OPERATIONS WITH GEARBOX REMOVED

GEARBOX–5 SPEED

Operations With Gearbox Removed

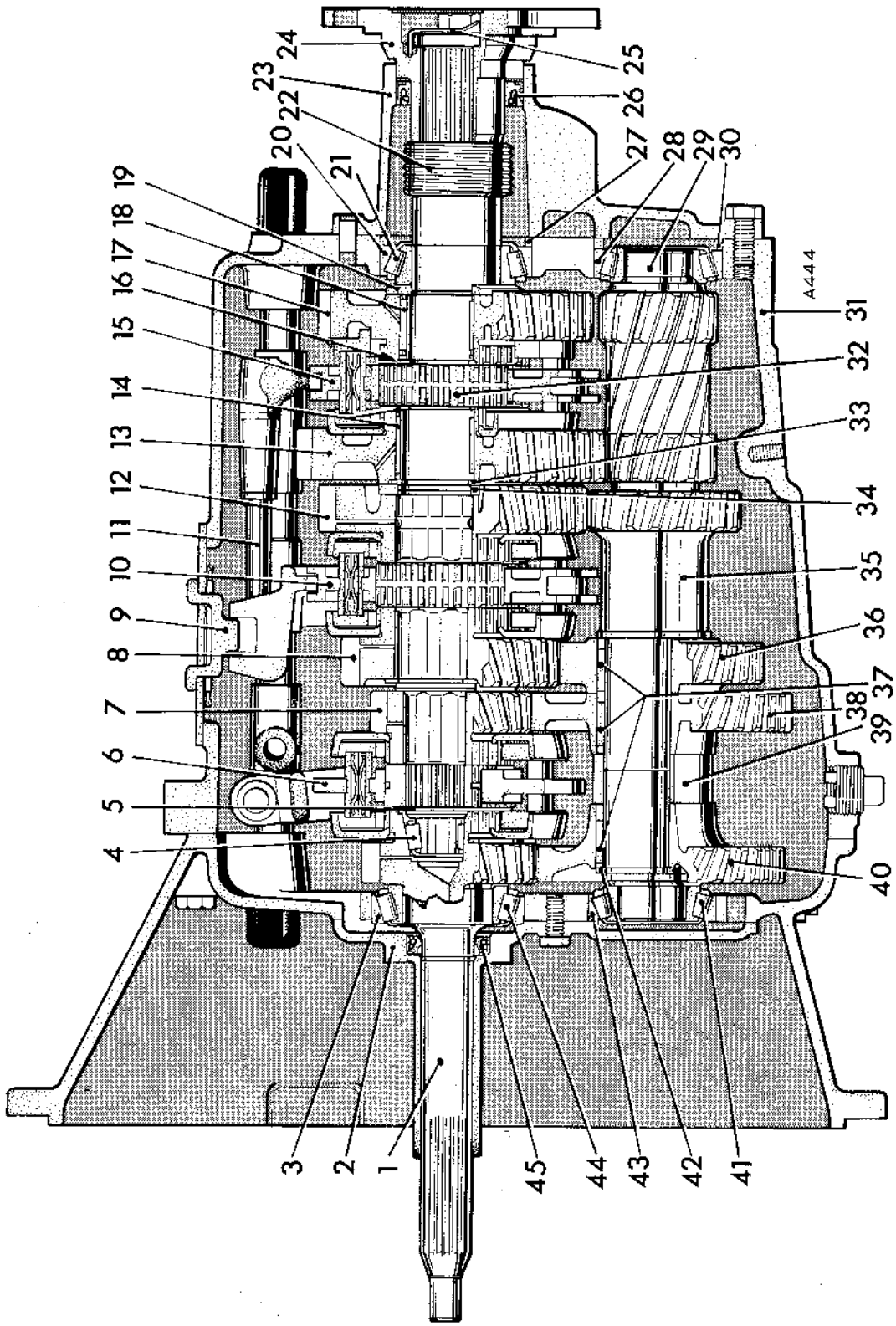

Fig. 1 *Sectional view of gearbox*

OPERATIONS WITH GEARBOX REMOVED

GENERAL

Setscrews

All setscrews used on the gearbox are self-locking nylon patch setscrews, and do not require washers. The setscrews are suitable for re-use a maximum of twelve times. Threads should be coated with "Wellseal" jointing compound prior to re-assembly.

Locally Manufactured Equipment

Three different size tubes are required for re-fitting the taper roller bearings, full manufacturing details are given in Section F202.

FRONT COVER

To Remove

Disconnect and remove push rod.

Remove four cross-head screws securing gaiter clamp plate and gaiter. Remove clamp plate and gaiter.

Remove split pin from fork pivot pin, withdraw pivot pin.

Remove clutch fork withdrawal mechanism.

Position the gearbox as shown in Fig. 2 to prevent movement of the front bearing races.

Remove the seven setscrews securing the front cover.

Remove front cover and gasket.

