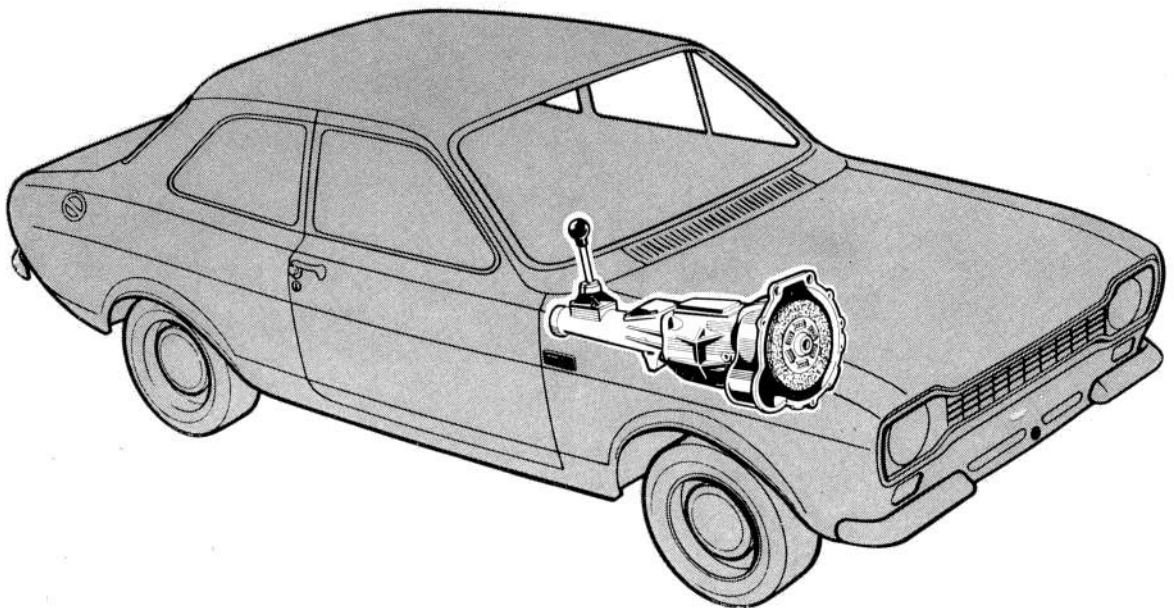


7/1

# CLUTCH and GEARBOX



# ESCORT TWIN CAM

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(Includes OPS 7657-A and A1)
-

## ESCORT TWIN CAM

### GENERAL DESCRIPTION

#### Clutch

The clutch mechanism consists of a single dry plate disc with a diaphragm spring pressure plate bolted to the engine flywheel. The clutch release system is hydraulically actuated, and adjustment is provided by an adjusting nut and lock-nut on the slave cylinder piston rod. The slave cylinder is mounted on the left-hand side of the clutch housing, and joined by a two-piece, part-solid, part-flexible pipe via a connection on the bulkhead to the master cylinder. This is located inside the passenger compartment on the clutch pedal bracket.

The diaphragm spring is pivoted on specially shouldered pins and retained to these pins by two fulcrum rings. The spring is retained to the pressure plate by three spring steel clips which are riveted to the pressure plate. When the diaphragm's centre is moved towards the flywheel by the release bearing the diaphragm's outer edge deflects towards the gearbox causing the clutch to disengage.

#### Gearbox

The gearbox has four forward ratios and one reverse. All the forward gears are engaged through forged blocker ring synchromesh units.

The constant mesh gears between the countershaft, mainshaft and main drive gear are helical to ensure quiet operation whilst reverse idler gear is spur cut and meshes with teeth cut on the outside of the first/second gear synchroniser sleeve, and cluster gear.

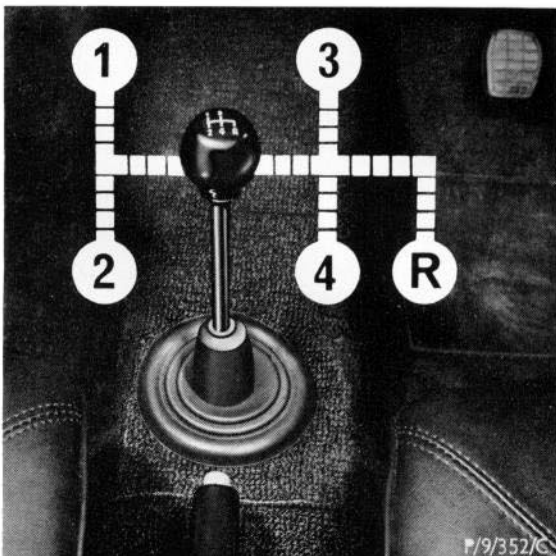
The remote floor-change shift lever is built into the extension housing, and a single rod running parallel with the mainshaft transfers the lever movement to the three selector rails in the gearbox.

### SERVICE AND REPAIR OPERATIONS

#### OP 7000-A GEARBOX AND CLUTCH HOUSING ASSEMBLY - REMOVE AND INSTALL

##### To Remove

1. Open the boot and disconnect the battery.
2. Jack up front and rear of the car and fit stands.
3. Open bonnet and fit wing covers.
4. Partially drain the radiator, disconnect the top hose, and also the oil cooler hoses at the filter bowl connections.



**Gear Lever Positions**

5. Disconnect the solenoid to starter motor lead from the starter motor, and remove the dipstick and rubber dipstick tube from the engine.
6. Suitably scribe the steering shaft and flexible joint to ensure correct alignment on re-assembly and remove the clamping bolt.
7. From inside the driving compartment, unscrew the two bolts securing the lower end of the steering column to the floor pan. Then unscrew the two crosshead screws securing the top end of the column to the fascia panel, disconnect the two multi-plug connectors and withdraw the column assembly.
8. Unseat the gear lever boot from the transmission tunnel, unscrew the dome nut and withdraw the lever from the extension housing.
9. Unscrew the nut securing the engine rear steady bar mounting located above the passenger side parcels shelf.
10. Unscrew the other nut from the engine compartment side and remove the steady bar mounting.
11. Disconnect the "O" rings supporting the exhaust system, unscrew the clamp bolt where the system joins the downpipe, and separate the joint.
12. Mark the driveshaft and pinion flanges to ensure correct alignment on reassembly and unscrew the four securing bolts. Lower the driveshaft assembly and withdraw it from the gearbox, suitably plugging the extension housing to prevent loss of oil.
13. Support the rear end of the gearbox with a jack and remove the four bolts securing the rear mounting to the underbody.
14. Lower the gearbox slightly and unscrew the bolt retaining the speedometer drive to the gearbox and place the drive gear and cable out of the way.
15. Disconnect the clutch fluid supply pipe from the slave cylinder and plug the end to prevent loss of fluid and ingress of dirt.
16. Support the engine front crossmember with a second jack and remove the four mounting bolts, replacing each one with a 3 in. (7.62 cm.) long bolt and washer.
17. Carefully lower the engine until the crossmember is supported on the long bolts. Remove the jack and place it under the rear of the sump.
18. Lower the back of the gearbox to its fullest extent, until the sump is resting on the supporting jack.
19. From underneath the car remove the three bolts securing the flywheel dust cover from the bell housing. Remove the two bolts securing the starter motor and move it forwards to disengage the starter pinion. Remove the remainder of the bell housing to engine mounting bolts noting that the two topmost bolts secure both the clutch fluid supply pipe brackets and the engine rear stabiliser bracket.
20. Slide the gearbox rearwards while supporting its weight, and detach it from the engine.

#### **To Install**

21. Ensure that the adaptor plate is correctly positioned on the rear of the engine, then offer the gearbox up so that the main drive gear spigot enters the crankshaft pilot bearing. Push the gearbox fully home and temporarily secure with two bolts on opposite sides of the bell housing done up finger-tight.
22. Support the end of the extension housing with a jack, and then replace the rest of the engine to bell housing bolts, remembering that the two topmost bolts secure both the clutch fluid supply pipe brackets and the engine rear stabiliser bracket.

