SECTION H

THE GEARBOX UNIT

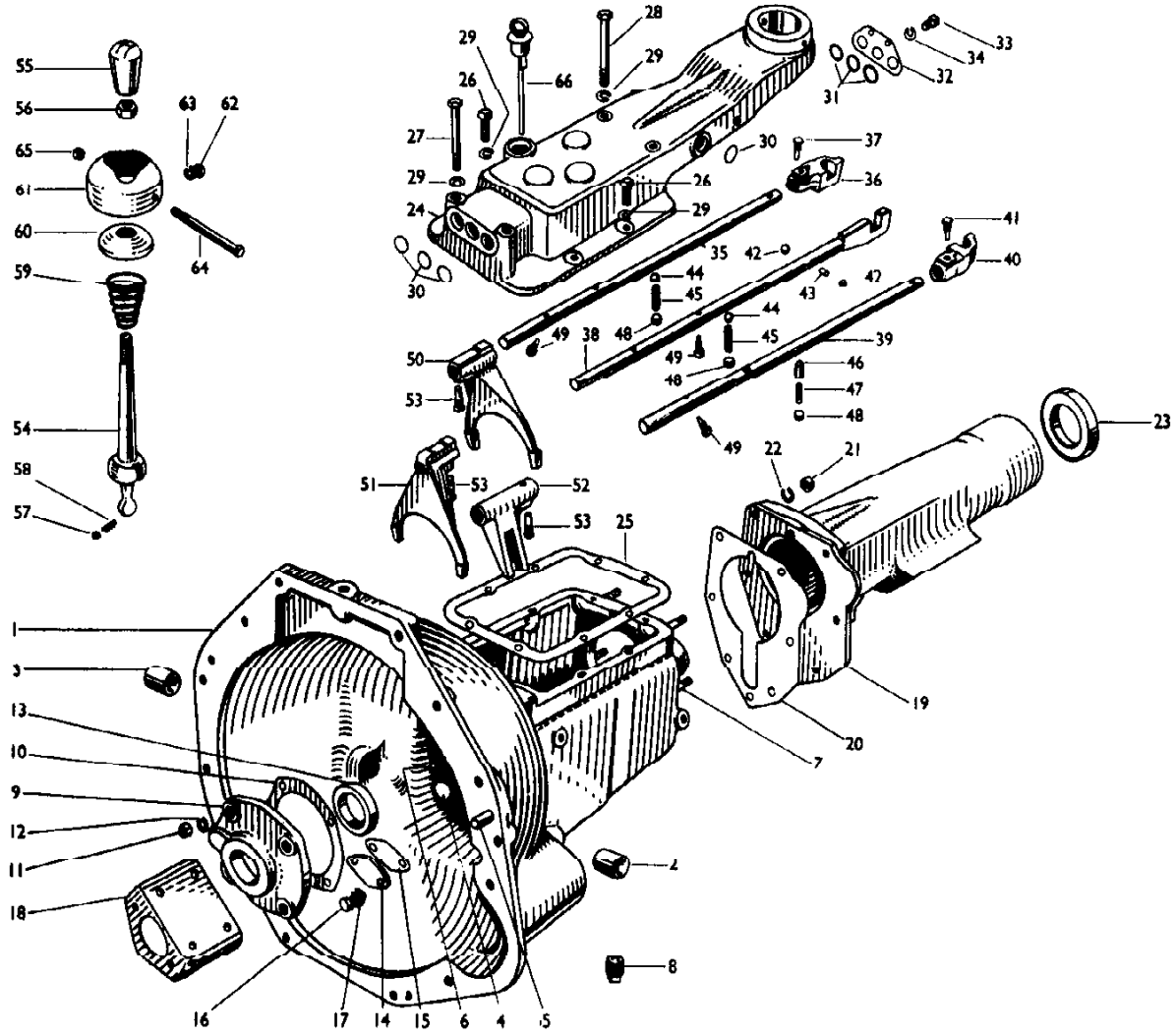


Figure H1

Exploded view of gearbox casing and top cover.

1. Gearbox casing.
2. L.H. clutch operating shaft bush bearing.
3. R.H. clutch operating shaft bush bearing.
4. Welch washer plug.
5. Locating dowel.
6. Primary shaft cover mounting stud.
7. Rear casing mounting stud.
8. Drain plug.
9. Primary shaft cover.
10. Joint washer.
11. Nut.
12. Spring washer,
13. Primary shaft oil seal.
14. Countershaft front end cover.
15. Joint washer.
16. Bolt.
17. Spring washer.
18. Slave cylinder bracket.
19. Rear casing.
20. Joint washer.
21. Nut.
22. Spring washer.
23. Rear oil seal.
24. Top cover.
25. Joint washer.
26. Short bolts.
27. Intermediate length bolt.
28. Long bolt.
29. Spring washers.
30. Welch washer plugs.
31. Rubber "O" ring seals.
32. Seal retaining plate.
33. Bolt.
34. Spring washer.
35. First and second speed selector rod.
36. Selector rod end.
37. Tapered bolt.
38. Third and top speed selector rod.
39. Reverse selector rod.
40. Selector rod end.
41. Tapered bolt.
42. Interlocking ball.

43. Interlocking plunger.
44. Indent ball.
45. Spring.
46. Reverse plunger.
47. Spring.
48. Closing plugs.
49. Stop bolts.
50. First and secon d selector fork.
51. Third and top selector fork.
52. Reverse selector fork.
53. Tapered bolts.
54. Gear selection lever.
55. Gear selector knob.
56. Lock nut.
57. Gear lever anti-rattle plunger.
58. Plunger spring.
59. Gear lever spring.
60. Spring plate.
61. Cover plate.
62. Bolt.
63. Spring washer.
64. Gear lever retaining bolt.