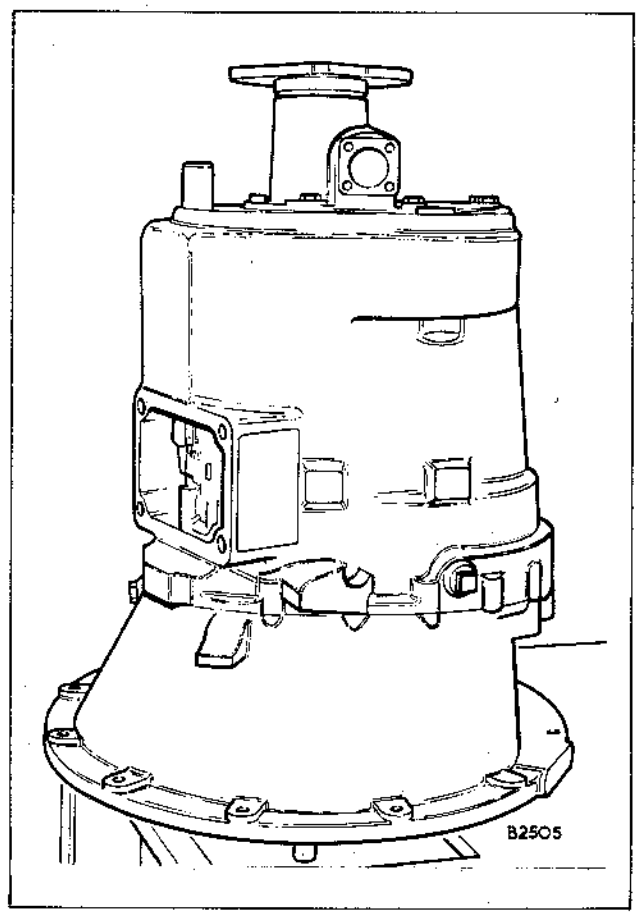

Fig. 2 *Gearbox on bench showing cut-away*

Key to Fig. 1

1. PRIMARY SHAFT
2. FRONT COVER
3. BEARING TRACK
4. TAPER ROLLER BEARING
5. CIRCLIP
6. FOURTH/FIFTH SYNCHROMESH ASSEMBLY
7. MAINSHAFT FOURTH GEAR
8. MAINSHAFT THIRD GEAR
9. INTERLOCK PLATE
10. SECOND/THIRD SYNCHROMESH ASSEMBLY
11. SELECTOR SHAFT ASSEMBLY
12. MAINSHAFT SECOND GEAR
13. MAINSHAFT FIRST GEAR
14. NEEDLE ROLLER BEARING AND SPACER RING
15. FIRST/REVERSE SYNCHROMESH ASSEMBLY
16. INTERLOCK RETAINING RINGS
17. REVERSE GEAR
18. NEEDLE ROLLER BEARING
19. SPACER WASHER
20. BEARING TRACK
21. TAPER ROLLER BEARING
22. SPEEDOMETER DRIVE GEAR
23. SPEEDOMETER GEAR CASE
24. DRIVE COUPLING
25. SETSCREW,LOCKWASHER AND WASHER
26. OIL SEAL
27. SPACER RING
28. BEARING TRACK
29. TAPER ROLLER BEARING
30. SPACER RING
31. GEAR CASE
32. SYNCHROMESH HUB
33. INTERLOCK RETAINING RINGS
34. THRUST WASHER AND LOCK PIN
35. LAYSHAFT
36. LAYSHAFT THIRD GEAR
37. WOODRUFF KEYS
38. LAYSHAFT FOURTH GEAR
39. SPACER
40. CONSTANT MESH GEAR
41. TAPER ROLLER BEARING
42. SNAP RING
43. SPACER RING
44. TAPER ROLLER BEARING
45. OIL SEAL

Inspection and Overhaul

Clean the mating flange faces.

Check the cover and oil seal for wear and damage. Renew as necessary.

To Renew the Oil Seal

Using a suitable hooked tool remove the oil seal from the front cover.

Smear the inner and outer seal diameters of new seal using grease Retinax A.

Position the new seal in the front cover and secure in position using Special Tool 18G 134DK.

To Refit

Refitting is a reversal of the removal procedure noting the following points:

Fit a new gasket using a suitable jointing compound.

Coat the setscrew threads with "Wellseal" jointing compound.

Ensure the oil seal is not damaged when refitting cover.

Ensure that the release bearing carrier anti-rotation roll pin is fitted within the withdrawal fork throat, away from the spring retainer.

GEARBOX

To Dismantle

To assist in dismantling and rebuilding the gearbox, it should be mounted in a mounting bracket, supported by a shaft on which the fixture can be rotated.

In the event of a mounting bracket not being available, a hole should be cut in the bench top large enough to accept the primary shaft and allow access to the housing setscrews.

Remove the four setscrews securing the top cover, remove cover, interlock plate and two gaskets, one either side of interlock plate.

Remove the reverse light switch.

Remove the four external and ten internal setscrews, leaving two setscrews diagonally opposed, securing the clutch housing.

Position the gearbox on the bench as shown in Fig. 2.

Unpeen the lock washer, unscrew the flange retaining setscrew.

Remove the flange setscrew, lock washer and flange washer, withdraw coupling flange.

Remove the six setscrews, lift off the speedometer gear case and gasket.

Remove the speedometer drive gear noting the gear undercut fits towards casing.

Remove the mainshaft and layshaft bearing spacers and shim packs.

Using a slide hammer with Special Tools S4235A-1 and 18G 284AT, screw the adaptor into the reverse idler shaft, impact out the shaft (Fig. 3).

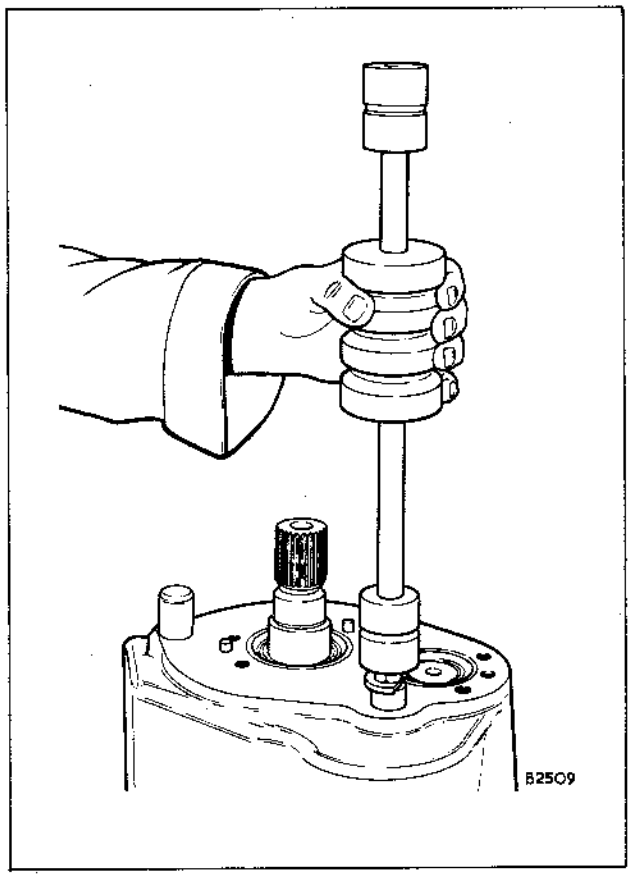

Fig. 3 *Removing reverse idler shaft*

Insert the dummy shaft Special Tool LC175, this allows the idler gear to be repositioned off centre to allow the gear case to be removed.

Remove the two remaining setscews securing the gear case and clutch housing.

Shake the casing to clear the reverse gear and withdraw the case squarely to prevent damage to taper roller bearings. The gear assembly is completely accessible as shown in Fig. 4.

Remove the gear case gasket.

