

VII. Trouble-Shooting Hints

Cause	Remedies
Acceleration unsatisfactory in all Gears, Engine races	
Insufficient oil in hydraulic coupling	Check stall speed, fill up with oil as specified
Mechanical Clutch slips too long after Shift	
a) With car overrunning engine Adjusting screw of reducing valve screwed in too far b) With accelerator fully depressed Adjusting screw of electrical switch contact at rear axle screwed in too far c) With accelerator partly depressed Spring-loaded diaphragm incorrectly adjusted	Adjust as specified in Section "VI. Adjustment and Checking", Point 2 a. Adjust as specified in Section "VI. Adjustment and Checking", Point 3. Replace control element
Braking Downshift too fierce	
Adjusting screw of reducing valve unscrewed too far	Adjust as specified in Section "VI. Adjustment and Checking", Point 2 a.
Downshift too fierce when accelerating	
Adjusting screw of electrical switch contact at rear axle unscrewed too far	Adjust as specified in Section "VI. Adjustment and Checking", Point 3.
Electrical switch contact at rear axle defective	Replace the switch contact
Limit switch at servo assembly jammed in "off" position or defective	Free up or replace switch
Braking Downshift sometimes smooth, sometimes fierce	
Reducing valve fouled or foreign body at valve head	Remove and clean reducing valve. See Section "VI. Adjustment and Checking", Point 2 b.
Mechanical Clutch slips on sudden Acceleration or on Hills	
Driven plate of mechanical clutch oiled-up.	Replace driven plate Note: Do not wash out in gasoline. If a trichloro-ethylene bath is available an attempt may be made to clean the linings. Remove the cause of oiling-up, checking engine, hydraulic coupling and transmission

Cause	Remedies
Pull-rod at servo assembly incorrectly adjusted	Adjust as specified
Driven Plate fails to stop turning at Idle Speed	
Hub of driven plate jammed in splineway of transmission drive shaft Considerable run-out at driven plate, linings distorted or broken	Free up; if necessary, install new driven plate Replace driven plate
Driven Plate tends to go on turning during Shifts	
Pull-rod at servo assembly incorrectly adjusted Leakage in the hose lines or in the supply reservoir Roller bellows in servo assembly defective	Adjust as specified Repair leak Replace servo assembly
Mechanical Clutch fails to disengage during Shifts	
Break in circuit Break in hose lines or considerable leakage in hose lines or in supply reservoir Roller bellows in servo assembly defective Contact surfaces in electrical switch contact of shift lever burnt or fouled Electro-magnet of control valve defective	Trace and repair. Check fuse! Repair leaks Replace servo assembly Clean contact surfaces Replace electro-magnet
Mechanical Clutch fails to engage after Shift	
Contact at shift lever sticking	Free up contact at shift lever

Removal and Installation of Hydraulically-Operated Clutch with Transmission

Job No.
25-1

The hydraulically-operated automatic clutch and the transmission can only be removed together as one unit. It is not possible to remove the transmission alone. In view of the weight of the two assemblies it is better never to undertake the work of removal without having the car standing over a pit. The procedures involved in the case of Model 219 are the same as in the case of Model 220 S since all Hydrak-equipped cars have four-point engine-suspension.

Removal:

1. Disconnect the ground cable at the negative terminal of the battery.
2. Disconnect the two reversing light switch cables at the cable connector (5) (Fig. 25-1/1).

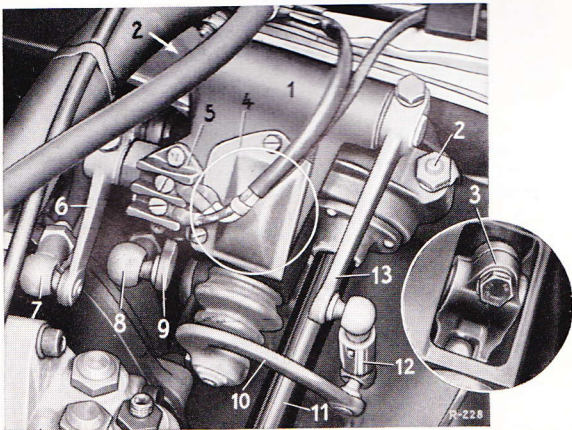


Fig. 25-1/1

- | | |
|-----------------------------------|-------------------------------------|
| 1 Bearing | 8 Shift rod ball-cup connector |
| 2 Hexagon screw | 9 Relay shaft lever |
| 3 Selector lever at shift tube | 10 Lever at shift tube |
| 4 Dust cover | 11 Steering tube |
| 5 Cable connector | 12 Spring-loaded ball-cup connector |
| 6 Selector lever | 13 Relay lever |
| 7 Selector rod ball-cup connector | |

3. Detach the selector rod and the shift rod (7) and (8) (see Fig. 25-1/1). To do this, remove the spring clips (4) from the ball-cup connectors and press the rods off the ball-studs (Fig. 25-1/2).