## ESCORT TWIN CAM

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23. Replace the starter motor and the lower dust cover.
24. Reconnect the clutch fluid supply pipe to the slave cylinder.
25. Jack up the rear of the gearbox until the engine and gearbox assembly is level. Place a second jack under the engine front crossmember and raise this until it abuts the chassis. Replace each long bolt **in turn** with the original bolts, to facilitate correct crossmember alignment. Tighten to a torque of 25 to 30 lb. ft. (3.46 to 4.15 kg.m.). Remove the supporting jack.
26. Engage the speedometer drive gear in the extension housing and secure with the retaining bolt and yoke.
27. Engage and tighten the gearbox rear mounting bolts, noting that one of these bolts also retains the earth strap. Remove the supporting jack.
28. Remove the plug from the extension housing, engage the driveshaft with the gearbox mainshaft splines, re-align the driveshaft and pinion flanges and secure with the four nuts and bolts.
29. Engage the exhaust system with the manifold downpipe, refit the supporting "O" rings and secure the front joint with the clamping bolt.
30. Replace the gear lever, secure with dome nut fitted with a new gasket and replace the rubber boot on the transmission tunnel.
31. Engage the steering shaft with the flexible joint while ensuring to re-align the marks previously made and tighten the clamp bolt.
32. Fit the bolts securing the lower end of the steering column and also the two crosshead screws at the top end of the column.
33. Reconnect the multi-plug connectors behind the facia panel.
34. Fit the engine steady bar insulator and secure with the two retaining nuts.
35. Reconnect the radiator top hose and the oil cooler hoses to the oil pump.
36. Reconnect the starter motor lead, and replace the flexible dipstick tube and dipstick.
37. Refill the cooling system with a 50% solution of Ford Antifreeze Plus, and check the oil, topping up if necessary.
38. Bleed the clutch hydraulic system as described in Operation No. 7500-A.
39. Jack up the front and rear of the car, remove the stands and lower the car to the ground.
40. Reconnect the battery and close the boot.
41. Start the engine and check for oil and water leaks.
42. Remove the wing covers and close the bonnet.

### **OP 7000-A1** EXTRA: CLUTCH RELEASE BEARING – RENEW

#### **To Remove**

1. Detach the release arm rubber gaiter.
2. Withdraw the clutch housing bearing and release arm assembly from the clutch housing after releasing the retaining spring securing the release arm to the fulcrum pin.
3. Unhook the release arm from the bearing.
4. Press the release bearing from the hub.

**To Install**

5. Press the release bearing onto the hub.
6. Engage the release arm in the hooked ends of the release bearing. Apply molygrease between fork and hub.
7. Pass the release arm through the aperture in the clutch housing, slide the release bearing onto the main drive gear bearing retainer (which has previously been smeared with molygrease), and secure the release arm by fitting the retaining spring on the fulcrum pin.
8. Replace the rubber gaiter.

**OP 7000-A2 EXTRA: CLUTCH PRESSURE PLATE AND/OR DISC - REMOVE AND INSTALL**

**Tools Required**

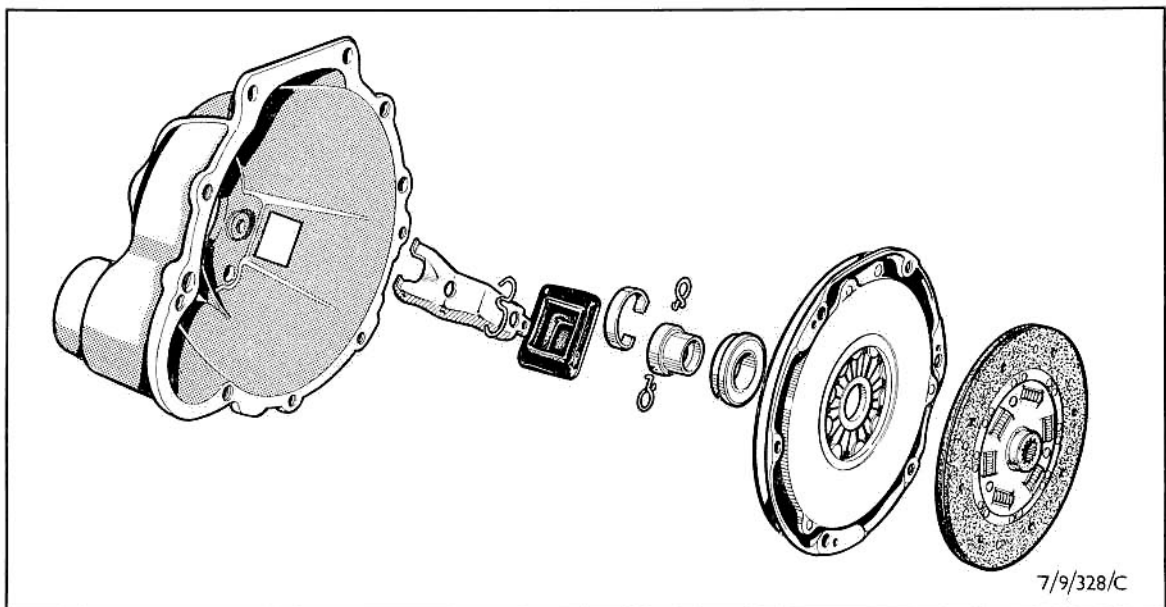
P.7091-A Clutch disc locator (modified) or Tool P.7137

**To Remove**

1. Slacken the six clutch retaining bolts evenly, working diagonally across the clutch.
2. Remove the clutch disc and pressure plate.

**To Install**

3. Apply a light smear of molygrease to the main drive spline then place the clutch disc in position on the flywheel with the hub towards the flywheel (the flywheel side of the disc is marked near the centre). Align the clutch disc with the locator Tool P.7091-A (modified) or Tool No. P.7137.
4. Refit the pressure plate assembly, locating on the dowels. Fit the six securing bolts and spring washers; torque to 12 to 15 lb. ft. (1.7 to 2.1 kg.m.).
5. Remove the locator tool.



**Clutch Components — Exploded View**



**OP 7000-A3 EXTRA: CLUTCH PILOT BEARING – RENEW**

**Tools Required**

- 7600-A or B Clutch pilot bearing remover (main tool)
- CP.7600-7 Clutch pilot bearing remover (adaptor)
- P.7137 Spigot bearing replacer and clutch disc locator

1. Push the adaptor, Tool No. CP.7600-7, behind the bearing and screw the main tool, 7600-A or B, into the adaptor. Tighten the wing nut to extract the bearing.
2. Position the new bearing on Tool No. P.7137 with the integral grease seal away from the crankshaft. Tap it into place in the crankshaft flange, ensuring that the bearing is 0.156 to 0.175 in. (3.96 to 4.44 mm.) below the crankshaft flange.

**OP 7000-A6 EXTRA: MAIN DRIVE GEAR BEARING RETAINER OIL SEAL – RENEW**

**Tools Required**

- P.7136 Main drive gear oil seal replacer

**To Dismantle**

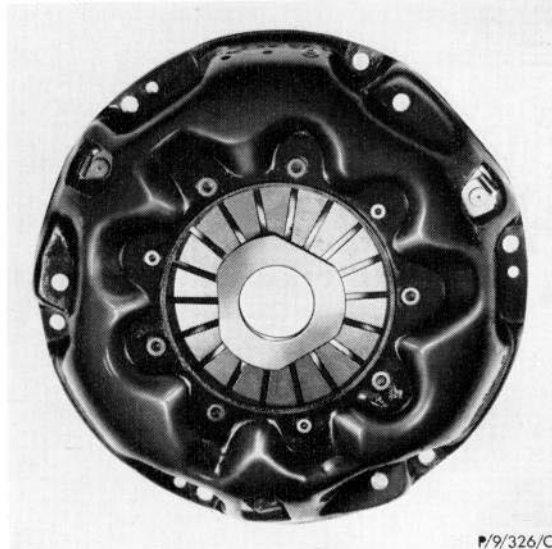
1. Remove clutch release arm and bearing.
2. Unscrew the three bolts and spring washers securing the main drive gear retainer to the gearbox case.
3. Withdraw the retainer and paper gasket.
4. Remove the retainer oil seal with suitable tool.

**To Reassemble**

5. Place a new oil seal on the replacer (Tool No. P.7136) so that when fitted the lips of the seal face the gearbox. Drive the seal into the retainer.