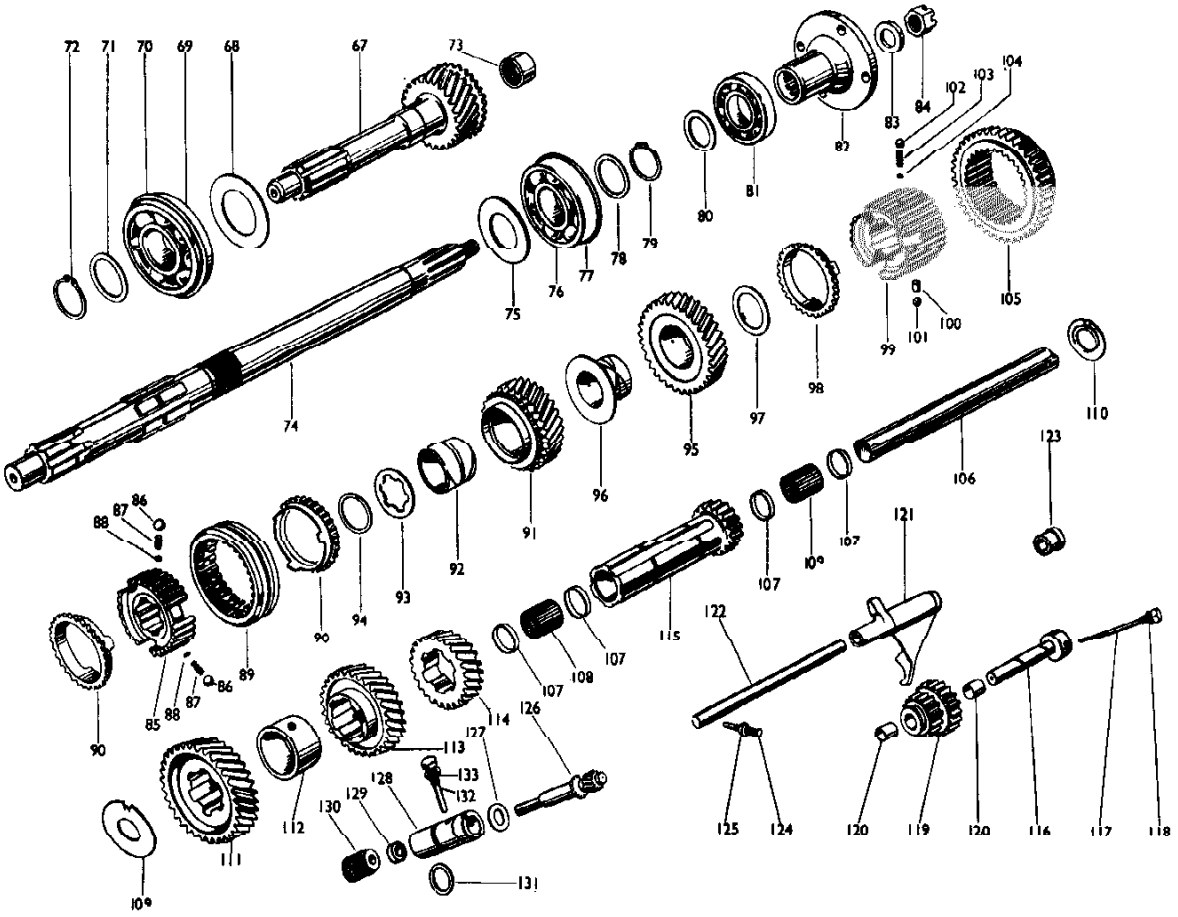


Figure H2.

Exploded view of gearbox unit (moving components).

67. Primary shaft.
68. Oil thrower.
69. Primary shaft ball bearing race.
70. Outer ball race circlip.
71. Ball bearing race thrust washer.
72. Circlip.
73. Mainshaft needle roller bearing.
74. Mainshaft.
75. Mainshaft ball bearing race washer.
76. Mainshaft ball bearing race.
77. Outer ball race circlip.
78. Ball bearing race thrust washer.
79. Circlip.
80. Rear ball bearing race washer.

81. Mainshaft rear ball bearing race.
82. Rear coupling flange.
83. Washer.
84. Castillated nut.
85. Third and top splined hub.
86. Synchronising ball.
87. Synchronising spring.
88. Synchronising shim.
89. Third and top speed operating sleeve.
90. L.H. top speed synchronising ring.
90. R H. third speed synchronising ring.
91. Third speed drive gear.
92. Third speed drive gear bush bearing.
93. Third speed thrust washer.
94. Mainshaft circlip.
95. Second speed drive gear.
96. Second speed drive gear flanged bush bearing.
97. Second speed thrust washer.
98. Second speed synchronising ring.
99. Second and first splined hub.
100. First speed interlocking plunger.
101. First speed interlocking ball.
102. Second speed synchronising ball.
103. Second speed synchronising spring.
104. Second speed synchronising shim.
105. Second and first gear operating sleeve.
106. Countershaft.
107. Needle roller bearing retaining ring.
108. Countershaft needle roller bearing assembly.
109. Front countershaft gear cluster thrust washer.
110. Rear countershaft gear cluster thrust washer.
111. Primary shaft constant mesh gear.
112. Countershaft gear cluster distance piece.
113. Countershaft third speed driving gear.
114. Countershaft second speed driving gear.
115. Countershaft first speed driving gear.
116. Reverse gear spindle.
117. Countershaft and reverse gear locating pin.
118. Washer.
119. Reverse compound gear.
120. Reverse gear bush bearings
121. Reverse gear selector fork.
122. Reverse gear selector rod.
123. Reverse gear selector rod bush.
124. Reverse gear selector rod locating screw.
125. Locating screw lock nut.
126. Speedometer driven pinion (14T).
127. Speedometer drive thrust washer.
128. Speedometer body and bush bearing assembly.
129. Oil Seal.
130. Screwed adaptor.
131. Rubber "O" ring.
132. Speedometer bush bearing locating bolt.
133. Locating bolt washer.

