front union on the side cover.

Servicing 5B-12-15

Special Tools Required: See operation 7A-03-16

Disassembly

1. Remove the p.t.o. side cover as stated in operation 5B-11-15.
2. Remove the nut securing the pressure test pipe and remove the pipe.
3. Drive out the roll pin securing the lever to the selector shaft.
4. Withdraw the selector shaft from the side cover and remove the detent and spring.
5. Remove the sealing ring from the selector shaft.

Reassembly

1. Examine the detent and spring and replace if necessary, then fit the spring and detent to the side cover.
2. Refit the selector shaft to the side cover, then fit a new sealing ring to the shaft.
3. Refit the lever and secure with a new roll pin.
4. Refit the pressure test pipe, with new sealing ring, to the side cover and secure with the nut.
5. Refit the p.t.o. side cover as stated in operation 5B-11-15.

INDEPENDENT POWER TAKE-OFF

P.T.O. SHAFT

Oil Seal

Removal and Replacement 5B-13-16

Special Tools Required: MF 167 Seal Protector
MF 168 Seal Remover/Replacer
550 Universal Handle

Removal

1. Drain the centre housing of oil.
2. Remove the pin from the control beam lower pivot.
3. Remove the p.t.o. shield, cap, check chain mounting bracket and oil seal housing retainer plate.
4. Slide the oil seal and housing assembly off the p.t.o. shaft.
5. Fig. 3. Remove the oil seal using tool MF 168 and 550 handle as shown.

Replacement

1. Fig. 4. Replace the oil seal using tool MF168 and 550 handle as shown.
2. Fig. 5. Fit oil seal protector MF 167 over the rear end of the p.t.o. shaft and slide the oil seal assembly onto the shaft as shown. Remove the oil seal protector.
3. Replace the oil seal housing retainer plate (with cut-out facing downwards) and locate onto the two flats on the oil seal housing.
4. Refit the check chain mounting bracket, p.t.o. cap, shield and control beam pin.
5. Refill the centre housing with recommended oil.

Shaft Removal and Refitment

Shaft Removal and Refitment 5B-14-16

Special Tools Required: MF 167 Seal Protector
MF 168 Seal Remover/Replacer
550 Universal Handle

Removal

1. Drain the centre housing of oil.
2. Remove the pin from the control beam lower pivot.
3. Remove the p.t.o. shield secured by one bolt and spring washer.
4. Remove the p.t.o. cap.
5. Remove the four nuts, four spring washers, two spacers and two bolts securing the check chain mounting bracket, and remove the bracket from the centre housing.
6. Remove the p.t.o. shaft oil seal housing retainer plate.
7. Withdraw the p.t.o. shaft from the centre housing, complete with oil seal assembly and bearing.
8. Remove the oil as stated in operation 5B-13-16.

Refitment

1. Fit a new seal to the housing before reassembly as stated in operation 5B-13-16.
2. Enter the p.t.o. shaft with its bearing into the centre housing and align the splines on the front end of the shaft into the i.p.t.o. unit.
3. Fig. 5. Fit oil seal protector MF 167 over the rear end of the p.t.o. shaft and slide the oil seal assembly onto the shaft as shown. Remove the oil seal protector.
4. Replace the oil seal housing retainer plate (with cut-out facing downwards) and locate onto the two flats on the oil seal housing.
5. Replace the check chain mounting bracket, p.t.o. cap, shield and the control beam pin.
6. Refill the centre housing with recommended oil.

Rear Bearing

Removal and Replacement 5B-15-16

Special Tools Required: MF 167 Seal Protector
MF 200 Hand Press
MF 200-25 Adapter

Removal

1. Remove the p.t.o. shaft as stated in operation 5B-14-16
2. Slide the oil seal assembly off the p.t.o. shaft.
3. Remove the bearing retaining snap ring from the collar on the p.t.o. shaft.
4. Fig. 6. Press off the bearing using multi-purpose bearing remover MF 200-25 as shown.
5. Examine the bearing and replace if necessary.

Replacement

1. Press the bearing onto the p.t.o. shaft.
2. Refit the snap ring.
3. Refit the p.t.o. shaft and seal, as stated in operations 5B-13-16 and 5B-14-16 not forgetting to fit a new 'O' ring.

Needle Roller Bearing

Removal and Replacement 5B-16-16

Special Tools Required: See operations 7A-03-16 and 3A-05-03
MF 195 Puller
MF 195-5 Adapters

Removal

1. Remove the i.p.t.o. unit as stated in operation 5B-08-12.
2. Remove the Left Hand axle shaft housing assembly and the differential assembly, as stated in operation 5A-20-17.
3. Remove the p.t.o. shaft as stated in operation 5B-14-16.
4. Fig. 7. Assemble tool MF 195-5/1 to the needle roller bearing from the front. Fit tool MF 195 and bar MF 195-5/2 to the centre housing as shown, screw the bar into tool MF 195-5/1 and remove the bearing.
5. Examine the bearing and replace it if necessary.

Replacement

1. Fig. 8. Position the new bearing squarely over its bore in the centre housing from the rear. Fit tool MF 195-5/1 into the bearing from the rear. Screw the bar tool MF 195-5/2 into tool MF 195-5/1 from the front and, using a suitable support for main tool MF 195, pull the bearing into its bore in the centre housing as shown.
2. Refit the p.t.o. shaft as stated in operation 5B-14-16.
3. Refit the differential case assembly, and Left Hand axle shaft housing assembly, as stated in operation 5A-20-17.
4. Refit the i.p.t.o. unit as stated in operation 5B-08-12.

HYDRAULIC TEST

When carrying out hydraulic tests, clean fresh oil, of the recommended grade must be used an should be warmed to a temperature of 50°C (120°F) by running under load, before testing. The use of either excessively hot, or cold oil can seriously affect the instrument readings.

I.P.T.O. Pressure Test 5B-17-17

Special Tools Required: MF 810 Gauge
MF 810-6 Adapter.

1. Fig. 18. Remove the plug on the side cover and fit the adapter MF 810-6 and the MF 810 Gauge as shown.
2. Start the engine and select Multi-Power 'HIGH' and engage 'ENGINE P.T.O.' With the oil at the correct temperature the gauge should indicate the following minimum pressures,

550 engine rev/min	17,5 Kg/cm^2 (250 lb/in^2)
2000 engine rev/min	25,3 Kg/cm^2 (360 lb/in^2)