Remove the hexagon brass plug in the clutch housing, adjacent to the selector fork assembly, withdraw the detent spring and ball (Fig. 4).

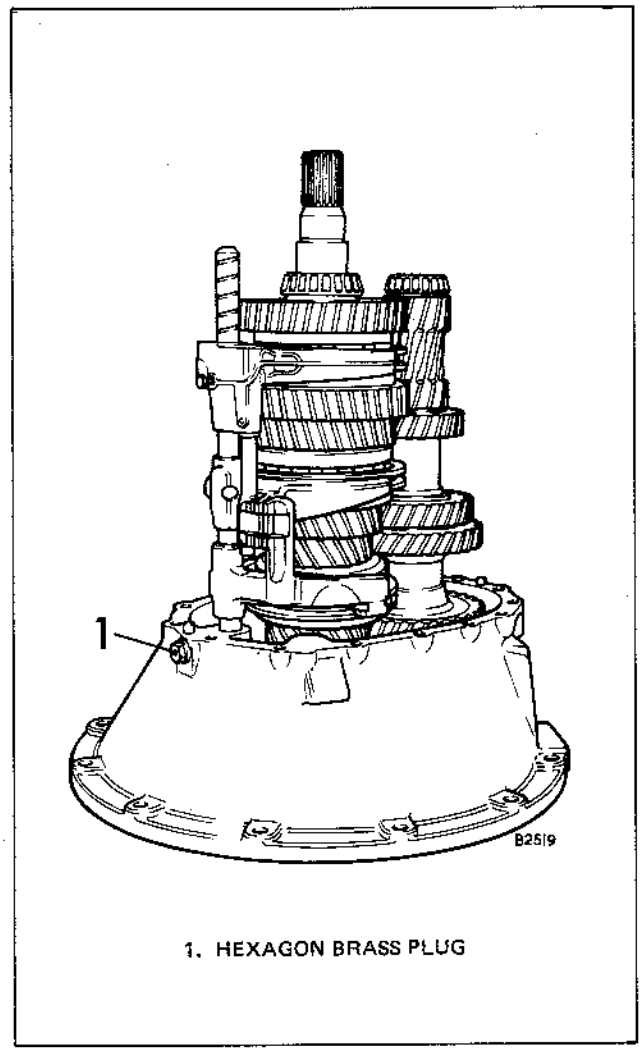

Fig. 4 *Gear case removed*

Lift clear the mainshaft and selector assembly as a complete unit (Fig. 5) from clutch housing. Remove the selector fork assembly from the mainshaft.

Lift the layshaft assembly clear of the clutch housing.

Note: Care should be taken during removal of layshaft assemblies, to ensure that no damage occurs to gear teeth or faces.

Withdraw primary shaft with fifth synchro cup attached, taking care not to damage oil seal.

Remove the front cover this Section, extract the mainshaft and layshaft bearing races.

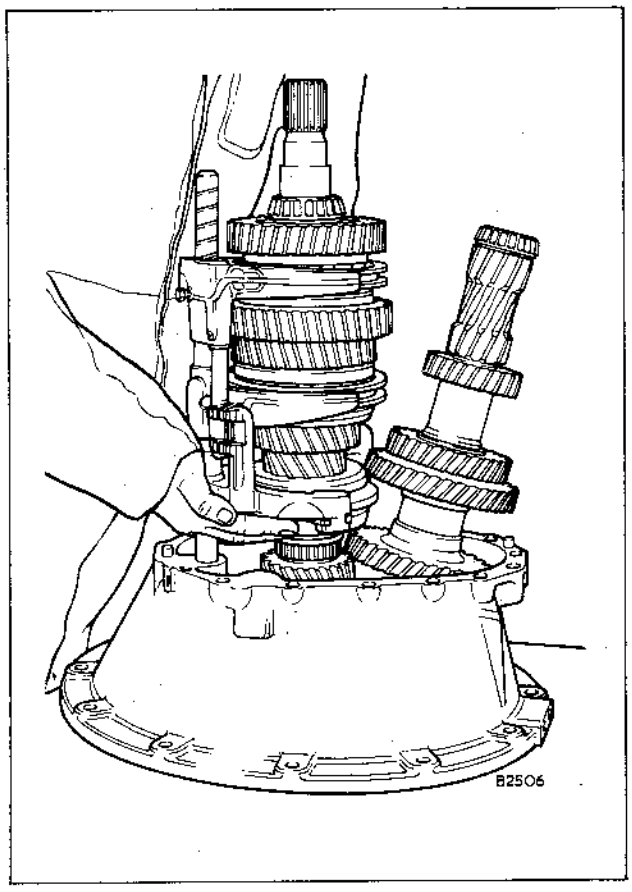

Fig. 5 *Mainshaft and layshaft removal*

PRIMARY SHAFT

To Dismantle

Remove fifth synchro cup from primary shaft dog teeth.

Note: The fifth synchro cup has a reinforcing plate spot welded to back.

Withdraw the taper roller bearing using Special Tool 18G 47 AK-1 in conjunction with a hand press (Fig. 6).

Note: Care must be taken to ensure Special Tool is correctly located around bearing.

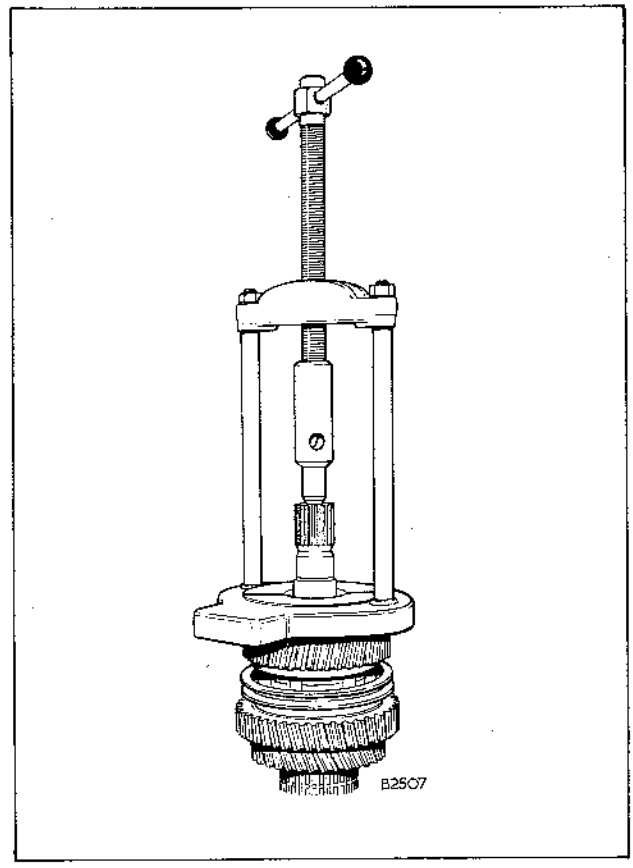

Fig. 6 *Withdrawing taper roller bearing*

Inspection and Overhaul

Thoroughly clean all components.

