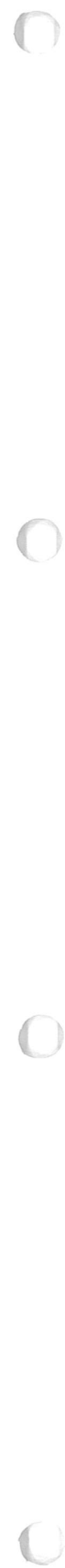


SECTION F

GEARBOX

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F. 1. GENERAL DESCRIPTION

The gearbox fitted is equipped with four forward speeds which are all of the constant mesh type and provided with synchromesh engagement. A reverse gear of the normal spur type is also fitted in the box whilst all the forward constant mesh gears are of the helical type, to ensure quiet operation. The gears are selected manually by a floor mounted gear lever.

There are three selector shafts and a selector fork is attached to each shaft by a setscrew. The forks on the left-hand and centre shafts engage in groove machined in the periphery of the third and top gear and the first and second gear synchroniser sleeves respectively. A fork attached to the right-hand shaft engages with a groove in the reverse idler gear hub.

The selector shafts are free to slide in the gearbox case but an interlocking plunger device situated in the front of the gearbox case prevents more than one shaft being moved at a time, thus preventing the engagement of two gears simultaneously. Index notches corresponding to the neutral and gear positions are machined in the respective shafts and are engaged by spring-loaded locking balls in the gearbox top face and cover to positively locate the gears.

The rear ends of the forged selector shafts protrude into the gearbox extension housing. The first and second gear and the reverse gear selector shafts both being hooked. The third and top gear selector shaft is slotted on the inner face of the forged end and is bent so that the slot is adjacent to the hook in the first and second gear selector shaft. A relay lever engages with the reverse selector shaft hook and forms a gear selector gate with the forward gear selector shaft ends, by means of a slotted lug adjacent to the first and second selector shaft hook.

DESCRIPTION

The gearbox and clutch housing are bolted to the engine. The drive from the engine is through the clutch to the gearbox by a splined shaft integral with the main drive gear, the clutch disc being free to slide on these splines. The main drive gear runs in a ball race in the gearbox case and the shaft is supported at the forward end by a spigot located in a bearing fitted in the end of the engine crankshaft.

The main drive gear bearing is retained on the shaft by a circlip, the main drive gear and bearing assembly being retained in the gearbox by another circlip located in a groove in the bearing outer race and a retainer bolted to

the gearbox case front face. An oil seal in the bearing retainer prevents oil leaking out onto the clutch disc. The main drive gear is in mesh with the countershaft cluster gear which runs on needle roller bearings divided equally between each end of the countershaft.

The mainshaft is supported in the main drive gear by a spigot located in needle roller bearings and runs in a ball race mounted in a carrier sandwiched between the gearbox and the extension housing. The mainshaft extension is supported at the rear end by the drive shaft sliding joint, which runs in a bearing bush fitted in the rear end of the extension housing. An oil seal is also fitted at this location.

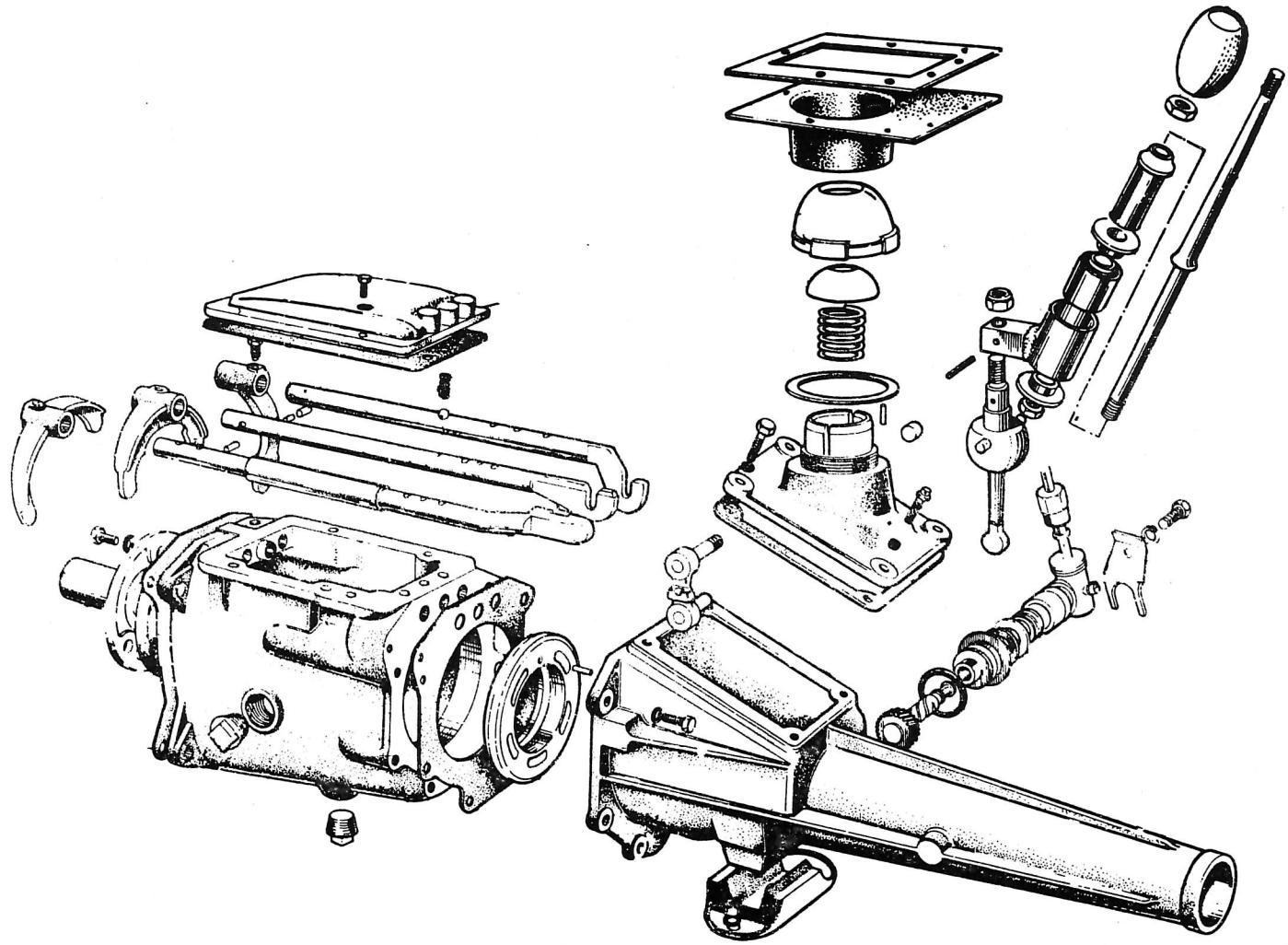
The first, second and third gears are in constant mesh with the counter-shaft cluster gear and are free to rotate on the mainshaft, the first gear on a steel bush, which is positively located by a steel ball, and the other two directly on the shaft itself. The forward gears are engaged by blocker type synchroniser assemblies splined to the mainshaft, between the first and second gears and between the third and main drive gears. The mainshaft bearing, first gear and bush, first and second gear synchroniser and the second gear, together with the speedometer drive gear and spacer are retained by a nut locked with a tab washer, on the mainshaft extension, the speedometer drive gear being positively located by a steel ball. The third gear and the third and top gear synchroniser are retained at the forward end of the mainshaft by a circlip.

The reverse spur gear is machined on the outside of the first and second gear synchroniser sleeve and a reverse idler spur gear is mounted parallel to the mainshaft and countershaft.

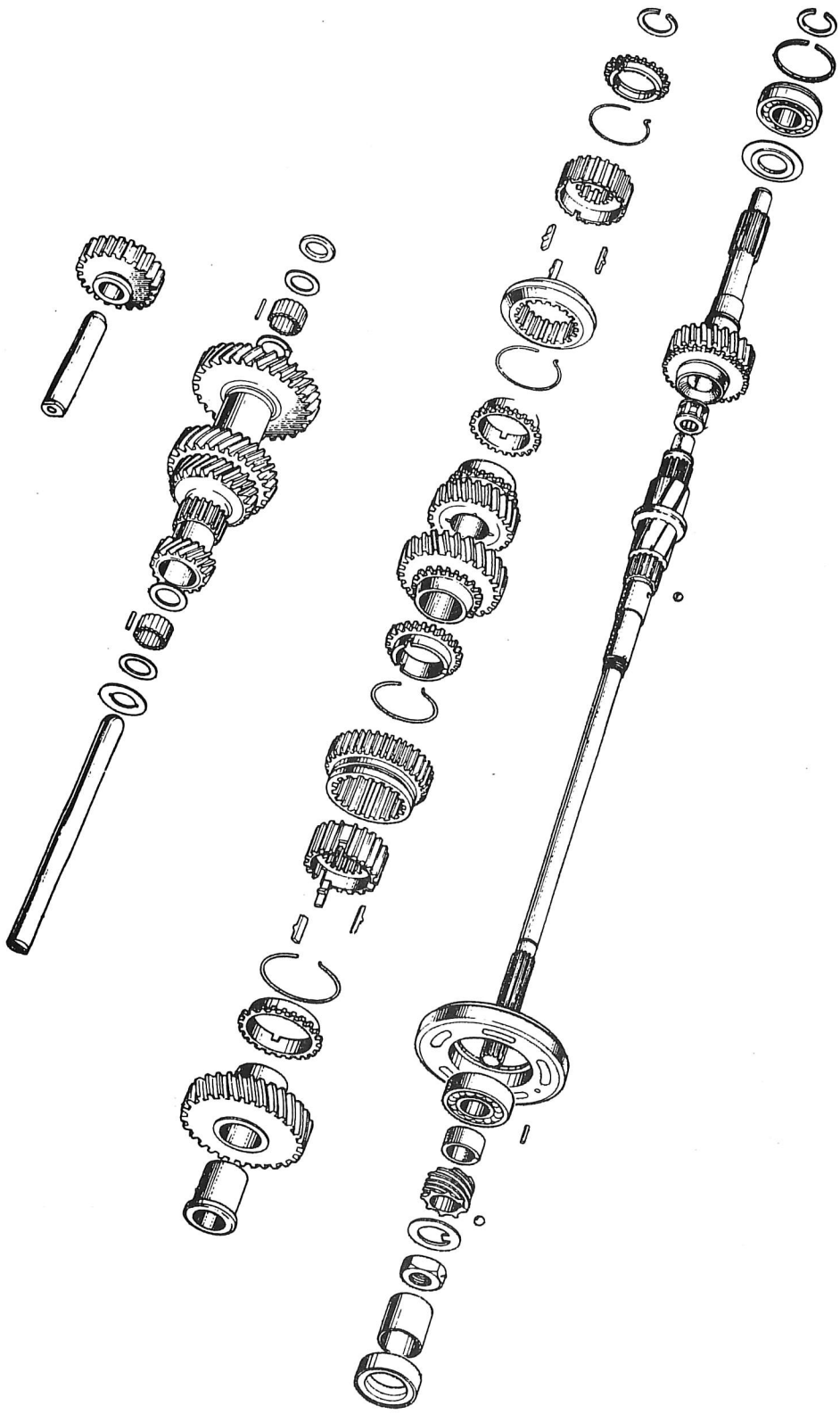
LUBRICATION AND MAINTENANCE

The gears are lubricated by an extreme pressure gear oil, (see Section 'O'), which partially fills the gearbox case; a combined filler and level plug and a drain plug being provided to facilitate service. The counter-shaft cluster gear, which is almost completely submerged, picks up oil as it revolves to lubricate the mainshaft and main drive gears and bearings and, also the selector shafts and forks. Oil passing through the main drive gear bearing is returned to the gearbox case by a slot in the bearing retainer and an oil drain hole in the gearbox case front face. An oil seal in the bearing retainer prevents the oil from leaking out along the main gear shaft and onto the clutch disc.

Oil thrown up by the gears is collected in a channel in the left-hand side of the gearbox case and runs back into the extension housing to lubricate the speedometer gears and the mainshaft extension bush. An oil seal in the end of the extension housing prevents the oil from leaking out around the drive shaft sliding joint. Oil trapped by the seal returns to the extension housing through



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SECTION F

a slot under the bush. A pocket of oil is retained in the extension housing by the front face which is recessed to locate the mainshaft bearing carrier plate. oil hole, in the front face, drains surplus oil back into the gearbox case via annular grooves and a slot in the mainshaft bearing carrier plate.

The gearbox is ventilated by a breather incorporated in the rear left-hand bolt retaining the remote control housing to the extension housing. Ventilation slots in the extension housing front face and the mainshaft bearing carrier plate being provided for air to flow between the gearbox case and the extension housing.

THE SYNCHRONISERS

The synchronisers are of the 'blocker ring' type and consist of a hub, which is splined to the mainshaft and an outer sleeve splined to the hub. The hub has three inserts or blocker bars supported by two light circular springs, which hold the blocker bars against the synchroniser sleeve and, in the neutral position, in engagement with notches machined in the internal splines of the sleeve. The blocker bar springs, which are positioned on either side of the hub, have tags at one end located in a common insert, the other end being free. The springs are fitted so that the free ends run in opposite directions. A bronze blocker ring is interposed between the synchroniser and each forward gear, having a tapered face to mate with the corresponding face on the gear.

The blocker rings have dog teeth die-cast on their external diameter and are cut away at three equal points to locate on the blocker bars. Radial clearance, to give approximately half a pitch of the dog teeth on the blocker ring and gear, exists between the slots and blocker bars.

When engaging a forward gear, the respective synchroniser is moved towards the required gear. The blocker bars, which are in engagement with the sleeve, also move and push the blocker ring into contact with the tapered face of the gear, which revolves at a different speed to the mainshaft and synchroniser. The frictional drag which exists between the tapered face of the blocker ring and gear will keep one side of the slots against the blocker bars, so that the dog teeth will be out of line with teeth on the sleeve. This prevents gear engagement as long as there is any difference in the speeds between the mating cones.

As the speeds equalise, however, the blocker ring centralises itself, allowing the sleeve to move fully to engage the dog teeth of the gear.

THE POWER FLOW

Neutral

In neutral, with the engine running, the main drive gear and counter-shaft gear revolve and the first, second and third gears revolve on the mainshaft.

The mainshaft, reverse idler gear and first and second gear synchroniser are, of course, stationary.

First

To engage first gear, the first and second gear synchroniser (which is also the reverse mainshaft gear) is moved rearwards so that the internal teeth engage the dog teeth on the gear, so locking the first gear to the mainshaft. Power is transmitted from the main drive gear to the front counter-shaft gear, to the first gear, then to the first and second gear synchroniser and mainshaft.

Second

Second gear is engaged by moving the first and second gear synchroniser forward, to lock the second gear to the mainshaft. Power is then transmitted from the main drive gear, to the front countershaft gear, to the second gear, then to the first and second gear synchroniser and mainshaft.

Third

Third gear is engaged by sliding the sleeve of the third and top gear synchroniser rearwards to engage with the dog teeth on the third gear, so locking it to the mainshaft. The power train is then from the main drive gear to the countershaft gear, to the third gear then to the third and top gear synchroniser and mainshaft.

Top

Top gear is direct drive, the main drive gear being locked to the mainshaft by the action of the third and top gear synchroniser, which has been moved forward so that the internal teeth on the sleeve engage the dog teeth on the main drive gear.

Reverse

Reverse is engaged by moving the reverse idler gear forward so that it meshes with a spur gear on the countershaft (located between the first and second gear) and also with the spur gear machined on the outer diameter of the first and second gear synchroniser. Power is transmitted from the main drive gear to the front countershaft gear, up to the reverse idler gear and then the reverse mainshaft gear on the first and second gear synchroniser and mainshaft.