3. Disengage p.t.o. and stop engine, remove the gauge and adapter and refit the plug in the side cover.

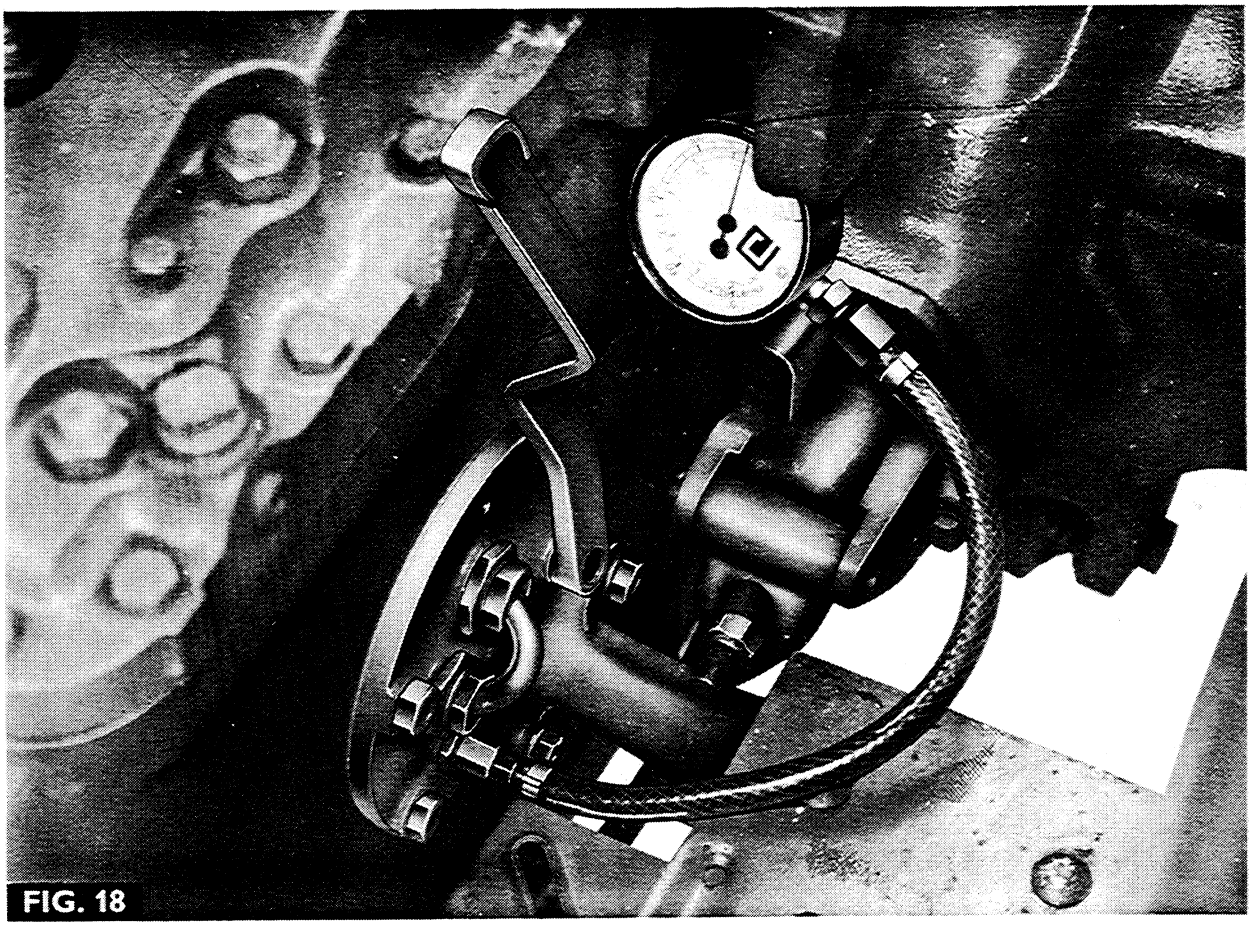


FIG. 18

FRONT AXLE

Part 6 Section A

GENERAL

The front axle assembly consists of a centre beam and two outer axles. The centre beam pivots on a pin, which is located in bushes in the axle support. The pin is secured to the centre beam by a peg bolt and locknut. The outer axles can be bolted to the centre beam in alternative positions to provide front wheel track adjustment.

FRONT AXLE

FRONT TRACK ADJUSTMENT 6A-01-02

The front track is adjustable in 102 mm (4 in) steps from 1219 to 2032 mm (48 to 80 in) (1320 to 2032 mm (52 to 80 in) for power steering tractors). For settings above 1625 mm (64 in) the foot throttle (if fitted) must be repositioned.

The settings from 1219 to 1828 mm (48 to 72 in) are obtainable as follows:–

1. Jack up the front of the tractor.
2. Fig. 1. Remove the two bolts (1), nuts and washers securing each outer axle arm to the centre beam.
3. Remove the bolt (2), nut and washer securing each power steering ram bracket to the centre beam (power steering tractors only)

   NOTE – DO NOT REMOVE THE BOLT (5) SECURING EACH RAM BRACKET TO THE OUTER AXLE ARMS.

4. Loosen the locknut (4) and bolt (3) securing each telescopic ball end to the front of each drag link.
5. Fig. 2. Adjust the outer axle arms and the ball ends to the required track setting.
6. Refit the bolts (1), nuts and washers, ensuring that the bolt heads are correctly located in the triangular holes in the centre beam, and tighten the bolts to 22 kg-m (160 lb-ft).
7. Refit the bolts (2), nuts and washers and tighten to 7 kg-m (50 lb-ft) (power steering tractors only).

   NOTE – THESE BOLTS ARE NOT USED FOR SETTINGS ABOVE 1422 MM (56 IN) BUT SHOULD BE RETAINED IN THE CENTRE BEAM FOR USE WHEN REVERTING BACK TO SETTINGS OF 1422 MM (56 IN) OR LESS.

8. Tighten the bolts (3) to 5 Kg-m (35 lb-ft) and then tighten the locknuts (4).

For track settings of 1930 mm (76 in) and 2032 mm (80 in), reverse the front wheels and set the outer axles to 1727 mm (68 in) and 1828 mm (72 in) respectively.

NOTE – THE 1930 MM (76 IN) AND 2032 MM (80 IN) SETTINGS SHOULD ONLY BE USED WHEN ABSOLUTELY NECESSARY AND NEVER WITH FRONT MOUNTED EQUIPMENT.

Foot Throttle Adjustment

If a front wheel track setting of 1625 mm (64 in) or over is required, reposition the foot throttle as follows:–

1. Fig. 3. Remove the bolt (6) securing the relay lever to the relay shaft.
2. Remove the two bolts (8) securing the pedal support bracket to the footrest mounting bracket.
3. Position the pedal support bracket to the two outer holes in the footrest mounting bracket and secure with the two bolts (8).
4. Position the relay lever (7) to the inner groove on the relay shaft and secure with the bolt (6).

Toe-in Adjustment 6A-02-02

Special Tool Required: Track Gauge

1. Locate the tractor on firm level ground and place the front wheels in a straight ahead position.
2. Using a suitable track gauge, check the toe-in, which should be 3,2 mm ($\frac{1}{8}$ in).
3. If adjustment is required, slacken the bolt securing the drag link rear ball end, and rotate the ball end clockwise or anti-clockwise to increase or decrease the toe-in as required.
4. Reitighten the drag link bolt, ensuring that it runs directly across the slot in the drag link.

   NOTE – ADJUSTMENT SHOULD BE MADE EQUALLY TO BOTH DRAG LINK REAR BALL ENDS.

FRONT HUB SERVICING 6A-03-02

Disassembly

1. Jack up the tractor and remove the wheel.
2. Fig. 4. Remove the hub cap (17) and gasket (16).
3. Straighten out and remove the split pin (15).
4. Remove the slotted nut (14) and tab located washer (13).
5. Lift the hub (11) complete with bearings (10 and 12) and seal (9) from the axle spindle.
6. Remove the outer bearing cone (12) from the hub.
7. Drive out the inner bearing cone (10) from the hub, this will also remove the seal (9).
8. Drive out the bearing cups from the hub.

Examination

Thoroughly wash out the old grease or dirt from the hub components, using CLEAN paraffin.

Check the condition of the hub, spindle and roller bearings.

Any worn or damaged components should be replaced. Always fit a new seal (9), split pin (15) and gasket (16).

Reassembly

1. Refit the bearing cups into the hub.
2. Refit the inner bearing cone (10).
3. Fit a new seal (9), with the flat face towards the centre of the hub, and tap the seal right into the recess in the hub.
4. Pack the hub $\frac{1}{3}$ full with grease and position the hub on the axle spindle.
5. Refit the outer bearing cone (12), the tab located washer (13) and the slotted nut (14).
6. Rotate the hub and tighten the slotted nut to 8,3 kg-m (60 lb-ft), then slacken off the nut two to three flats to give hub end float.
7. Fit a new split pin (15).
8. Refit the hub cam (17) with a new gasket (16).
9. Grease the hub until grease exudes past the seal.
10. Refit the wheel and tighten the bolts to 8,3 kg-m (60 lb-ft), then remove the jack.

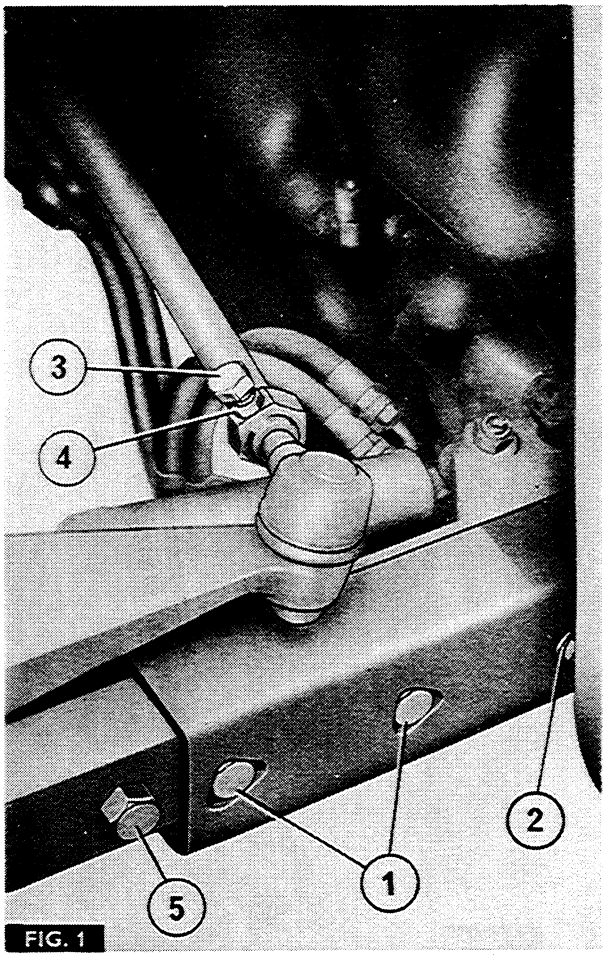


FIG. 1

	1219mm (48in)
	1320mm (52in)
	1422mm (56in)
	1524mm (60in)
	1624mm (64in)
	1727mm (68in)
	1828mm (72in)