**Release Bearing Assembly**



**Diaphragm Spring and Pressure Plate Assembly**



6. Apply a smear of molygrease to the main drive gear bearing retainer then fit the retainer to the gearbox. Cover the main drive gear splines before fitting the retainer and oil seal to prevent damage to the seal lip on assembly. First fit a new gasket on the gearbox front face. Ensure that the oil groove in the retainer is in line with the oil passage in the gearbox casing and that the gasket does not cover this passage. Coat the three retaining bolts with sealer (Part No. ESEE-M4G-1008A) and fit them, complete with spring washers. Tighten securely.
7. Replace clutch release arm and bearing.

**OP 7000-A7 EXTRA: EXTENSION HOUSING REAR OIL SEAL – RENEW**

**Tools Required**

7657	Extension housing oil seal remover
P.7657-4	Extension housing oil seal remover (adaptor)
P.7095	Extension housing oil seal replacer

1. Extract the extension housing oil seal by screwing Tool No. P.7657-4 into Tool No. 7657 and screw the assembly into the seal. Tighten the tool centre bolt to withdraw the seal.
2. Fit new extension housing oil seal by driving it squarely into position using Tool No. P.7095.

**OP 7000-A8 EXTRA: EXTENSION HOUSING REAR BUSH – RENEW**

**Tools Required**

7657	Extension housing oil seal remover
P.7657-4	Extension housing oil seal remover (adaptor)
P.7095	Extension housing oil seal replacer
P.7149	Extension housing bush remover
P.7150	Extension housing bush replacer

1. Extract the extension housing oil seal by screwing Tool No. P.7657-4 into Tool No. 7657 and screw the assembly into the seal. Tighten the tool centre bolt to withdraw the seal.
2. Extract extension housing bush using Tool No. P.7149.
3. Assemble a new bush to the replacing Tool No. P.7150 and drive into position.
4. Fit new extension housing oil seal by driving it squarely into position using Tool No. P.7095.

**OP 7000-B CLUTCH RELEASE BEARING – RENEW**  
(Includes OPS 7000-A and A1)

**OP 7000-C CLUTCH DISC AND/OR PRESSURE PLATE – REMOVE AND INSTALL**  
(Includes OPS 7000-A and A2)

**OP 7000-D CLUTCH PILOT BEARING – RENEW**  
(Includes OPS 7000-A, A2 and A3)

**OP 7003-A GEARBOX ASSEMBLY – REMOVE AND INSTALL**  
(See OP 7000-A)

**OP 7003-A1 EXTRA: SELECTOR MECHANISM – OVERHAUL**  
(Includes removing selector lever and selector forks)

**Tools Required**

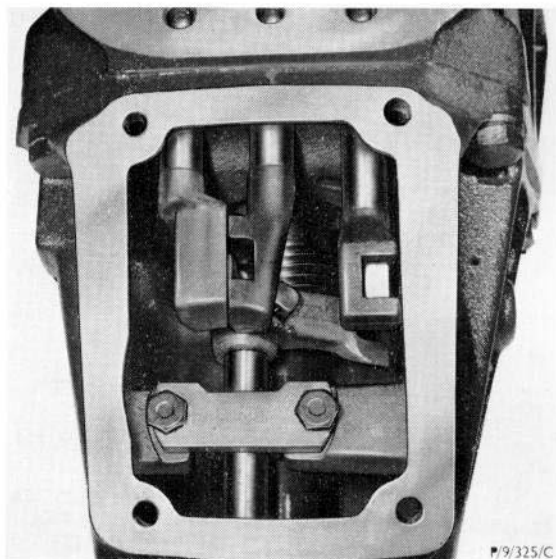
200A	Engine stand
P.7089	Gearbox mounting bracket

### To Remove

1. Using the gearbox mounting bracket mount the gearbox on the engine stand.
2. Remove the gearbox top and inspection covers, springs and detent balls.
3. Remove the tapered screw securing the selector forks to the selector rails.
4. Remove the central first/second gear rail.
5. Remove the left-hand side third/top gear rail and slide off the over-run stop tube.
6. Unscrew the bolt securing the angled selector arm to the extension rod in the extension housing after removing the locking wire. Slide off the arm.
7. Remove the extension rod forward bearing bridge.
8. Unscrew the three gear lever turret bolts and withdraw it complete with extension rod.
9. Disengage the reverse rail from the reverse relay lever and remove the rail.
10. Lift the lock tabs and remove the two retaining bolts and extract the plunger ball and springs.

### To Install

11. Fit the reverse gear selector rail (identified by two detent grooves) through the right-hand bore in the extension housing.
12. Locate the selector fork on the rail then engage the rail in the gearbox case and on the reverse relay lever.
13. Slide the extension rod through the bore in the turret housing and fit the turret to the extension housing. Secure with three bolts and spring washers.
14. Refit the forward bearing bridge over the extension rod, with the cut-out forwards, and secure it with two bolts.
15. Replace the angled selector arm on the extension rod with the arms uppermost. Secure it with a bolt and lock with wire.
16. Fit the centre rail (identified by a cross drilling with a floating pin in one end). Ensure that the uppermost arm of the angled selector arm is to the left of the rail. Engage the first/second gear selector fork as the rail is pushed in.



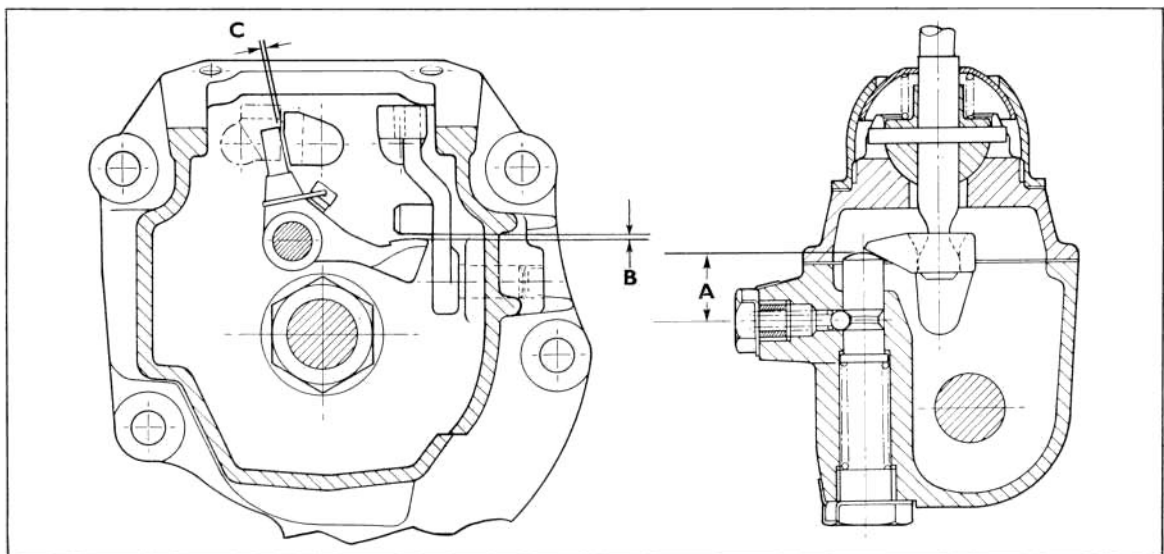
**Gearbox Inspection Cover Removed**

17. Slide in the third/top gear rail, passing it through the over-run stop tube and the third/top selector fork.
18. Secure the selector forks to the rails, and fit the gear lever.
19. Fit the spring-loaded plunger and the detent ball and spring in the bores beneath the gear lever turret. Do not bend up the lock tabs at this stage.
20. Select either third or fourth gear and check that the angled selector arm clears the first/second gear selector rail flat (C). If a fouling condition occurs, fit the next sized plunger down. Conversely, if fouling occurs between the angled selector arm and the reverse gear face (B) the next sized plunger up should be fitted, see following table.

The plungers available are as follows:—

<i>Part Number</i>	<i>Size and Dimension A</i>
2821E-7K187-H	0.870 in. (2.21 cm.)
2821E-7K187-G	0.840 in. (2.10 cm.)
2821E-7K187-F	0.810 in. (2.06 cm.)
2821E-7K187-E	0.780 in. (1.98 cm.)
2821E-7K187-D	0.750 in. (1.91 cm.)

21. When the correct plunger has been fitted, bend up the lock tabs.
22. Replace the top cover, detent balls and springs, securing with four bolts and spring hole washers.
23. Replace the inspection cover, and secure with bolts and spring washers. The breather should be towards the rear of the gearbox.
24. Check engagement of all gears.