F. 2 - GEARCHANGE ASSEMBLY

To Remove

1. From inside the car, remove the tunnel top (see Section 'B'), followed by the gear change lever grommet.
2. Extract the screws securing the sealing plate and aperture seal.
3. Unscrew the nylon gearchange lever cap. Lift out the assembly.

To Replace

1. Use a new gasket between the gear change cover and the lever cap.
2. Replace the gearchange lever assembly. Ensure the cap is tight by tapping with a suitable drift.
3. Replace the aperture seal noting that the shorter flange is towards the fascia panel. Fit the sealing plate.
4. Refit the gearchange lever grommet. Refit the tunnel top (see Section 'B')

F. 3 - GEARBOX ASSEMBLY

To Remove

1. Remove bonnet (see Section 'B').
2. Disconnect the battery.
3. Remove the radiator (see Section 'K').
4. Remove the engine (see Section 'E'), together with the gearbox, after first removing gearbox mounting bracket.
5. Remove gearbox from engine.

To Replace

1. Fit gearbox to engine.
2. Replace engine into car.
3. Refit radiator.
4. Reconnect battery.
5. Refit bonnet.

F. 4 - GEARBOX ASSEMBLY - OVERHAUL

1. Remove the gearbox (Section 'F.3').
2. Drain the oil into a suitable receptacle.
3. Before commencing dismantling, ensure that gears are in the neutral position.
4. Remove the clutch release bearing mechanism (see Section 'Q').
5. Remove the clutch housing by unscrewing and removing the four bolts and lockwashers securing the housing to the gearbox case. If required, drive out the clutch release arm fulcrum pin.
6. Remove the gearbox top cover plate, by unscrewing four bolts and lockwashers securing the cover plate to the gearbox and carefully lift off the cover plate as the selector shaft locking springs are located in the cover plate and can be lost when the cover is removed.
7. Withdraw the selector shaft locking springs and balls from their locations.
8. Ensure that the gearbox is in the neutral position and remove the locking wire from the bolt heads. Unscrew the square-headed taper bolts

- securing the selector forks to the selector shafts.
9. Withdraw the third and top selector shaft to the rear, supporting the sleeve fitted to the third and top selector shaft. Lift out the sleeve.
 10. Withdraw the first and second gear selector shaft and remove the floating pin from the cross drilling at the forward end of the shaft. Rotate the shaft through 90° and remove it from the gearbox casing.
 11. Withdraw the reverse selector shaft to the rear rotating it 90° clockwise to prevent it fouling the extension housing.
 12. Lift the selector forks from the locating grooves on their respective gears.
 13. If required, remove the interlock plungers from their location in the gearbox casing.
 14. Remove the extension housing and mainshaft assembly by unscrewing the bolts and spring washers securing the housing to the gearbox casing.
 15. Remove the speedometer driven gear and the gear bearing from the extension housing.
 16. Withdraw the extension housing.
 17. From the front face of the gearbox case, using a brass drift, drive the countershaft towards the rear a limited amount until it is free from the front of the gearbox case. Using a dummy countershaft push the countershaft completely out of the gearbox. The countershaft gear will now lie at the bottom of the gearbox case permitting the mainshaft to be withdrawn.
 18. Withdraw the complete mainshaft assembly to the rear.
 19. Remove the main drive gear bearing retainer by unscrewing the three bolts and spring washers securing the retainer to the gearbox case. Withdraw the retainer, large circlip and the paper gasket. Carefully tap out the main drive gear.
 20. Withdraw the countershaft gear and the two thrust washers from the gearbox. The countershaft or cluster gear is mounted on forty needle rollers (twenty at each end). A small washer is located on either side of each set of rollers to retain them in position. Push out the dummy countershaft, remove the retaining washers and needle rollers.
 21. Withdraw the reverse idler shaft using Tool No. 'P.7043'. Should this tool not be available, locate a nut, a flat washer and a sleeve on a 5/16in, 25 UNF - 2 threaded bolt, screw bolt into the reverse idler shaft and tighten the nut to withdraw the shaft.
 22. Dismantle the mainshaft by bending back the tab on the lockwasher, and unscrewing the nut securing the speedometer drive gear. Remove the nut, lockwasher, speedometer gear. Extract the locating ball and remove the spacer.

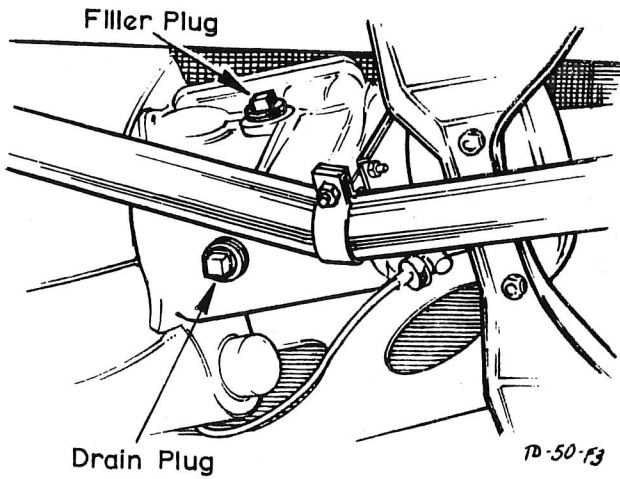


Fig. 3. OIL FILLER & DRAIN PLUGS.

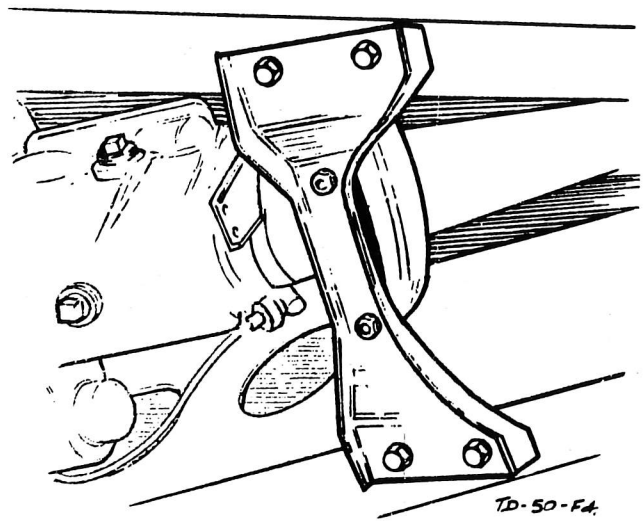


Fig. 4. GEARBOX MOUNTING BRACKET.

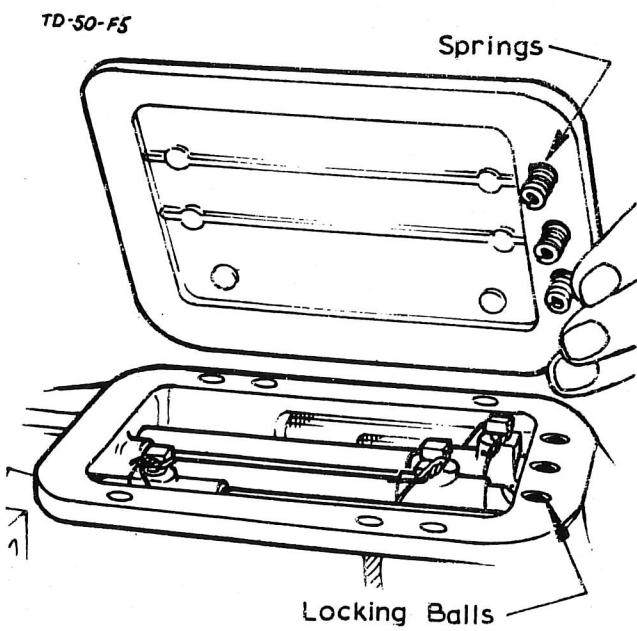


Fig. 5. REMOVING COVER PLATE

23. Remove the third gear and third and top gear synchroniser assembly.
Remove the small diameter circlip at the forward end of the mainshaft.
Press the mainshaft out of the third and top gear synchroniser, and third gear whilst supporting the mainshaft from beneath to prevent it dropping.
24. Press off the mainshaft together with the sandwich plate mainshaft bearing and the first gear bush. Remove the first gear bush locating ball.
25. Press off the second gear and the first and second synchroniser assembly from the mainshaft.

NOTE

The synchroniser hubs and sleeves and also the mainshaft are mated together. Mating marks are etched on the corresponding splines of the hub and sleeve, and near the hub and mainshaft splines. The synchroniser and hub assembly are serviced as a unit consisting of the synchroniser sleeve, three blocker bars, two circular springs and the synchroniser hub.

The first gear rotates on a hardened steel bush that is lubricated via three holes in the first gear adjacent to the dog teeth. Always ensure that these holes are kept clear.

26. Dismantle the main drive gear by removing the circlip securing the main drive gear bearing, support the bearing and press the main drive gear out of the bearing.
27. Extract the oil seal from the rear of the extension housing, examine the extension housing rear bearing bush, and remove it, if necessary, by driving it into the housing.
28. Locate a new bearing and enter it into the rear of the housing with the split in the bush uppermost, i.e. opposite the groove in the extension housing bore. Drive the bearing squarely into position until the rear end of the bearing is flush with the deeper recessed face of the extension housing.
29. Locate a new mainshaft oil seal so that the lip on the seal faces into the extension housing and drive the seal into position in the housing.
30. To overhaul the main drive gear bearing retainer, remove the oil seal from the bearing retainer.
31. Place a new oil seal so that the annular driving face is located in the channel between the sealing lip and the metal case. Drive the seal into position.

To Reassemble the Gearbox

1. Inspect all parts for wear. Any that are considered unserviceable should be replaced.

In the following sequence it is assumed that all precautions regarding cleanliness are taken and that all gaskets, oil seals, and lockwashers are

- renewed.
2. Scribe a mark in line with the centre of the key-way on the outer edge of the bush flange on the mainshaft and another one along the centre line of the speedometer hole as far as the boss of the first and second gear synchroniser hub splines.
 3. Assemble the second gear to the mainshaft so that the dog teeth are towards the rear.
 4. Locate a blocker ring on the cone face of the second gear.
 5. Assemble the first and second gear synchroniser unit. If a new unit is to be installed, slide the synchroniser sleeve (reverse mainshaft gear) off its hub. Clean preservative from the hub, sleeve, blocker bars and springs. Lightly oil.
 6. Fit the synchroniser sleeve over the hub with the mating marks aligned. Locate a blocker bar in each of the three slots cut in the hub.
 7. Install a blocker bar spring in one blocker bar. Note the direction of rotation of the spring. Fit the other spring to the opposite face of the synchroniser unit, ensuring that the spring tag locates in the same blocker bar as the spring previously fitted but, with this second spring running in the opposite direction. Leave the other end of each spring free.
 8. Locate the first and second gear synchroniser on the mainshaft (selector fork groove to the rear) taking care that the mating splines on the hub and shaft correspond.
 9. Fit a blocker ring in the first and second gear synchroniser so that the cut-outs in the blocker ring fit over the blocker bars and hold the components in their place on the shaft.
 10. Place the first gear bush locating ball in the mainshaft.
 11. Locate the hardened steel bush in the first gear with the shoulder on the bush away from the first gear dog teeth. Fit this assembly on the mainshaft so that the dog teeth are located adjacent to blocker ring and first and second gear synchroniser and, with the help of the marks on the shaft and bush ensure that the ball fits in the bush key-way.
 12. Position the sandwich plate on the mainshaft with dowel hole to the rear. Fit the mainshaft bearing. Slightly withdraw the sandwich plate to the rear to fit over the bearing.
 13. Ensure that the cut-outs in the second gear blocker ring (the first one fitted) are aligned with the blocker bars in the first and second gear synchroniser, and also that the mainshaft and hub mating marks are still aligned and press the bearing onto the shaft. Check that the first and second gears are free to rotate. Remove the assembly from the press.

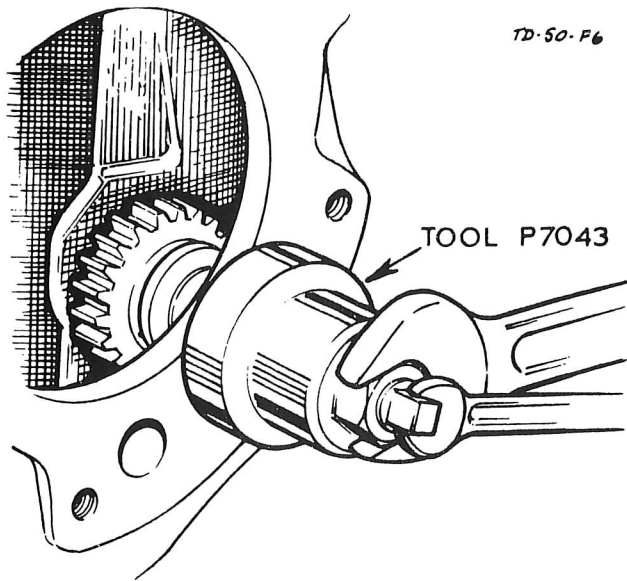


Fig. 6. REMOVING REVERSE IDLER GEAR

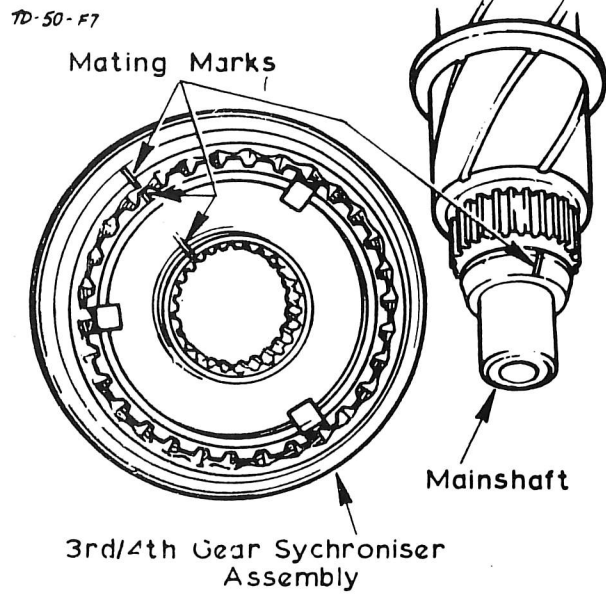


Fig.7. MATING MARKS BETWEEN MAIN-SHAFT & SYNCHRONISER

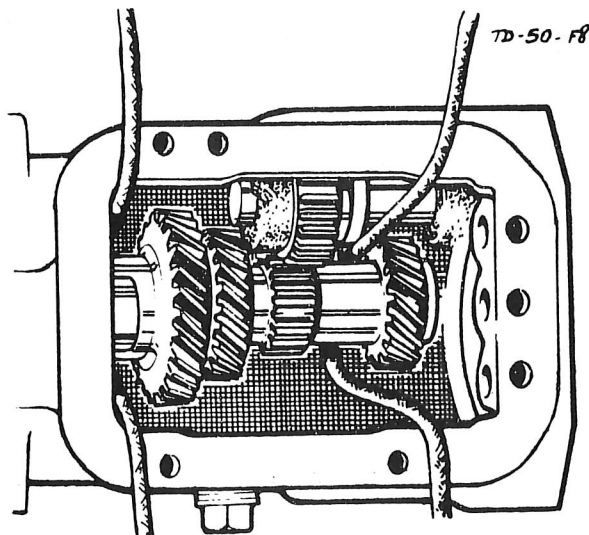


Fig.8. FITTING COUNTERSHAFT

14. Slide the third gear onto the shaft with the dog teeth away from the thrust collar on the shaft and locate the blocker ring on the taper face of the gear.
15. Locate the third and top gear synchroniser hub on the mainshaft with its long boss towards the front of the shaft. Ensure that the mating marks on the hub and shaft correspond.
16. Support the third and top gear synchroniser hub on the adaptor. Locate the shaft so that the mating marks on hub and the shaft are in line. Where the synchroniser hub is sliding fit, ensure that it does not rock on the splines. Fit the circlip in its locating groove to retain the assembly in position.
17. Fit the synchroniser sleeve on its hub with the mating marks in line. Locate a blocker bar in each of the three slots cut in the hub. Install a blocker bar spring (at the rear of the hub) so that the tag end locates in a blocker bar the other end being left free. Note the direction of rotation of this spring. Fit the other spring at the front face of the synchroniser ensuring that the tag on this spring locates in the same blocker bar as the spring previously fitted but with this spring running in the opposite direction. Leave the other end of this spring free also.
18. Slide the spacer onto the mainshaft, install the locating ball for the speedometer drive gear in its seating and fit the gear with shoulder to the rear. Fit the lockwasher over the shaft and locate the tab on the inner diameter into the groove on the inside of the speedometer drive gear. Screw on the nut and tighten to the torque loading given in 'TECHNICAL DATA'. Bend over a section of the outer edge of the lockwasher so that it securely locks the nut.
19. Position the main gear bearing on the gear, with the external circlip groove on the bearing away from the gear, support the assembly with the main drive gear and press the bearing right home on the gear. Fit the smaller diameter circlip in the groove provided in the shaft of the main drive gear.
20. Reassemble the countershaft. Fit a retaining washer to abut the machined shoulder inside the gear, one at either end. Oil the needle rollers and locate twenty in the recess in the countershaft gear. Fit a retaining washer then insert the dummy countershaft to retain the rollers in position. Repeat this procedure at the other end of the countershaft. Locate the thrust washers in position in the gearbox. Ensure that the tongues on each washer are located in the machined recesses in the gearbox.
21. Position the countershaft gear in the bottom of the gearbox casing, taking care not to displace the thrust washers. A piece of string fitted under either end of the countershaft gear at this stage will facilitate assembly later. See Figure 8.