FIG. 2

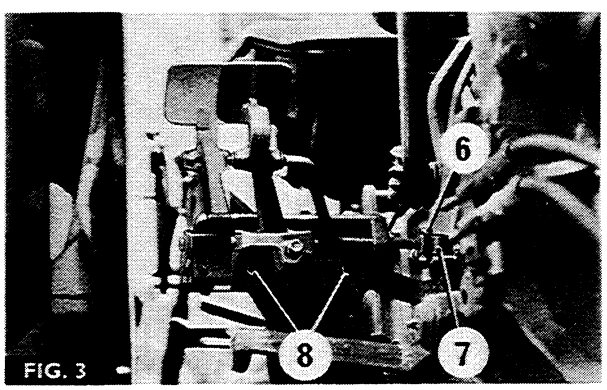


FIG. 3

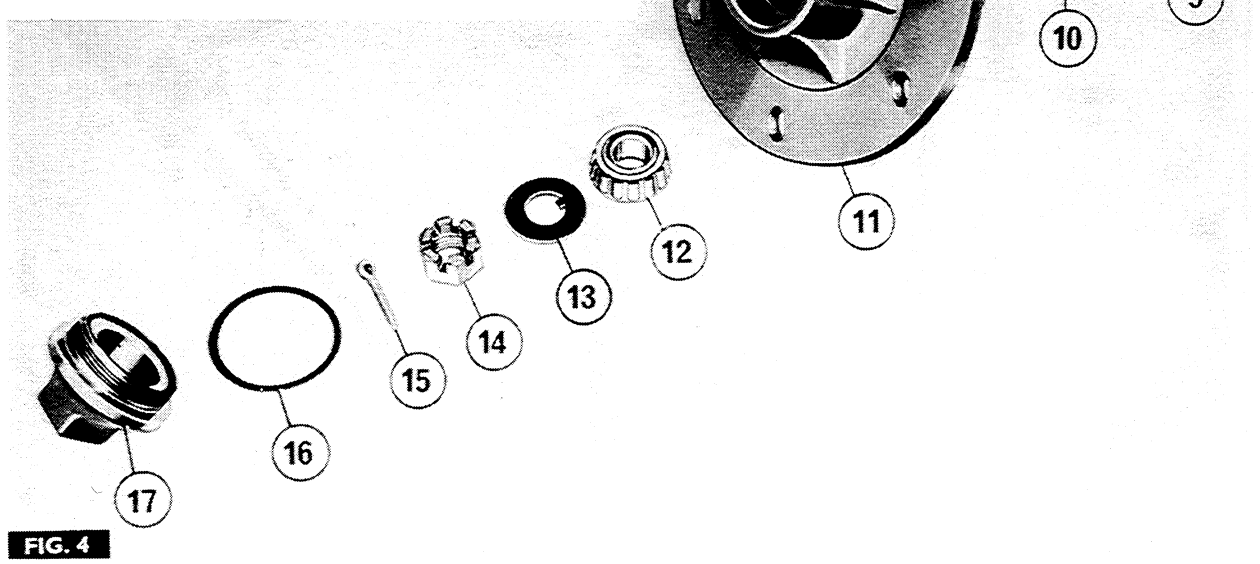


FIG. 4

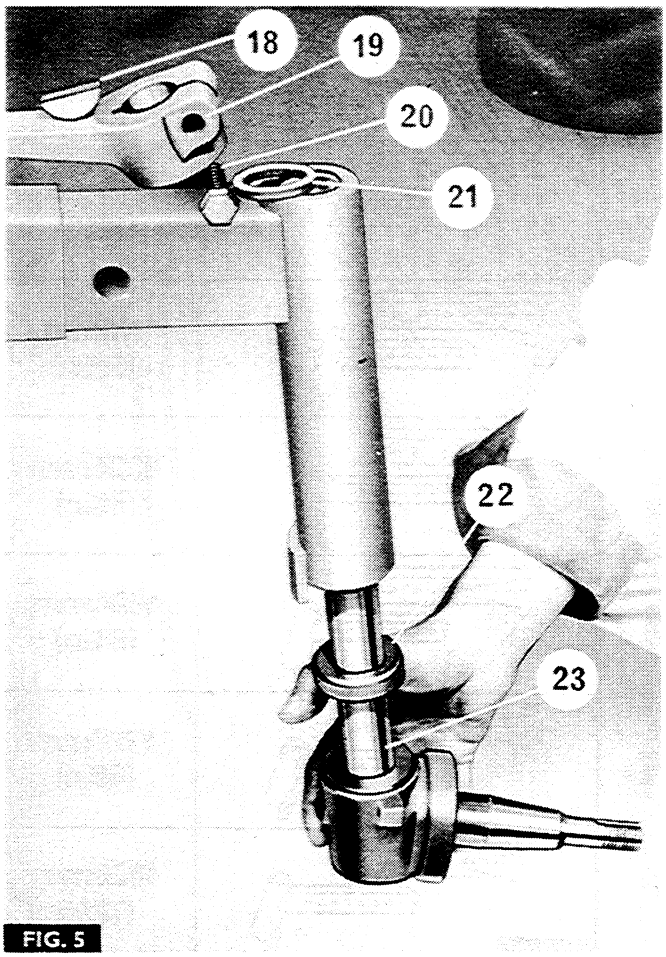


FIG. 5

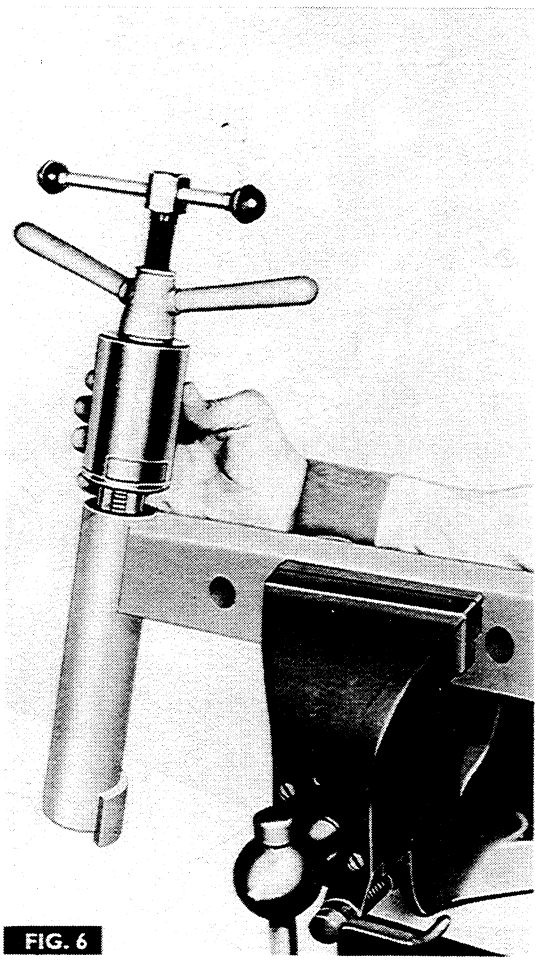


FIG. 6

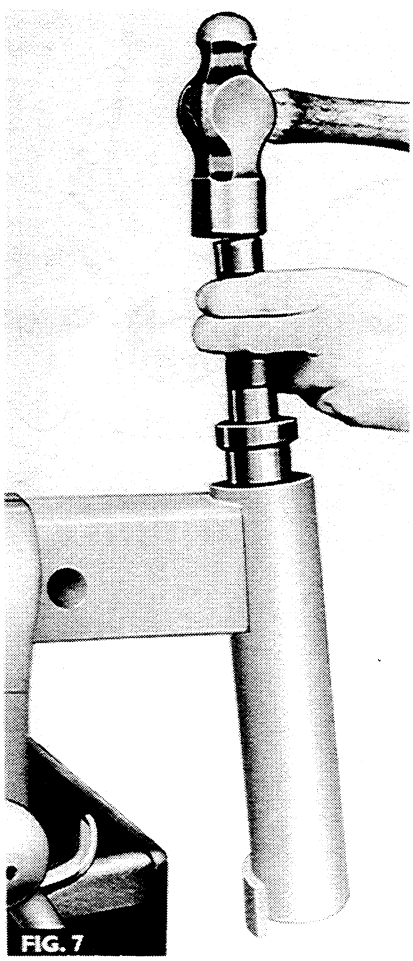


FIG. 7

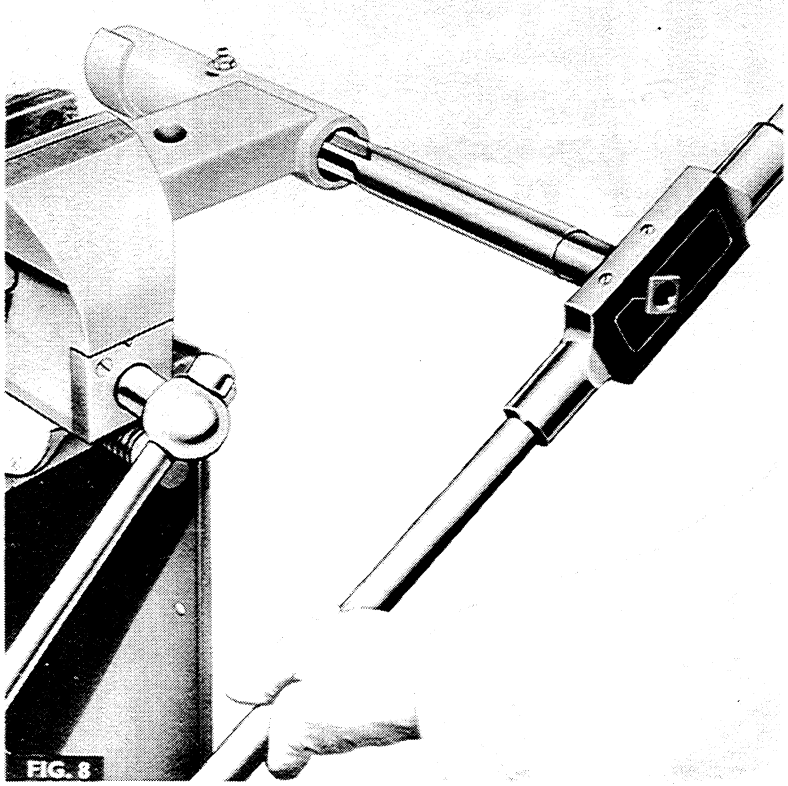


FIG. 8

SPINDLE SHAFT

Removal and Refitment 6A-04-05

Removal

1. Jack up the tractor and remove the hub as stated in operation 6A-03-02.
2. Fig. 5. Remove the bolt (20), nut and washer securing the spindle arm (19) and detach the arm from the spindle shaft (23).
3. Remove the key (18) and the seal (21) from the spindle shaft.
4. Lower the spindle shaft (23) and bearing (22) out of the housing.

Examination

Examine the spindle shaft (23) and the thrust bearing (22) for wear or damage. When reassembling use a new seal (21), key (18) and replace the thrust bearing (22) if necessary.

Refitment

1. Fit the bearing (22) to the spindle (23) with the thrust face downwards.
2. Refit the spindle to the housing, then fit a new seal (21) and key (18).
3. Refit the arm (19), securing it with the bolt (20), washer and nut and tighten the bolt to 7 kg-m (50 lb-ft).
4. Grease the spindle, through the nipple on the housing, with a recommended grease.
5. Refit the hub as stated in operation 6A-03-02.

OUTER AXLE ARM

Removal and Refitment 6A-05-05

Removal

1. Jack up the tractor and remove the front wheel.
2. Remove the spindle and hub assembly as stated in items 2 to 4 of operation 6A-04-00.
3. Fig. 1. Remove the two bolts (1) nuts and washers securing the outer axle arm to the centre beam.
4. Remove the bolt (2) nut and washers securing the power steering ram bracket to the centre beam (power steering tractors only).
5. Remove the bolt (5) nut and washer securing the power steering ram bracket to the outer axle arm (power steering tractors only).
6. Withdraw the outer axle arm from the centre beam.

Refitment

1. Refit the outer axle arm in the centre beam.
2. Secure the power steering ram bracket to the outer axle arm with the bolt (5) nut and washer and tighten the bolt to 22 kg-m (160 lb-ft) (power steering tractors only).
3. Refit the bolts (1) nuts and washers, ensuring that the bolt heads are correctly located in the triangular holes in the centre beam and tighten the bolts to 22 kg-m (160 lb-ft).
4. Refit the bolt (2) nut and washers and tighten to 7 kg-m (50 lb-ft) (power steering tractors only).
5. Refit the spindle and hub assembly as stated in items 1 to 4 of operation 6A-04-00.
6. Refit the wheel and tighten the bolts to 8,3 kg-m (60 lb-ft), then remove the jack.

Spindle Housing Servicing 6A-06-05

Special Tools Required: MF 263 Bush Remover
MF 263-1 Adapter
MF 19A Reamer
550 Universal Handle

Procedure

1. Remove the outer axle arm as stated in operation 6A-05-00.
2. Fig. 6. Assemble the bush remover MF 263 and adapter MF 263-1 as shown.
3. Enter the adapter into the bush by turning the upper handle, then extract the bush by rotating the lower handle.
4. Invert the outer axle arm and similarly extract the other bush.
5. Fig. 7. Position the new bush squarely over the bore, as shown, then drive in the new bush using the 550 handle and the adapter MF 263-1.
6. Invert the outer axle arm and similarly drive in the other new bush.
7. Fig. 8. Using the tool MF 19A, as shown, ream the two bushes.
8. Remove all swarf from the housing by washing the housing in clean paraffin and ensure that the grease nipple hole is clear.
9. Refit the outer axle arm as stated in operation 6A-05-00.