**Reverse Plunger Section**

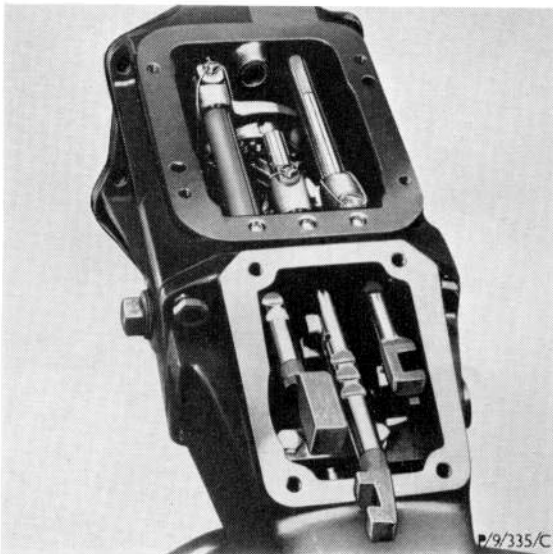
**OP 7000-A12 EXTRA: EXTENSION HOUSING AND MAINSHAFT ASSEMBLY – REMOVE AND INSTALL**

**To Remove**

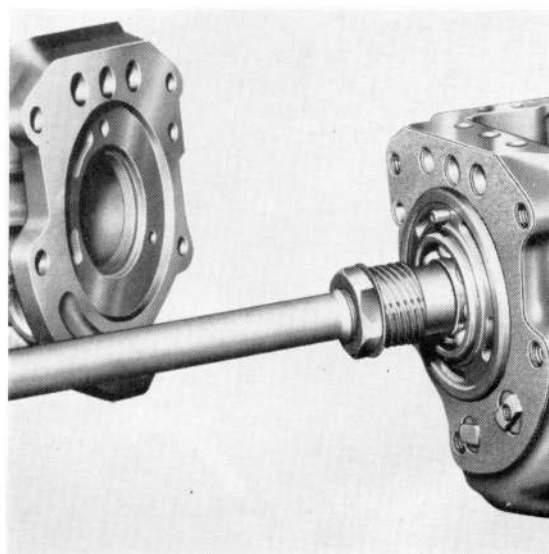
1. Remove the gearbox top cover and springs, and the inspection cover. Tip the gearbox and remove the detent balls.
2. After removing the lock wires, release the tapered screws securing the selector forks to the selector rails.
3. Remove the central first/second gear rail, taking care that the floating pin in the forward end of the rail does not fall out.
4. Remove the left-hand side third/top gear rail, detaching the over-run stop tube.
5. Unscrew the bolt securing the angled selector arm to the extension rod after removing the locking wire. Slide off the arm.
6. Remove the extension rod forward bearing bridge.
7. Unscrew the three gear lever turret bolts and withdraw it complete with extension rod.
8. Remove the extension housing complete with the reverse selector rail.
9. Lift out the selector forks.
10. From the front face of the casing, drive the countershaft rearwards slightly, then using a dummy countershaft, Tool No. P.7113, push the countershaft out of the gearbox. The countershaft gear will now lie at the bottom of the gearbox case.
11. Withdraw the mainshaft assembly from the gearbox.

**To Install**

12. Install the caged needle rollers in the bore in the main drive gear.
13. Position a blocker ring inside the third/top gear synchroniser assembly, aligning the slots with the blocker bars.
14. Position a new extension housing gasket on the rear of the gearbox, securing it with a thin smear of grease.