22. Fit the large diameter circlip in its locating groove on the main drive gear bearing and fit the main drive gear in the gearbox.
23. The internal diameter of the seal is smaller than the external diameter of the main drive gear splines, which on assembly, should be covered with masking tape to protect the seal. Place a new gasket on the gearbox front face and fit the retainer, ensuring that the oil slot in the retainer is in line with the drain hole in the gearbox casing. Coat the three retaining bolts with a jointing compound, fit a spring washer on each bolt, then tighten the bolts securely. Remove the masking tape from the main drive gear splines.
24. Position the reverse idler gear with the groove for the selector fork towards the rear of the gearbox. Fit the shaft in the case and through the gear so that the flats will line up with the locking recess in the extension housing.
25. Install the needle roller bearing in the bore of the main drive gear, and fit a new gasket over the rear face of the gearbox.
26. Position a blocker ring over the taper face of the top gear and a cork gasket over the rear face of the gearbox case.
27. Pass the mainshaft assembly through the rear of the gearbox, locating the mainshaft spigot in the roller bearing in the bore of the main drive gear. As the mainshaft is tapped in, the mainshaft bearing carrier plate will fit into the recess provided in the gearbox. Align the dowel pin with the central selector shaft hole ready for the assembly of extension housing.
28. Carefully, with the aid of the pieces of string (see operation 21), lift the gear into mesh with the mainshaft and main drive gear and, taking care that the thrust washers are not displaced, carefully refit the countershaft from the rear, keeping it in contact with the dummy shaft. Tap the countershaft in, so that the front face just protrudes from the front face of the gearbox case, ensure that the locking face at the rear of the countershaft is positioned so that it will mate with the locking recess cast in the extension housing. Remove the string.
29. Fit the extension housing. Ensure that the cork gasket, is correctly located. Pass the extension housing over the mainshaft whilst ensuring that the dowel in the main bearing carrier plate locates in the drilling provided in the housing. Secure the extension housing to the gearbox case with the bolts (suitably covered with jointing compound) and spring washers.
30. Refit the clutch housing and secure in place with its bolts and lockwashers. Fit the fulcrum pin if it has been removed.
31. Check that all gears can be obtained, then place all gears in the neutral position.
32. Assemble the clutch release mechanism (see Section 'Q').

33. Reassemble the selector mechanism by ensuring that the interlock plungers are correctly located in the front face of the box. If the interlock plungers have been removed it will be necessary to withdraw the expansion plug from the right-hand side of the gearbox casing to correctly locate the plungers. Push the plunger into the casing until it is located in the first cross drilling. Locate the other plunger in a similar manner. Fit a new expansion plug.
34. Locate the selector forks on the gears, ensure that the gearbox is in neutral and install the reverse gear selector shaft turning it through 90° .
35. Align the hole in the shaft with the bolt hole in the selector fork and fit the square-headed bolt, tighten it securely and lock with soft iron wire.
36. Install the first and second gear selector shaft, turning this shaft through 90° to prevent it fouling the extension housing. Before the shaft is pushed fully home check that the floating pin is located in the shaft and then set the shaft in the neutral position. Align the hole in the shaft with the bolt in the selector fork and fit the square-headed taper bolt, tighten it securely and lock with a soft iron wire.
37. Install the third and top gear selector shaft. Locate the floating sleeve on the third and top gear selector shaft before pushing this through the fork and into the gearbox case. Align the hole in the shaft with the bolt hole in the selector fork and fit the square-headed taper bolt, tighten it securely and lock with soft iron wire. Ensure that all selector fork locking bolts are tightened and locked with soft iron wire.
38. Check that all gears can be selected and then leave them in the neutral position. Position a new gasket on the top face of the gearbox and install the selector shaft locking balls and springs. Fit the gearbox cover plate, ensuring that the springs are correctly located in the drillings and secure it with four bolts and lockwashers.
39. Refit the gearbox (see Section 'F.3') and refill with oil.

ADDITIONAL INFORMATION

F.5. - 'JUMPING OUT OF GEAR'

Where the above problem is experienced, the following procedure is recommended.

1. Remove the gearbox top cover and invert it.
2. Place the 3 selector springs in their recesses in the cover and measure how far they protrude above the face of the cover with the gasket in position. The

dimensions must be within .335/.375 in. (8.5/9.5 mm.). If necessary, the dimension can be achieved by the addition of steel shims .25 in. (6.35 mm.) diameter x .048 in. (1.219 mm.) thickness, inserted below the springs in their recesses in the cover.

3. Check that no radial clearance can be felt in the reverse idler gear and that there is no casting 'flash' adjacent to reverse gear which could impede the selection of 'reverse'. Replace the top cover.
4. Check that movement of the gear lever is not impeded by the lip at the top of the nylon gearchange lever cap (see Fig.9), thus preventing full engagement of the gears. If necessary, trim this lip with a knife to obtain sufficient clearance.

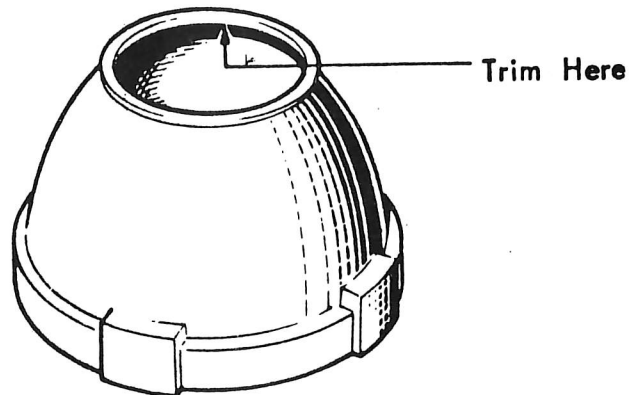


Fig. 9. GEARCHANGE LEVER CAP

5. Check that the reverse lamp switch does not impede forward movement of the reverse gear selector rod. If necessary, slacken the locknut and adjust the height of the switch body.

F.6 - GEARBOX NOISE

It is recommended that where normal noises emitted from the gearbox are offensive to the ear, the following action be taken.

- a. Replace the existing lower seal of the gear lever aperture with a new seal (Part No. 050 F 6000).
- b. On 'S' models, replace the gearshift lever surround felt with the new felt (Part No. A050 B 1802), this new felt continuing forward behind the facia panel. On models other than 'S', it will be found advantageous to fit the felt, as none was fitted originally.

F.7 - GEARBOX FAULT FINDING

FIRST, ascertain that a problem exists. Check the car on the road with the Customer driving. Let him (or her) demonstrate the defect. This will show exactly what the problem is and also provide an opportunity to check that the Customer is using the gearbox correctly. Proceed as follows:

1. OIL LEAKS

It must be remembered that any leaking oil will be blown backwards by the car's motion, thus giving a false location of an oil leak. The following gives some of the less obvious possible locations.

a. Extension Housing Seal: Check that oil is not leaking from the welch plug in the end of the propeller shaft yoke. Check that oil is not leaking from the gear lever pivot, reverse stop plug or the turret screw.

b. Extension Housing to Gearbox Casing Gasket: Check that oil is not coming from the top cover plate or from the rear cover plate/gear lever pivot. Ensure that the rear cover is correctly fitted (i.e. vent hole to the rear). Check that oil is not leaking from the speedometer drive, or drive blanking plug. Check that oil is not coming from the extension housing retaining bolt threads.

c. Main Drive Retainer: Before replacing the oil seal, check for pressure of oil inside the retainer bore. If no oil can be seen, then the seal is not leaking. This points the leak to either the main drive gear retainer gasket, or past the threads of the retaining bolts. Ensure that the oil is not leaking past the crankshaft rear oil seal.

2. GEARBOX NOISES

a. Gear Noise: Some noise is inevitable with a new gearbox, or when new gears have been fitted. These noises will decrease as the mating parts 'bed-in'. Do NOT dismantle a new gearbox or attempt rectification until the gearbox has been in Service for at least 1,000 miles (1,600 km.) unless the noise is indicative of a serious failure, or if continual running will result in serious damage. If the noise is still excessive after 1,000 miles (1,600 km.),

it will then be necessary to dismantle the gearbox and examine the individual gears. Careful testing prior to dismantling will direct the examination to the defective gear(s), (i.e. drive or over-run side of gears, constant mesh if in all gears, etc.) If the noise occurs on the over-run in either 1st, 2nd or 3rd. gears inspect the main drive gear on the over-run side of the teeth for incorrect bearing pattern. When the bearing can be seen to be heavy at the dog teeth end, with about half the tooth length showing contact, the main drive gear only should be replaced. These wear conditions produce a known source of noise problems. Knocks or clicks can be seen as a bright point on the gear tooth surface usually at the tip or end of the tooth adjacent to a damage mark on the outside of the tooth. With good diagnosis these can be stoned down and rebuilt. This will eliminate the necessity of fitting a new gear for what is in fact, a very minor and easily rectified error. Gear teeth should have a smooth finish and the wear pattern should be evenly disposed on each tooth.

b. Knocking or Tapping: This is usually caused by a gear tooth imperfection (burr, high spot, chip etc.). It may be evident in one particular gear or in all gears if the main drive pair are at fault.

c. Bearing Noise: This is a growling noise. It is indicative of a bearing breaking up. If the noise is evident in the intermediate gears only, then the mainshaft spigot bearing is suspect. If the noise is evident in all gears, including neutral, then the main drive gear (probably) or the countershaft rollers (possibly) are suspect.

Note: If with the car stationary and the engine running, a noise is evident when the clutch pedal is depressed, DO NOT suspect the gearbox. It should be obvious that, under these conditions, no part of the gearbox is moving and thus cannot cause a noise.

Literal descriptions of audible noises are always open to mis-interpretation and dispute. While the foregoing descriptions will be helpful, it is advisable for Dealer personnel to accumulate sufficient experience to be able to diagnose noises quickly and accurately and it is most important that the car owner should demonstrate the defect.

3. GEAR LEVER SIZZLE

a. Hissing noise from base of gear lever whilst on drive and over-run: Check the surface finish of the synchroniser sleeve selector fork groove. The finish should be smooth and flat with no nicks or burrs.

Note: The 'sizzle' noise may be amplified by a damaged or badly fitted gear lever boot. Check the run-out on the synchroniser sleeve. This should NOT be more than .020 in. (.51 mm.).

4. JUMPING OUT OF GEAR

a. Disengagement of gear on drive or over-run:

Checks with gearbox still in car: Check gear linkage adjustment. Ensure that there are no damaged or distorted components and that there is no excessive free movement. Check for broken or cross-threaded gear lever cap. Replace any necessary components and adjust linkage.

Note: If linkage is adjusted and the problem is cured, there is normally no need to take further action. Consideration should however, be given to removing the gearbox to rectify any damage to the gearbox components caused by the 'jump out'. Ensure there is adequate clearance between the gear lever and the centre console, with the lever in gear. Replace cap or lever as necessary.

Checks with gearbox removed from car: Ensure there is adequate clearance at each end of the selector rails in each gear and also at the over-run stop when the gear is engaged. Ensure that the interlock plungers and detent balls are free and fully seating in the groove in the rails. Remove the gearbox top cover and check the selector mechanism. Fit selector rail with solid end (Part No. 2824E-7K335-A).

Forward gears only: Check the mainshaft end-float. It should not exceed .030 in. (.76 mm.). Remove the mainshaft assembly and dismantle the area required (i.e. if it jumps out of 1st. gear remove the components associated with 1st gear).

Check that the tab washer retaining the mainshaft nut is intact. The tab washer should prevent the nut from turning. If the bearing is retained by a circlip, ensure that the circlip directly behind the mainshaft bearing is of the correct type and is correctly seated in its groove. Examine the gear and sleeve dog teeth for back-angling (1st and 3rd gears only), which must be evenly disposed. Check all dog teeth for damage (chipped teeth, etc.). Check that the sleeve is a good sliding fit on the hub.

If either the gear or the sleeve is damaged, then the damaged component and the synchro ring should be renewed. Examine the appropriate selector fork for wear. If the wear is excessive, then the forks should be renewed. Ensure the selector forks are fitted the correct way around. Check hub and sleeve assembly for damage and renew if necessary.

Reverse gear only: Check that the reverse idler gear can be fully engaged with both main-shaft and countershaft gears. Ensure that the idler gear bush is correctly positioned in the bore of the gear and not misplaced. Check that the bush is a good fit on the idler shaft. If the idler gear is damaged it should be renewed. Also check associated components (cluster gear, 1st/2nd hub and sleeve assembly, etc.), which may have been damaged. Check that the 1st/2nd gear sleeve is a sliding fit on its hub. Replace gear and bush assembly.

5. GEARSHIFT PROBLEMS

- a. Difficult selection - Stiff movement of lever throughout its travel, or in one plane:-
- b. Baulking - Gear will not go in first time but will go in second or third attempt:-
- c. Notchiness - Undue increase in effort when engaging a gear:-

Checks with gearbox still in car: Check clutch operation (see Section 'Q' of this publication). Engage gear once, pull out and re-engage. There should be no baulking with clutch disengaged. Examine selector rails. Remove gearbox.

Checks with gearbox removed from car: Check that the selector rails with the selector forks disconnected, slide freely when the selector balls, or plungers and springs are removed. Hold the rails not being checked, in the neutral position. Check that all the interlock plungers and the detent balls and springs are fitted. Check that their operation is not restricted by swarf, etc., (see also mainshaft checks). Clean out swarf, fit new components and check operation. Check that the correct selector rail is fitted (compare with a new part). Check that the notches for the interlocks and the balls are correct. Ensure that the 'flat' to allow oil dispersion is machined on the rail.