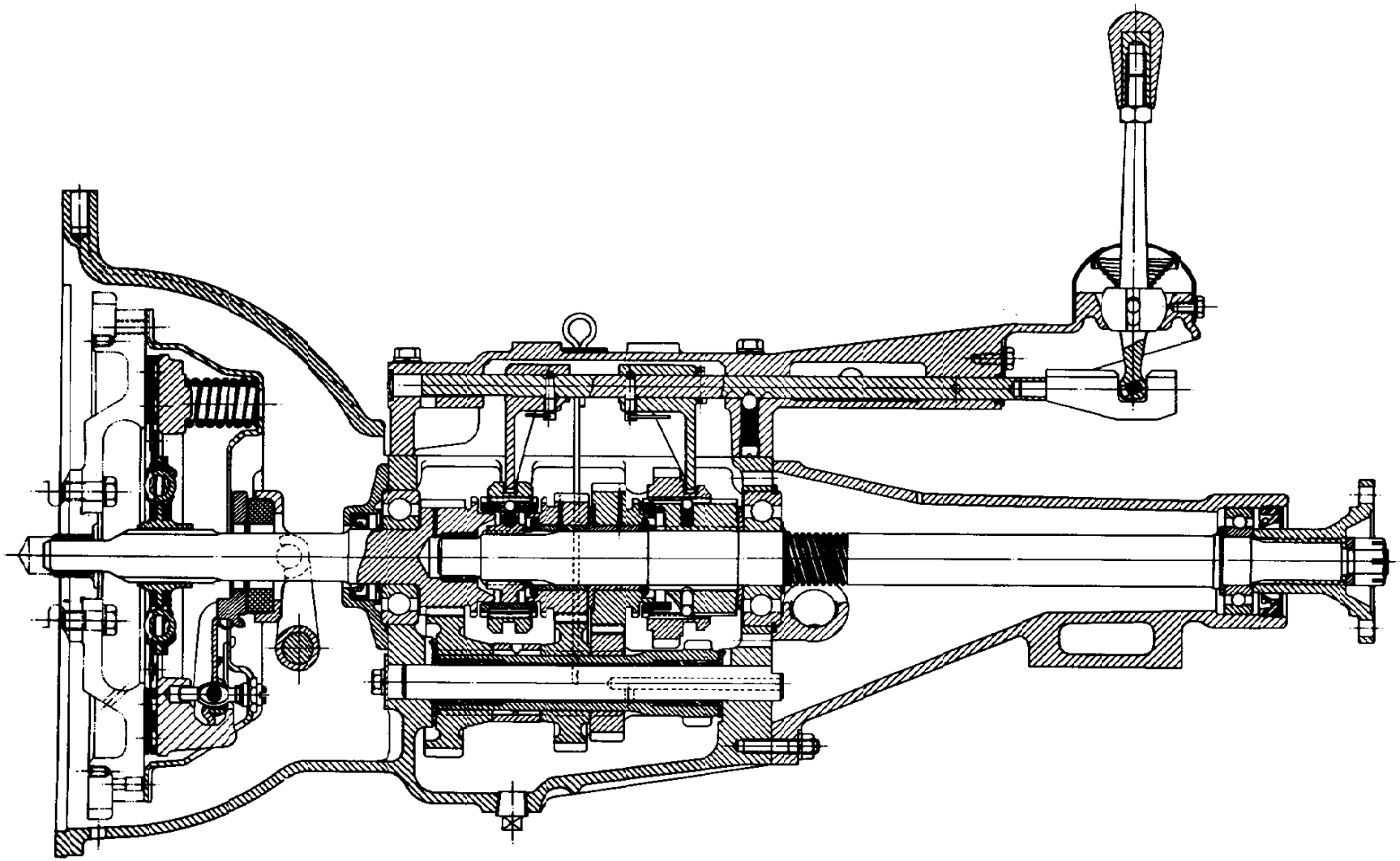


Figure H3. Cross section of gearbox unit

SECTION H

THE GEARBOX UNIT

GEARBOX RATIOS

FIRST	2.933	:	1	
SECOND	1.742	:	1	)
THIRD	1.232	:	1	) Synchromesn engagement
TOP	1	:	1	)
REVERSE	3.771	:	1	

OVERALL RATIO WITH 3.58 : 1 REAR AXLE

FIRST	10.500	:	1
SECOND	6.236	:	1
THIRD	4.410	:	1
TOP	3.58	:	1
REVERSE	13.50	:	1

THE GEAR SELECTION

DESCRIPTION Fig. H4.

Gear selection is effected by a short selector lever mounted at the extended rear end of the gearbox top cover. It is of the conventional "H" type with first and second gear on the L.H. side and third, top and reverse gear on the R.H. side. To avoid the inadvertent engagement of the Reverse gear, a step has been incorporated in the rear end. the reverse gear selector rod necessitating an upward and sideways lift of the selector lever.

TO SELECT THE GEARS

The clutch pedal must always be depressed when selecting any gear.

FIRST	Move the selector lever to the left and forward.
SECOND	Move the selector lever to the left and rearward.
THIRD	Move the selector lever to the right and forward.
TOP	Move the selector lever to the right and rearward.

NEUTRAL Move the selector lever to the mid-point of its forward and rearward travel when it will pass across from the first and second gear travel to the third and top travel or vice versa.

REVERSE Select neutral, move the selector lever to the right and lift; it will then travel further to the right, when it should be moved rearward.

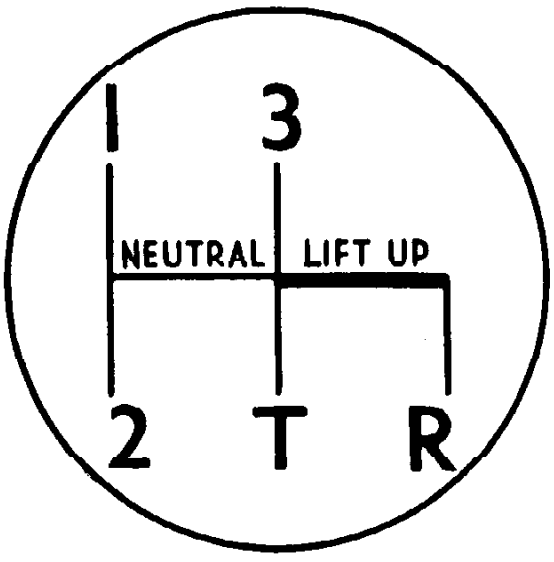


Figure H4 (Left)

Gear lever positions.

THE TOP COVER ASSEMBLY

DESCRIPTION

The top cover assembly, while forming a lid for the gearbox, also houses the gear selector forks in its front end, the selector rods of which connect with the gear selector lever at its rear end and the dipstick for checking the oil content is situated in the R.H. side of its top face. Oil sealing of the selector rods is effected by welch washer plugs at the front end and rubber "O" rings at the rear, the latter being retained in position by a plate.

It must be realised that when the selector lever is moved to either L. or R. it is the selector rod on the OPPOSITE side to the lever that moves.