CENTRE BEAM ASSEMBLY

Removal and Refitment 6A-07-05

Removal

1. Remove the radiator as stated in Part 3B.
2. Jack up the tractor under the sump.
3. Remove the nuts securing each drag link ball end to the spindle arms and release the ball ends.
4. Fig. 1. Remove the two bolts (1) nut and washers securing each outer axle arm to the centre beam.
5. Remove the bolt (2) nut and washers securing each power steering ram bracket to the centre beam (power steering tractors only).

   NOTE – DO NOT REMOVE THE BOLT (5) SECURING EACH RAM BRACKET TO THE OUTER AXLE ARMS.

6. Withdraw each outer axle arm from the centre beam complete with their wheels.
7. Fig. 9. Remove the circlip (24), peg bolt (28), nut (27) and washer (26) securing the pivot pin (30).
8. Fit a 7/16 UNC bolt into the front of the pivot pin (30).
9. With one operator each side supporting the centre beam (25), withdraw the pivot pin (30).
10. Lift the centre beam clear of the axle support (29) and remove the shims (31).

Examination

Check the end faces of the centre beam journals and the pivot pin for wear. Examine all bores and threads for wear or damage.

In the event of accident damage, check the centre beam for bending or twisting. If the centre beam has been in any way deformed, it must be replaced, as steering characteristics and tyre wear can be severely affected. Also the centre beam may have been dangerously weakened due to straining of the welded seams.

Refitment

1. Place the centre beam into position on the axle support.
2. With one operator each side supporting the centre beam, align the bore of the centre beam and the support casting, then push the pivot pin, with the circlip groove towards the rear of the tractor, into position.
   Do not yet fit the peg bolt (28) or circlip (24). (24).
3. Push the centre beam fully rearwards, then measure the end float using feeler gauges.
4. From the following tables, select shims to give the correct end float.

Tractors prior to Serial No. 600465

End Float: 0,07 to 0,17 mm (0.003 to 0.007 in)

Part No.	Shim Thickness	
	mm.	in.
888 361 M1	0,127	0.005
888 362 M1	0,254	0.010
888 366 M1	0,508	0.020

Tractors after Serial No. 600465

End Float: 0,05 to 0,25 mm (0.002 to 0.010 in)

Part No.	Shim Thickness	
	mm.	in.
1863 312 M1	0,89	0.035
1863 313 M1	1,02	0.040
1863 314 M1	1,15	0.045

5. Supporting the centre beam, withdraw the pivot pin (30), then fit the new shims (31) at the front of the centre beam, then refit the pivot pin, securing it with a new circlip (24).
6. Thoroughly degrease the tapped hole in the centre beam, the peg bolt (28) and the locknut (27).
7. Rotate the pivot pin until the peg bolt hole is aligned with the hole in the centre beam.
8. Apply a few drops of either Locktite Grade AV or Casco Metalock LF5 to the peg bolt, then fit the washer (26) and the peg bolt and nut (27 and 28). Tighten the peg bolt to 7,5 kg-m (55 lb-ft), then tighten the lock nut to 5,5 kg-m (40 lb-ft).
9. Remove the 7/16 UNC bolt from the pivot pin.
10. Refit the outer axle arms to the centre beam.
11. Fig. 1. Refit the bolts (2) nuts and washers and tighten to 7 kg-m (50 lb-ft) (power steering tractors only)
12. Refit the bolts (1), nuts and washers, ensuring that the bolt heads are correctly located in the triangular holes in the centre beam, and tighten the bolts to 22 kg-m (160 lb-ft).
13. Refit the drag link ball ends to the spindle arms and tighten the nuts to 12,5 kg-m (90 lb-ft).
14. Refit the radiator as stated in Part 3B and remove the jack.