Mainshaft: Check the mainshaft end-float. It should not exceed .030 in. Maximum (.76 mm.). Remove the mainshaft and measure the end-float of the gears (see Technical Data). Check that the tab washer retaining the mainshaft nut is intact. The tab washer should prevent the nut from rotating. If the bearing

is retained by a circlip, ensure that the circlip directly behind the mainshaft bearing is of the correct type and is correctly seated in its groove. Remove. Remove the 3rd/4th or 1st/2nd synchroniser assembly (which one to remove obviously depends on which gear was difficult to engage.) Check that the insert springs are correctly assembled, ensuring the ends of both springs pick up in the same blocker bar and that they are both either positioned in a clockwise or anti-clockwise direction as viewed from the front. Check also that the inserts are not damaged. Examine the synchroniser ring insert slots for signs of damage. Renew only the components that are damaged. Do not renew the complete synchroniser assembly, unless either the sleeve or hub itself is damaged. Dismantle the mainshaft and re-build, using new components as required to give correct end-floats. Check that the sleeve is a good sliding fit on the hub. Inspect the dog teeth on the gear, sleeve and synchroniser ring. Check for damage and offset chamfering. If the synchroniser ring only is damaged then renew only the synchroniser ring. If either the gear or sleeve is damaged renew this part and the synchroniser ring.

Note: Sleeve teeth can have up to .020 in. (.51 mm.) 'flat' across each apex, before the gear needs to be replaced. Renew synchroniser assembly.

6. GEAR LEVER VIBRATION

a. Violent fore and aft forced vibration of the gear lever:

Using feeler gauges, measure the clearance between the over-run stop tube and the rear end of the 3rd/Top selector fork boss with 3rd gear engaged. This dimension should not be greater than .005 in. (.127 mm.). If it is in excess of this figure it will be necessary to fit a new stop tube (Part No. 2821E-7A072-B), and a graded clip so that the gap is reduced to less than .005 in. (.127 mm.). The graded clip has a basic part number of '2821E-7K714' plus a suffix which varies with the thickness. Do not fit a graded clip which is too large; this can lead to 3rd gear 'jump out'. The Service stop tube is colour-coded RED. A plain tube without a circlip is fitted in Production. Circlips must be fitted with the plain tube. Check the mainshaft end-float which should not exceed .030 in. (.76 mm.). If it does, check that the tab washer retaining the mainshaft nut is intact. The tab washer should prevent the nut from rotating. If the bearing is retained

by a circlip ensure that the circlip directly behind the mainshaft bearing is correctly seated in its groove. Remove the selector mechanism and rails to gain access to the 3rd/4th synchroniser sleeve. Measure the run-out of the side of the fork groove, with the sleeve in the 3rd gear position, using a suitable dial indicator. Place a dummy propshaft on the end of the gearbox to simulate a load. The run-out should be measured while rotating the input shaft to simulate driving conditions. This should be repeated three or four times with the gear dog teeth engaging on different teeth on the sleeve. If the run-out exceeds .020 in. (.51 mm.) the synchroniser assembly should be renewed.

7. GEAR 'CRASHING'

a. A characteristic grating or crashing noise which occurs when engaging a gear:

Checks with gearbox still in car: Check clutch operation (see Section 'Q').

Note: If it is found that the crashing is caused by defective clutch operation, consideration should be given to whether any further work is required. This decision should be based on the severity of the crashing and the length of time it has been evident.

Checks with gearbox removed from car: Check that all the synchroniser rings are fitted. Dismantle the mainshaft and examine the dog teeth on the gear and sleeve, renew damaged components and re-build the mainshaft with synchroniser rings. Remove the mainshaft assembly and dismantle the area required (i.e. if it crashed in 1st gear, only dismantle the components associated with 1st gear). With the synchroniser still assembled check that the insert springs are correctly fitted. They should run anti-clockwise (starting from the tang) when viewed from either side, sldo the spring tangs should be located in the same insert. Check the inserts themselves are undamaged. Inspect the dog teeth on the synchroniser ring, sliding gear and the gear. If either the sleeve or the gear is undamaged then renew this part and the synchroniser ring. Inspect the synchroniser ring for wear of the internal thread. Examine the gear cone finish for signs of grooving or chatter marks. The cone should have a smooth lightly polished surface. When the blocker ring is screwed onto the cone it should grip the cone when turned under hand pressure; if it does not, determine whether the gear or synchroniser ring is at fault.

lightly polished surface. When the blocker ring is screwed onto the cone it should grip the cone when turned under hand pressure; if it does not, determine whether the gear or synchroniser ring is at fault.

8. JAMMING IN GEAR

a. Impossible to disengage gear: Check the gearchange linkage. Remove the gearbox top cover and reset the linkage correctly. Check that the selector forks or selector lever is securely attached to the selector rails. Check that all the interlock plungers are fitted. Secure the fork or selector arm to the rail. Remove the old pin or screw from the inside of the gearbox. Examine the selector rails. Ensure that they are free to move. Check that they are not distorted or jammed by foreign matter between the selector rails and the gearbox casing. Dismantle and rebuild with interlock plungers (check that the interlock plungers that should have been fitted are not loose in the bottom of the casing).

Note: If gears are difficult to disengage check the mainshaft end-float.

9. BLOCKER RING RATTLE

a. Screeching noise from gearbox when driving in any forward gear. Most noticeable in 2nd gear: To overcome this problem, select parts to give a minimum clearance of .004 in. (.102 mm.) between the blocker ring and synchroniser hub recess.

10. GEARBOX REPAIRS

When replacing any parts in the gearbox check that the new components are free from any possible defects such as back-angling, chamfering, pits and clearances, etc.

This is particularly important with regard to damage on gear teeth, as a nick or burr on a tooth will necessitate a second repair. Storage and handling of gears during repair is also vitally important.

Where damage has been found to a gearbox part, such as dog teeth, it is important that the casing be washed out prior to re-assembly as these particles will only cause further damage. It may be necessary to remove the cluster gears where excessive foreign matter has been found.

New circlips, roll pins and gaskets must be fitted where these have been removed or disturbed and Hylomar sealer should be applied to all bolt threads on re-assembly to prevent oil leakage.

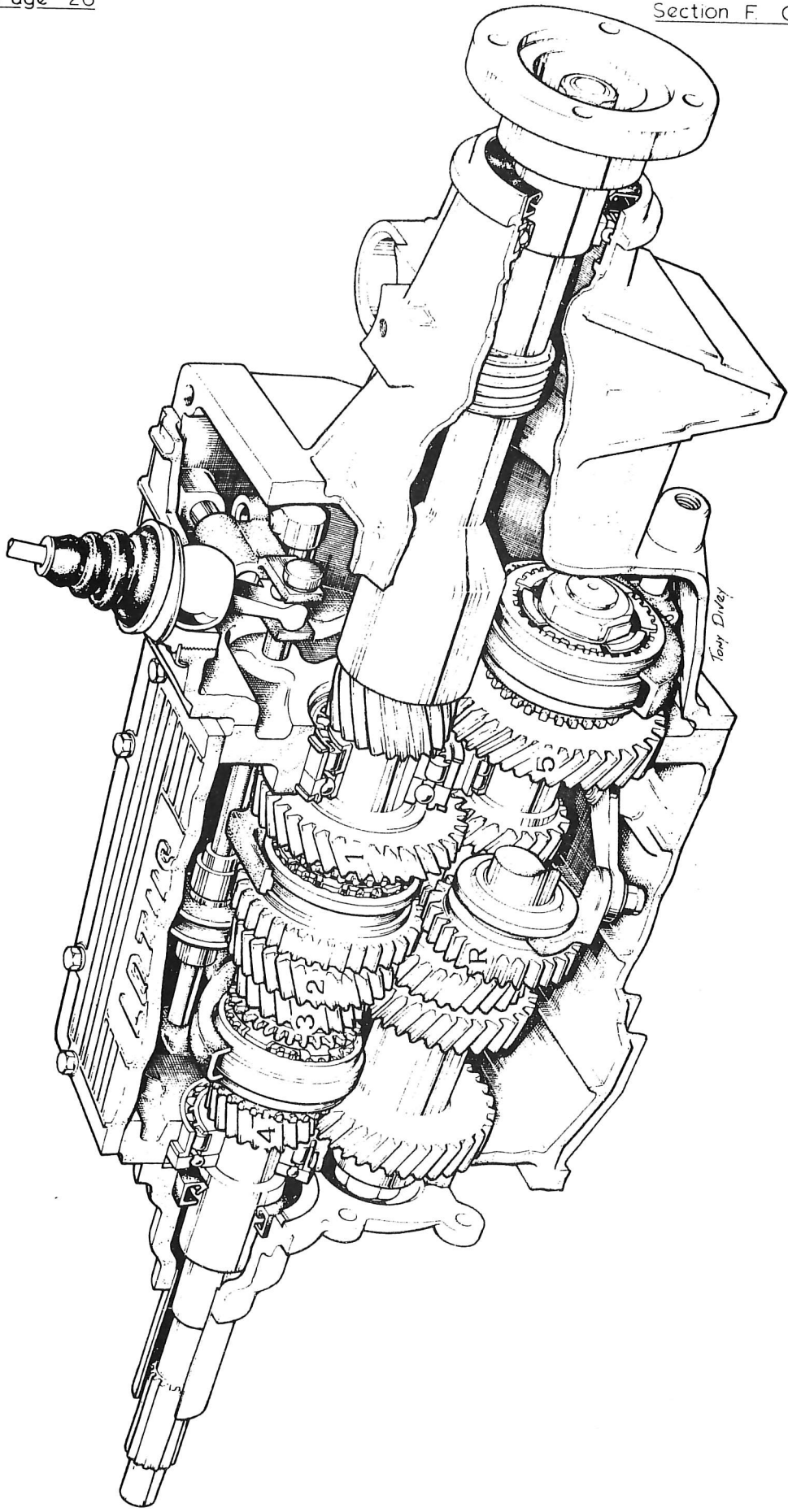


Fig. 10. 5 Speed Gearbox Assembly.

F.8 - 5 SPEED GEARBOX ASSEMBLY

To Remove

1. Remove the bonnet (see Section 'B').
2. Disconnect the battery (see Section 'M').
3. Remove the radiator (see Section 'K').
4. Disconnect the propeller shaft at the differential flange. Do NOT disconnect the forward end of the shaft at this stage.
5. Remove the engine/gearbox as an assembly (see Section 'E'). Immediately the front end of the propeller shaft is clear of the chassis diaphragm (when lifting the engine/gearbox assembly), it can be disconnected from the gearbox. It is NOT RECOMMENDED that the propeller shaft be disconnected at the sliding joint, as this could affect the balance on replacement, particularly if the splines within the shaft are NOT located in their original alignment.
6. Remove gearbox from the engine, and if further dismantling is necessary, mount on a suitable stand.

To Replace

1. Fit gearbox to the engine. Select 4th. gear, then remove gearshift lever. If the gears are left in Neutral when the lever is removed, there is a possibility that the selector link (B, Fig.11) may become detached from the selector extension shaft ball end (C, Fig.11).
2. Position the engine/gearbox assembly in the engine compartment, then attach the forward end of the propeller shaft to the flange on the gearbox. Before finally pushing the assembly in to its location, connect the speedometer cable on the gearbox, ensuring that right-angled drive is positioned to point forwards, obliquely to left. Replace the engine/gearbox assembly by reversing the removal procedure. When refitting the gearshift lever, it will be found much easier if the circlip (located just above the rubber bellows) is removed. This action releases the tension on the threaded portion of the lever, thus ensuring that its threads are NOT crossed. Using Special Tool (32A) fully tighten the gearshift lever, replacing the circlip on completion.

3. Refit the propeller shaft to the differential flange.
4. Replace the radiator, reconnect the battery and replace the bonnet.
5. Finally, with the car standing on its wheels, check the oil level (socket-headed screw at right-hand front side.)

F.9 - GEARBOX ASSEMBLY OVERHAUL

To Dismantle (see also Section F.11)

1. Remove the gearbox and drain the oil into a suitable receptacle, noting that the SOCKET-HEADED, NOT the domed-headed plug, is the drain plug.
2. Release the six bolts and remove the bellhousing. Do NOT misplace the ring dowels.
3. Release the four bolts and remove the gearshift lever cover, together with its gasket.

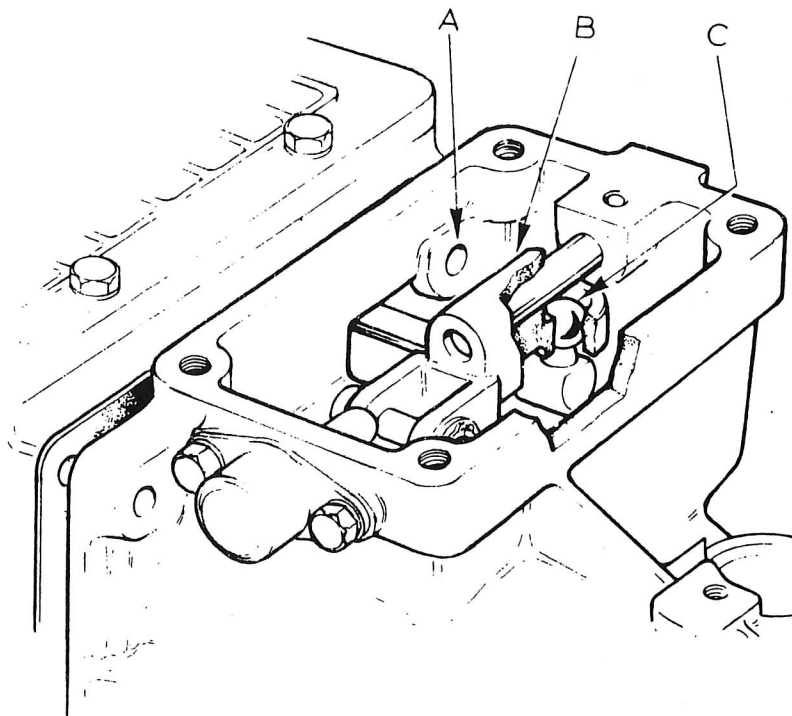


Fig. 11. OUTPUT SHAFT HOUSING

4. Release the seven bolts securing the output shaft (tailshaft) housing to the main casing, noting that one of the seven bolts is located inside the output shaft housing at the upper R/H corner (A, Fig.11). Ease the selector link (B, Fig.11) from the selector extension shaft ball end (C, Fig.11) and remove output shaft housing together with its gasket. Do not misplace ring dowels.
5. Release the eight bolts securing the top cover to the main casing, and remove cover together with its gasket.
6. Release the six bolts securing the front cover. Remove cover, together with its gasket, noting that seal and spacer will be removed with cover.
7. Attach main casing to a suitable gearbox stand.