Taper Roller Bearing

Immerse the bearing in white spirit or a good quality paraffin and clean, using a suitable brush. Following cleaning, the bearing must be dipped in clean, thin oil immediately. Examine the rollers for wear, pitting or flat spots. Renew the bearing if any of these faults are evident. Check the outer race for pitting or damage. Renew as necessary.

Primary Shaft

Check the bearing spigot for wear or damage. Examine the counter bore which houses the mainshaft taper roller bearing for pitting and wear. Insert the shaft in a new clutch driven plate and check for burrs and backlash on the splines. Examine the gear teeth for wear or damage.

To Re-assemble

Refit the taper roller bearing on to the shaft, using a suitable steel tube see Section F 202 and Fig. 7.

Refit the fifth synchro cup onto the primary shaft dog teeth.

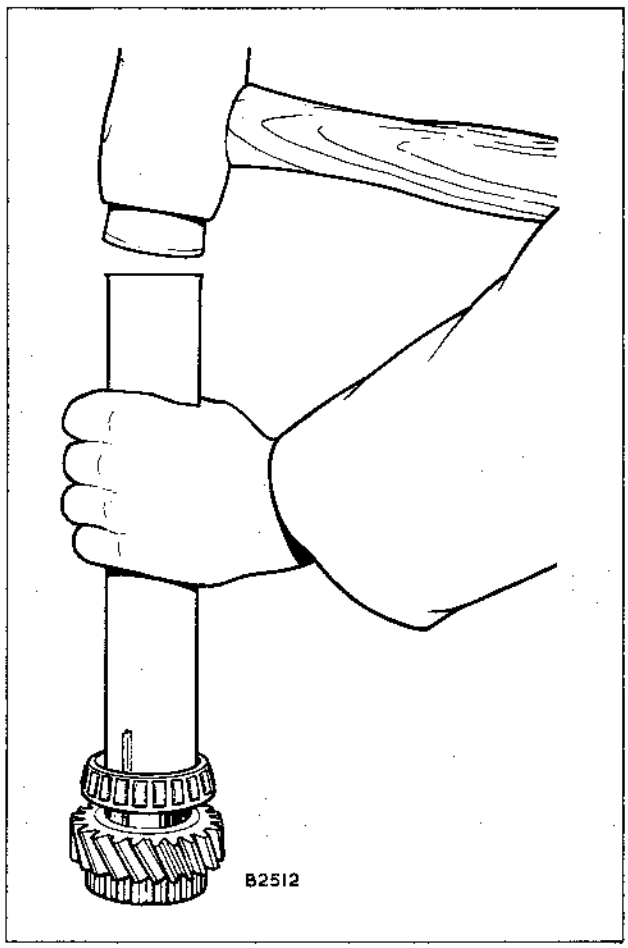

Fig. 7 *Refitting taper roller bearing*

MAINSHAFT

To Dismantle

The mainshaft dismantling falls logically into two sections. The front section covering all items forward of the second/third synchro hub, the rear section covering all items aft of the hub.

Before dismantling the mainshaft, identify each synchro cup to its respective synchro assembly.

Front Section Dismantling

Remove the fourth/fifth synchro assembly and fourth gear synchro cup.

Position the mainshaft in a vice using soft jaws.

Remove the front taper roller bearing using the Special Tool 18G 47BE in conjunction with hand press RG 47 (Fig. 6).

Remove and discard circlip from the front of the shaft.

Remove the fourth/fifth synchromesh hub.

Remove mainshaft fourth gear.

Prise off the third gear interlock retaining rings (Fig. 8).

Remove mainshaft third gear.

Remove the third gear synchro cup, second/third synchro assembly and second gear synchro cup.

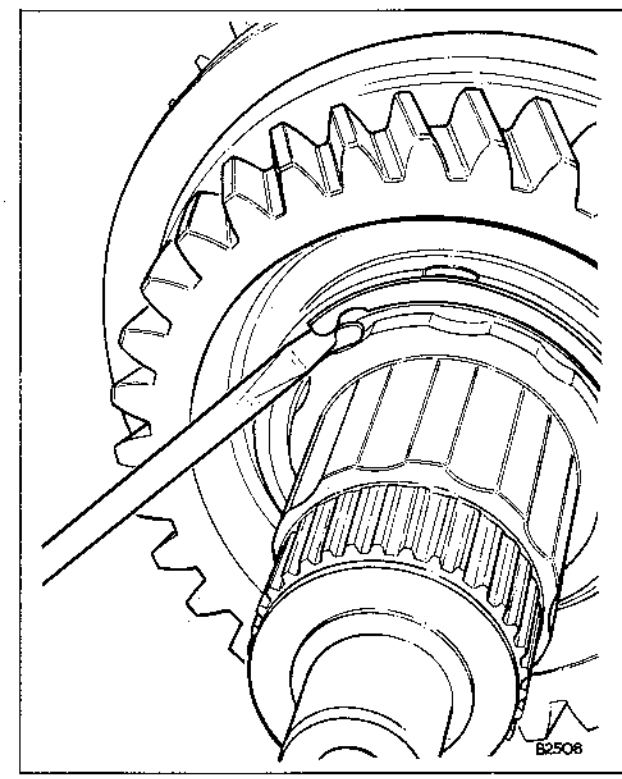

Fig. 8 *Removing interlock retaining rings*

Rear Section Dismantling

Invert the mainshaft in the vice.

Remove the rear taper roller bearing using Special Tool 18G 47AK-1 in conjunction with hand press RG 47, similar to Fig. 6.

Note: Care must be taken to ensure special tool is correctly located around bearing.

Remove the rear bearing spacer washer.

Remove the reverse gear and needle roller bearing.

Remove the first/reverse synchro assembly.

Remove the first/reverse hub interlock retaining clips.

Remove the first/reverse synchromesh hub.