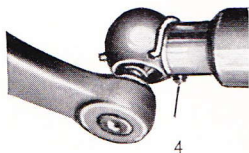


Fig. 25-1/2

4 Spring clip

4. Unscrew and remove the upper screw for fixing the starter and the two upper screws

at the clutch housing, working from the engine compartment side.

Note: The upper left screw is a hexagon screw with washer and lock washer. All other screws are hexagon socket screws.

The upper right screw is also accessible from the opening in the transmission tunnel.

5. Take off the cover plate for the propeller shaft intermediate bearing. Then unscrew the two hexagon screws for fixing the intermediate bearing (Fig. 25-1/3).

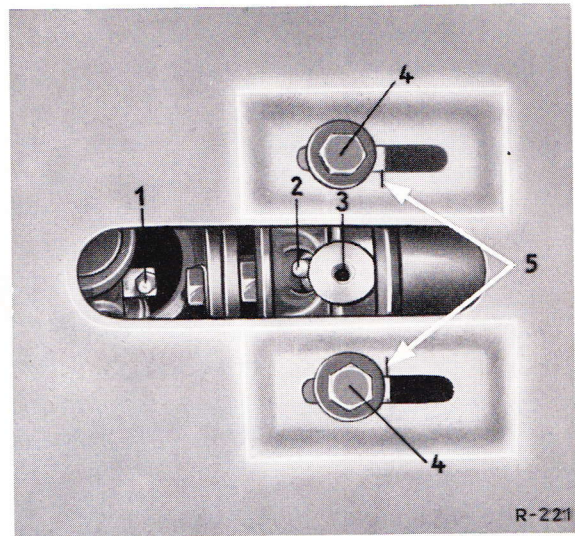


Fig. 25-1/3

- | |
|--|
| 1 Front universal joint pinion rim grease fitting |
| 2 Pinion rim grease fitting for annular grooved ball bearing |
| 3 Threaded bore for cover plate fixing screw |
| 4 Fixing screw for bearing bracket |
| 5 Position marking of bearing bracket on chassis base panel |

6. Disconnect the propeller shaft at the transmission. To do this, unscrew and remove the three fitted bolts holding the shaft plate to the transmission flange, paying attention to the washers between the shaft plate and the flange (see Fig. 25-1/10).

7. Disconnect the flexible speedometer drive shaft at the transmission, unscrewing the hexagon screw at the rear transmission housing cover and pulling out the drive shaft.

8. Detach the pull-rod for actuating the mechanical clutch at the clutch throw-out lever (see Fig. 25-0/14).
9. Unscrew the two cover plates on the clutch housing – one at the bottom at the front of the housing (1) and the other on the left side of the housing (2) (Fig. 25-1/4).

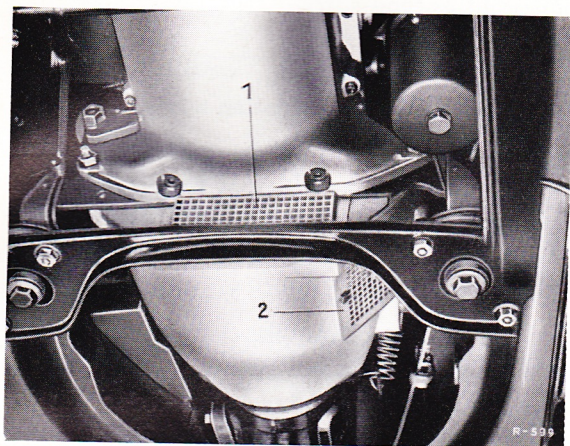


Fig. 25-1/4

- 1 Cover plate, air outlet, front
- 2 Cover plate, air outlet, side

10. Unscrew the six hexagon screws for fixing the hydraulically-operated automatic clutch assembly to the flywheel and remove them. When this is done, the crankshaft should be turned each time to the position giving easy access to the screw-heads (Fig. 25-1/5).