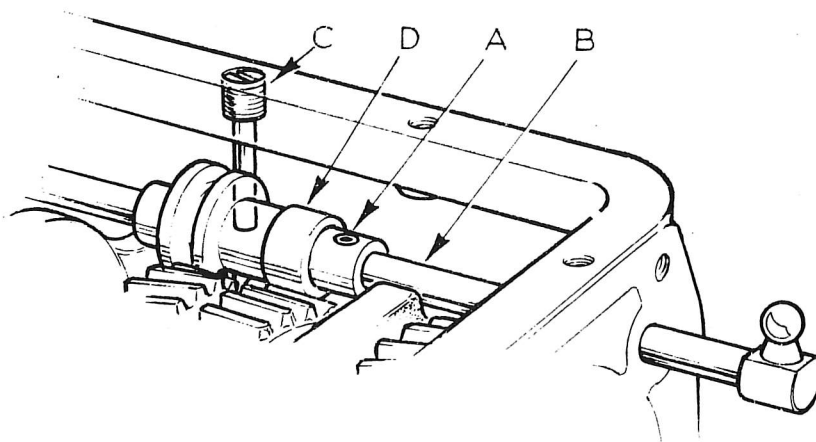


Fig. 12. INTERLOCK SPOOL AND SELECTOR SHAFT

Main Casing

1. Support selector extension shaft and push out roll pin (A, Fig.12). Remove shaft extension (B, Fig.12).
2. Release locating pin (C, Fig. 12) for interlock spool (D, Fig.12) at right-hand top of casing. Remove interlock spool and selector shaft (E, Fig.12).
3. Lock in any two gears and remove nuts from both ends of layshaft, noting that they are secured with lockwashers. Note that the front nut is threaded left-hand, whereas the rear nut is threaded right-hand. Remove the nut (A, Fig.15) at the rear end of the third motion shaft, (Left-hand thread).

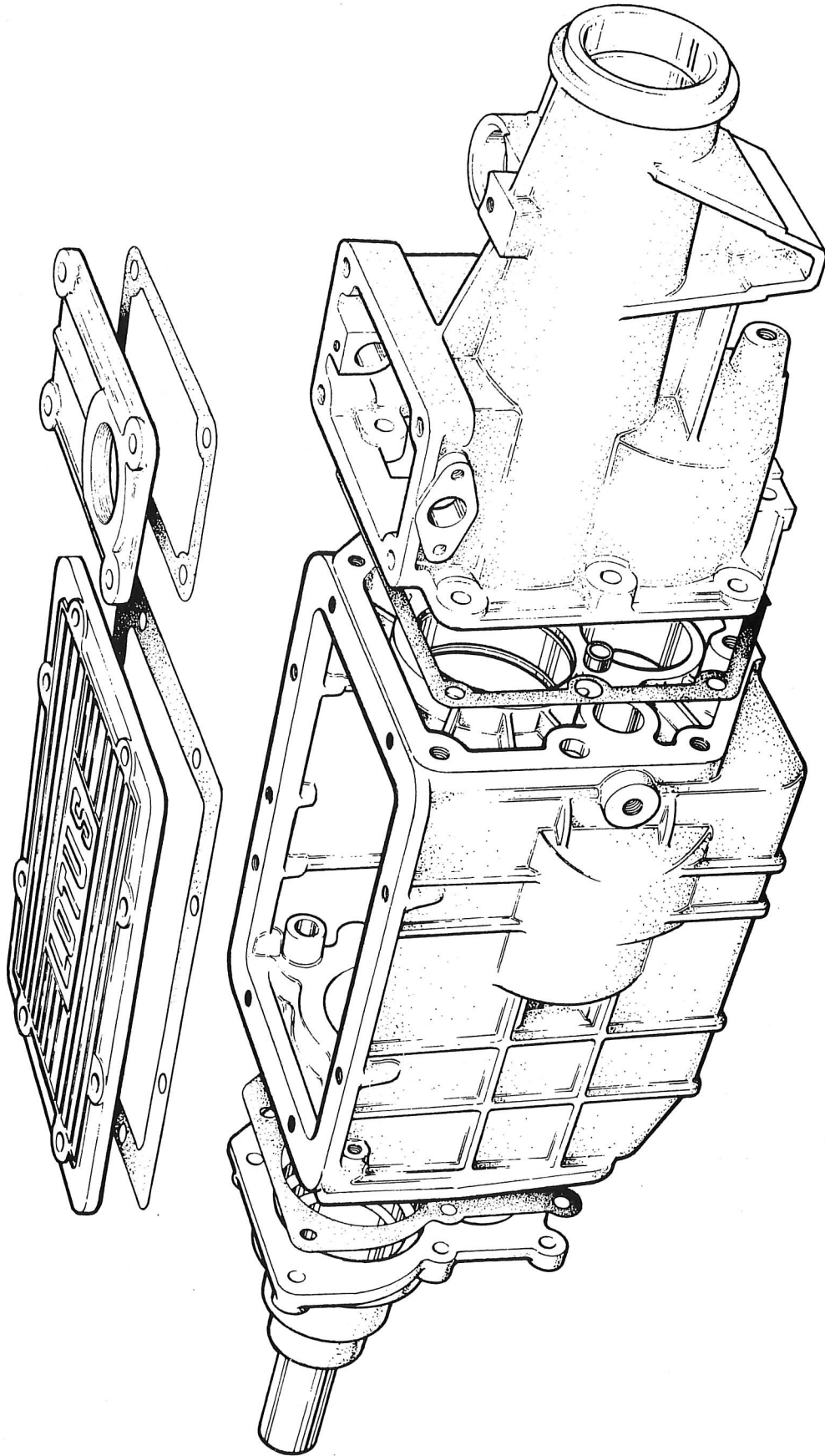


Fig. 13. GEARBOX CASINGS & COVERS

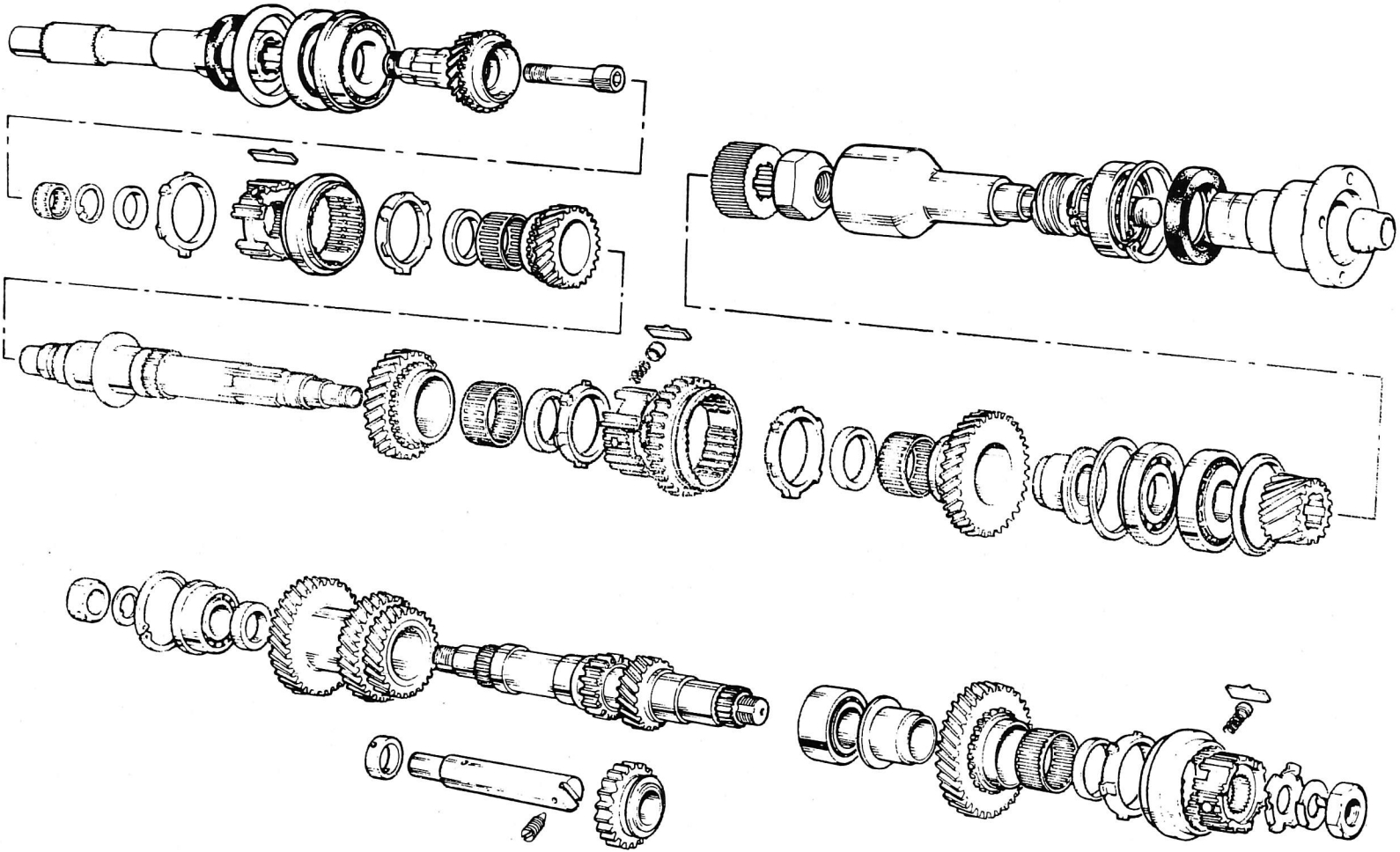


Fig. 14. GEARBOX INTERNAL COMPONENTS

- Using a suitable puller, remove the output shaft (tailshaft) adaptor (B, Fig.15).

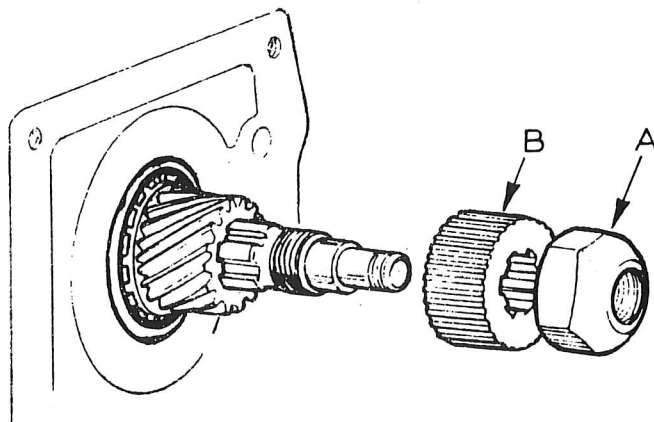


Fig. 15. 5th. GEAR PINION, ADAPTOR AND NUT

- Select Neutral. Release bolt securing the 5th. gear selector fork (A, Fig 16) and remove fork, 5th gear synchroniser (B, Fig.16), baulk ring (C, Fig.16), bearing spacer (A, Fig. 17), 5th gear (B, Fig.17), 5th. gear needle bearing (C, Fig. 17) and its bearing hub (D, Fig.17).

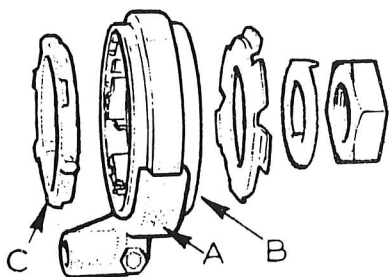


Fig. 16. 5th. GEAR SYNCHRONISER

Remove Reverse idler shaft and collar.

- Push out roll pin (A, Fig.19) securing the collar (B, Fig.19) to the Reverse idler shaft (C, Fig.19). Release locating screw for Reverse idler shaft, this being the socket-headed screw at left hand rear of casing.

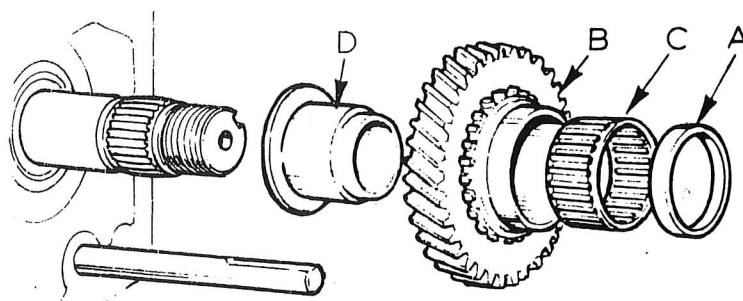


Fig. 17. 5th. GEAR, BEARING, SPACER AND HUB

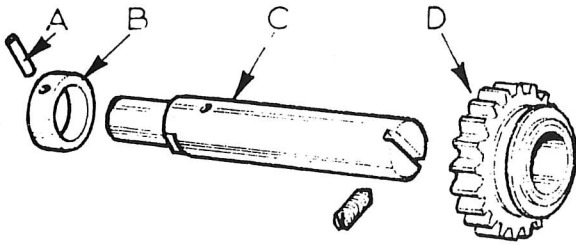


Fig. 19. REVERSE IDLER SHAFT ASSEMBLY

7. Push the Reverse idler gear (D, Fig.19) clear of the laygear, then using puller (18G284) and adaptor (18G284AE) screwed on

to rear end of layshaft, pull out the layshaft together with the rear bearing. As the layshaft (A, Fig.20) is removed, the laygear (B, Fig.20) with its spacer (C, Fig. 20), will drop to the bottom of the casing.

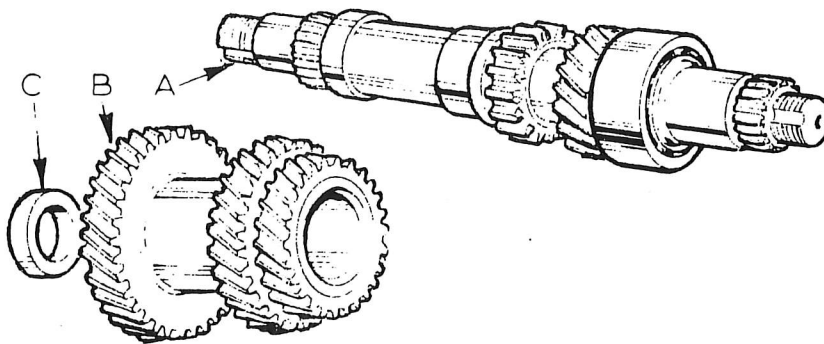


FIG. 20. LAYSHAFT AND LAYGEAR

8. Insert adaptor (18G284AAC/2) between 4th. gear and the 1st. motion shaft bearing, ensuring that the 'thin' face is against the bearing (Fig. 21). Using puller (18G284), with adaptors (59A, 60A and 61A), withdraw the 1st. motion shaft assembly (of which the 4th. gear is a part), and remove needle bearing and the 4th. gear baulk ring.

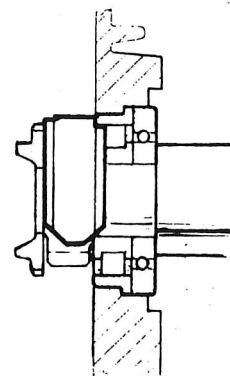


Fig. 21. ADAPTOR 18G284AAC/2 IN POSITION

9. Remove the selector shaft locating screw, this being the socket-headed screw on the right-hand front of casing. Turn the shaft (A, Fig. 22) through 180° and push out towards front of casing. As the shaft is pushed through the selector forks (B and C, Fig.22), insert the dummy shafts (Special Tool 14A) into the forks to retain the detent springs and balls.