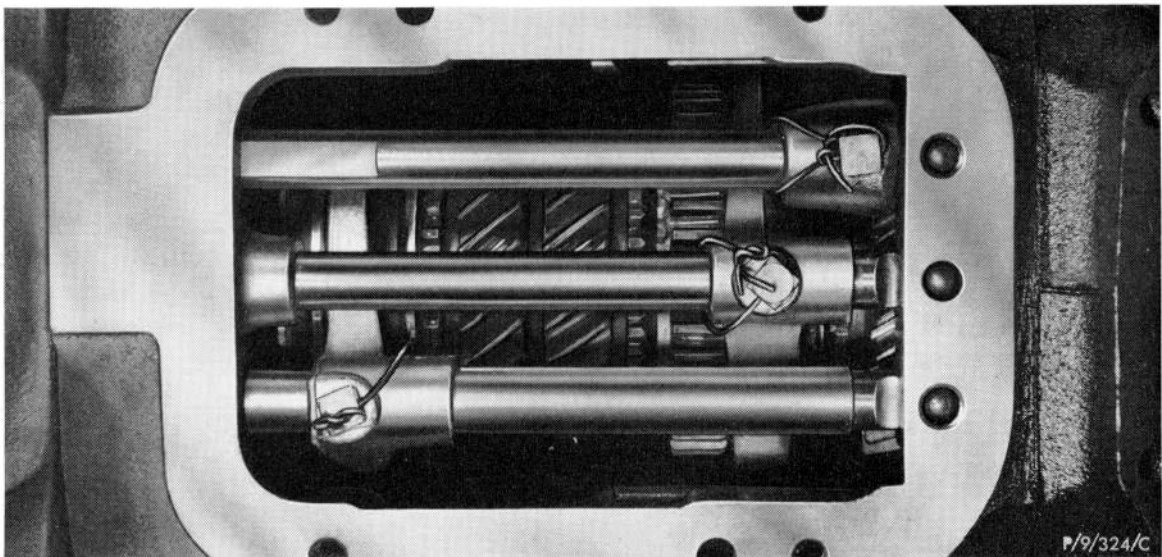


**Centre Rail**



**Extension Housing Removed**

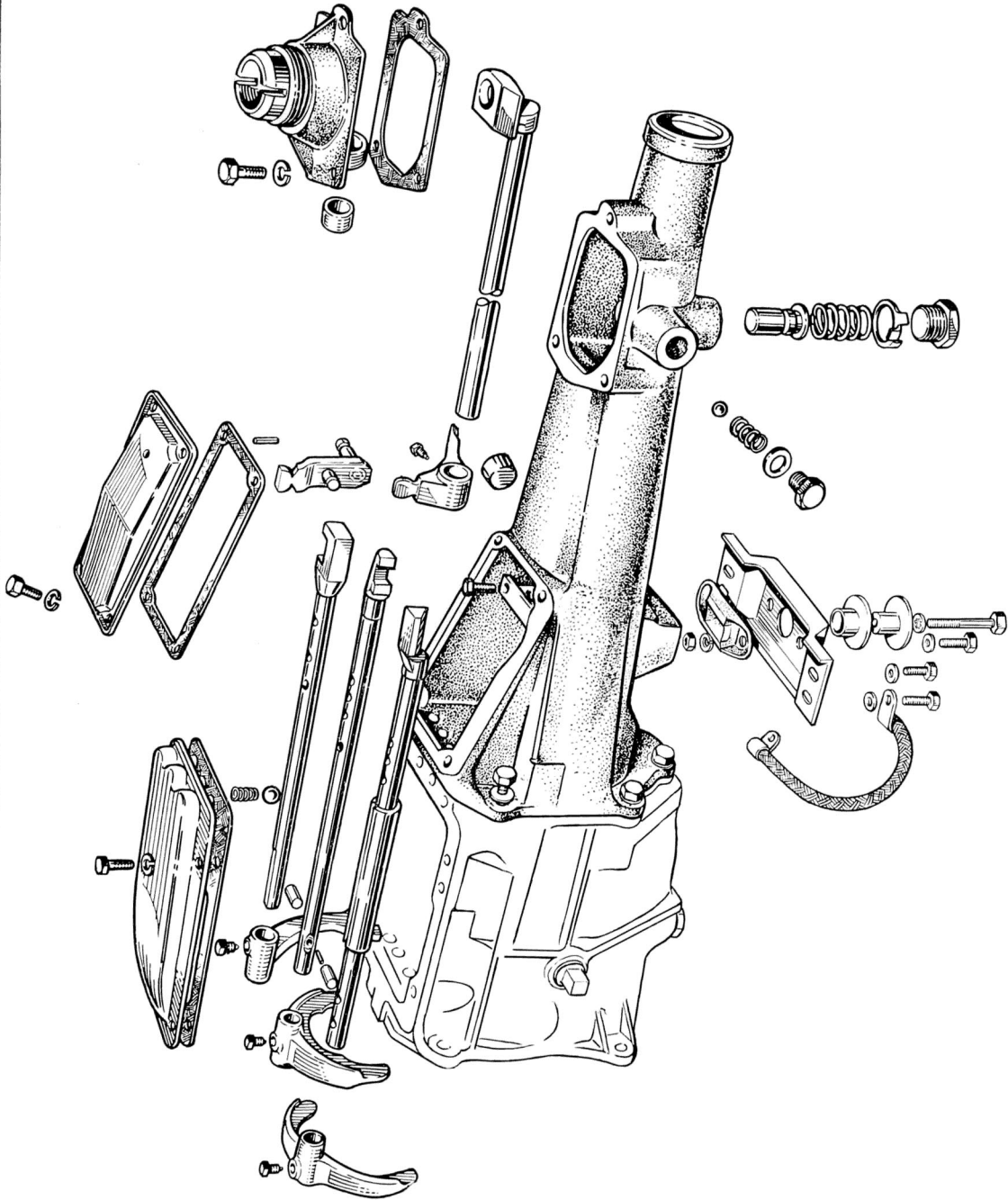
15. Pass the mainshaft into the gearbox, locating the front spigot in the main drive gear bearing. Tap the mainshaft in, aligning the dowel pin on the rear bearing carrier with the centre selector rail hole.
16. Carefully, with pieces of string at each end, lift the countershaft gear into mesh with the mainshaft and main drive gears. Take care that the thrust washers in the case at each end of the countershaft gear are not displaced.
17. Refit the countershaft from the rear, keeping it in contact with the dummy countershaft and finally tap it in so that the front face just protrudes from the gearbox.
18. Ensure that the flat on the end is so positioned to fit in the recess in the extension housing.
19. Slide the extension rod through the bore in the turret housing and fit the turret to the extension housing. Secure with three bolts and spring washers.
20. Engage the reverse rail in the gearbox case and push the extension housing home. Fit the five bolts and spring washers.
21. Refit the forward bearing bridge over the extension rod, with the cut-out forwards, and secure it with two bolts.
22. Replace the angled selector arm on the extension rod with the arms uppermost. Secure it with a bolt and lock with wire.
23. Slide the reverse rail back slightly, fit the centre rail, (identified by a cross drilling with a floating pin in one end). Ensure that the uppermost arm of the angled selector arm is to the left of the rail. Engage the first/second gear selector fork as the rail is pushed in.
24. Slide in the third/top gear rail, passing it through the over-run stop tube and the third/top selector fork.
25. Screw the selector forks to the rails, and fit the gear lever.
26. Select either third or fourth gear and check that the angled selector arm clears the first/second gear selector rail flat (C). If a fouling condition occurs, fit the next sized plunger down. Conversely, if fouling occurs between the angled selector arm and the reverse gear face (B) the next sized plunger up should be fitted, see following table and Operation No. 7003-A4.



**Selector Fork Positions**

ESCORT TWIN CAM

P/9/329/C



Gearbox — Exploded View



The plungers available are as follows:—

<i>Part Number</i>	<i>Size and Dimension A</i>
2821E-7K187-H	0.870 in. (2.21 cm.)
2821E-7K187-G	0.840 in. (2.10 cm.)
2821E-7K187-F	0.810 in. (2.06 cm.)
2821E-7K187-E	0.780 in. (1.98 cm.)
2821E-7K187-D	0.750 in. (1.91 cm.)

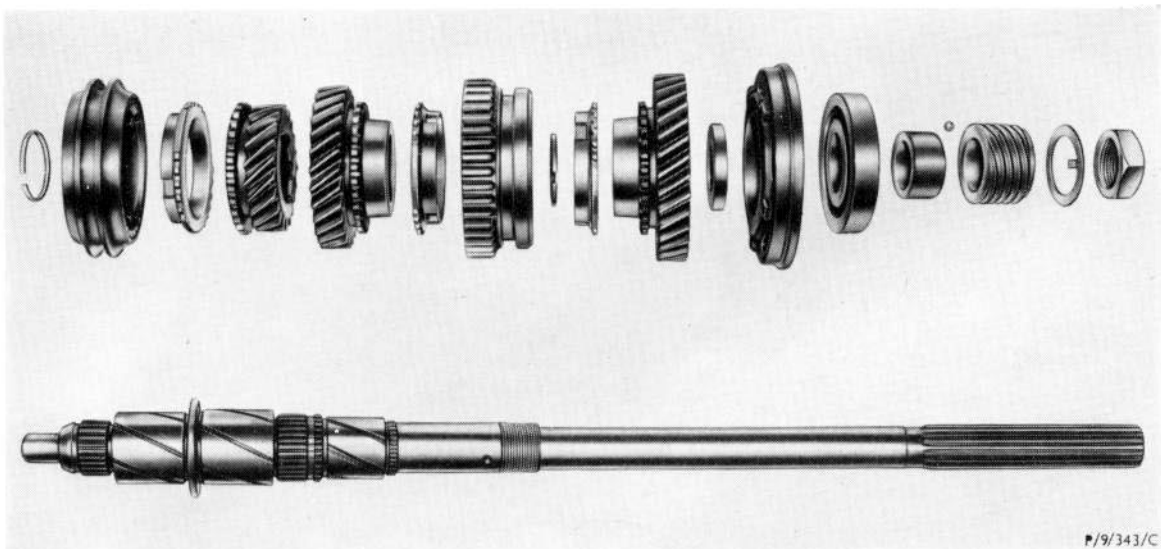
27. When the correct plunger has been fitted, bend up the lock tabs.
28. Replace the top cover, detent balls and springs, securing with four bolts and spring washers.
29. Replace the inspection cover, and secure with bolts and spring washers. The breather hole should be towards the rear of the gearbox.
30. Check engagement of all gears.

**OP 7003-A13 EXTRA: EXTENSION HOUSING AND MAINSHAFT ASSEMBLY – OVERHAUL**

**Tools Required**

- P.7098 Mainshaft nut spanner
- P.4090-6 Third/top synchroniser remover
- P.4090-7 First gear and mainshaft bearing remover
- P.4090-3 First/second synchroniser remover
- P.4000-31A Mainshaft bearing replacer
- P.7657-4 Extension housing oil seal remover
- P.7095 Extension housing oil seal replacer
- P.7038 Extension housing bearing remover/replacer

1. Dismantle the mainshaft assembly.
  - (a) Lift up the retaining tab behind the mainshaft nut and then unscrew this nut (use ring spanner, Tool No. P.7098). Remove the speedometer drive gear, lock-ball and spacer from the mainshaft.



**Mainshaft — Exploded View**



ESCORT TWIN CAM

P/9/344/C



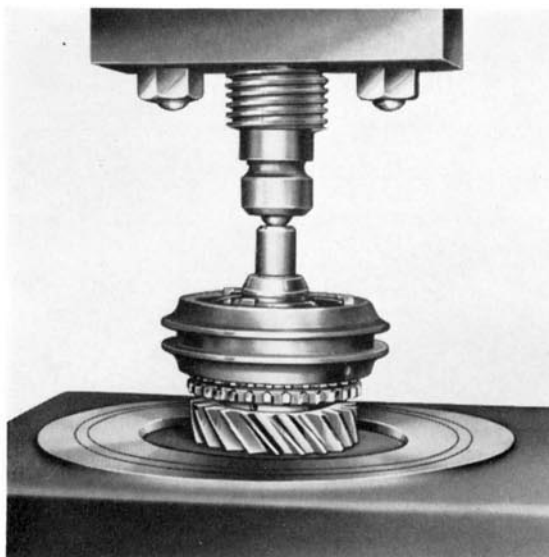
Gearbox Internals — Exploded View

- (b) Remove the circlip at the forward end of the mainshaft and discard it. Locate the adaptor (Tool No. P.4090-6) around the rear face of the third gear and in the base plate of a press. Press the mainshaft out of the third/top gear synchroniser and the third gear whilst supporting the mainshaft from beneath to prevent it dropping.
  - (c) Remove the first gear, splined collar, bearing carrier and bearing from the mainshaft by locating the adaptors (Tool No. P.4090-7) around the front face of the first gear and in the base plate of a press. Press the components off the mainshaft in the same way as in item (b) above but bring the ram down on the splined end.
  - (d) Carefully remove the circlip which is located in the mainshaft behind the first/second gear synchroniser hub and discard it.
  - (e) Locate the adaptors (Tool No. P.4090-3) around the front face of the second gear and in the base plate of a press. Press the second gear and the first/second gear synchroniser assembly from the mainshaft.
- NOTE - The synchroniser hubs and sleeves are mated together and also to the mainshaft. Mating marks are etched on the corresponding splines of the hub, the sleeve and adjacent to the spline on the mainshaft.