FRONT AXLE SUPPORT

Bush Removal and Replacement 6A-08-06

Special Tools Required: MF 322 Bush Remover and Replacer
550 Universal Handle

Removal

1. Remove the centre beam as stated in operation 6A-07-00.
2. Fig. 10. Drive out the two bushes from the axle support using the bush remover MF 322 and the 550 handle.

Refitment

1. Using the 550 handle and the bush replacer MF 322 drive the new bushes into the axle support, as shown.

   NOTE – THE BUSHES MUST BE 0,508 MM (0.020 IN) BELOW THE FACES IN THE SUPPORT ADJACENT TO THE CENTRE BEAM.

2. Refit the centre beams as stated in operation 6A-07-00.

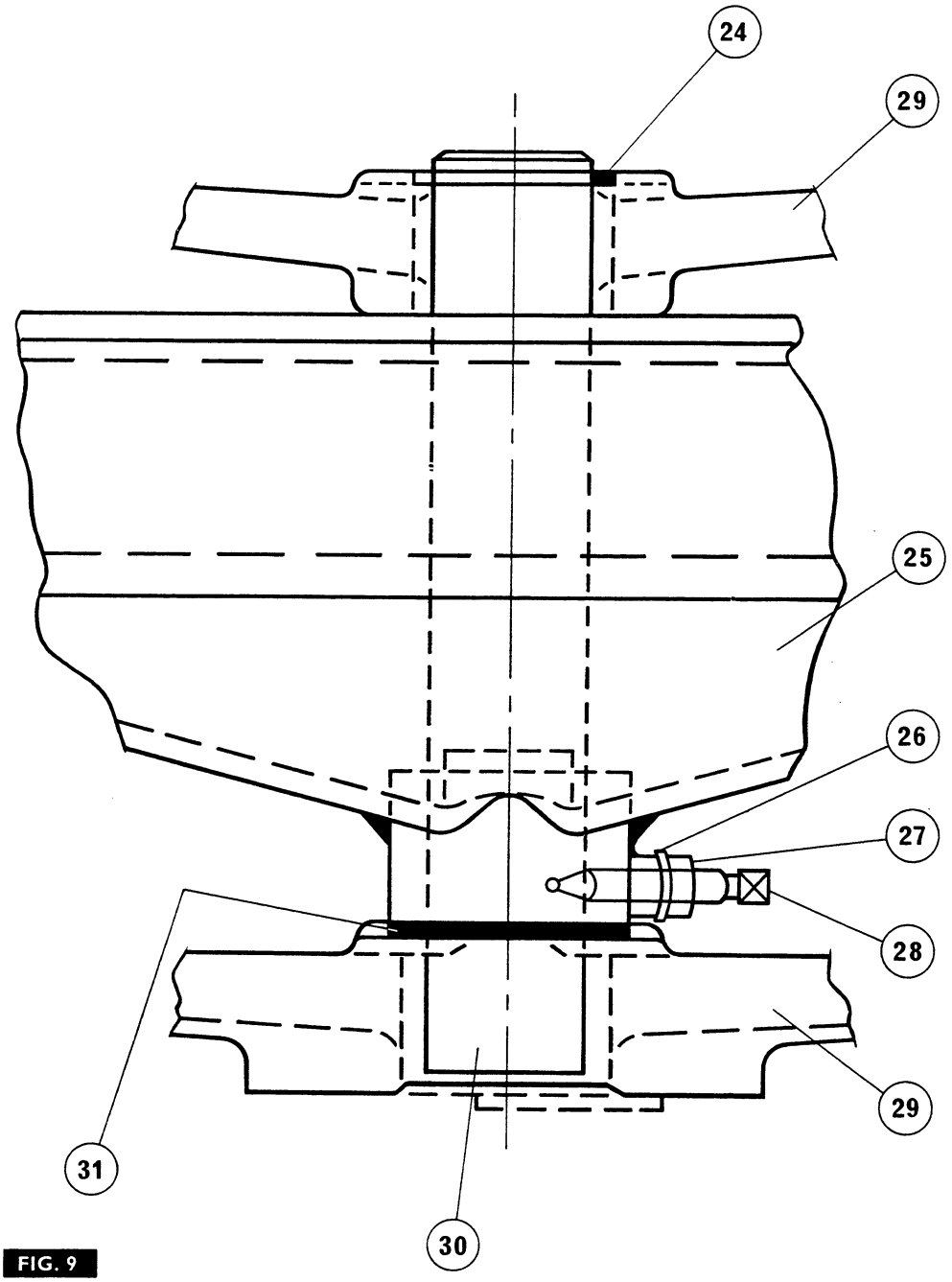


FIG. 9

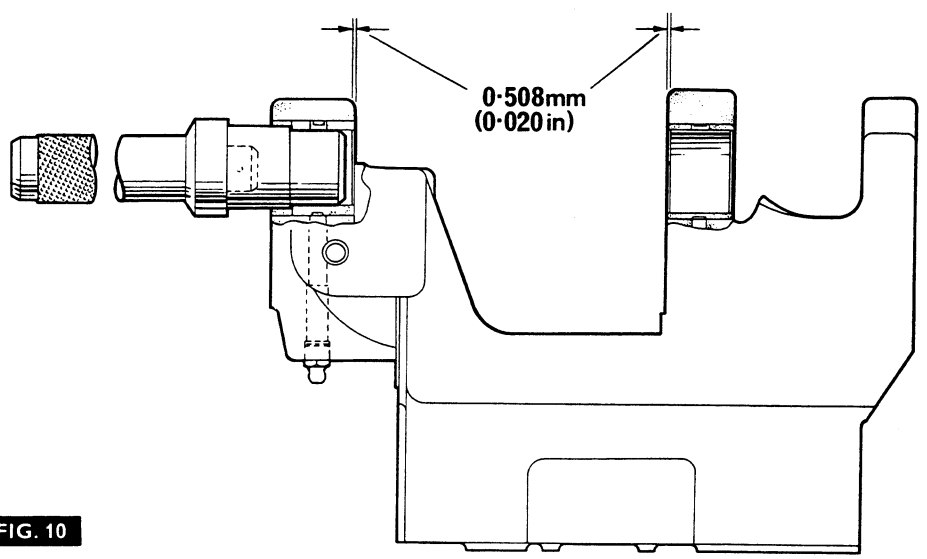


FIG. 10

WHEELS AND TYRES

Part 6 Section B

WHEELS AND TYRES

REAR TYRES

General

The tyres fitted to MF Farm Machinery tractors can be divided fairly easily into three separate categories:

1. Field (Dunlop RT40, Goodyear Traction Sure Grip or Firestons F151).
2. Universal Field and Road (Goodyear Sure Grip All Service, Firestone F151 or Dunlop RT35).
3. Grassland, Sand or Hard Surfaces (Firestone A.N.S. or Goodyear All Weather).

Each of the above types of tyre has been designed especially to give the best grip and wear characteristics obtainable in the specified conditions. On grassland, such as parks and golf courses, worn field or universal type tyres can also be used successfully.

Traction

Very few tractors are used to their fullest capacity, mainly due to inability of the driver to control excessive wheelspin.

If a tractor (or any other wheel driven machine) is being driven along a smooth flat surface, the tyre tread will grip the road provided that the torque applied to the wheel is not in excess of the coefficient of friction between the tyre and the road. When the tyre grips the road without slipping, the condition is one of 100% traction.

Unfortunately, due to tread design and other factors, the maximum rate of traction normally obtainable in the most favourable conditions (i.e. smooth concrete) is approximately 90%, i.e. the tractor will pull a load of 90% of the weight acting on its rear wheels, e.g. a tractor working on smooth dry concrete, with a weight of 5000 kg acting on its rear wheels. Allowing for a coefficient of traction of 90%, the tractor will be capable of pulling a load of approximately:

$$\frac{5000}{1} \times \frac{90}{100} = 4500 \text{ kg}$$

When ploughing or performing similar operations in the field, the coefficient of traction is reduced to around of 45 to 50%. This is the reason for ballasting the rear end of the tractor, thereby increasing the weight acting on the rear axle and thus increasing the tractive effort of the tractor.