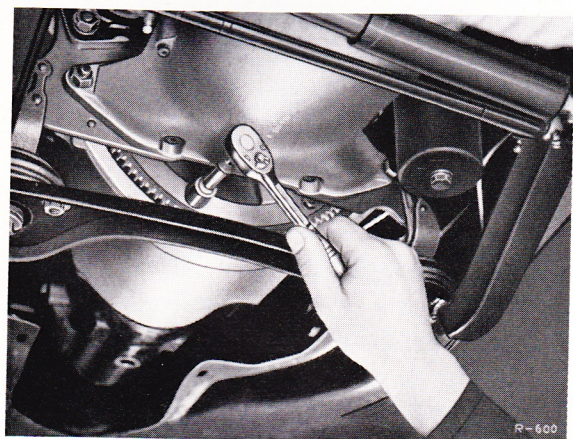


Fig. 25-1/5

11. Fit Retaining Bracket (1) 180 589 04 61 to the clutch housing (Fig. 25-1/6).

Note: It is absolutely necessary to fit the retaining bracket to the clutch housing when removing or installing the hydraulically-

operated automatic clutch in order to prevent the clutch unit from slipping out of its position on the drive shaft.

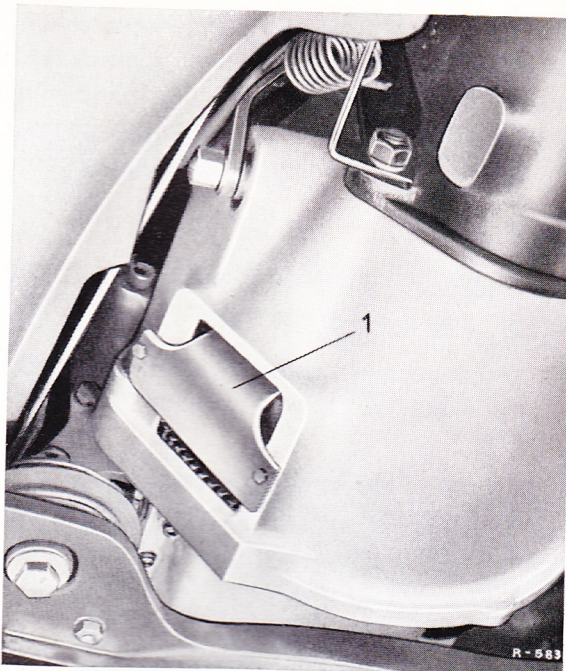


Fig. 25-1/6

1 Retaining Bracket 180 589 04 61

12. Unscrew the two hexagon screws for fixing the bracket to the support for the exhaust pipe suspension.
13. Take out the lower hexagon socket screw for fixing the starter and also the three remaining hexagon socket screws at the clutch housing and remove, together with the support for the exhaust pipe suspension.
14. Pull the transmission backward a little and carefully lower it.

Note: Before the fixing screws are finally removed from the clutch housing, the transmission must be supported either by a car jack or by a second mechanic.

15. Detach Retaining Bracket 180 589 04 61 from the clutch housing and pull out the clutch assembly.

Installation:

16. Clean the outside of the transmission and the clutch housing. The cover plates for the clutch housing must be free from dirt.
17. Check the graphite ring of the clutch throw-out bearing to see if it is still serviceable (Fig. 25-1/7).

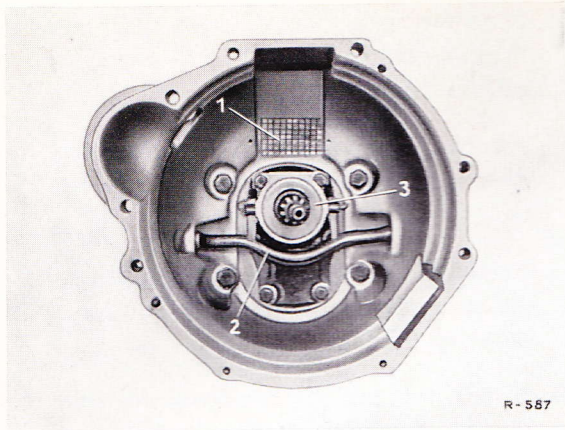


Fig. 25-1/7

- 1 Cover plate, air inlet, top
- 2 Throw-out fork
- 3 Graphite ring (throw-out bearing)

18. Lightly grease the transmission drive shaft and then put in the assembled clutch unit, turning the unit slightly and finally so positioning it that one of the recesses (short cooling ribs), which lies centrally between two of the threaded bores, points vertically downward (arrows in Fig. 25-1/8). Then screw Retaining Bracket 1805890461 onto the clutch housing (see Fig. 25-1/6).

Push the centering ring onto the bearing journal at the hydraulic coupling.

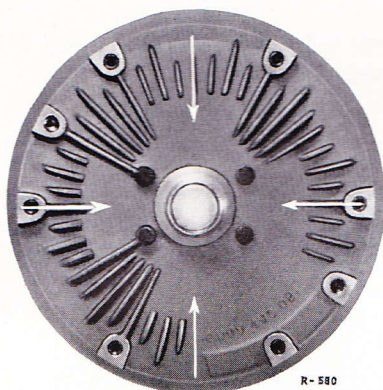


Fig. 25-1/8

19. Turn the flywheel on the crankshaft to the point where two of the humps which lie between two of the threaded bores, point vertically downward (arrows in Fig. 25-1/9).