Remove the first gear synchro cup.

Remove the first gear, needle roller race and distance piece fitted at rear of gear.

Remove the interlock retaining clips securing the second gear thrust washer.

Remove the second gear thrust washer, located by a retaining pin in the mainshaft.

Withdraw the thrust washer retaining pin.

Remove the second gear.

Inspection and Overhaul

Thoroughly clean all components. When checking for wear refer to Manufacturing Data.

Gear Teeth

Examine all the gear teeth for damage or wear. Any gear with worn or damaged teeth should be renewed. Check the gear internal diameters.

Taper Roller Bearings

Immerse the bearing in white spirit or a good quality paraffin and clean, using a suitable brush. Following cleaning, the bearing must be dipped in clean, thin oil immediately. Examine the rollers for wear, pitting or flat spots. Renew the bearing if any of these faults are evident.

Needle Roller Bearing

Examine the needle rollers for wear or pitting. If either is present on any one roller, renew the bearing.

Synchromesh Assembly

Ensure that the synchro cup dog teeth are in good condition. The tapered exterior of the baulk rings incorporate fine, closely pitched grooves designed to break down the oil film rapidly on the synchro cups, as the mating faces engage. Ensure that the grooves are not worn, if wear is apparent the complete synchromesh assembly including synchro cups must be renewed, as the assembly cannot be dismantled, being rivetted together. If the assembly is to be refitted ensure that no foreign material is present in baulk ring grooves.

Check the baulk rings for concentricity by marking the synchro cup with a thin coating of engineer's marking blue and offer up the baulk ring. Examine the result obtained which should show a corresponding blue marking on the tops of all the baulk ring grooves. With the synchro cup fitted to the baulk ring there should be a minimum clearance of 1.016 mm (0.04 in) between the cup and the face of the baulk ring.

Interlock Retaining Rings

Check rings for wear or damage.

Mainshaft

Check the mainshaft for wear or damage. Fit the drive coupling to its splines and check for backlash. If backlash is apparent, renew the driving coupling, should backlash again be noted, renew the mainshaft. Check the bolt holes in the coupling flange for elongation, and renew the coupling if evident.

To Re-assemble

Rear Section

Note: All components, splines and wear faces MUST be lubricated with Molybdenum Disulphide grease as they are re-assembled.

When refitting interlock retaining rings:-

The radius face of the half ring MUST always face a rotating part.

The square face MUST ALWAYS face a non-rotating part.

Place mainshaft in a vice using soft jaws, rear end upwards.

Fit the second gear, dog teeth downwards.

Fit the locking pin into the mainshaft.

Fit the second gear thrust washer over the locking pin.

Fit the second gear interlock retaining rings.

Note: The square face of the ring must face the thrust washer.

Fit the first gear needle roller bearing, with its spacer ring above it.

Fit the first gear dog teeth upwards over the bearing.

Position the first gear synchro cup on the dog teeth.

Fit the first/reverse synchro hub.

Fit the hub interlock retaining rings, square face to the hub.

Fit the first/reverse synchromesh assembly, with the blocked off portion upwards.

Fit the reverse gear needle roller bearing and reverse gear with dog teeth downwards.

Fit the reverse gear spacer washer, flat face downwards.

Refit rear taper roller bearing (Fig. 9) using suitable steel tube see Section F 202.

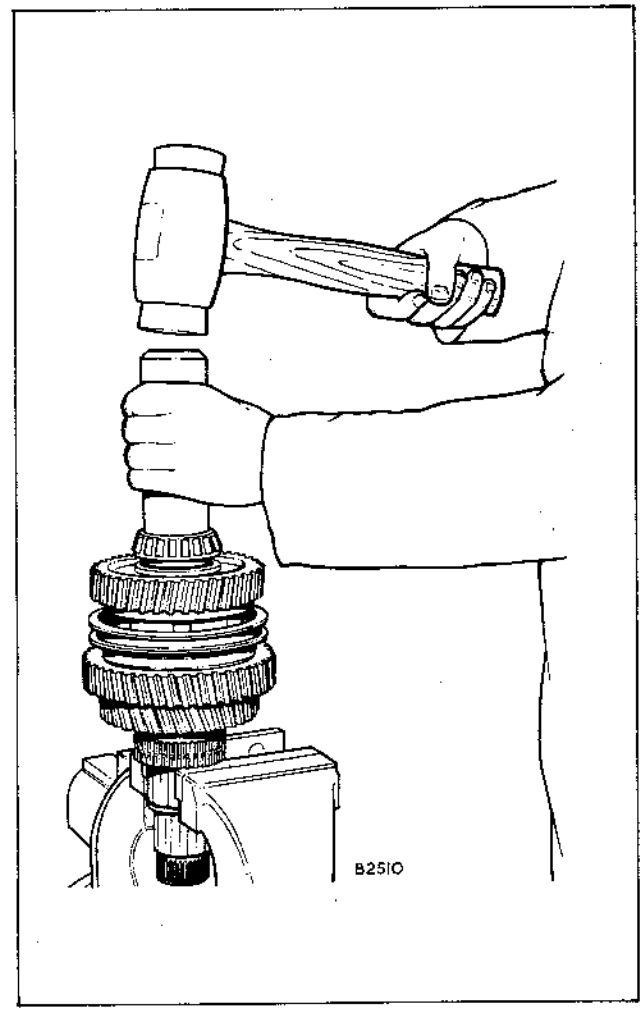

Fig. 9 *Refitting mainshaft rear taper roller bearing*

Front Section

Invert the mainshaft in the vice.

Fit the second gear synchro cup.

Fit the second/third gear synchromesh assembly followed by the third gear synchro cup.

Fit the third gear with the dog teeth downwards.

Fit the third gear interlock retaining rings, square face to the gear.

Fit the fourth gear with the dog teeth upwards.

Fit the fourth/fifth synchro hub and secure using a new circlip.

Refit front taper roller bearing using a suitable steel tube see Section F 202 and Fig. 10.

Check that all gears rotate freely and that the correct clearance is ensured, see Manufacturing Data.

Fit the fourth gear synchromesh cup.

Fit the fourth/fifth synchromesh assembly and synchro cup.