The coefficients of traction mentioned can only be achieved by ensuring that all of the factors which affect the tractor performance are adjusted to suit the ground condition.

Some of the factors are:

1. Tyre Pressures – must be set at the lowest pressure for the load being carried and the size and the ply-rating of tyre being used.
2. Tyre Tread – the tyre tread should not be more than ⅓ to ½ worn for efficient ploughing. The lug-bars must face in the correct direction (most tyres have arrows on the sidewalls to indicate the correct direction of rotation).
3. The correct section and size of tyre should be used for certain ground conditions. Some examples are:
   a. Clay –Large diameter, narrow section tyres. These tyres have a small contact area and will concentrate a larger amount of weight on the on the contact area than would a wide section tyre, thus helping the lug-bars to 'bite' into the soil and give traction.
   b. Very light sandy soil – or peat. Any wide section tyre will allow the weight acting on the rear end of the tractor to be spread over a large area than with a narrow tyre, thus preventing sinkage and crushing of the furrow.
   c. Stony Ground – Large diameter, wide section tyres will spread the wear out over a large area of tread and give good flotation.
   d. Sand – Sand requires an entirely different type of tyre, for if ordinary lug-bar type tyres are used, they will greatly disturb the surface of the sand and rapidly dig themselves into an ever increasing depth. In these conditions, a smooth tread pattern, on as wide a tyre as possible is required, to disturb the surface as little as possible and give good flotation.

CORRECT TYRE USAGE FOR ECONOMICAL LIFE

Pressures

Tyre pressure must be maintained at the manufacturers' recommended minimum to give the best possible performance. This minimum is determined by the weight acting on the rear end of the tractor and can be calculated from the table given in the Specification Seciton.

Incorrect inflation of tyres has the following effects.

Over-Inflation

Excessive tyre pressure deprives the tyre of its self-cleaning properties. This causes wheelspin, which in turn causes sinkage, thus increasing the rolling resistance of the tyre and lowering the power available for traction.

Frequent and prolonged bouts of wheelspin cause rapid tyre wear. Another effect of over-inflation is that the casing of the tyre is very susceptible to damage from sharp rocks or similar objects due to the inability of the casing to 'give' on contact.

Under-Inflation

If a tyre has insufficient pressure to support the casing, this may be deflected to such an extent that the plies may become separated. Such damage is irrepairable and the tyre must be replaced. Excessive deflection allied to a high drawbar pull can cause wrinkling of the tyre sidewalls which, if allowed to occur continually can cause the tyre to 'creep' on the rim and tear out the valve.

A visible warning of under-inflation is uneven wear of the lug-bars, indicated by 'gouging' of the centre of the bars.

Cleanliness
Certain liquids can cause considerable harm to tyres, if they are not quickly removed. Some of the worst offenders are oil, grease and some crop sprays which can contain considerable quantities of acid or alkali. If any of the above penetrate into the plies through small holes or splits, rapid deterioration will result.

Effective Tyre Pressures
Details of the maximum pressures usable with the various sizes and ply-ratings of tyres fitted are given in the Specification Section. These maxima are only used when very heavy loading of the tractor is required.

Under normal conditions the following pressures can be used, but must be increased if extra loading is involved.

Ploughing: 0,84 kg/cm^2 (12 lb/in^2)

If bolt-on ballast weights are used, the pressure must be raised accordingly. When working on a hillside pressure should be raised by 0,14 kg/cm^2 (2 lb/in^2) in both tyres, because as each tyre alternately takes most of the load when it is on the side of the tractor nearest the bottom of the slope, the pressure must be raised accordingly to cope.

When using a non-reversible plough the pressure of the landside tyre may be reduced by 0,14 kg/cm^2 (2 lb/in^2) although the differential lock should be used to compensate for wheelspin by one wheel only.

Road Work
When driving a tractor on the road, higher speeds can be used than in the field. In such conditions the pressure can be raised by 0,28 kg/cm^2 (4 lb/in^2) (not Firestone F151) to prevent squirming and gouging of the lug-bars.

If a two wheel trailer, or manure spreader is used, the weight exerted on the tractor drawbar should be determined and the pressure adjusted to suit.

Using a Front End Loader
If a loader is fitted to the tractor, a counter-weight is frequently fitted to the tractor rear linkage as a safety precaution. If a counter-weight is to be fitted the tyre pressure should be raised to compensate.

INNER TUBE

Removal and Refitment 6B-01-03

Special Tools required: 'Bead-breaking' tool
3 lb. Hammer
Tyre levers

Removal
1. Lay the wheel on the ground with the valve uppermost.
2. Deflate the tyre by removing the valve core. Remove the valve retaining nut.
3. Fig. 1. Drive the 'bead-breaking' tool between the tyre and rim, taking care not to damage the rim or the tyre.
4. After the bead has been released from the rim, invert the wheel and repeat Item 3.
5. Fig. 2. Lubricate the rim, tyre and base of the tube with a solution of soap and water or similar rubber lubricant.

   NOTE – NEVER USE PETROLEUM OR SILICONE BASE GREASES.

6. Fig. 3. Starting at the valve location, pry the tyre off the rim, taking small bites with tyre levers, and ensuring that the bead on the opposite side is fully located in the mounting well.
7. Fig. 4. With the wheel in a vertical position, pull the tyre forwards and remove the tube.

Examine the bead seating area of the rim. Remove any build-up of rust, corrosion or old rubber. Inspect inside the tyre casing for foreign matter or damage.

Refitment
1. Fig. 5. Inflate the tube until 'rounded out'. Place the tube in the tyre with the valve located in the valve hole. Refit the valve retaining nut finger tight.
2. Fig. 6. Refit the tyre, starting opposite the valve location taking small bites with long tyre levers and keeping the fixed part of the bead fully located in the well.

A solution of soap and water, or similar rubber lubricant, brushed on to the rim and bead will help fitment.

NOTE – CARE MUST BE TAKEN NOT TO PINCH THE TUBE WHEN FITTING.

3. Fig. 7. Centre the tyre on the rim and inflate to approx. 2,5 kg/cm^2 (35 lb/in^2).

   NOTE – NEVER STAND OVER THE ASSEMBLY WHEN INFLATING, REMOTE CONTROL INFLATION EQUIPMENT SHOULD BE USED.

4. Remove the valve core and completely deflate the tyre.
5. Refit the valve core and inflate to recommended pressure.

   NOTE – IF BEADS FAIL TO SEAT AT 2,5 KG/CM^2 (35 LB/IN^2) THE TUBE MAY BE PINCHED, DO NOT INCREASE THE PRESSURE BUT REMOVE THE VALVE CORE AND RELEASE TYRE FROM RIM. LUBRICATE TYRE, BEAD AND RIM AND REINFLATE TO 2,5 KG/CM^2 (35 LB/IN^2). REPEAT PROCESS UNTIL BOTH BEADS ARE PROPERLY SEATED.

TYRE

Removal and Refitment 6B-02-04

Special Tools Required: 'Bead-breaking' tool
3 lb Hammer
Tyre levers

Removal
1. Remove inner tube as stated in operation 6B-01-03.
2. Figs. 8 & 9. With the wheel in a vertical position pry off the tyre taking small bites with the tyre levers. The use of rubber lubricant will help removal.

Refitment
1. Place the rim on the ground, lubricate the bead and rim and place the tyre on rim.
2. Fig. 10. Refit the tyre to rim, using long tyre levers.
3. Refit the inner tube as stated in operation 6B-01-03.

REAR WHEELS

General (Fig. 11)
This tractor is available with W10 x 32 pressed steel, single disc wheels fitted with 11–32 tyres.

TRACK SETTINGS

Fig. 12. Track settings between 1321 mm (52 in) and 1542 mm (60 in) are available with wheels set normally and from 1625 mm (64 in) to 1930 mm (76 in) with the wheels reversed.

TRACK ADJUSTMENT PROCEDURE

1. Select the required track setting.
2. Slightly slacken either the wheel to axle, or rim to disc nuts, or both, according to requirements.
3. Using a jack capable of lifting 3000 kg (3 tons) raise the rear wheels just clear of the ground.
4. Remove the rim from the disc, or the complete wheel, or both, and re-assemble them with the rim and disc in their new position. Tighten the nuts to a torque of 14 kg-m (100 lb-ft).
   If the wheels are to be reversed, they have to be transferred to the opposite side of the tractor.
5. Re-fit the wheel and tighten the wheel nuts progressively and evenly to a torque of 27,5 kg-m (200 lb-ft).
6. Lower the tractor to the ground and remove the jack.