Note: It is important to pay attention to the correct positioning of flywheel and clutch unit since otherwise there is a danger that when the transmission is put into the hous-

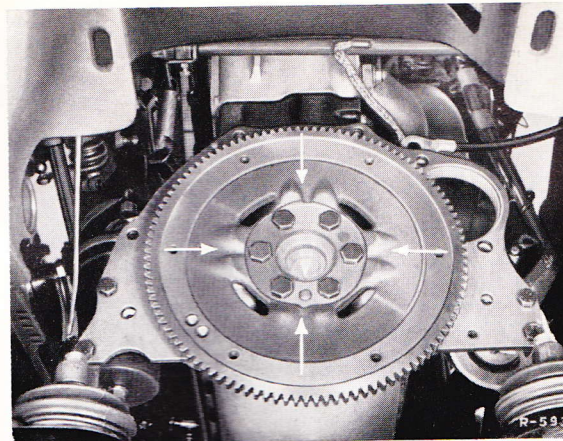


Fig. 25-1/9

ing, the humps on the flywheel will press against the cooling ribs of the hydraulic coupling and the clutch end plate will be distorted.

20. Slide in the transmission with the clutch unit, taking care that the selector rod and the shift rod are not bent and that the cable for the reversing light switch and the ground lead at the starter are not jammed.
21. Screw in the screws for fixing the clutch housing to the engine and also the starter fixing screws and tighten them up. Do not forget the washer for the upper left hexagon screw.

Note: When placing the screws in position, do not forget the ground cable and the ground lead at the starter and the exhaust pipe suspension support. Also make sure that the jointing flange for the starter is properly positioned.

22. Check that the flywheel and the hydraulic coupling are in the correct position, turning the clutch unit to the position where the screw holes in the flywheel are exactly opposite the threaded holes in the hydraulic coupling.

Screw in the six hexagon screws with lock washers and tighten them up evenly, turning the crankshaft a little further round each time (see Fig. 25-1/5).

After tightening the screws, check once again whether the hydraulic coupling is correctly positioned with respect to the flywheel.

23. Remove the retaining bracket from the clutch housing and screw on the two cover plates.

24. Press the propeller shaft forward and connect it, not forgetting the rubber seal (3) (Fig. 25-1/10).

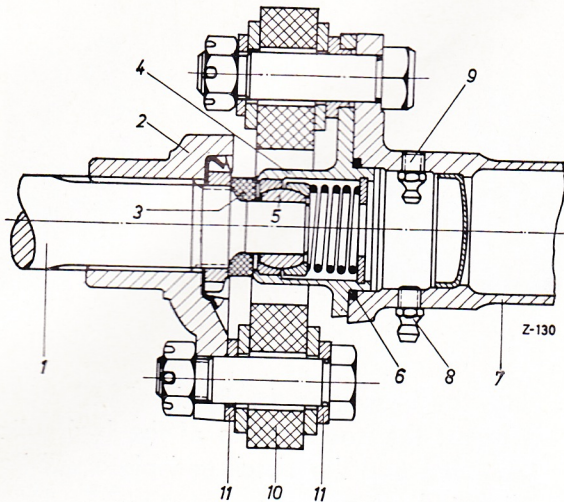


Fig. 25-1/10

- | | |
|--------------------------------------|-----------------------------|
| 1 Transmission main shaft | 6 Sealing ring |
| 2 Three-way flange on the main shaft | 7 Propeller shaft |
| 3 Seal | 8 Pinion rim grease fitting |
| 4 Centering cross | 9 Relief grease fitting |
| 5 Centering ball | 10 Shaft plate |
| | 11 Washer |

25. If a new shaft plate is to be installed, care must be taken to ensure that the double-links of the shaft plate are under tensile strength in the direction of rotation of the engine.

In order to assist differentiation, a small shoulder (a) has been made on the outside of the first hole of each double-link. The shoulder must always point in the direction of the transmission (Fig. 25-1/11).