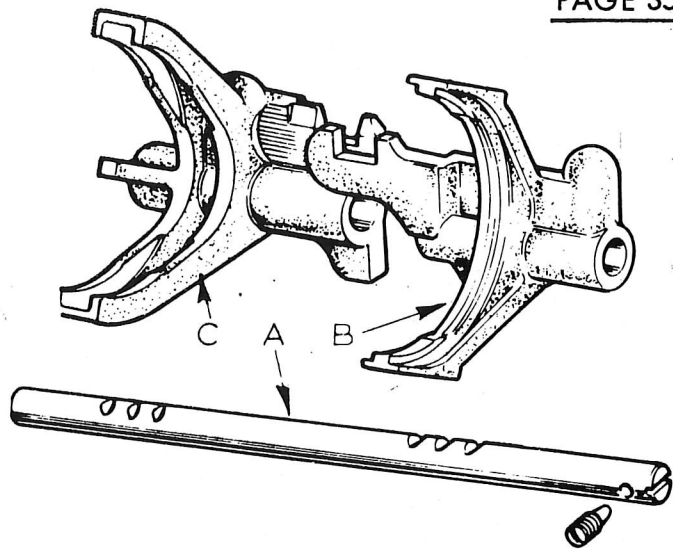


Fig.22. SELECTOR FORKS AND SHAFT

10. Remove the 1st./2nd. (B, Fig.22) and 3rd./4th. (C, Fig.22) selector forks.

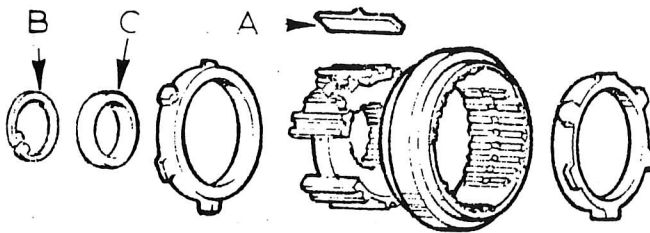


Fig. 23. 3rd./4th. SYNCHRONISER ASSEMBLY

11. Remove the three keys (A, Fig.23) from the hub of 3rd./4th. synchroniser assembly. Remove the circlip (B, Fig.23) locating the hub, and the selective spacer (C, Fig.23). Slide

out the hub taking care NOT to misplace the three plungers and springs. The synchro collar of the 3rd./4th. synchroniser assembly is removed by first sliding 3rd. gear towards the front, then rotating the collar over 3rd. gear to clear the 3rd. motion shaft (Fig.24).

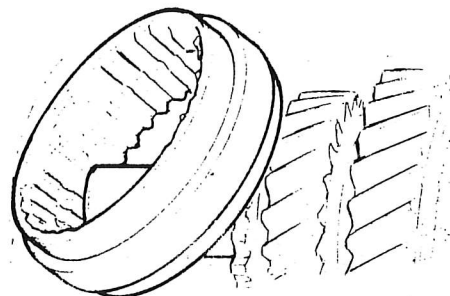


Fig.24. REMOVING SYNCHRONISER COLLAR

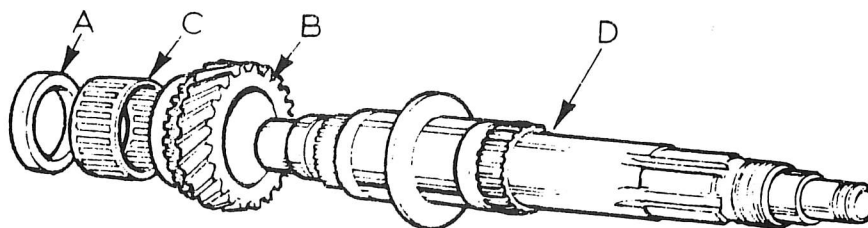


Fig. 25. 3rd. GEAR AND 3rd. MOTION SHAFT

12. Remove the 3rd. gear baulk ring spacer for bearing (A, Fig. 25), 3rd. gear (B, Fig. 25.), and needle bearing (C, Fig. 25) from the 3rd. motion shaft, (D, Fig. 25). From the rear of the casing, using drift (18G1155), push out the 3rd. motion shaft. The action of pushing out the shaft will release the final drive pinion.

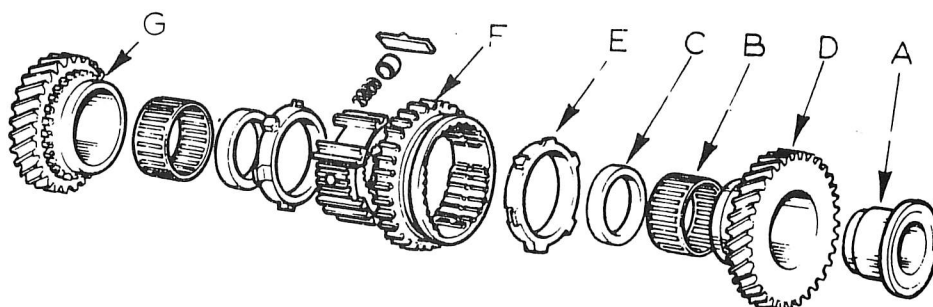


Fig. 26. 1st. AND 2nd. GEAR ASSEMBLIES

13. Remove bearing hub (A, Fig. 26.), bearing (B, Fig. 26.), hub spacer (C, Fig. 26.), 1st gear (D, Fig. 26.) baulk ring (E, Fig. 26.), 1st./2nd. synchroniser assembly, (F, Fig. 26.), the second baulk ring, the second spacer, the second bearing and 2nd. gear (G, Fig. 26.). Keep hub with its own gear.
14. Remove laygear, spacer and Reverse idler gear from bottom of casing.
15. Release circlip from front layshaft bearing and using puller (18G248) with adaptor (18G284AL), remove front layshaft bearing.
16. Release circlip from 3rd. motion shaft rear bearing. Using puller (18G284) with adaptor (18G284AM/1, remove bearings.

17. From beneath exterior of casing, remove the 5th./Reverse selector detent plug (domed-headed), with its spring and plunger
18. Rotate 5th./Reverse selector shaft (Fig.27) through 180° such that the 'flat' on shaft will clear the Reverse arm when it is withdrawn. Using dummy shaft (14A), tap out existing shaft towards front of casing. As the existing shaft is tapped out, the dummy shaft will enter its location, thus retaining the spring, ball and plunger in the Reverse interlock assembly. Note also, that as the existing shaft is removed, the core plug in the front wall of casing will be displaced from its location.

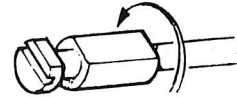


Fig. 27. REVERSE SELECTOR SHAFT

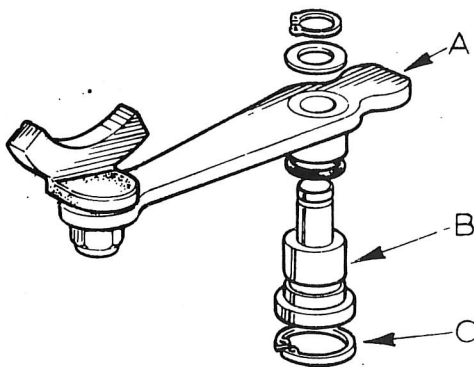


Fig. 28. REVERSE SELECTOR ASSEMBLY

19. Remove the circlip and washer retaining the Reverse selector lever (A, Fig.28) to its pivot (B, Fig.28). From beneath the exterior of casing, release the circlip (C, Fig. 28), and withdraw pivot complete with 'O' ring.

20. Remove Reverse selector lever and selector interlock (A, Fig.29). Release the two bolts (B, Fig.29) with their locking plate, securing the interlock plate (C, Fig.29) to the casing. Note that spacers (D, Fig.29) are fitted between the plate and the casing. Pull the sleeve nuts (E, Fig.29) with their 'O' rings from the exterior of the casing.

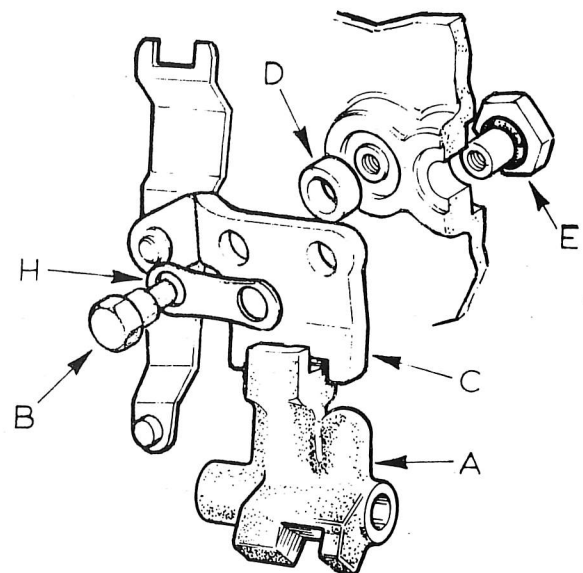
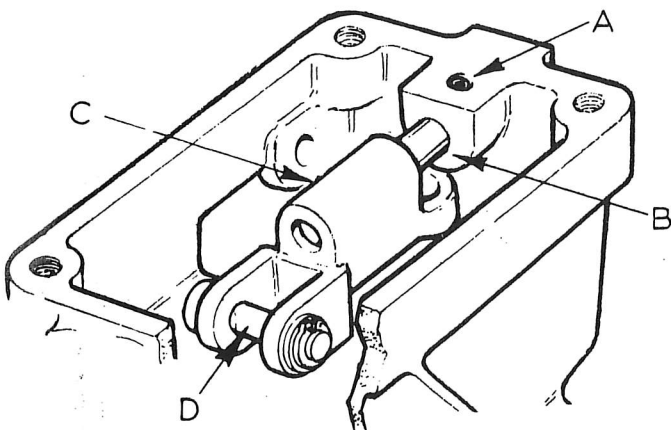


Fig.29. INTERLOCK ASSEMBLY.

21. Remove main casing from stand.

Output Shaft (Tailshaft) Housing

1. Remove 5th./Reverse cross-gate plunger assembly by releasing the two bolts on the left hand side of housing.
2. Withdraw the one securing bolt and remove speedometer drive assembly.



3. Push out the roll pin (A, Fig.30) securing the selector link pin (B, Fig. 30), and remove pin and link (C, Fig. 30).
4. Remove nut securing flange to the output shaft, and press out shaft with speedometer driving gear attached, from the flange. Release the circlip located inside the housing, but in

Fig.30. SELECTOR LINK AND PIN

front of the bearing. Withdraw flange and oil seal. Release second circlip and remove bearing.

NOTE: if it is necessary to replace the flange or oil seal for any reason, the output shaft housing MUST first be removed, as the circlip is securing the flange inside the bearing.

1st Motion Shaft Assembly

The assembly is comprised of two main parts: the Input Shaft and the 1st Motion Shaft, of which 4th gear is an intergral part. These two shafts are splined together and retained in position by a socket-headed bolt.

1. Remove bolt. Screw the Special Tool (80A) into the bolt location and tighten. Applying load to the tool head, press the shafts apart, and remove the tool.
2. Remove bearings.

To Re-assemble1st. Motion Shaft Assembly

1. With the 1st. motion shaft (Part No. B050F 0283B), (A, Fig.31) vertical on the bed of a press (4th. gear end downwards), push on the roller bearing (B, Fig.31) with its flange uppermost, applying load ONLY to inner ring of bearing. Push on ball bearing (C, Fig.31). Check threads of both the bolt (D, Fig.31) and in the input shaft (E, Fig.31), particularly when new components are being used. Ensure, by means of an internal adaptor

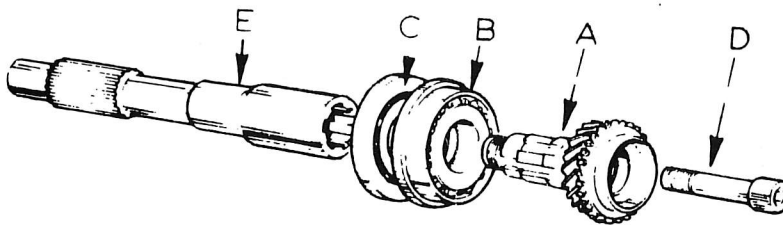


Fig. 31. 1st. MOTION SHAFT ASSEMBLY

- the cone face rim of 4th. gear is NOT damaged by the press.
2. Slide input shaft onto the 1st. motion shaft, ensuring that the splines are aligned. Press together, applying load ONLY to the spigot end of the shaft.
 3. Apply 'Loctite' to the thread of the bolt, then insert through the 1st. motion shaft and into the input shaft, thus securing the two parts of the assembly together. Torque load the bolt to:

26 - 28 lbs. ft. (3.59 - 3.87 kg.m.)

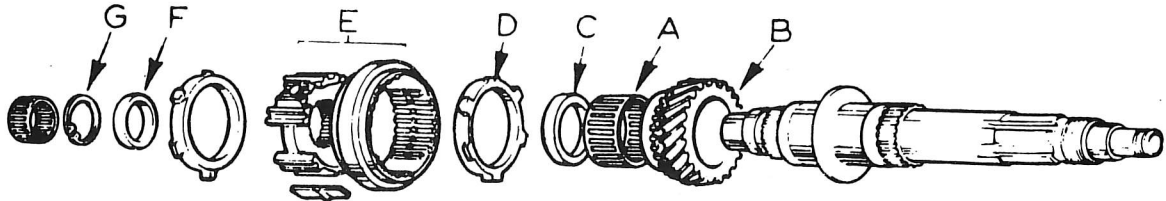
3rd Motion Shaft Assembly

Fig.32. 3rd. MOTION SHAFT

1. Fit the following parts to the shorter end of the shaft: needle roller bearing (A, Fig.32.), 3rd. speed gear (B, Fig.32.), spacer (C, Fig.32.), baulk ring (D, Fig.32.), 3rd./4th. synchroniser assembly (E, Fig.32.), ensuring that the oil grooves face towards 3rd. gear, selective spacer (F, Fig.32), and circlip (G, Fig.32). Note that the 3rd./4th. synchroniser assembly has relieved teeth and recesses on BOTH SIDES of the outer cone, whereas the 5th. synchroniser (fitted later) has relieved teeth and a recess on ONE SIDE ONLY of the outer cone. Check keyway in hub is aligned with keyway in collar (Fig.33). Lightly oil grooves.

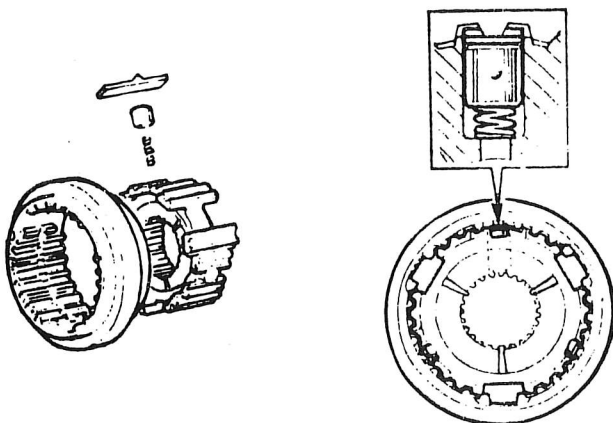


Fig.33. 3rd./4th. SYNCHRONISER

2. With a feeler gauge, check the end-float between the shaft shoulder and 3rd. gear (Fig.34). This should be .005/.008 in. (.13/.20 mm.); if outside this tolerance, replace the selective spacer (F, Fig. 32). Ensure circlip is fully engaged in its slot.

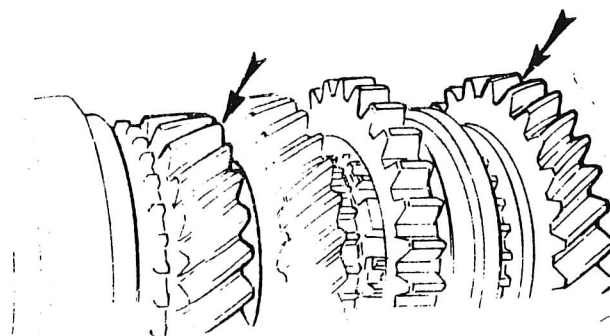


Fig. 34. ARROWS SHOW END-FLOAT CHECK POSITIONS

3. On the other end of the shaft, fit the needle roller bearing (B, Fig. 35), 2nd. speed gear (G, Fig. 35), spacer (C, Fig. 35), baulk ring (E, Fig. 35), 1st./2nd. synchroniser assembly (F, Fig. 35), second spacer, second needle roller bearing, second baulk ring, 1st gear (D, Fig. 35) with its selective hub (A, Fig. 35).