REMOVAL AND REPLACEMENT
GEAR LEVER KNOB

1. REMOVAL

Grip the rubber gear lever knob at the top end of the gear selection lever and slacken the locknut beneath, remove the gear lever knob by turning it anti-clockwise.

2. REPLACEMENT

The replacement of the gear lever knob is the reversal of the removal sequence.

REMOVAL AND REPLACEMENT
DIPSTICK

1. REMOVAL

Remove the rubber plug from the top side of the transmission cover and withdraw the dipstick vertically upward through the aperture.

2. REPLACEMENT

The replacement of the dipstick is the reversal of the removal sequence.

REMOVAL AND REPLACEMENT
GEARBOX TOP COVER ASSEMBLY

1. SEATS AND TRANSMISSION COVER

Remove the seats and transmission cover from the car as detailed in the BODY SECTION Q.

2. GEARBOX TOP COVER

Ensure the neutral gear is selected. Remove the top cover assembly from the gearbox by withdrawing eight bolts.

3. REPLACEMENT

The replacement of the gearbox top cover is the reversal of the removal sequence but ensure that both gearbox and top cover assembly are in the neutral position before offering up the latter.

DISMANTLING AND ASSEMBLING
GEARBOX TOP COVER ASSEMBLY Figs. H5 and H6.

1. GEAR SELECTOR LEVER

Ensure that the gearbox top cover is in the neutral position and remove the knob from the top of the selector lever by slackening the locknut. Withdraw the cap, spring retainer, spring and gear selector lever from the rear end of the gearbox top cover assembly by removing a bolt, and a transversely fitting nut and bolt. Remove the plunger and spring at the bottom ball end.

2. SELECTOR ROD LOCATING PLUNGERS

Withdraw the two steel balls, plunger and springs from the three vertical bores in the rear gearbox fitting face by removing the three screwed plugs.

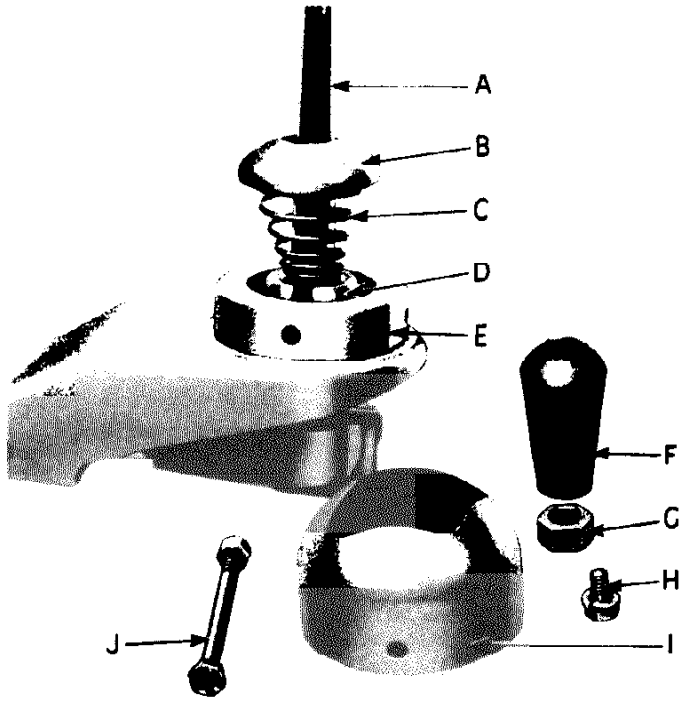


Figure H5
Gear lever assembly.

A. Gear selection lever.
B. Spring retainer.
C. Spring.
D. Ball of gear lever.
E. Gearbox top cover.
F. Gear selection lever knob.
G. Gear lever knob locknut.
H. Rear bolt.
I. Cap.
J. Gear lever retaining nut and bolt.

3. FIRST AND SECOND SELECTOR ROD ASSEMBLY

Withdraw the first and second selector rod assembly from the R.H. side of the top cover casing by removing the stop and selector fork bolts after cutting the locking wire and exercising care to control the run of the interlocking steel ball. Detach the end from the selector rod by withdrawing the bolt after cutting the locking wire.

4. REVERSE SELECTOR ROD ASSEMBLY

Repeat the previous operation 3 with the reverse selector rod assembly situated in the L.H. side of the gearbox top cover assembly.

5. TOP AND THIRD SELECTOR ROD ASSEMBLY

Repeat the operation 3 with the top and third selector rod assembly situated in the centre of the gearbox top cover assembly, but in this instance the selector rod interlocking steel ball is replaced by a short plunger.

6. SEAL RETAINING PLATE

Remove the seal retaining plate and three seals from the rear end of the gearbox top cover casing by withdrawing two bolts.

7. GEARBOX TOP COVER CASING

The three welch washer plugs in the front face and the two, one each side, of the gearbox casing can be removed as detailed in the ENGINE UNIT, SECTION D.

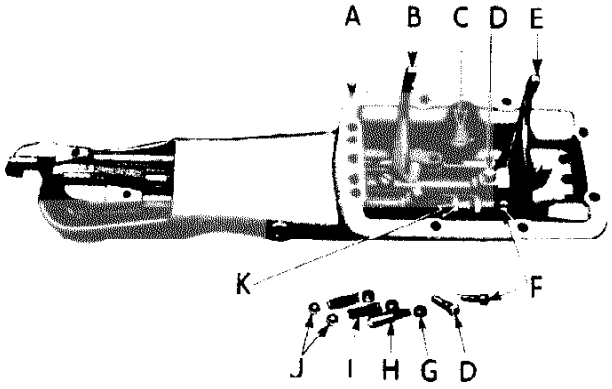


Figure H6.
Selector cover assembly showing underside

A. Selector cover.
B. First and second gear selector fork.
C. Dipstick location.
D. Taper securing screw.
E. Top and third selector fork.
F. Selector stop bolt.
G. Screwed plug.
H. Reverse rod locating plunger and spring.
I. Locating ball springs.
J. Steel ball.
K. Reverse selector fork

8. ASSEMBLING

The assembling of the gearbox top cover assembly is the reversal of the dismantling sequence, but particular attention must be given to the following points:

(i) That the selector rod plunger is located inside the top and third selector rod with a smear of grease before it is offered up to the gearbox top cover.