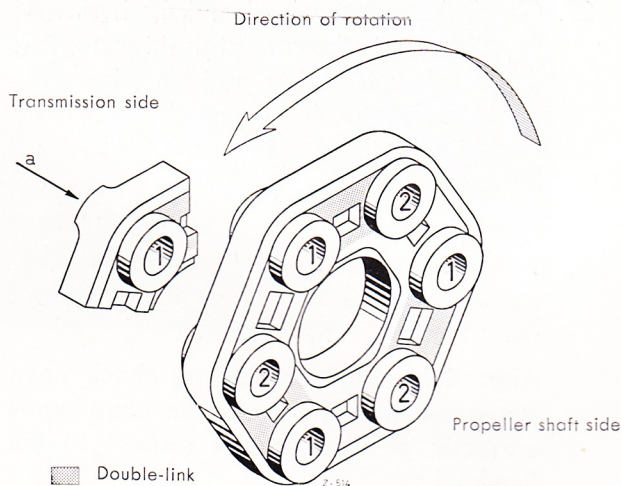


Fig. 25-1/11

- 1 Attach to the three-way flange of the transmission
2 Attach to the three-way flange of the propeller shaft

26. Slide the speedometer drive shaft into the rear transmission housing cover and tighten up the clamping screw.
27. Attach the pull-rod (3) for actuating the clutch, to the throw-out lever (see Fig. 25-0/14).
28. Install the intermediate bearing of the propeller shaft so that it is not under stress (see Fig. 25-1/3).
29. Attach the selector rod and the shift rod and fix the spring clips to the ball-cup connectors (see Fig. 25-1/1).
30. Connect the two cables for the reversing light switch at the cable connector (see Fig. 25-1/1).
31. Connect the ground cable to the battery.
32. Check the adjustment of the free play of the pull-rod for the clutch-actuating mechanism. The play should be 10-12 mm (see Job No. 25-0, Section VI, Adjustment and Checking).
33. Check the adjustment of the steering-wheel gear shift and if necessary, re-adjust.

Note: Checking must be done with the engine running since the vacuum available for actuating the mechanical clutch with the engine stopped will only serve for at the most two shifts.

Removal and Installation of Mechanical Clutch

Job No.

25-2

Removal:

1. After removing the hydraulically-operated automatic clutch, place it on Mounting Plate 180 589 03 31.
2. Unscrew the 6 hexagon screws for fixing the clutch. Unscrew evenly, a few turns at a time at each screw (Fig. 25-2/1). Take off the mechanical clutch and the driven plate.

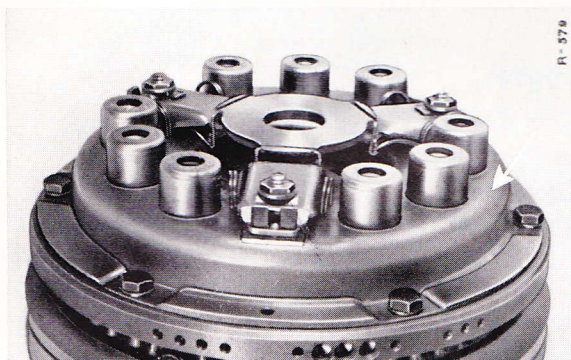


Fig. 25-2/1

↙ Mechanical clutch

3. Fix the retaining bracket of Mounting Plate 180 589 03 31 to the drive plate (Fig. 25-2/2). Then tap up the locking plate and unscrew the grooved nut with Crowfoot Wrench 180 589 16 07.

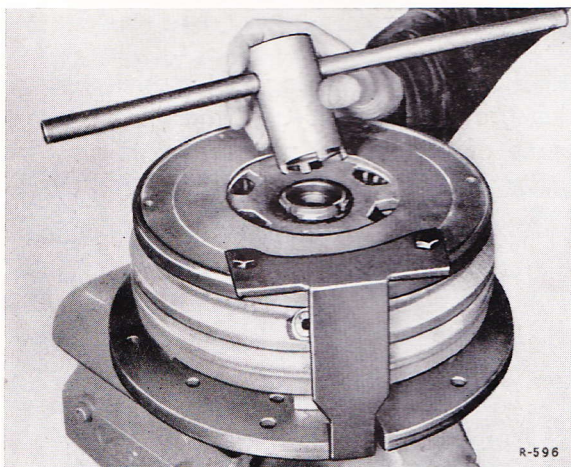


Fig. 25-2/2

4. Pull off the drive plate, using a suitable twin-claw puller (Fig. 25-2/3). The puller must be placed with the claws pointing to the inside.

Note: Mark the position of the drive plate and the hydraulic coupling before pulling off. This is necessary because there are balancing bores in the drive plate. Since the drive plate is balanced, an appreciable amount of unbalance would result if the two members were assembled turned through 180°. This in turn would cause uneven operation of the hydraulically-operated automatic clutch.

If the drive plate is replaced, the new plate must be brought to the same state of balance as the old one. Static balancing is good enough.