BALLASTING

General
To impart extra weight on the rear wheels of a tractor, several methods may be employed:
1. Pressure Control or Draft Control
2. Liquid Ballast
3. Bolt-on Weights

Each of these methods has advantages and disadvantages, but all work well in practice and any two, or even all three may be combined for absolute efficiency.

PRESSURE CONTROL AND DRAFT CONTROL

This feature, exclusive to Massey-Ferguson tractors, is described in detail in Part 7A of this Manual.

LIQUID BALLAST

Liquid filling of the tyres is a well known and widely used method of weighting the rear of a tractor. To prevent damage by frost, calcium chloride should be dissolved in the water used to fill the tyres, thus forming an anti-freeze solution. The calcium chloride used should be 'Commercial Grade 70 to 72% $CaCl_2$'.

The following table and actual filling method is based on data supplied by the Dunlop, Goodyear and Firestone Tyre Companies. This table is, of necessity, a compromise, because tyres of the same nominal size manufactured by different companies differ slightly in internal dimensions, which may alter the degree of filling by a small percentage, but this will not affect the actual performance of the tyre.

MIXING THE CALCIUM CHLORIDE WATER SOLUTION

WARNING – NEVER POUR THE WATER ON TO CALCIUM CHLORIDE. ALWAYS ADD CALCIUM CHLORIDE TO WATER.

Procedure is as follows:
1. Consult the chart and weigh out the correct quantity of calcium (column 1) but do not put it in the mixing tank.
2. Measure the volume of water shown in column two and put it into the tank.
3. Add the calcium chloride to the water slowly.

NOTE – WHEN CALCIUM CHLORIDE AND WATER ARE MIXED A CHEMICAL REACTION CAUSES GREAT QUANTITIES OF HEAT TO BE PRODUCED. THE HOT SOLUTION MUST NOT BE USED – WAIT UNTIL IT HAS COOLED.

4. Add the remaining volume of water indicated in column 3 to the solution.

TYRES FILLED WITH WATER

If a tyre has been previously filled with water and calcium chloride anti-freeze is to be added, drain off the amount indicated in column 5 of the table.

Mix a solution from the quantities shown in columns 1 and 2 and allow to cool.

Re-fill the tyre with this solution to make up the correct filling.

WARNING – NEVER ATTEMPT TO ADD PURE CALCIUM CHLORIDE TO A TYRE FILLED WITH WATER, AS THE RESULTANT HEAT AND EXPANSION CAN CAUSE TYRE DAMAGE.

Ballasting Procedure
There are two methods of liquid ballasting tractor tyres, 75% filling and 100% filling. The 75% filling method is the most common, and is easier to achieve than 100% filling,not requiring a motorised pump.

The 100% filling increases casing vulnerability to impact damage and accordingly 75% filling is recommended by Tyre Manufacturers.

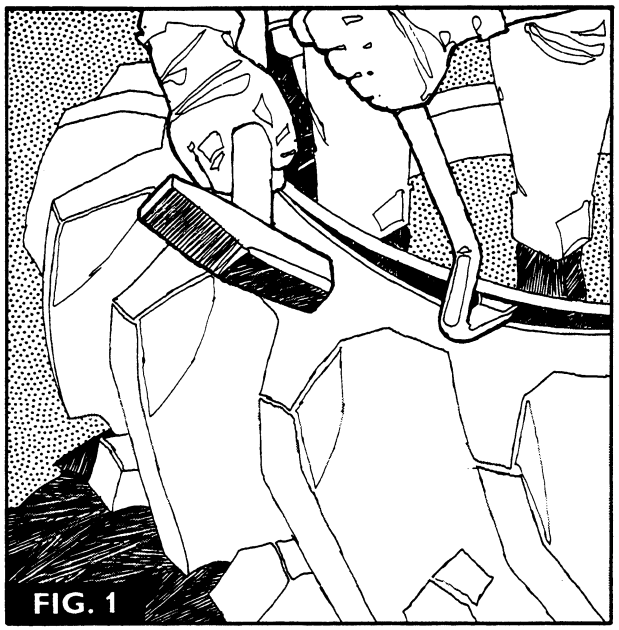


FIG. 1

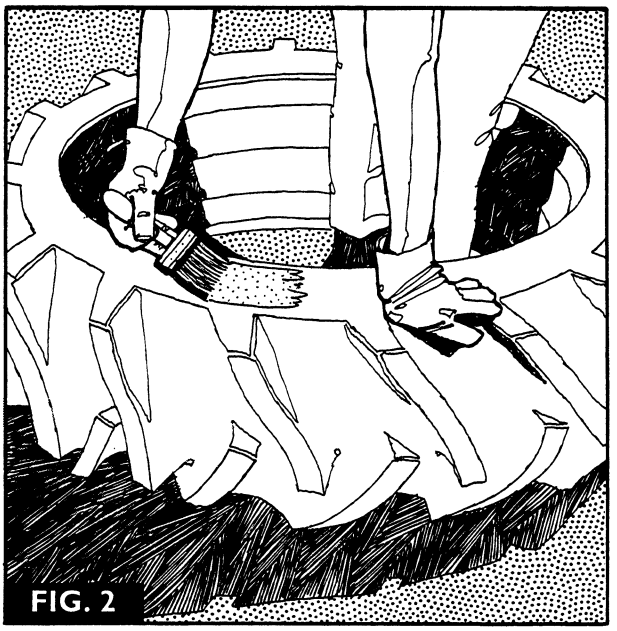


FIG. 2

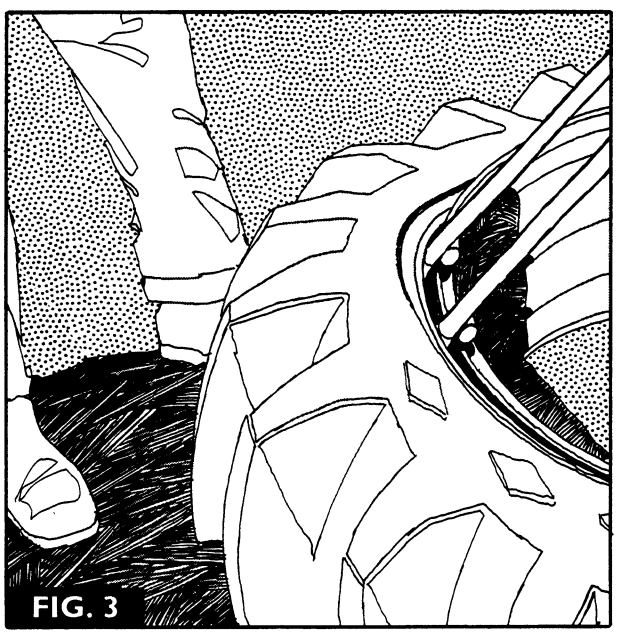


FIG. 3

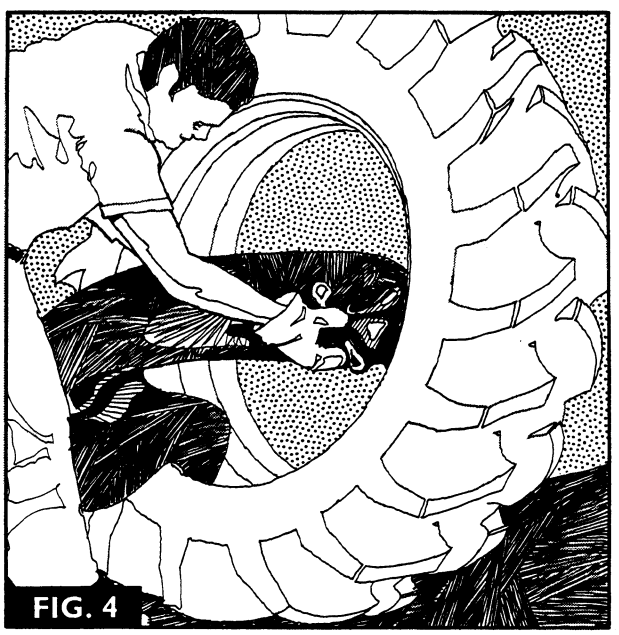
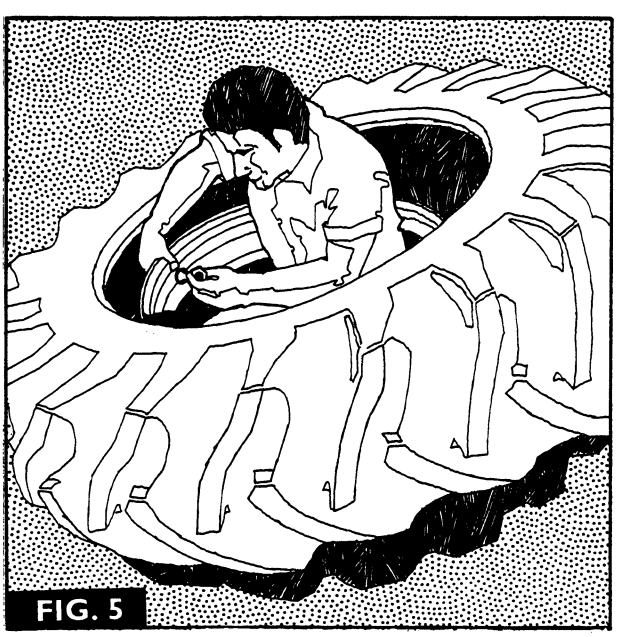