(ii) That the interlocking steel ball, positioned one each side of the reverse selector rods, can be rolled down its appropriate bore and pressed into its transverse bore only when those selector rods already fitted are in the neutral position. This operation is best effected when it is positioned on one of its side faces.

(iii) That the screw plugs securing the selector rod locating details are screwed home so that their top faces are below the gearbox fitting face.

(iv) That the load on the gear selector knob required to select any gear is checked before the top cover assembly is attached to the gearbox casing, as detailed below

DIMENSIONS

	ENGLISH	METRIC
Bore in top cover for selector rod	0.5025" 0.4995"	12.7635 mm. 12.6873 mm.
Dia. of selector rod	0.4985" 0.4975"	12.6619 mm. 12.6365 mm.
Thickness of selector fork ends	0.278" 0.275"	7.0610 mm. 6.9850 mm.
Width between legs of reverse	0.505" 0.500"	12.827 mm. 12.700 mm.

TOP COVER SELECTOR ROD LOADINGS

A particular load must be placed on the gear selector knob to effect any gear selection. The loadings are specified hereafter and are the loads applied to the gear selector lever when the top cover assembly has been removed from the gearbox.

TO CHECK THE LOADING

Remove the gearbox top cover from the top face of the gearbox casing as detailed on page Mount the top cover assembly securely in the protected jaws of a vice. Attach a spring balance to the knob of the gear selector lever and select each position in turn by applying the load through the spring balance and note the reading. When the determined loads differ from those specified the loading must be adjusted as detailed later and the components replaced by the reversal of the

removal sequence.

TO ADJUST THE LOAD

Remove the appropriate screwed plug from the rear gearbox fitting face. Check the free length of the spring and examine the reverse selector rod plunger or the steel balls of the two remaining selector rods for wear and replace when necessary. The loading on the plunger or steel balls can be reduced or increased by rubbing down the inside face of the screwed plug or by adding shims between the underside of the spring and the inside face of the screwed plug respectively. It should be noted that these shims must be fabricated locally.

DIMENSIONS

	ENGLISH	METRIC
First and second selector rod release loading	34lbs. 32lbs.	15.422 kgs. 14.515 kgs.
Third and top selector rod release loading	20lbs. 17lbs.	9.072 kgs. 7.711 kgs.
Reverse selector rod release loading	23lbs. 21lbs.	10.433 kgs. 9.525 kgs.
Free length of first/second and third/top selector springs.	1.075"	27.955 mm.
Free length of reverse selector spring	0.825"	20.955 mm.
Bore in top cover for reverse selector plunger.	0.377" 0.376"	9.5758 mm. 9.5504 mm.
Dia. of reverse selector plunger.	0.375" 0.374"	9.525 mm. 9.4996 mm.

REMOVAL AND REPLACEMENT

GEARBOX UNIT

DESCRIPTION Fig. H7.

The gearbox unit can be removed from the car by two methods:

(i) Leaving the engine unit in position. This entails the removal of the front seats and transmission cover as detailed in the BODY UNIT SECTION Q.

(ii) Together with the engine unit as detailed in the ENGINE UNIT, SECTION D, and then detaching the gearbox unit from its mounting plate at the rear of the cylinder block as detailed on page H10.

Both methods have their own merits and when any overhauling of the engine unit is to be carried out, no doubt the removal of the gearbox with the engine unit has advantages. The decision rests with the engineer.

REMOVAL AND REPLACEMENT, GEARBOX UNIT
LEAVING ENGINE UNIT IN POSITION Fig. H7.

1. ELECTRIC STARTER MOTOR

Detach the battery earthing lead and remove the electric starter motor from the L.H. side of the engine unit as detailed in the ELECTRICAL EQUIPMENT, SECTION O, PART I.

2. SEATS AND TRANSMISSION COVER

Remove the seats and transmission cover from the cockpit of the car as detailed in THE

BODY, SECTION Q.

3. PROPELLER SHAFT FRONT COUPLING

Detach the propeller shaft coupling from the gearbox coupling flange as detailed in the PROPELLER SHAFT, SECTION I.

4. CLUTCH SLAVE CYLINDER AND BRACKET

Remove the clutch slave cylinder and bracket from the R.H. side of the clutch bell housing as detailed in THE CLUTCH UNIT, SECTION C.

5. SPEEDOMETER FLEXIBLE DRIVE

Withdraw the speedometer flexible drive from the adaptor in the R.H. side of the gearbox rear casing by slackening the knurled nut.

6. GEARBOX REAR MOUNTING

Detach the gearbox rear casing from the two metal and rubber bonded pads by withdrawing four bolts.

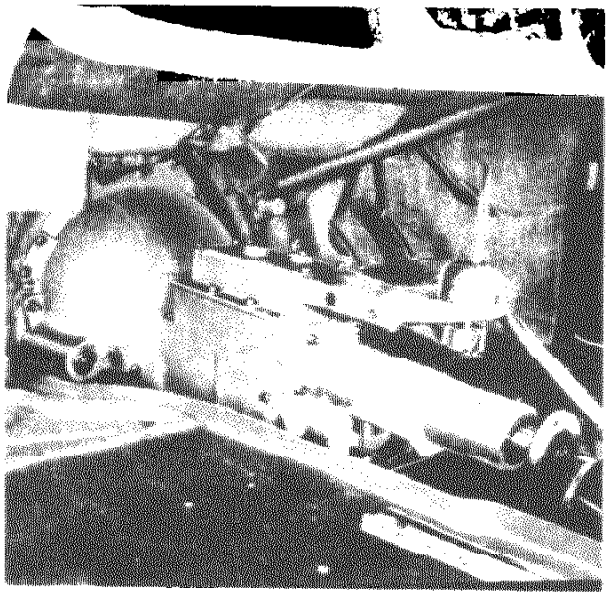


Figure H7

Gearbox situated in cockpit.

7. GEARBOX UNIT

Drain the gearbox unit of oil as detailed on page H15.

Position a jack under the gearbox unit and raise the gearbox rear casing no more than 0.250" (6.350 mm.) above its rear mountings. Position a second jack under the engine sump to take the weight of the engine unit without lifting the gearbox unit from the rear jack. Detach the gearbox unit from the plate on the rear face of the cylinder block by withdrawing seven bolts and four nuts and bolts and withdraw the gearbox from the two locating dowels in a rearward direction and remove from the cockpit of the car.