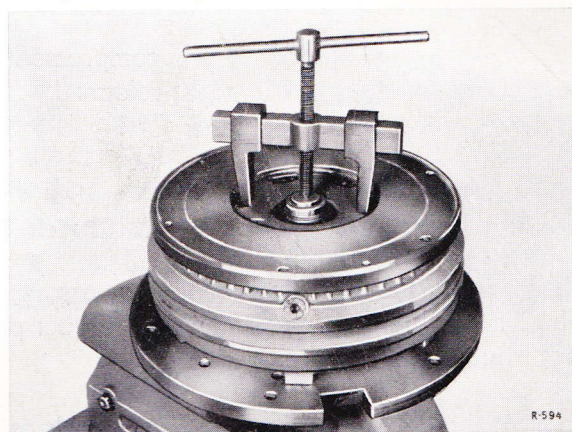


Fig. 25-2/3

Installation:

5. Put on the drive plate, not forgetting the Woodruff key. **Pay attention to the markings which were made when the clutch was removed.**
6. Put in the locking plate and tighten the grooved nut hard. (Tightening torque approx. 20-25 mkg). Then lock the grooved nut.

Note: When screwing up, make sure that the bevelled surface of the grooved nut points **downward** and **not** as shown in Fig. 25-2/2, **upward**.

7. Put on the driven plate with the raised boss side upward, that is, pointing to the pressure plate.
8. Place Centering Arbor 180 589 05 61 in position and screw up the clutch evenly all round.

Hints on Repair of the Mechanical Clutch

A. Drive Plate

The clutch face of the drive plate can, if necessary, be re-turned or reground. A total stock removal of 1.0 mm is permissible. When the drive plate is new, the dimension "a" is 14.5 ± 0.1 mm (see Fig. 25-0/4). When re-conditioning, care must be taken to ensure that the distance $d = 1.5$ mm is maintained. The part of the drive plate face which is set back should be turned off (or turned down) by the same amount as the clutch face (see Fig. 25-0/4).

If the drive plate has to be replaced, the new plate must be brought to the same state of balance as the old one. Static balancing is good enough.

B. Driven Plate

When the driven plate is new, its thickness is

compressed $b = 7.8 \pm 0.3$ mm.

released $b = 8.8 \pm 0.3$ mm.

C. Clutch Pressure Plate

The contact pressure plate can, if necessary, be re-turned or reground. A total stock reduction of 1.0 mm is permissible. When the contact pressure plate is new, the dimension "c" is 14.5 mm (see Fig. 25-0/4).

If more than 0.5 mm of stock is removed, ground steel washers of the thickness of total stock removed, must be placed between the clutch pressure springs and the spring grommets, in order to restore the original thrust pressure (for further details see Workshop Manual Model 190, Job No. 25-4). The total spring pressure is 480 kg.

The throw-out lever must be carefully and evenly adjusted. The thrust ring (20) must not move from its position since in this case, the clutch will tend to grab (see Fig. 25-0/4). The distance from the upper edge of the thrust ring to the friction surface of the contact pressure plate must be $40 - 0.5$ mm. Adjustment must be made by using a washer the thickness of the compressed driven plate, i. e. $b = 7.8 \pm 0.3$ mm.

Removal and Installation of Axial Seal of Hydraulic Coupling

Job No.
25-4

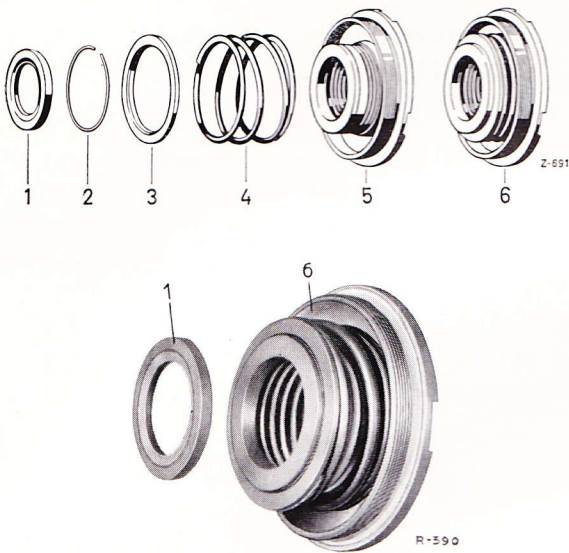


Fig. 25-4/1

- 1 Graphite sealing ring
- 2 Snap ring
- 3 Spring-retaining ring
- 4 Pressure spring
- 5 Threaded ring with metal bellows and pressure ring
- 6 Axial seal (assembled)

Removal:

1. Drain the oil from the coupling.
2. Unscrew the axial seal with Crowfoot Wrench 180 589 17 07. To do this, place the hydraulic coupling on the Mounting Plate 180 589 03 31 under an arbor press (Fig. 25-4/2). As the threaded ring is unscrewed, the arbor of the press must be correspondingly released.