2. Reassemble the mainshaft assembly.

When reassembling the mainshaft **new** circlips must be used.

- (a) Slide the second gear along the mainshaft and onto its bearing so that the dog-teeth face at the rear.
- (b) Locate a blocker ring on the cone face of the second gear.
- (c) Assemble the first/second gear synchroniser:
  - (i) If a new unit is being installed, slide the synchroniser sleeve off the splined hub. Clean all the preservative from the hub, sleeve, blocker bars and springs. Lightly oil them.
  - (ii) 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.



Removing Third Gear



Synchroniser Mating Marks

P/9/336/C

(iii) Install a blocker bar spring to run around, clockwise, or anti-clockwise, inside the synchroniser sleeve beneath the blocker bars. The tagged end of the spring must locate in the "U" section of a blocker bar. 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 just previously fitted and runs in the same rotational direction. View direct onto one side of the synchroniser assembly and note the direction of rotation of the spring (clockwise or anti-clockwise). View direct onto the other side of the synchroniser assembly—the direction of rotation of the spring should be the same as for the first spring, when viewed face on (see illustration).

(d) Locate the first/second gear synchroniser assembly on the mainshaft and engage it on the splines as far as possible. Fit a suitable adaptor (Tool No. P.4090-7) behind the synchroniser assembly and locate it in the bed of a press. Press the mainshaft into the synchroniser assembly, taking care that it does not tilt as it moves over the circlip groove.

(e) Carefully fit a new circlip to the groove in the mainshaft behind the first/second gear synchroniser.

(f) Fit a blocker ring in the first/second gear synchroniser so that the cut-outs in the blocker ring fit over the blocker bars.

(g) Slide the first gear onto the mainshaft so that the dog-teeth are located adjacent to the blocker ring on the first/second gear synchroniser.

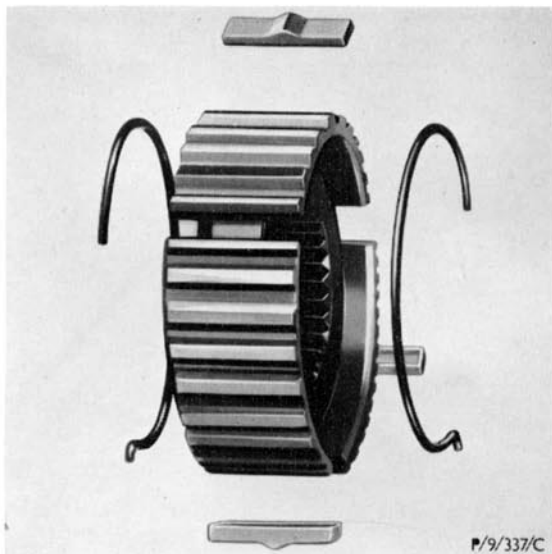
(h) Fit the splined collar behind the first gear.

(i) Position the bearing carrier on the mainshaft with the dowel hole to the rear. Fit the mainshaft bearing. Slightly withdraw the bearing carrier rearwards to fit over the bearing.

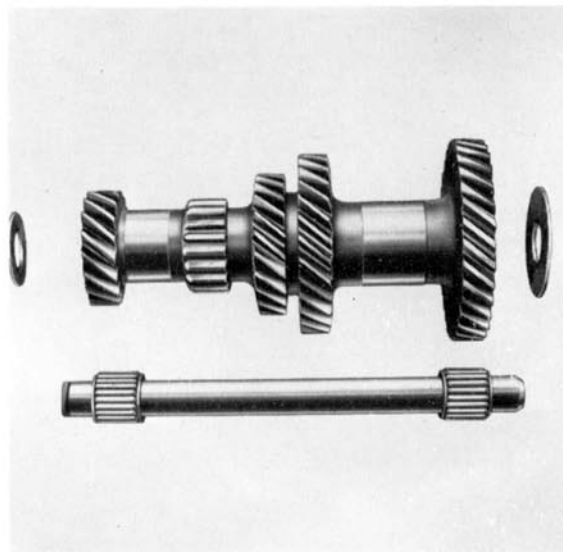
(j) Locate the adaptor (Tool No. P.4000-31A) over the bearing and insert the assembly in a slave ring (Tool No. 370) in the bed of a press. Press the bearing home onto its journal on the mainshaft.

(k) Slide the third gear onto the front end of the mainshaft with the dog-teeth away from the integral thrust collar. Locate a blocker ring on the taper face of the gear.

(l) Place a blocker bar spring in position on the rear face of the third/top gear synchroniser hub and note its direction of rotation. Ensure that the mating marks on the hub and mainshaft correspond and engage it on the splines as far as possible.



Synchroniser Spring Rotation



Countershaft — Exploded View

- Support the hub on the adaptor (Tool No. P.4090-7) and locate it in the bed of a press. Press the hub fully home and then fit a new circlip on the mainshaft in front of the hub.
- (m) Locate the blocker bars in position and fit the synchroniser sleeve onto the hub with the back angling on the internal splines facing the third gear and the mating marks in line.
- (n) Install the remaining blocker bar spring in the synchroniser hub in the same way as described previously (paragraph (c) iii).
- (o) Place the spacer and lock-ball on the mainshaft and slide on the speedometer gear and lock tab. Screw on the mainshaft nut and torque to 25 lb. ft. (3.4 kg.m.) (use ring spanner, Tool No. P.7098). Bend the lock tabs to retain the nut.
3. Extract the extension housing oil seal by screwing Tool No. P.7657-4 into Tool No. 7657 and then screw the assembly into the seal. Tighten the centre bolt to remove the seal.
  4. Drive the rear bearing into the housing to remove it. Use Tool No. P.7038.
  5. Punch out the retaining pin and remove the reverse relay lever from the extension housing.
  6. Locate a new bearing on Tool No. P.7038 and drive it into the extension housing until the rear end is flush with the deeper recessed face. This bearing must be fitted with the oil lubrication scroll starting at the bottom when viewed from the rear.
  7. Install the reverse relay lever in the extension housing. Tap in a new retaining pin.
  8. Fit a new extension housing oil seal, driving it into position with Tool No. P.7095.

**OP 7003-A14 EXTRA: GEARBOX – OVERHAUL**

**Tools Required**

P.7043	Reverse idler gear remover
P.4090-3A	Main drive gear bearing remover
P.7136	Main drive gear oil seal replacer
P.7113	Dummy countershaft
P.4000-29	Detail "a" and "b" Main drive gear bearing replacer

**To Dismantle**

1. Unscrew the three bolts and spring washers securing the main drive gear retainer to the gearbox case. Withdraw the retainer and paper gasket, taking care not to damage the seal. Carefully tap out the main drive gear.
2. Remove the countershaft gear and two thrust washers from the gearbox. In both ends of the countershaft there are twenty-two needle rollers retained by a small washer on each side of each set of rollers. Remove these rollers and the dummy countershaft.
3. Withdraw the reverse idler shaft with Tool No. P.7043. Should this tool not be available, locate a nut, a flat washer and a sleeve on a  $\frac{5}{16}$  in. 24 UNF threaded bolt. Screw the bolt into the reverse idler shaft and tighten the nut to withdraw the shaft.
4. Dismantle the main drive gear. Remove the circlip securing the main drive gear bearing, support the bearing in adaptors (Tool No. P.4090-3A) and press out the main drive gear.
5. Overhaul the main drive gear bearing retainer if necessary:—
  - (a) Remove the oil seal and discard it.
  - (b) Place a new seal on the replacer (Tool No. P.7136) so that when fitted the lips face the gearbox. Drive the seal into the retainer.