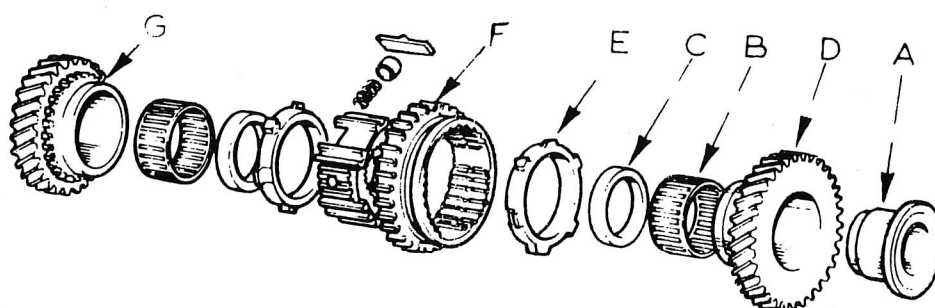


Fig. 35. 1st AND 2nd. GEAR ASSEMBLIES

4. Fit Special Tool (33A) behind hub to retain all parts during further assembly. Temporarily fit nut to retain special tool. Check end-float between hub shoulder and 1st. gear; this should be .005/.008 in. (.13/.20 mm.). If outside this tolerance, replace the selective hub.

Selector Forks

1. Using Special Tool (29A), insert into 1st./2nd. selector fork until end of tool is level with ball hole. Insert spring and detent ball into hole, and using a pin punch to hold down the ball on its spring, push tool past the ball.

2. Repeat procedure above for the 3rd./4th selector fork.
3. Line up selector forks and place in position on synchroniser collars.

Output Shaft Housing

1. Using Special Tool (22A), insert bearing (A, Fig.36) into the output shaft housing from the exterior.
2. Fit circlip (B, Fig.36) into output shaft housing against the outer face of the bearing.
3. Using Special Tool (21A) insert oil seal (C, Fig.36) into the output shaft housing from the outside.

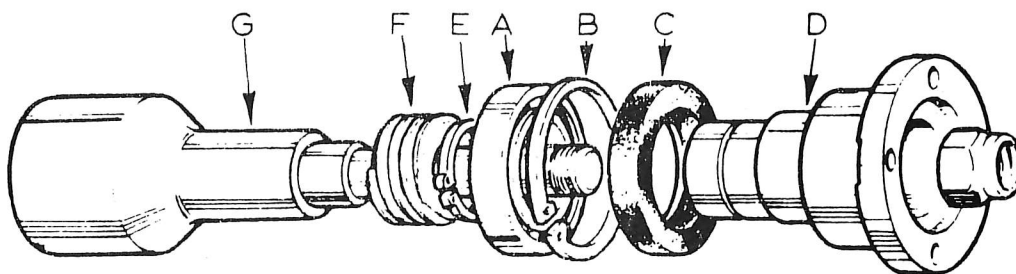


Fig.36. OUTPUT SHAFT

4. Apply a film of oil to the faces of the output flange (D, Fig.36) which will contact the oil seal, and press flange into bearing. From inside of housing, fit the circlip (E, Fig.36) to the output flange.

NOTE: If it is necessary to replace the oil seal, the housing, must be removed from the gearbox assembly to gain access to the circlip retaining the output flange.

5. Fit the speedometer driving gear (F, Fig.36) to the output shaft (G, Fig.36), with its FLAT face towards the shoulder on the output shaft.
6. Insert shaft into output flange, and fit retaining nut. Torque load the nut to 120 lbs. ft. (16.59 kg.m.).

7. Insert operating pin (A, Fig. 37) through the fork end holes of selector link (B, Fig. 37), securing with washer and circlip.
8. Hold selector link on the inside of the output shaft housing in its relative position. Insert selector link pin (C, Fig. 37) into the link from the exterior of the housing, securing the link pin to the housing with its roll pin (D, Fig. 37).

NOTE: This is not the final fitted position of the selector link.

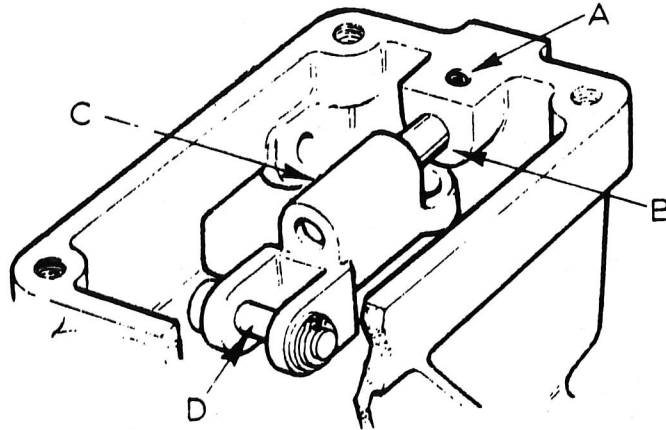


Fig.37. SELECTOR LINK AND PIN

Main Casing

1. Mount the main casing on a suitable stand.
2. Fit inner snap ring, ensuring that step faces away from the bearing. Fit the two 3rd. motion shaft bearings. Select the outer snap ring from the range available (see Service Parts List) to eliminate end-float on the bearings. Remove outer snap ring and bearings.
3. Fit 'O' ring to Reverse selector lever pivot pin. From underside of casing, with the aid of a drift, drive in the pivot pin. Secure the pin with its circlip.
4. Fit Reverse selector fork to Reverse selector lever, securing with its washer and nut. Fully tighten the nut. Place selector lever on the pivot pin, securing with spacer and circlip.
- 4a. From gearbox No.501, the Reverse idler gear and its associated parts have been altered, and can only be fitted as a complete assembly, after relieving the main casing in this area (to ensure the assembly is returning fully to its Neutral position). The new parts are: Reverse idler gear (B050 F 6040Z), Reverse selector lever (B050 F 6048Z), pivot pin (B050 F 6026Z), 'O' ring (A050 F 6066Z) and circlip (A050 F 6063Z) securing the pivot. Parts superseded by the new assembly are: Reverse idler gear, Reverse selector fork, spacer washer, fork securing nut, Reverse selector lever, pivot pin, circlip securing Reverse selector and spacer washer.

5. Using Special Tool (14A), insert into Reverse selector interlock until end of tool is level with ball hole. Insert spring and ball into hole, and using a pin punch to hold ball on its spring, push tool past ball. Fit selector interlock with tool into its location, ensuring that selector lever is in lugs of interlock. Push tool fully through interlock to retain ball and spring.

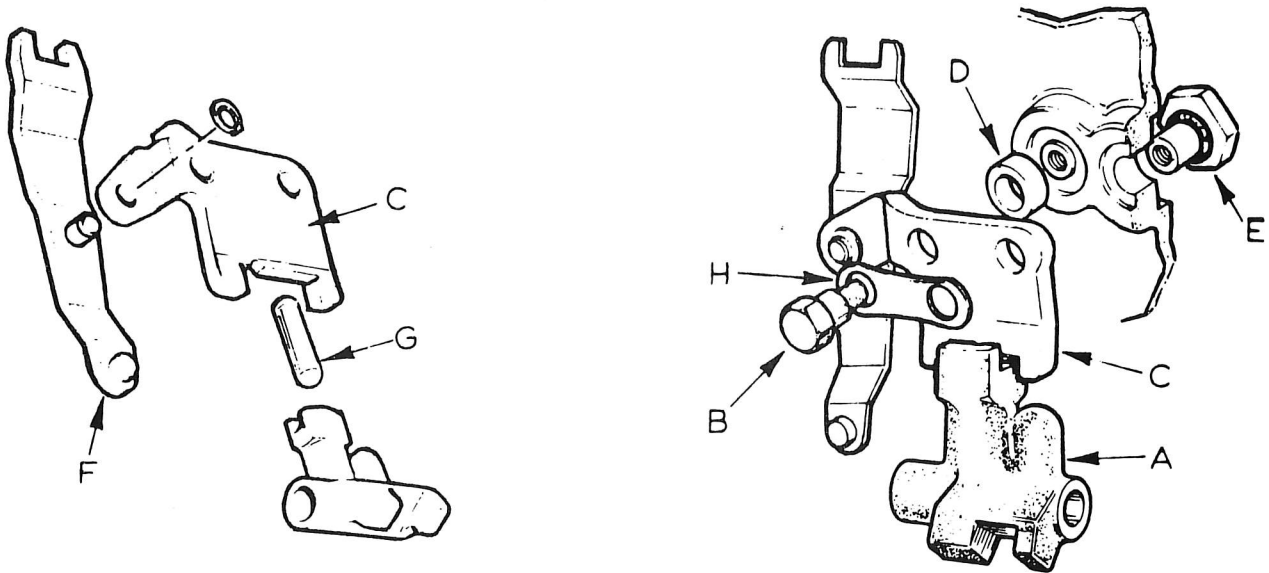


Fig. 38. 5th./REVERSE OPERATING LEVER AND SELECTOR INTERLOCK

6. Fit plunger (A, Fig. 38) into selector interlock. Fit 5th/Reverse operating lever (B, Fig. 38) to interlock plate (C, Fig. 38), by inserting its peg through the single hole in plate. Secure with 'thin' circlip, noting that its 'flat' face is towards end of pin - this to resist the thrust. Ensure plunger is still in position, then fit plate in selector interlock. Secure plate to casing with retainers and bolts; from exterior of casing, insert retainers (D, Fig. 38) to which their 'O' rings have already been fitted. From inside the casing, use securings in order of: bolts (E, Fig. 38), tabwasher (F, Fig. 38), then through interlock plate, spacers between plate and casing, and finally into the previously fitted retainers. Torque load the bolts to 20 lbs. ft. (2.76 kg.m.)

7. Insert Reverse/5th. selector shaft through the core plug hole in the right-hand front face of casing, and into the selector interlock, pushing the special tool out in the process. The selector shaft must be rotated during the inserting process to clear the Reverse operating lever. With the shaft in position, turn back through 180° to engage its slot in Reverse operating lever. Temporarily insert 1st./2nd./3rd./4th. selector shaft (Part No. B050 F 0298Z) into its location, and a second 1st./2nd./3rd./4th. selector into the upper shaft location. With the aid of a depth micrometer placed across the two shafts, measure the distance to the top front edge of the 5th/Reverse operating lever. This should be $.40^{+} .005$ in. ($10.16^{+} .127$ mm.). If the measurement is less than this dimensions, insert shims (available in thicknesses of .016 in and .024 in.), between the interlock plate and its spacers. Finally, bend over the tabwasher to lock the retaining bolts.
8. From beneath exterior of casing, insert detent plunger and spring, retaining with copper washer and domed plug. Torque load the plug to 20 lbs. ft. (2.76 kg.m.).
9. Insert Reverse idler shaft, (grub screw indent facing outwards - smaller end first), part-way through hole into casing. Locate groove on Reverse idler gear in Reverse selector fork; groove on gear towards rear of casing. With the aid of an aluminium (or similar) soft drift, insert idler shaft through gear to enable collar to be pushed on. Note that roll pin hole in collar is offset; larger offset must be towards gear. Drive shaft fully through until indent 'lines up'. Insert grub screw using 'Wellseal' on thread. Insert roll pin through collar and into idler shaft.
10. Place the laygear in bottom of casing with the larger pinion (4th) towards front of casing. Insert 3rd. motion shaft assembly, together with selector forks, through the open top of the casing and out through the rear wall.

11. Insert Special Tool (31A) through front wall of casing from the exterior.
Secure to front of casing.

12. Remove nut and Special Tool from 3rd. motion shaft.

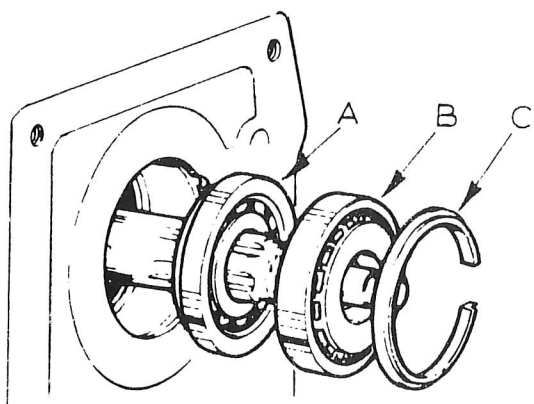


Fig. 39. 3rd. MOTION SHAFT
BEARINGS

13. Using Special Tool (25A), fit bearing (A, Fig. 39) with its stepped face towards front of gearbox. Again, using the same tool, insert outer track of second bearing (B, Fig. 39), then fit bearing. Fit snap ring (C, Fig. 39) behind bearing, ensuring that gap in ring is AWAY FROM cut-out in casing bore, and that step is AWAY FROM bearing. Remove Special Tool (31A).

14. Fit the baulk ring to the flange of 4th. gear (1st. motion shaft). Place oiled needle roller bearing on 3rd. motion shaft. Fit 1st. motion shaft assembly with the aid of the front cover. Slightly tap the outer race of bearing into casing. Fit thickest spacer ring into front cover, lubricate seal, place cover in position (without its gasket), insert and progressively tighten the bolts, pulling the cover down evenly, thus pushing in the bearing and 1st. motion shaft assembly. Remove the front cover.

15. Insert the layshaft through the lower rear bore, with its two machined diameters into laygear. Ensure the splines on the layshaft and inside the laygear are fully engaged. Use Special Tool (28A) to locate the front end of layshaft.

16. Using Special Tool (25A), and from outside the casing (Fig.40), fit the rear layshaft bearing, so that it is flush with the casing.
- NOTE: The bearing hub is in two parts, the smaller of which is fitted first.

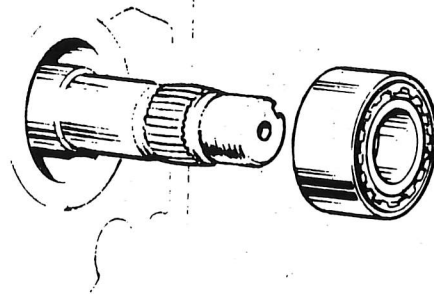


Fig.40. REAR LAYSHAFT BEARING

17. Remove the Special Tool (28A) locating the front end of the layshaft.
18. Fit spacer to the layshaft with its tapered end towards the laygear.
19. Using Special Tool (19A), fit the front layshaft bearing into the lower bore of the casing, with its smaller diameter towards the laygear. Fit the circlip in front of the bearing, ensuring that it is fully engaged in the slot in the casing.
20. From front of casing, insert 1st./2nd./3rd./4th. selector shaft (Part No. B050F 0298Z) first (indents facing downwards). As the shaft is pushed in, the tool holding the selector forks will be pushed out. Rotate the shaft with a screwdriver through 180° until the indent is visible, when the detent balls will 'click' into position. Fit grub screw to which 'Loctite' has first been applied to its thread.

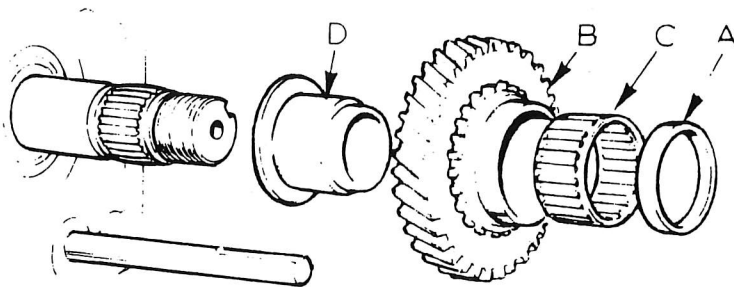


Fig. 41. 5th. GEAR ASSEMBLY

21. Assemble 5th. gear (B, Fig.41) to its hub (D, Fig.41), with its bearing (C, Fig.41) and spacer (A, Fig.41). With assembly inverted (spacer against surface plate,) check end-float between gear and hub flange. This

should be .005/.008in (.13/.20mm.); if incorrect, replace the selective bearing hub. Fit assembly to rear end of layshaft.