Note: This is necessary because the threaded ring is inserted with sealing compound and is difficult to slacken. Be careful that the crowfoot wrench does not slip.

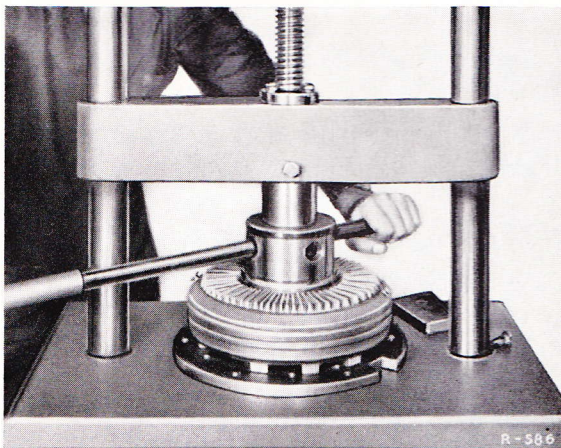


Fig. 25-4/2

3. Remove the axial seal together with graphite ring (Fig. 25-4/3).

Note: Pay attention to the position of the graphite ring – lettering around the circumference – so that the mating seal surfaces can be put together again in the same position on installation.

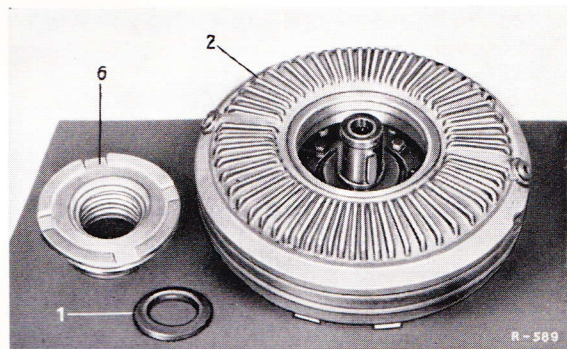


Fig. 25-4/3

- 1 Graphite ring
- 2 Hydraulic coupling
- 3 Axial seal

Disassembly:

4. Place the axial seal under a suitable press and use a suitable device to exert pressure on the ring of the pressure spring until the snap ring is freed (Fig. 25-4/4).

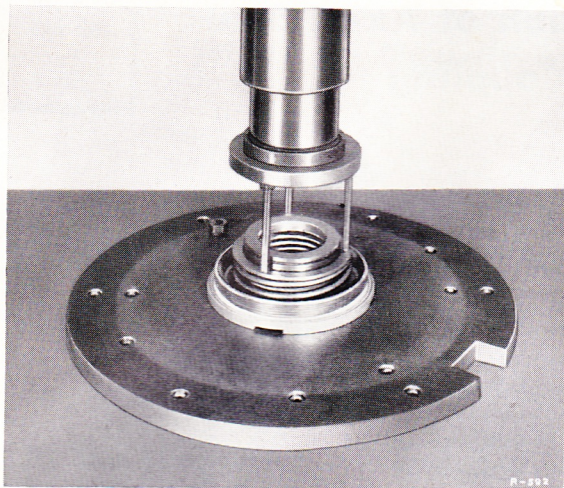


Fig. 25-4/4

5. Take out the ring and the pressure spring.
6. Test the pressure spring.

Test Values:

Wire gage	Free length	Length under load	
		mm	kg
5.6	45.0	24.0	30 + 5

The spring must always be tested since it will usually be found to have weakened if there has been any overheating of the coupling.

Re-assembly:

7. Re-assemble the axial seal under the press. Take care that the snap ring (2) is properly positioned (see Fig. 25-4/1).

Lapping of Sealing Surfaces:

8. Lap the sealing surfaces at the flange shaft of the secondary member at the graphite ring and at the pressure ring, using Polisher 180 589 09 63.

This work should always be carried out if there is any leakage at the axial seal and it should be carried out with great care.

The oil-tightness and consequently the reliability of the hydraulic coupling depends

on these sealing surfaces being in perfect condition.

The polisher consists of a ground sleeve for re-conditioning the flange shaft and a small round polishing plate for the graphite ring and the pressure ring. If necessary, the graphite ring should be replaced.

Lapping should be done with the aid of the lapping paste "Micromant No. 1000", grain 00, obtainable from the firm of K. Mahl, Berlin-Zehlendorf.

Note: The polishers should be carefully handled and should always be kept well ground, ready for use.