### To Reassemble

6. Reassemble the countershaft gear:—  
Fit a retaining washer to abut the machined shoulder inside the gear. Grease the needle rollers and locate twenty-two in the recess in the gear. Fit a retaining washer over the rollers and slide the dummy countershaft (Tool No. P.7113) through the gear. Repeat the procedure for the rollers at the other end. Grease the thrust washers and locate them in position inside the gearbox with the tongues in the machined recesses.
7. Position the countershaft gear in the bottom of the gearbox case, taking care not to displace the thrust washers.
8. Assemble the main drive gear. Position the main drive gear bearing on the gear with the external circlip groove on the bearing away from the gear. Support the assembly with the adaptor (Tool No. P.4000-29, detail "a") and press the bearing home on the gear, using a press adaptor (detail "b") located in the spigot recess of the main drive gear. Fit the small circlip in the groove in the shaft.
9. Fit a large circlip to the groove in the main drive gear bearing and then fit the main drive gear to the gearbox.
10. Fit the main drive gear bearing retainer to the gearbox. Cover the main drive gear splines before fitting the retainer and oil seal to prevent damage to the seal lip on assembly. First fit a new gasket on the gearbox front face. Ensure that the oil groove in the retainer is in line with the oil passage in the gearbox casing and that the gasket does not cover this passage. Coat the three retaining bolts with sealer (Part No. EM-4G-47) and fit them, complete with spring washers. Tighten securely.
11. Position the reverse idler gear inside the gearbox with the selector fork groove towards the rear. Fit the shaft through the case and gear so that the flats will be positioned to mate with the recess in the extension housing.

**OP 7003-B** SELECTOR MECHANISM – OVERHAUL  
(Includes OPS 7003-A and A1)

**OP 7003-K** GEARBOX ASSEMBLY – OVERHAUL  
(Includes OPS 7003-A, A1, A12, A13 and A14)

**OP 7003-M** EXTENSION HOUSING AND MAINSHAFT ASSEMBLY – OVERHAUL  
(Includes OPS 7003-A, A12 and A13)

**OP 7202-A** GEAR LEVER – REMOVE AND INSTALL

### To Remove

1. Lift the gear lever gaiter and unscrew the dome nut. Withdraw the gear lever.

### To Install

2. Locate the gear lever in the extension housing so that the end engages correctly with the selector rail. Secure in position by screwing the dome nut into the extension housing. Locate the gear lever gaiter and check that all gears are obtainable. If necessary move the gear lever knob so that the gearshift pattern is correctly shown, lock the adjustment with the threaded ferrule beneath the knob.

**OP 7500-A** CLUTCH HYDRAULIC SYSTEM – BLEED

### Tools Required

P.2006          Bleed tube

1. Clean the area around the bleed valve on the slave cylinder and remove the dust excluding rubber cap.

2. Fit a bleed tube, Part No. P.2006, and place the other end of the tube in a jar containing fluid, Part No. ME-3833-F, keeping the end of the tube beneath the surface of the fluid throughout the bleeding operation.
3. Open the bleed valve by turning it anti-clockwise and slowly depress and release the clutch pedal several times. For each stroke some fluid and/or air should be pumped out of the tube. If neither fluid nor air is pumped out, the bleed valve is not properly opened or there is a blockage in the pipe line.

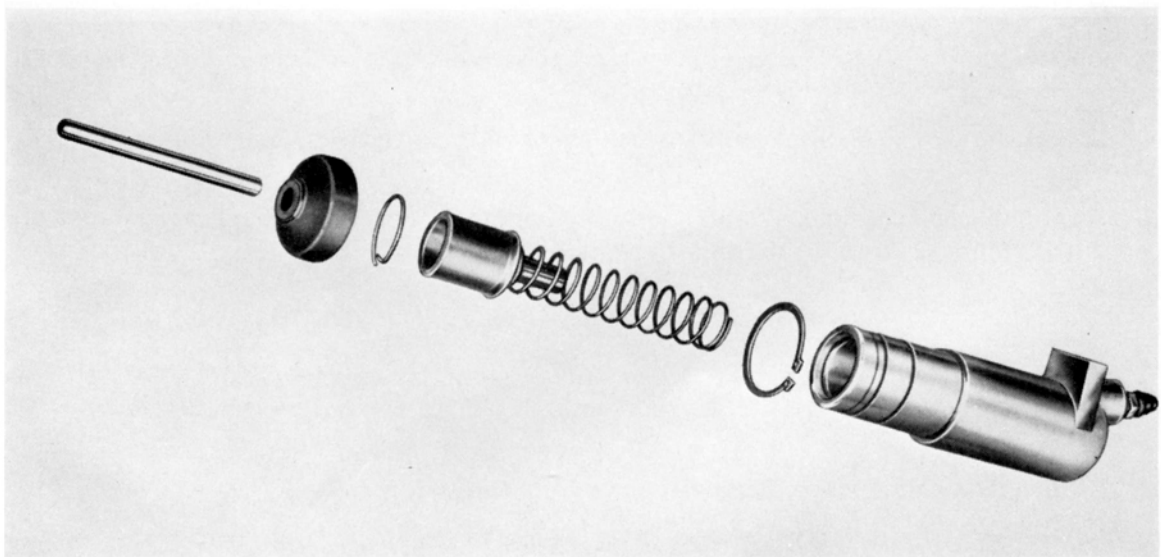
NOTE – Where air in the system is suspected, remember that initial application of the clutch pedal will cause air trapped in the bleed tube to be forced into the fluid container.

4. Continue depressing and releasing the clutch pedal slowly until no more air bubbles emerge from the tube, ensuring that the fluid level in the reservoir is maintained during the bleeding operation.  
Do not replenish the reservoir with fluid obtained from the system as it may be aerated or contaminated.
5. Close the bleed valve tightly with the pedal fully depressed, when fluid alone comes out of the bleed tube with each stroke of the clutch pedal. Refit the dust cap on the valve.
6. Refill the reservoir to the correct level and refit the cap.

**OP 7501-B CLUTCH HYDRAULIC SLAVE CYLINDER – REMOVE AND INSTALL**

**To Remove**

1. Jack up the front of the car and fit chassis stands.
2. Detach the fluid pipe by unscrewing the union nut, using a blanking plug to prevent dirt entering the pipe. Remove the fluid pipe to slave cylinder adaptor.
3. Remove the retaining circlip from around the cylinder body after slipping the rubber boot off the slave cylinder.
4. Push the cylinder forwards out of its location, removing the boot and the push rod simultaneously.



**Clutch Slave Cylinder – Exploded View**



### To Install

5. Slide the cylinder into its location in the clutch housing flange from the front. Push the push-rod through the rubber boot and insert the push-rod, with the boot hanging loose, into the operating cylinder and clutch release arm.
6. Fit a circlip, ensuring that it is correctly located in its groove and fit the rubber boot on the slave cylinder. Replace the fluid pipe adaptor.
7. Reconnect the fluid pipe, tighten the union nut.
8. Bleed the system as described in Operation No. 7500-A.

### OP 7501-B1 EXTRA: CLUTCH HYDRAULIC SLAVE CYLINDER – OVERHAUL

#### To Dismantle

1. Remove the piston and seal by extracting the circlip from the cylinder body, and then removing the piston spring from the cylinder.
2. Unscrew the bleed valve on the side of the operating cylinder.
3. Pull the spring and then the rubber piston off the spigot at the front of the piston.
4. Wash all parts in hydraulic fluid, Part No. ME-3833-F, methylated sprit or commercial alcohol and examine the rubber piston seal carefully. Renew the seal if there is any sign of damage to the sealing lip.

#### To Reassemble

5. Locate the piston seal on the spigot at the front end of the piston with the recess in the seal away from the piston. Locate the spring on the piston spigot.
6. Dip the piston and seal in hydraulic fluid and carefully insert, spring first, into the cylinder.
7. Replace the bleed valve but do not tighten.

### OP 7501-C CLUTCH HYDRAULIC SLAVE CYLINDER – OVERHAUL (Includes OPS 7501-B and B1)

### OP 7534-A CLUTCH HYDRAULIC MASTER CYLINDER – REMOVE AND INSTALL

#### To Remove

1. Disconnect the clutch master cylinder push-rod from the pedal by unscrewing the nut and withdrawing the spring washer and bolt.
2. Detach the fluid pipes by unscrewing the union nuts, using blanking plugs to prevent ingress of dirt.
3. Remove the two nuts and spring washers securing the master cylinder to the pedal assembly bracket, and withdraw the master cylinder.
4. Empty the contents of the fluid reservoir into a waste container.