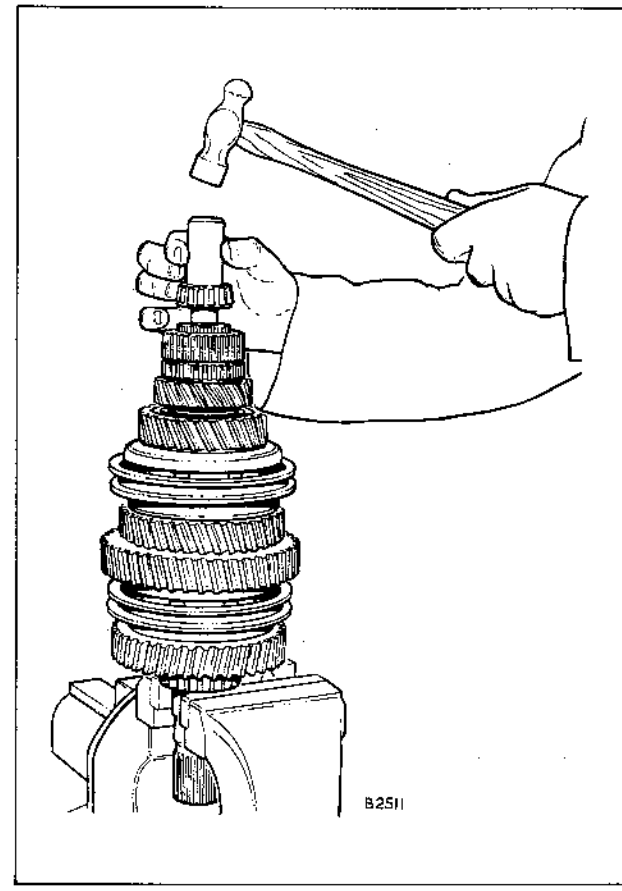

Fig. 10 *Refitting mainshaft front taper roller bearing*

SELECTOR FORKS

General

The three selector forks work on a common selector rail.

The first/reverse selector fork positioned and retained to the selector rail with a lockscrew. During use the selector fork and rail move as a complete unit.

The second/third and fourth/fifth selector forks sliding on the selector rail positioned by a detent ball and spring.

To Dismantle

Hold the selector fork assembly in a vice using soft jaws, gripping the spiral fluted end.

Withdraw by sliding the fourth/fifth and second/third selector forks, take care the detent ball and spring do not fly out.

Undo and remove the lockscrew securing the first/reverse fork to selector rail, slide off the fork.

Note: The first/reverse fork has an extension shaft retained with a roll pin. Under no circumstances must the roll pin be removed. The fork is serviced as a complete assembly.

Inspection and Overhaul

Thoroughly clean all components.

Examine the ball locking springs for damage. Renew as necessary. Examine the balls for wear, pitting or flat spots. Renew as necessary.

Check the slots in the forks for wear or damage. Examine the forks and bushing inserts for wear at the point of contact with their respective gears. Renew as necessary.

To Re-assemble

Refit the first/reverse fork in position on the selector rail (Fig. 11). Secure with a new lockscrew using Loctite.

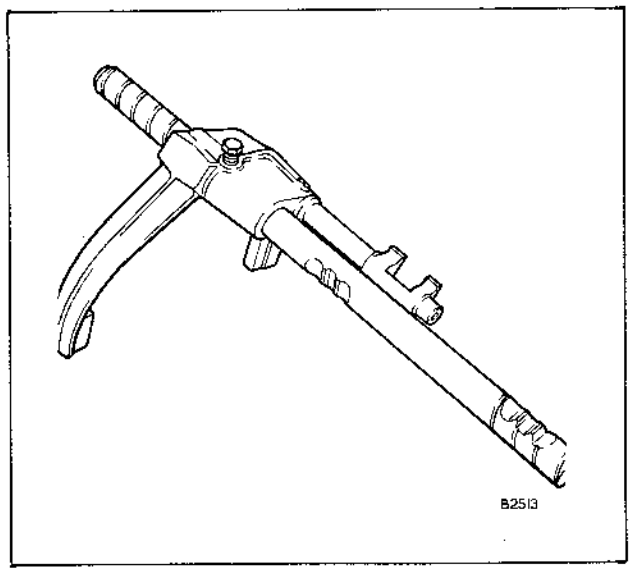

Fig. 11 *First/reverse fork in position*

Hold the selector rail in a vice using soft jaws, gripping the spiral fluted end.

Fit the detent ball and spring into the second/third selector fork, using a suitable diameter rod compress the ball and spring (Fig. 12) and slide onto the selector rail. Repeat the operation for the fourth/fifth selector fork.

With the selector assembly complete, all the gear change selector positions should be in line (neutral position).

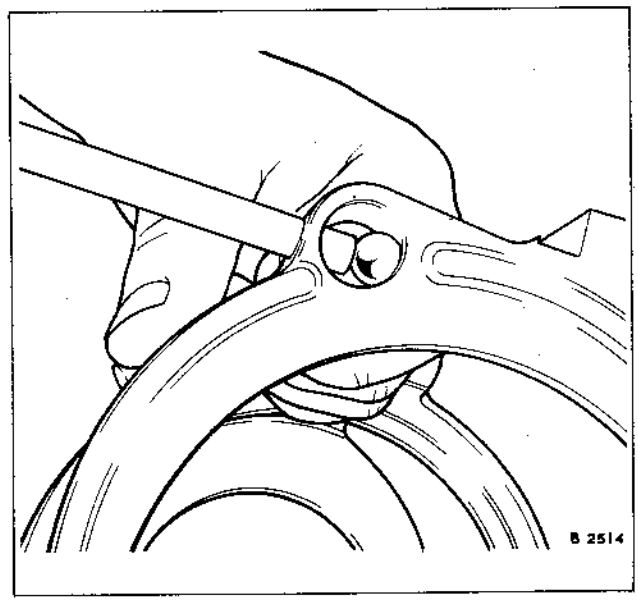

Fig. 12 *Compressing detent ball and spring*

LAYSHAFT

To Dismantle

Withdraw the front taper roller bearing using Special Tool 18G 47AK-1 in conjunction with a handpress (Fig. 6).

Note: Care must be taken to ensure special tool is correctly located around bearing.

Remove the snap ring.

Using a press with a three ton capacity, press off the constant mesh gear and withdraw the Woodruff key.

Remove the spacer.

Press off the third and fourth gears, remove the Woodruff keys.

If required withdraw the rear taper roller bearing using the same method as for front bearing.

Inspection and Overhaul

Thorough clean all components.