FIG. 4



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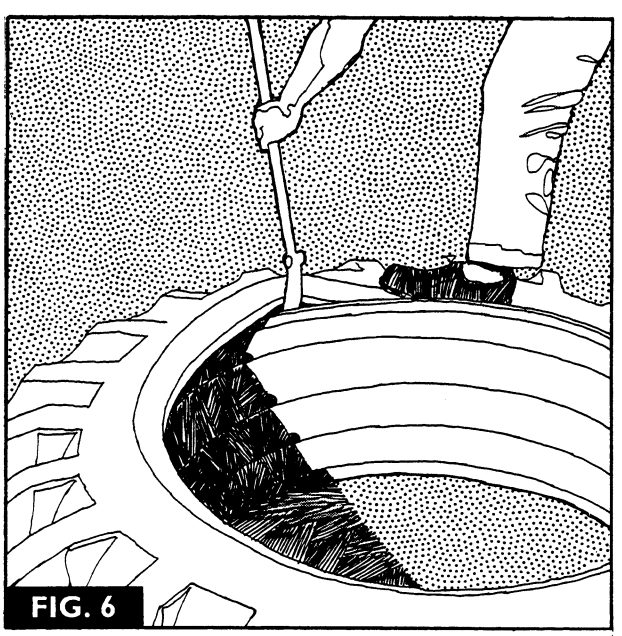


FIG. 6

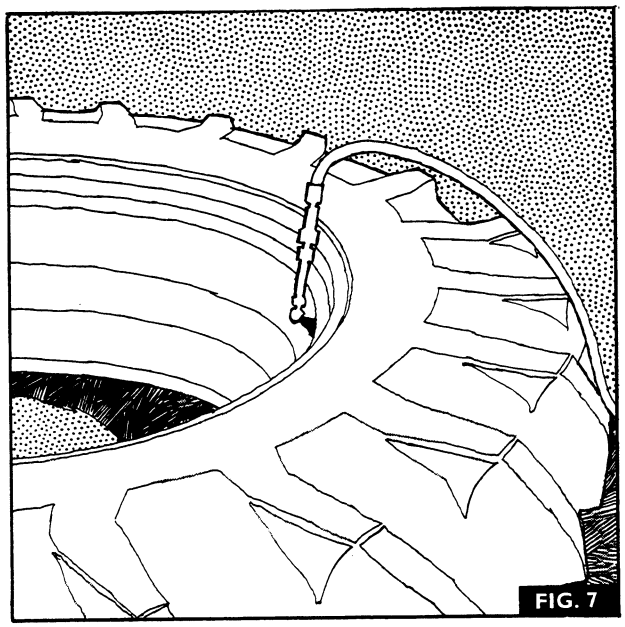


FIG. 7

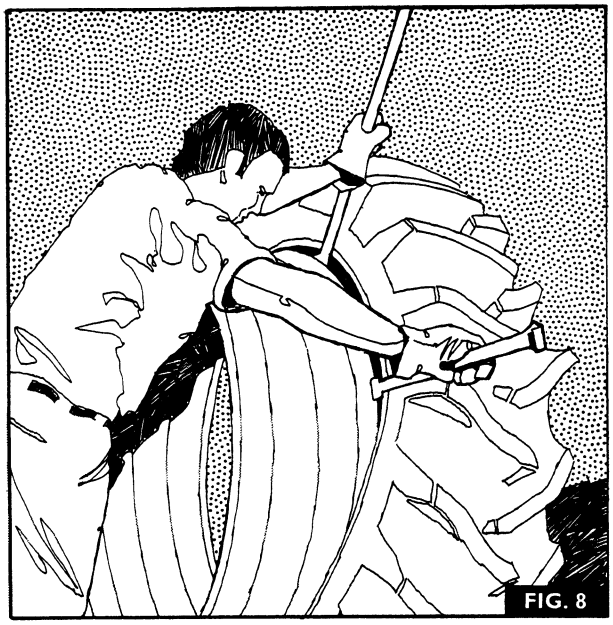
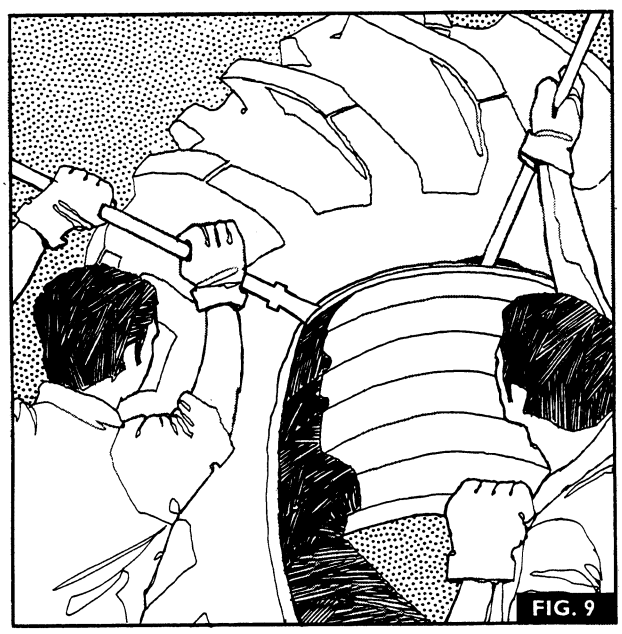


FIG. 8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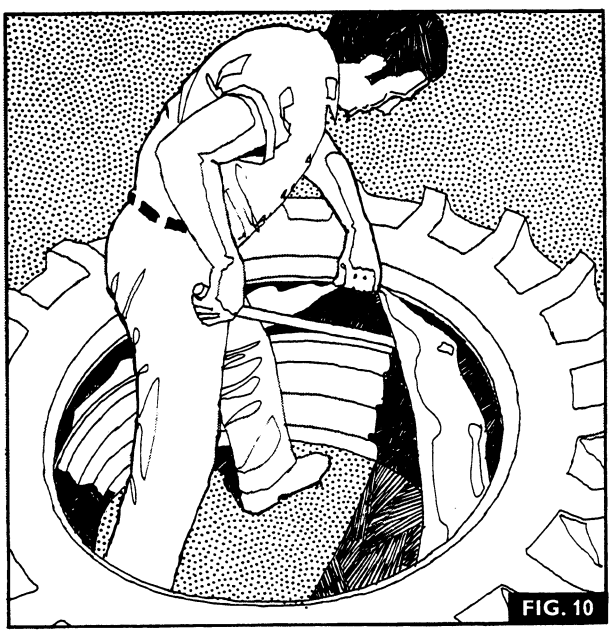
FIG. 10

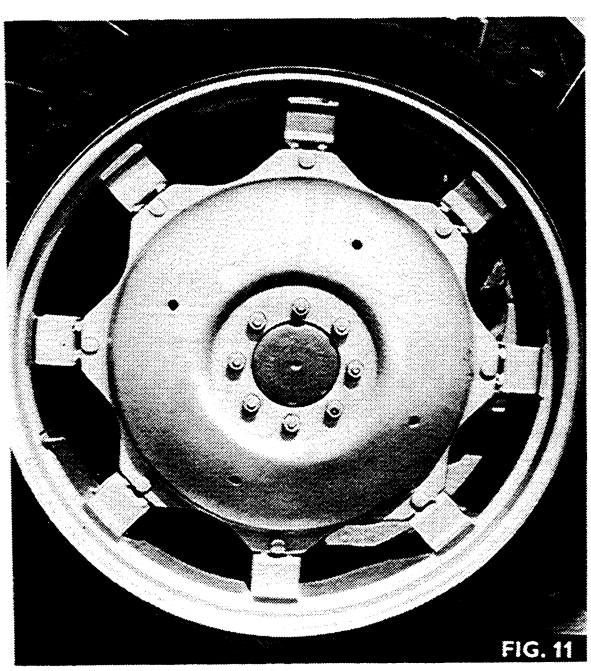
FIG. 11