Re-assembly:

9. Carefully clean the sealing surfaces.
10. Remove all traces of sealing compound residue from the thread in the clutch end plate and the contact pressure surface for the threaded ring. When this is done, the opening of the hydraulic coupling should be covered with Rubber Cover Disk 180 589 08 63 in order to prevent the sealing compound scrapings from entering the hydraulic coupling.
11. Remove the old sealing compound at the threaded ring of the axial seal and coat the contact pressure surface with new sealing compound. Sealing compound should not be put on the thread since it may penetrate into the interior of the hydraulic coupling when the threaded ring is screwed in.

Use Teroson Fluid 307 as sealing compound.
12. Put in the graphite ring, in the same position as it was before it was removed.
13. Install the axial seal, placing it under a press and, using Crowfoot Wrench 180 589 17 07 and the Mounting Plate 180 589 03 31, screw it in and tighten it up firmly.
14. Put in 1.5 liters of coupling oil.
Use new aluminium sealing rings for the screw plugs.

Supplementary Cable Harness for Hydraulically-Operated Automatic Clutch

Job No.
54-0

A supplementary cable harness is necessary for the wiring of the electrical assemblies of the hydraulically-operated automatic clutch (Fig. 54-0/1). The connections are shown in the following plan.

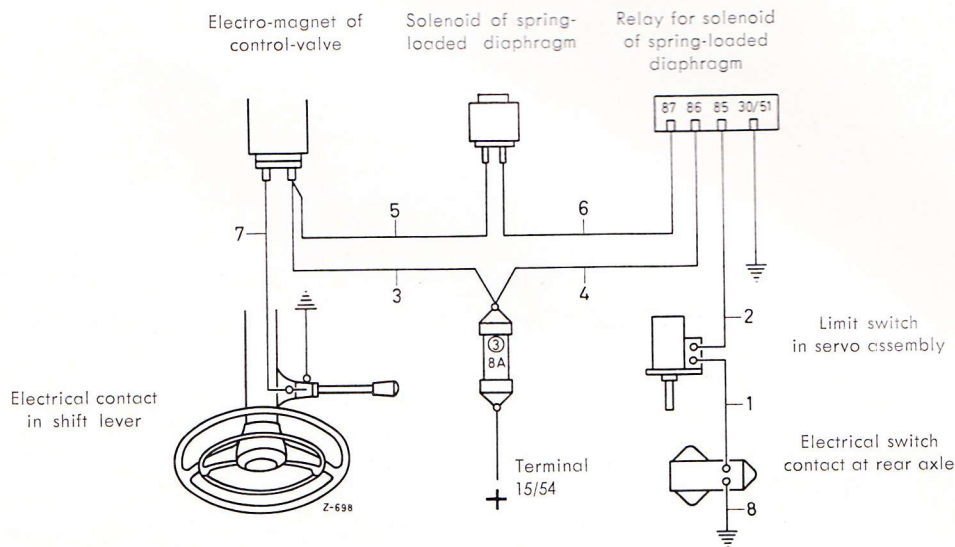


Fig. 54-0/1

Connections to Supplementary Cable Harness

Lead No.	Color of cable		Connection to	Other end
	Basic color	Colorcoding		
Harness Branch at Relay for Solenoid				
2	black	yellow	Relay Terminal 85	To limit switch at servo assembly
4	black	red	Relay Terminal 86	To fuse box, Fuse No. 3
6	brown	—	Relay Terminal 87	To solenoid of spring-loaded diaphragm
Harness Branch at Solenoid of Spring-Loaded Diaphragm				
6	brown	—	Solenoid	To relay Terminal 87
5	black	red	Solenoid	To electro-magnet of control valve

Lead No.	Color of cable		Connection to	Other end
	Basic color	Colorcoding		
Harness Branch at Electro-Magnet of Control Valve				
7	black	—	Electro-magnet of control valve	To cable connector for electrical contact in shift lever To solenoid of spring-loaded diaphragm To fuse box, Fuse No. 3
5	black	red	} Electro-magnet of control valve	
3	black	red		
Harness Branch at Limit Switch at Servo Assembly				
2	black	yellow	Limit switch	To relay Terminal 85
1	black	yellow	Limit switch	To electrical switch contact at rear axle Terminal +
Harness Branch at Cable Connector for Electrical Contact in Shift Lever				
7	black	—	Cable connector	To electro-magnet of control valve
Harness Branch at Fuse Box				
3	black	red	} Fuse No. 3	To electro-magnet of control valve
4	black	red		To relay Terminal 86
Harness Branch for Ground in Trunk Compartment				
8	brown	—	Trunk compartment	To electrical switch contact at rear axle
Harness Branch for Electrical Switch Contact at Rear Axle				
8	brown	—	Terminal — of electrical switch contact	To ground at trunk compartment
1	black	yellow	Terminal + of electrical switch contact	To limit switch at servo assembly

Note: A further separate ground lead is taken to ground from relay Terminal 30/51.