8. REPLACEMENT

The replacement of the gearbox unit is the reversal of the removal sequence but ensure that the hub of the clutch driven plate assembly aligns with the bearing in the rear end of the engine crankshaft as detailed in the CLUTCH UNIT, SECTION G.

REMOVAL AND REPLACEMENT, GEARBOX UNIT FROM ENGINE UNIT WHEN REMOVED FROM CAR

1. REMOVAL

Position the complete unit on a bench top so that the gearbox unit overhangs the edge. Secure and chock the engine unit and position a prop beneath the overhanging gearbox unit. Detach the gearbox unit from the mounting plate on the rear face of the cylinder block by removing all but the top two securing details. With the assistance of another, manually

taking the weight of the gearbox, withdraw the remaining two details. Remove the gearbox unit from the engine unit by moving it rearward in a horizontal direction.

2. REPLACEMENT

The replacement of the gearbox unit is the reversal of the removal sequence but particular attention must be given to the following points:

(i) That the hub of the clutch driven plate assembly aligns with the bearing in the rear end of the engine crankshaft as detailed in the CLUTCH UNIT , SECTION G.

(ii) That the weight of the gearbox unit is not allowed to hang on the rear end of the engine unit, this can be avoided by fitting the top two securing details promptly.

THE GEARBOX UNIT

DESCRIPTION

The gearbox unit is of the synchromesh sliding type providing four forward speeds and one reverse. The upper three gears have synchromesh engagement effected through cone clutches on single helical cut drive gears. The reverse and first speed have straight cut spur teeth, without synchromesh engagement and the compound reverse actuating gear is disengaged when the gearbox is set in neutral or any of the forward gears. The ratios are detailed on page H5.

The gearbox casing and clutch bell housing is an integral aluminium casting, the front face of the clutch bell housing is flanged to facilitate attachment to the gearbox support plate attached to the rear face of the cylinder block. The rear face of the gearbox casing is machined to accommodate the rear casing, this again is an aluminium casting and has two machined side faces; these provide the rear mounting point for the combined engine and gearbox unit.

The primary shaft is supported in the gearbox casing by a ball race and at its front end by a bearing in the rear end of the crankshaft; oil is prevented from escaping by a disc fitted on the gearbox side of the ball bearing race, and lip type seals front and rear.

The gearbox main shaft is supported at its front end by a needle roller bearing in the rear end of the primary shaft, at an intermediate point by a ball bearing race in the rear face of the gearbox casing and at its end by a second pressed in the end of the rear casing. The portion of the mainshaft inside the gearbox casing carries the following components front to rear.

(i) The double ended top and third speed synchronising unit mounted on the mainshaft splines.

(ii) The freely mounted third and second speed constant drive gears and bush bearings, these gears are in constant mesh with gears in the countershaft gear cluster below.

(iii) The first and second speed unit which incorporates a straight cut gear machined on the rear portion of the operating sleeve is mounted on the large mainshaft splines.

The speedometer drive gear is a worm cut in the mainshaft and engages a gear running in a bush bearing secured in the rear casing by a locating screw.

The countershaft is located in the rear end of the gearbox casing by a special screw which also locates the spindle of the compound reverse actuating gear. The countershaft gear cluster is mounted at both ends on needle roller bearings and located by bronze faced thrust washers.

The reverse actuating gear is of compound design having pressed in bush bearings and is mounted on a spindle which is positioned by the locating screw of the countershaft.

Gear selection is effected by forks. locating annular grooves machined in the operating sleeves or reverse actuating gear, positioned in the underside of the gearbox top cover and selected by a short selector lever at the end of the gearbox top cover assembly.

Lubrication is effected by the splash and mist thrown up by the countershaft gear cluster while the clutch is engaged and the engine is running with the gears drilled, the thrust washers grooved

and the bush bearings scrolled to provide more positive lubrication to their inner frictional surfaces. The oil content of the gearbox is checked by the dipstick situated in the R.H. side of the gearbox top cover and is replenished through the same aperture.

The gearbox unit is located and secured to the gearbox mounting plate on the rear face of the cylinder block by two dowels, seven bolts, four nuts and bolts and the two nuts and bolts which secure the electric starter motor.

OPERATION

The various "speeds" of the gearbox are obtained by sliding a gear or internally splined operating sleeve, located on the mainshaft by a splined hub, into engagement with a drive gear and so transmit the speed of the drive gear to the mainshaft. It will be appreciated therefore, that by varying the size of the drive gears, their speed of rotation will alter and so provide the various ratios required. The four drive gears required for the four forward speeds and one reverse are located as follows:-

(a) TOP — Incorporated in the rear end of the primary shaft, this of course, rotates at engine speed.

(b) THIRD — The first and smaller of the two freely mounted gears on the mainshaft; this meshes constantly with the larger of the two rear helical cut gears in the countershaft gear cluster.

(c) SECOND — The second but larger of the two freely mounted gears on the mainshaft; this meshes constantly with the smaller of the two rear helical cut gears in the countershaft gear cluster.

(d) FIRST AND REVERSE — The small straight cut gear at the rear end of the countershaft gear cluster.

The top ratio is obtained by sliding the operating sleeve forward to engage the dog teeth machined at the rear end of the primary shaft, hence the engine speed is transmitted to the gearbox mainshaft.

Third is obtained by sliding the operating sleeve rearward to engage the dog teeth machined on the third speed constant drive gear which is rotating at less than engine speed due to its own design and that of the countershaft gears.

Second is obtained by sliding the operating sleeve forward to engage the dog teeth machined on the second speed constant drive gear which is rotating at a lesser speed than that of the third speed constant drive gear due to its own design and also that of the countershaft gears.

First is obtained by sliding the first speed gear, machined on the front portion of its operating sleeve, rearward to engage the small spur gear at the end of the countershaft gear cluster.

Reverse is obtained by sliding the reverse actuating gear forward so that its large gear meshes with the small spur gear at the rear end of the countershaft gear cluster while its small gear meshes with the first speed gear on the operating sleeve of the first and second speed unit. The reduced ratio is effected by the small countershaft gear meshing with the larger of the reverse actuating gear and the smaller of the reverse actuating gear meshing with the large gear of the operating sleeve. The change of direction is effected by the adding of the reverse actuating gear itself.