Gear Teeth

Examine all the gear teeth for damage or wear. Any gear with worn or damaged teeth should be renewed.

Taper Roller Bearings

Immerse the bearing in white spirit or a good quality paraffin and clean, using a suitable brush. Following cleaning, the bearing must be dipped in clean, thin oil immediately. Examine the rollers for wear, pitting or flat spots. Renew the bearing if any of these faults are evident.

To Re-assemble

Fit the two Woodruff keys and press on the third and fourth gears, with extended hubs towards snap ring groove.

Fit the spacer and Woodruff key, press on the constant mesh gear with extended hub positioned away from snap ring groove, secure with a new snap ring.

Refit the taper roller bearings using a suitable steel tube, see Section F 202.

REVERSE IDLER GEAR

To Remove

Withdraw dummy shaft (Special Tool LC 175) from the gearcase.

Collect reverse idler gear, thrust washers and needle roller bearings from inside the gearcase.

Inspection and Overhaul

Thoroughly clean all components.

Gear Teeth

Examine the gear teeth for damage or wear. Renew as necessary.

Needle Roller Bearings

Examine the needle rollers for wear or pitting. If either is present on any one roller, renew the bearing.

Thrust Washers

Renew the washer if worn or damaged.

Reverse Idler Shaft

Examine the shaft for wear or damage. Renew the shaft if any defects are evident.

To Refit

Grease the thrust washers and fit in gearcase with locating tag in position in recess on gear bore face.

Grease and fit the two needle roller bearings into the gear.

Slide the reverse idler gear and bearings between the two thrust washers.

Slide in the reverse idler dummy shaft (Special Tool LC175) to retain gear, bearings and thrust washers in position.

INTERLOCK PLATE ASSEMBLY

To Dismantle

Remove the two spring clips (Fig. 13)

Drive out the two roll pins.

Remove the interlock slide.

Remove split pin and unscrew bias plunger retaining plug, remove spring and ball.

Remove bias plunger and springs.

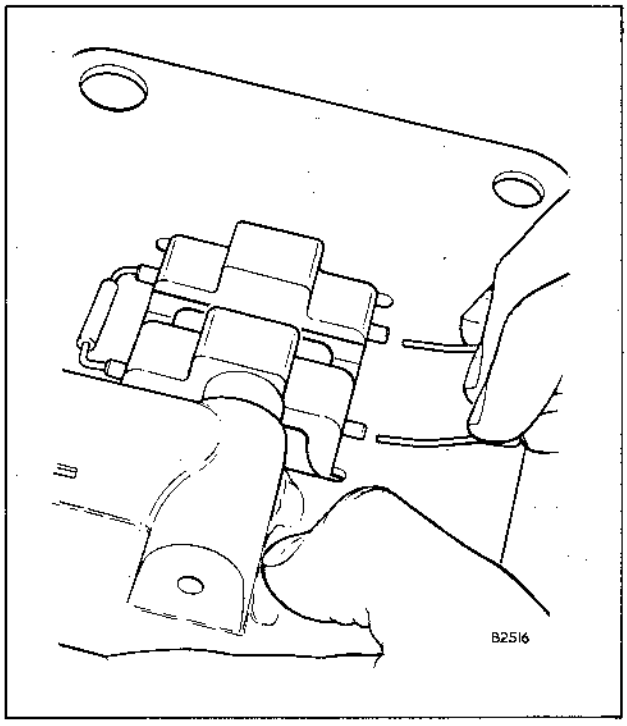

Fig. 13 *Removing/refitting spring clips*

Inspection and Overhaul

Thoroughly clean all components.

Check the interlock slide for wear or damage renew as necessary.

Examine the springs for damage. Renew as necessary.

Examine the balls for wear, pitting or flat spots. Renew as necessary.

To Re-assemble

Assemble bias plunger and springs into housing.

Assemble the bias plunger retaining ball and spring.

Screw in the plunger retaining plug until the end of the plug is flush with the housing.

Check the action of the plunger by inserting the assembly in a soft jawed vice, with the plunger horizontal, positioning a bolt against the plunger, tighten the vice so that the bolt depresses the plunger, and then release slowly. The plunger should move in and out smoothly with no seizing. Finally, lock the plug with a new split pin.

Refit the interlock slide into plate.

Drive home the two roll pins until they protrude equally from each side, take care not to damage the ends of the roll pins.

When fitting the two spring clips into the roll pins, they must be fitted so that on entry the nylon sleeve is clear of the plate, when thrust home the nylon sleeves will swing down onto the plate, preventing the interlock slide from rattling.

To Rebuild Gearbox

Fit a new oil seal in the front bearing cover, see this section.

Note: During assembly the primary shaft bearing track must be protruding enough through the front of the bell housing, to enable the front cover to centralise itself on the track.

Fit primary shaft bearing track into and protruding from the bell housing.

Coat a new gasket with jointing compound, fit over the protruding bearing track.

Fit the front cover, sliding the bearing track into the bell housing.

Fit the front bearing cover and secure with seven setscrews torque tightened to Data figure.

Position the bell housing on the bench over the cut-out.

Fit the layshaft bearing track into position to contact with the front cover.

Carefully place the prepared primary shaft into position taking care not to damage the front cover oil seal.

Place the prepared layshaft into position.

Assemble the selector forks to the mainshaft.

Place the mainshaft/selector fork assembly into position.

Refit the selector rail detent ball, spring and closing plug.

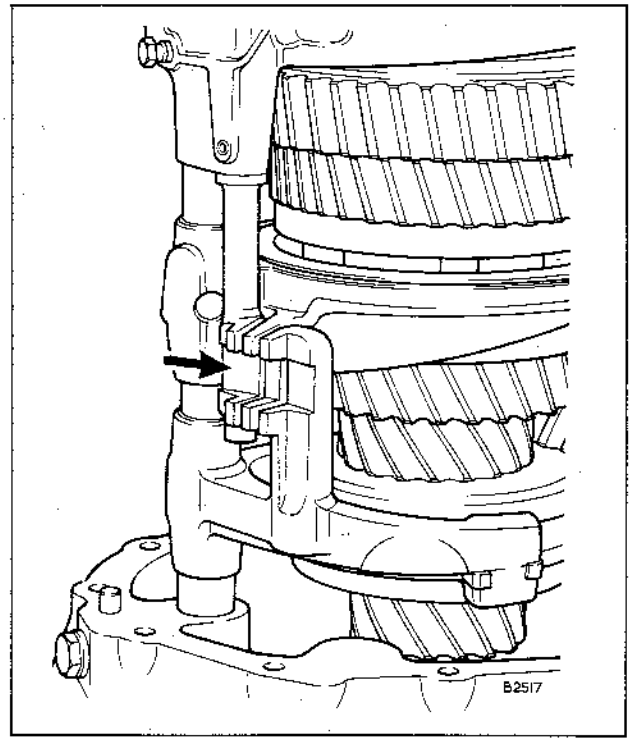

Fig. 14 *Selector lugs in neutral position*

Torque tighten to Data figure.