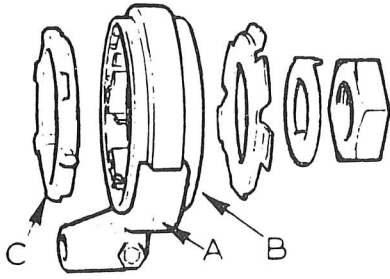


Fig.42. 5th. GEAR SYNCHRONISER

22. Place selector fork (A, Fig.42) on the 5th. synchroniser assembly (B, Fig.42), noting that the 'flat' (without grooves) face of the synchroniser is towards rear of layshaft. Slide assembly on to the layshaft together with its baulk ring (C, Fig.42), ensuring that

selector fork also slides on to its shaft at the same time. Align hole in fork with detent on selector shaft, insert grub screw, locknut and shakeproof washer. Fully tighten the screw, then its locknut. Fit retaining plate, tabwasher and nut.

23. With the machined face towards the bearing, fit the 5th. pinion to the 3rd. motion shaft. Fit the adaptor, followed by its nut, with cut outs butting against the pinion.
24. Fit tab washer and nut to front end of layshaft noting this is threaded left-hand.
25. Select 1st. and 3rd. gears then tighten the securing nuts to the following Torque Loadings:
- | | |
|-----------------------|---------------------------|
| Front Layshaft nut | 120 lbs.ft. (16.59 kg.m.) |
| Rear Layshaft nut | 120 lbs.ft. (16.59 kg.m.) |
| 3rd. motion shaft nut | 150 lbs.ft. (20.74 kg.m.) |

Note, when finally tightened, the 3rd. motion shaft nut 'flat' edges MUST be in line with splines on adaptor, otherwise the output shaft will foul the nut when assembled. Turn over tab washers on front and rear layshaft nuts.

26. Select Neutral. Turn input shaft by hand to check shaft turns freely. If shaft does NOT turn freely, tap each end of layshaft with a soft-faced hammer to centralise the bearings.

- 27. Repeat operation '26' with each gear selected.
- 28. Check that 1st. motion shaft bearings are fully entered in their housing bores.
- 29. To ascertain the correct 'nip' on the bearings, measure the depth of ring dowel recess in both the front wall of the main casing and the front cover. To this measurement, add the uncompressed thickness of gasket between main casing and front cover. Select a spacer equivalent in thickness to the measurements taken.

e.g.

Depth of recess in main casing	=A
Depth of recess in front cover	=B
Measure uncompressed new gasket thickness	=C
Size of spacer required	=A + B + C

Sizes of spacers available, are:

RED	5.20/5.23 mm.
BLACK	5.24/5.27 mm.
BLUE	5.28/5.31 mm.

- 30. Apply 'Wellseal' to both sides of the front cover gasket. Lubricate seal in front cover. Fit cover with its gasket, selected spacer and securing bolts. Tighten the bolts to a torque loading of 15 lbs.ft. (2.07 kg.m.). Check that all gears rotate freely.
- 31. Assemble interlock spool selector shaft assembly, using the later type of spool having straight sides to its slot. Insert assembly into the front shaft hole from the top of the casing, aligning the spool with the lugs on the selector forks. (For reference see Fig. 12).
- 32. From the rear wall of the casing, insert selector shaft extension with its ball end uppermost, and through into the selector shaft assembly, until roll pin holes are aligned. Support shafts and insert roll pin until flush with shaft. Insert interlock spool retainer through top face of casing and into spool.

Gearbox Assembly

1. Fit ring dowels to rear face of main casing.
2. Apply 'Wellseal' to both sides of gasket and attach to rear face of main casing.
3. Fit output shaft housing assembly to main casing. Turn selector link to engage with selector ball. Insert securing bolts with their washers and tighten to a torque loading of 15 lbs. ft. (2.07 kg.m.).
4. Replace speedometer drive assembly, retaining with its one bolt.
5. Check all moving parts for ease of rotation. The application of a small amount of oil to the moving parts will be beneficial.
6. Apply 'Wellseal' to both sides of gear selector cover gasket, place in position together with cover. Insert securing bolts with their washers and tighten to a torque loading of 15 lbs.ft. (2.07 kg.m.).
7. Fit gearshift lever (noting that it is slanted towards the rear), with the aid of Special Tool (32A). Note also that the threaded part of the lever is of nylon construction, and consequently softer than the cover thread, therefore ensure that threads are NOT crossed during assembly. Bend the locking tabs on the lever assembly to secure it to the top cover.
8. Into the hole at top left-hand side of output shaft housing, fit plunger, spring and spacer. Apply 'Silastic' to mating face of housing, and secure with its bolts and washers. BEFORE finally tightening the bolts, move the gearshift lever fully to the left, to ensure plunger is operating, and with lever held in this position, fully tighten the bolts.
9. Check that all gears can be selected.

10. Apply 'Wellseal' to the threads of the reverse lamp switch, then fit switch with its copper washer. Select Reverse gear, and with the aid of a test lamp, rotate switch in a clockwise direction until lamp illuminates. Turn switch a further half-turn clockwise and tighten securing locknut.
11. Fit core plug to lower right-hand front of casing, after smearing with 'Wellseal'.
12. Replace the drain plug (B, Fig. 43). Through the top of the gearbox, add three pints (1.7 litres; 3.6 US pints) of SAE 80 EP oil. Replace filler/level plug (A, Fig. 43).
13. Apply 'Wellseal' to both sides of the top cover gasket, place in position together with cover. Insert securing bolts with their washers and tighten to a torque loading of 15 lbs.ft. (2.07 kg.m.).
14. Fit ring dowels to front of casing.
15. Replace the bellhousing, tightening the bolts to a torque loading of 25 lbs.ft. (3.46 kg.m.).

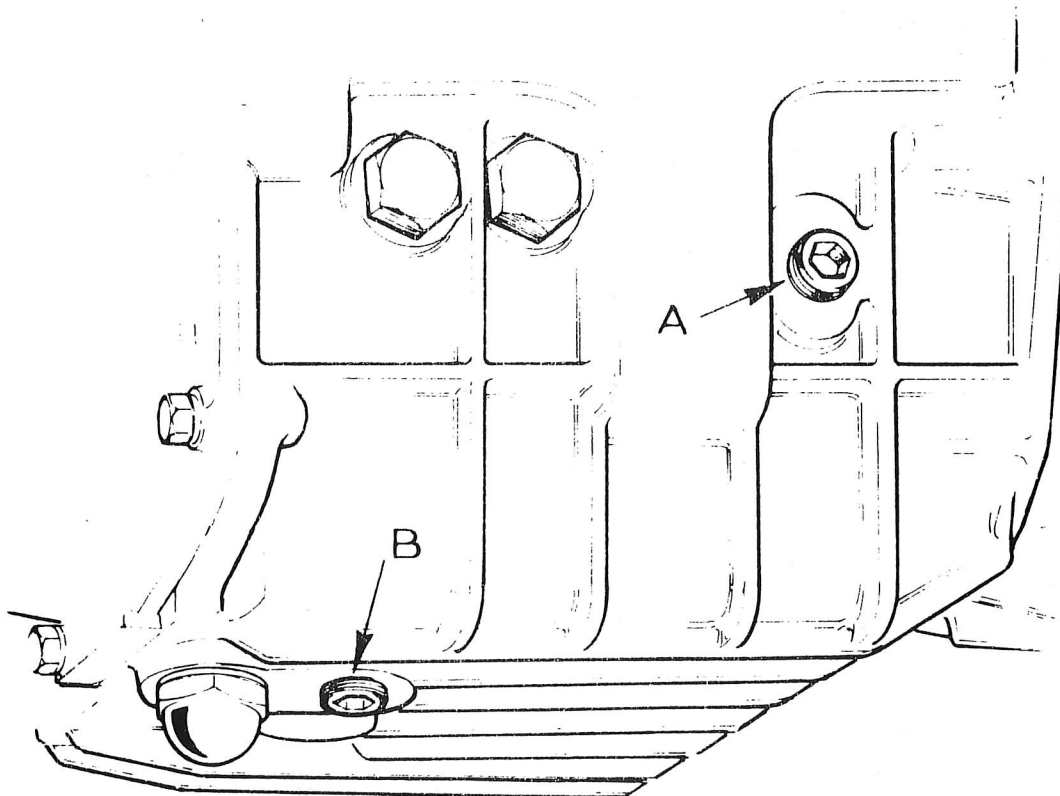


Fig.43. FILLER AND DRAIN PLUGS

F.10 - SPECIAL TOOLS

The following list of tools are essential, if it is intended to carry out any repair work on the gearbox.

The tools are in two lists; those designed by Lotus Cars Limited, and those already in existence (British Leyland) to be used in conjunction with the Lotus tools.

Lotus Designed Tools

TOOOTOO 14A	Dummy selector shaft (2 required)
TOOOTOO 19A	Drift - Front layshaft bearing
TOOOTOO 21A	Insertor - Output shaft housing oil seal
TOOOTOO 22A	Insertor - Output shaft housing bearing
TOOOTOO 24A	Insertor - Front cover oil seal
TOOOTOO 25A	Insertor - 3rd. motion shaft & rear layshaft bearings
TOOOTOO 28A	Dummy bearing - Front layshaft
TOOOTOO 29A	Dummy selector shaft
TOOOTOO 31A	Dummy 1st. motion shaft assembly
TOOOTOO 32A	Spanner - Gearshift lever
TOOOTOO 33A	Sleeve - 3rd. motion shaft
TOOOTOO 59A	Collet (2 off))
TOOOTOO 60A	Sleeve) 1st motion shaft assembly extractor
TOOOTOO 61A	Adaptor)
TOOOTOO 80A	Bolt - Input shaft/1st. motion shaft remover

British Leyland Tools

18G284	Impulse extractor (main tool)
18G284AE	Adaptor - Layshaft
18G284AAC/2	Adaptor - 1st. motion shaft
18G284AL	Remover - Front layshaft bearing
18G284AM/1	Remover - 3rd. motion shaft bearing
18G1155	Drift - 3rd. motion shaft

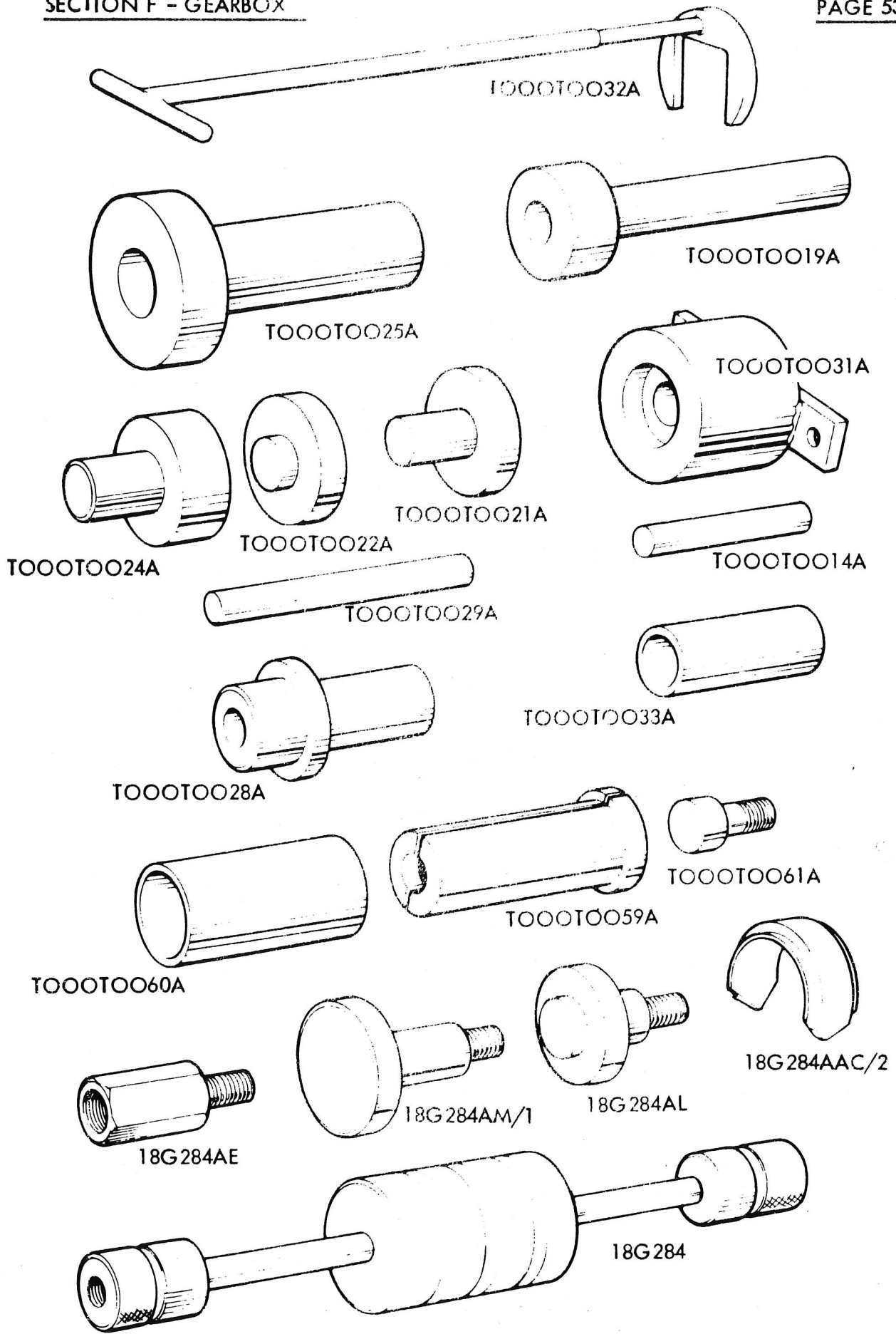


Fig 44. GEARBOX SPECIAL TOOLS

F.11 - AMMENDMENTSOversize Bearings:

BEFORE commencing dismantling the gearbox, check the underside adjacent to the Serial Number for the letters 'OS', this indicating there is one, or more, oversize bearings fitted in the gearbox assembly.

WHEN dismantling the gearbox, note that where oversize bearings are used, the letters 'OS' together with the amount of oversize (i.e. +.001, +.002, etc.) will be stamped adjacent to the bearing bore.

Oversize bearings are available under the following Part Numbers:

<u>Standard</u>	<u>+.001 in.</u>	<u>+.002 in.</u>	<u>+.003 in.</u>	<u>+.004 in.</u>
A050 F 6070Z	A050 F 6070A	A050 F 6070B	A050 F 6070C	A050 F 6070D
A050 F 6071Z	A050 F 6071A	A050 F 6071B	A050 F 6071C	A050 F 6071D
A050 F 6072Z	A050 F 6072A	A050 F 6072B	A050 F 6072C	A050 F 6072D
A050 F 6073Z	A050 F 6073A	A050 F 6073B	A050 F 6073C	A050 F 6073D
A050 F 6017Z	A050 F 6017A	A050 F 6017B	A050 F 6017C	A050 F 6017D
A050 F 6025Z	A050 F 6025A	A050 F 6025B	A050 F 6025C	A050 F 6025D