When the car is stationary with the clutch engaged and the engine running, the countershaft gear cluster and two constant drive gears on the gearbox mainshaft will rotate. By withdrawing the clutch, or de-clutching, this rotation will stop and so make it possible to select either the reverse or first speed as these have no synchromesh engagement. Once the car is in motion it will be possible to select any gear by de-clutching and moving the selector lever; the synchromesh engagement incorporated on the upper three speeds will equalise the speed of the drive gear to that of the mainshaft.

The de-clutching action frees the primary shaft from the engine and permits the synchromesh action to equalise the greater speed of the constant drive gear to that of the mainshaft thus facilitating easier gear selection.

DISMANTLING AND ASSEMBLING
GEARBOX UNIT

1. TOP COVER ASSEMBLY

Remove the top cover assembly from the top of the gearbox unit as detailed on page H6 Dismantle and assemble the top cover assembly as detailed on page H6.

2. CLUTCH ACTUATING MECHANISM

Remove the clutch actuating mechanism from the clutch bell housing as detailed in THE CLUTCH UNIT, SECTION G.

3. SPEEDOMETER DRIVE

Remove the speedometer drive from the R.H. side of the rear casing as detailed on page H10.

4. PROPELLER SHAFT
COUPLING FLANGE

Remove the propeller snaft coupling flange from the rear end of the mainshaft by detaching the castillated nut.

5. REAR CASING, REAR MAINSHAFT BEARING AND OIL SEAL.

Detach the rear casing from the rear face of the gearbox casing by removing seven nuts. Eject the rear mainshaft bearing and oil seal, when they are known to be well worn. from the extreme end of the rear casing.

6. COUNTERSHAFT

Remove the countershaft front cover plate from inside the clutch bell housing by withdrawing two bolts. Withdraw the reverse actuating gear spindle/countershaft locating screw from the L.H. side of the gearbox casing. Utilizing a countershaft needle bearing locator tool, fabricated locally to the dimensions specified on page H19 eject the countershaft from the gearbox casing. Centralise the needle bearing locating tool inside the countershaft gear cluster and allow the latter to sink to the bottom of the gearbox casing. The countershaft gear cluster is removed as detailed in a later sequence.

7. SYNCHRONISING RINGS

Check the gap between each synchronising ring and the dog teeth on the adjacent constant drive gear as detailed on page H23.

8. PRIMARY SHAFT ASSEMBLY

Remove the primary shaft cover assembly from inside the clutch bell housing by withdrawing four nuts. Prise out the oil seal when it is known to be badly worn. Withdraw the primary shaft from the front end of the gearbox. Dismantle the primary shaft assembly as detailed on page H34.

9. TOP AND THIRD SPEED SYNCHRONISING UNIT

Eject the mainshaft assembly rearward, sufficiently to clear the front mainshaft bearing from the rear face of the gearbox casing; tilt the front end upward and remove the top and third speed synchronising unit complete with synchronising rings. Dismantle the top and third speed synchronising hub as detailed on page H32.

10. MAINSHAFT CIRCLIP

Remove the mainshaft circlip from the splines in the front end of the mainshaft. Refer also to the notes on page H30.

Figure H8

Tilting mainshaft upward to remove top and third speed synchronising unit.

11. SECOND AND THIRD SPEED CONSTANT DRIVE GEARS, BUSHES AND THRUST WASHER.

Withdraw the flat third constant gear thrust washer from the splines in the front end of the mainshaft followed by the third and second speed constant drive gears, bushes and second constant gear thrust washer.

12. FIRST AND SECOND SPEED UNIT

Hold the first and second speed unit steady inside the gearbox casing and withdraw the mainshaft rearward and then remove the first and second speed unit from inside the gearbox casing together with the synchronising ring. Dismantle the first and second speed synchronising unit as detailed on page H25

13. FRONT MAINSHAFT BEARING

Remove the front mainshaft ball bearing race, small and large washers from the mainshaft by removing the mainshaft circlip. It will be noted that the large mainshaft washer has its chamfered face toward the ball bearing race. Remove the large circlip from the outer race of the ball bearing.

14. REVERSE SELECTOR ROD FORK AND ACTUATING GEAR

Remove the welch washer plug in the front face of the gearbox casing inside the gearbox casing as detailed in THE ENGINE UNIT, SECTION D. Withdraw the locating screw and locknut from the L.H. side of the gearbox casing, eject the reverse selector rod rearward, removing the selector fork from inside the gearbox and the selector rod insert from inside the rear gearbox face. Withdraw the reverse actuating gear spindle rearward and remove the gear from inside the gearbox casing; the reverse actuating gear spindle has been freed by the earlier withdrawal of the locating screw. Eject the bush bearings when they are well worn.

15. COUNTERSHAFT GEAR CLUSTER

Remove the countershaft gear cluster, large and small thrust washers from inside the gearbox casing, exercising care to keep the needle roller retainer tube in position. Dismantle the countershaft gear cluster as detailed on page H17

16. ASSEMBLING

The assembling sequence of the gearbox unit is the reversal of the removal sequence but particular attention must be given to the following points:

(i) That the countershaft gear cluster is assembled as detailed on page H17 : its end float checked as detailed on page H18 and positioned in the gearbox as detailed on page H17.

(ii) That the reverse actuating gear spindle and selector is fitted to the rear face of the gearbox as detailed on page H20.

(iii) That the end float of the second and third constant drive gears on their respective bush bearings is checked and adjusted as detailed on page H28 and then the end float of the bush bearings and thrust washers on the mainshaft as detailed on page H28 before the mainshaft is inserted in the gearbox casing and the first and second speed unit fitted.

(iv) That the front mainshaft bearing washer is fed on the rear end of the mainshaft flat side first so that the chamfered side is toward the ball bearing race.

(v) That the first and second speed unit is assembled as detailed on page H25 and it is fitted to the mainshaft as detailed on page H25.

(vi) That the second and third speed constant drive gears, bush bearings and thrust washers are fitted as detailed on page H27.

(vii) That a replacement mainshaft circlip is fitted to the front end of the mainshaft as detailed on page H30.