Ensure the selector lugs are in a neutral position (Fig. 14).

Coat a bell housing/gearbox casing gasket with jointing compound, fit to bell housing face.

Fit the prepared gearbox casing over the assembled gears.

Fit the twelve internal and four external securing setscrews in the bell housing. Torque tighten to Data figure.

Remove the dummy reverse idler shaft (Special Tool LC175)

Refit the reverse idler shaft.

Note: Ensure that the shaft flange is at the correct angle to allow the speedometer gear case to seat before driving home.

Refit the bearing tracks over the mainshaft and layshaft.

Note: Before fitting the speedometer gear case, calculations must be made to ensure the correct preload on both the mainshaft and layshaft bearings.

Fit the layshaft bearing ring spacer (without shims) onto the layshaft bearing track.

Using Special Tool 18G 191N, spread the legs to fit over the bearing spacer ring, with a rear cover setscrew, tighten down the special tool to a torque load of 6.8 Nm (5 lbf.ft.) whilst rotating the gear train to settle the bearings.

Set up a dial gauge indicator on a magnetic base, using the flat portion of the casing to obtain a zero reading (Fig. 15).

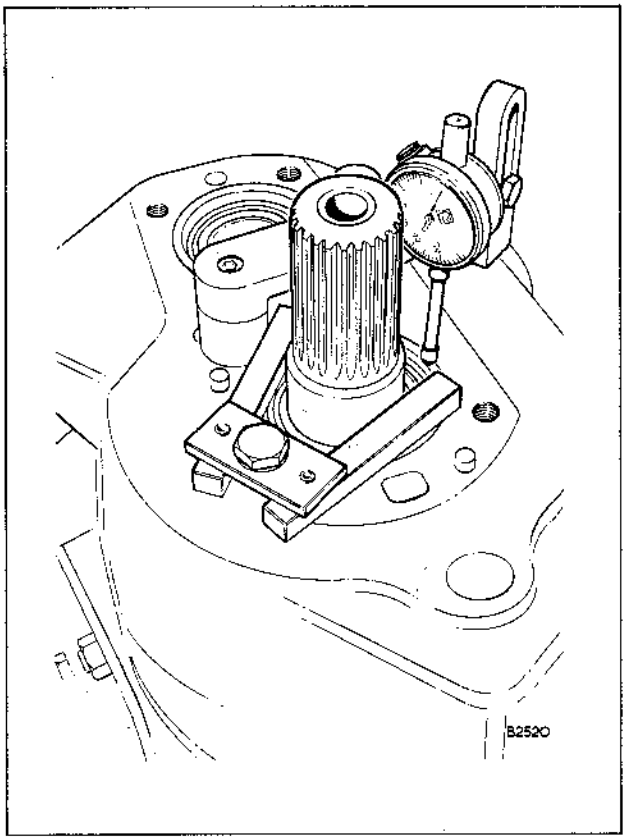

Fig. 15 *Establishing end float measurement*

Move the dial gauge indicator to contact the held down spacer ring, taking a reading at two diametrically opposite points, and record the average of these two depths.

Add 0.127 mm (0.005 in) to reading obtained above. The resultant figure is the thickness of shims to be fitted *under* the spacer ring. This adjustment should allow an end float of 0.025-0.076 mm (0.001-0.003 in).

Repeat the operation with the mainshaft bearing and spacer ring.

Select the correct shim pack for each bearing.

Fit the shim pack between the bearing tracks and spacer ring.

Fit the speedometer drive gear with the undercut portion towards the bearing.

Fit the speedometer gear case using a new gasket coated with jointing compound. Secure with six setscrews torque tightened to Data figure.

Refit drive coupling taking care not to damage oil seal.

Fit the drive coupling washer, lockwasher and setscrew. Torque tighten to Data figure and peen up lockwasher.

Fit the interlock plate using a new gasket coated with jointing compound, positioning the plunger housing to align with the reverse selector lugs (Fig. 16).

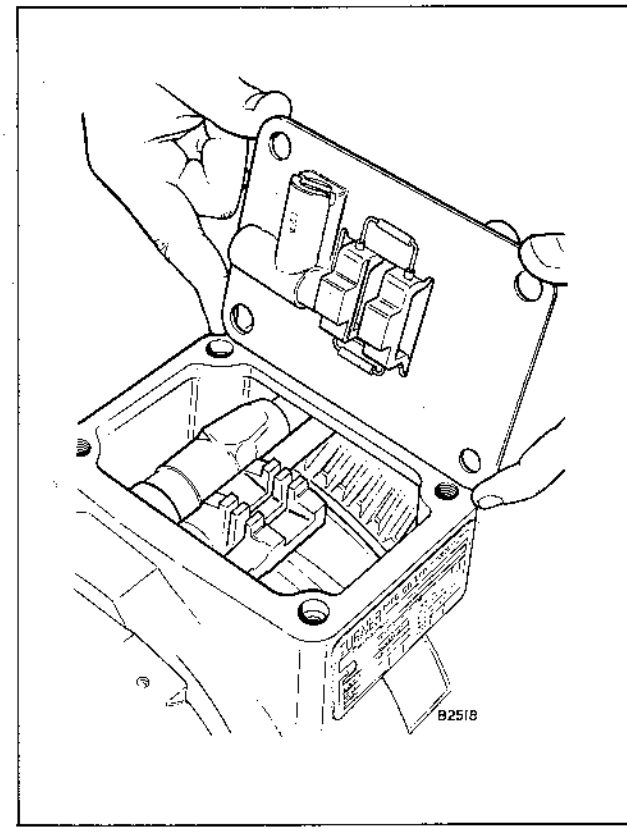

Fig. 16 *Positioning interlock plate*

Fit the top cover using a new gasket coated with jointing compound. Secure with four setscrews and washers torque tighten to Data figure.

Refit the reverse light switch.