#### To Install

5. Refit the master cylinder to the pedal bracket assembly, and secure with the two nuts and spring washers.
6. Reconnect the fluid pipes. **Do not overtighten the union.**
7. Reconnect the clutch master cylinder push rod to the pedal by passing the concentric bolts through the push rod and then the pedal. Fit a spring washer and nut; tighten to 12 to 15 lb. ft. (1.66 to 2.07 kg.m.) torque.



8. Top-up the master cylinder reservoir with clean approved fluid, ME-3833-F, and then bleed the system; see Operation No. 7500-A. Check the action of the clutch.

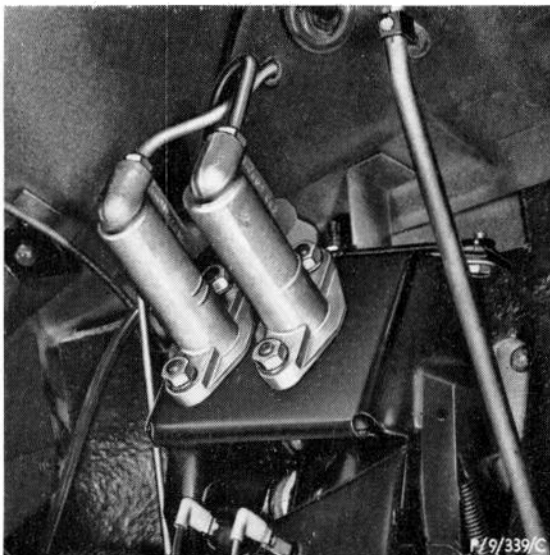
**OP 7534-A1 EXTRA: CLUTCH MASTER CYLINDER – OVERHAUL**

**To Dismantle**

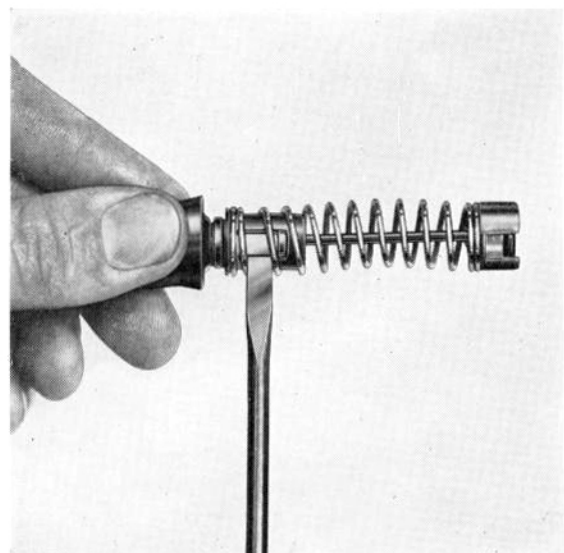
1. Remove the rubber boot. Withdraw the circlip and remove the pushrod.
2. Withdraw the piston and valve assembly from the cylinder.
3. Remove the piston from the valve assembly. The spring retainer is held in position on the spigot end of the piston by a tab which engages under a shoulder on the front of the piston. Lift up the tab and remove the spring retainer, spring and valve assembly from the piston.
4. Dismantle the valve assembly by compressing the spring and moving the valve stem to one side in the retainer, so releasing the end of the valve stem from the key-hole slot in the retainer. Slide the valve spacer and shim off the valve stem.
5. Remove the rubber valve seal and piston seal if necessary.
6. Wash the parts in methylated spirits, approved fluid ME-3833-F, or commercial alcohol. Carefully inspect the piston rubber seal and renew if there is any sign of damage to the sealing lip.

**To Reassemble**

7. Replace the piston seal with the lip away from the large diameter of the piston.
8. Fit the valve seal to the valve stem with the lip outwards and away from the spring. Slide the shim, valve spacer, with legs over the valve seal, and return spring over the valve stem. Ensure that the convex face of the shim abuts the valve stem flange.
9. Fit the spring retainer in the rear end of the return spring, compress the spring and locate the valve stem in the key-hole slot in the end of the spring retainer.



**Brake and Clutch Master Cylinder Location**



**Removing the Piston Valve**

## ESCORT TWIN CAM

10. Insert the front of the piston in the spring retainer, and secure it by locating the spring retainer tab under the front shoulder of the piston.
11. Dip the piston and seal in hydraulic fluid and insert the piston assembly in the cylinder, valve seal end first.
12. Install the push-rod in the master cylinder. Locate the washer and fit the retaining circlip.
13. Refit the rubber boot to the clutch master cylinder.

### **OP 7534-B** CLUTCH MASTER CYLINDER – OVERHAUL (Includes OPS 7534-A and A1)

### **OP 7657-A** EXTENSION HOUSING OIL SEAL – RENEW (Gearbox in situ)

#### **Tools Required**

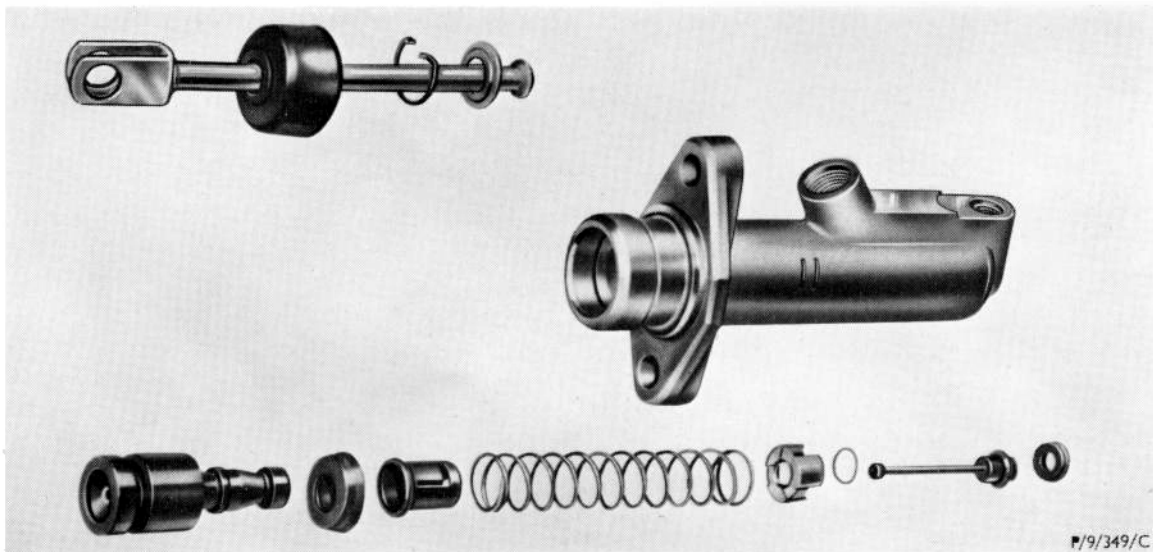
7657	Oil seal remover (main tool)
P.7657-4	Adaptor for 7657
P.7095	Oil seal replacer

#### **To Remove**

1. Chock the front wheels and jack up the rear of the car. Fit stands.
2. Mark the driveshaft pinion flanges and remove the four bolts and self-locking nuts.
3. Extract the oil seal from the rear of the extension housing using Tool No's. 7657 and P.7657-4.

#### **To Install**

4. Locate a new extension housing oil seal on replacer Tool No. P.7095, so that the lip on the seal faces into the extension housing and then drive the seal into position in the housing.
5. Replace the driveshaft by sliding the front universal joint yoke onto the splines of the mainshaft, taking care not to damage the extension housing oil seal. Align the mating marks on the driveshaft and pinion flanges, fit the retaining bolts and secure with four new self-locking nuts.



**Clutch Master Cylinder—Exploded**

6. Remove the stands, lower the car to the ground and remove the chocks from the front wheels.
7. With the car on level ground, check gearbox oil level and top-up if necessary.

**OP 7657-A1** EXTRA: EXTENSION HOUSING REAR BUSH – RENEW  
(Extension housing oil seal removed)

**Tools Required**

P.7149 Gearbox extension housing bush remover  
P.7150 Gearbox extension housing bush replacer

1. Insert the bush removing Tool No. P.7149 into the rear of the extension housing so that it locates on the forward end of the bush. Withdraw the bush.
2. Assemble the new bush to the replacing Tool No. P.7150, and drive it into position.

**OP 7657-B** EXTENSION HOUSING REAR BUSH – RENEW  
(Includes OPS 7657-A and A1)