(viii) That the top and third speed synchronising hub is assembled as detailed on page H32 and fitted to the mainshaft as detailed on page H32.

(ix) That the primary shaft is assembled as detailed on page H34 and fitted to the front gearbox face inside as detailed on page H34.

(x) That the free and engaged clearance between the dog teeth of the synchronising rings and those on the adjacent constant drive gear as detailed on page H23.

(xi) That the countershaft gear cluster is lifted upward into position as detailed on page H17.

(xii) That the gearbox top cover is assembled as detailed on page H6 and fitted to the top of the gearbox unit as detailed on page H6.

(xiii) That when the primary shaft cover is fitted over the splines on the front end of the primary shaft the splines are covered so that they will not damage the oil seal.

MAINTENANCE

FIRST 500 MILES (805 kms)

Drain and refill gearbox.

EVERY 5,000 MILES (8,050 kms)

Check oil level in gearbox.

EVERY 10,000 MILES (16,100 kms)

Drain and refill gearbox.

CHECKING THE OIL LEVEL
EVERY 5,000 MILES (8,050 kms)

Remove the large rubber plug from the top side of the transmission cover inside the cockpit of the car. Withdraw the dipstick, viewed through the plug aperture, wipe it dry and return it to the gearbox ensuring that it is pressed right home. Withdraw it for a second time and observe the "oil wet mark", top up the gearbox with the recommended brand and grade of oil through the dipstick aperture. Replace the dipstick and rubber plug to gearbox unit and transmission cover respectively.

DRAINING AND FILLING GEARBOX UNIT
FIRST 500 MILES (805 kms)
EVERY 10,000 MILES (16,100 kms) Figs. H9 and H10

Remove the large rubber plug from the top side of the transmission cover inside the cockpit of the car and withdraw the dipstick, viewed through the plug aperture. Remove the tapered drain plug from the underside of the gearbox and allow the oil to drain into a suitable receptacle; on completion of draining replace the plug. Fill the gearbox with the recommended brand and grade of oil through the dipstick aperture, checking the oil level with the dipstick. Replace the dipstick and rubber plug to gearbox unit and

transmission cover respectively.

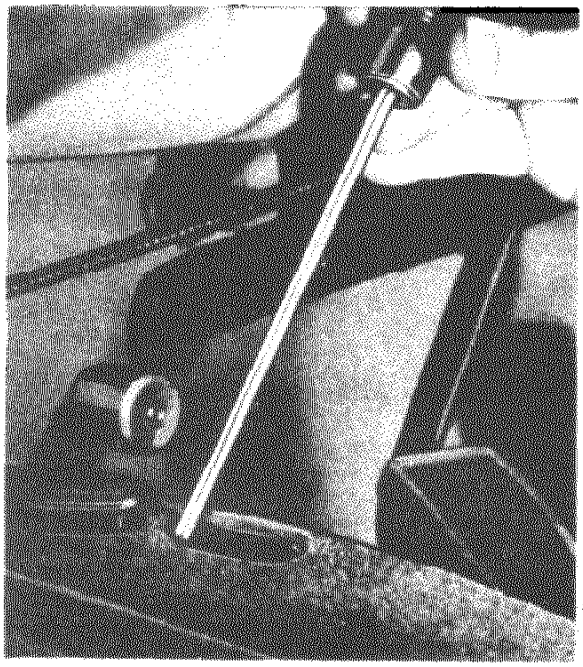


Figure H9

Location of gearbox dipstick

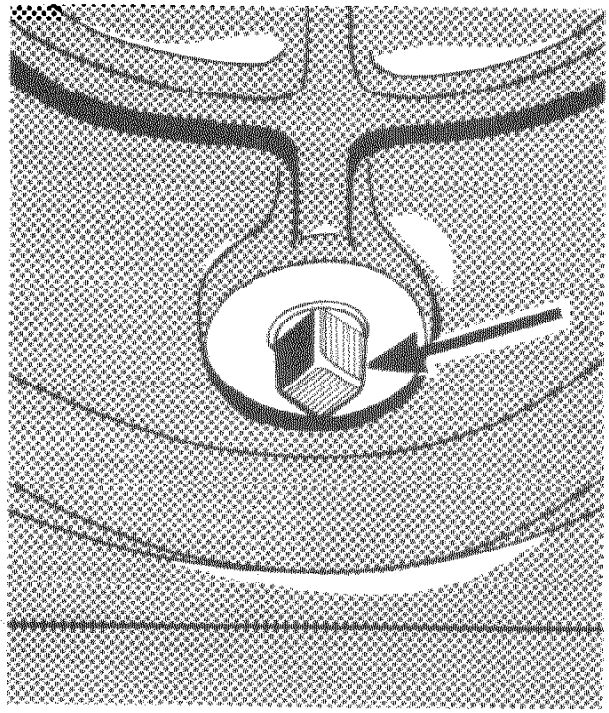


Figure H10

Location of gearbox drain plug

THE COUNTERSHAFT GEAR CLUSTER

DESCRIPTION Fig. H11.

The countershaft gear cluster is situated in the bottom of the gearbox unit and consists of three splined gears and a distance piece supported on the spigoted front end of a straight cut gear.

It is mounted on needle roller bearings at both ends and the thrust is taken by large and small thrust washers at its front and rear ends respectively. The thrust washers are prevented from rotating by raised tags locating slots in the gearbox casing. The spigoted straight cut gear is shorter than the assembled gear cluster and must not be fitted to the gearbox alone in an endeavour to determine the end float.

The front and largest gear is in constant mesh with the gear machined on the rear end of the primary shaft while the next two gears, for third and second speed operation, are in constant mesh with the two freely mounted gears on the mainshaft immediately above; all these gears have helical cut teeth. The rear gear, for reverse and first speed operation has straight cut teeth and meshes with the large gear of the reverse actuating gear and the gear machined on the rear portion of the first and second speed operating sleeve.

OPERATION

The countershaft gear cluster, which is in constant mesh with the primary shaft, will transmit engine power to the various gears with which it meshes, mounted on the mainshaft above. By utilizing gears of different sizes, various ratios can be produced and by providing a countershaft constant gear larger than that on the primary shaft, the output resultant in rotation will be less but the torque will be greater.

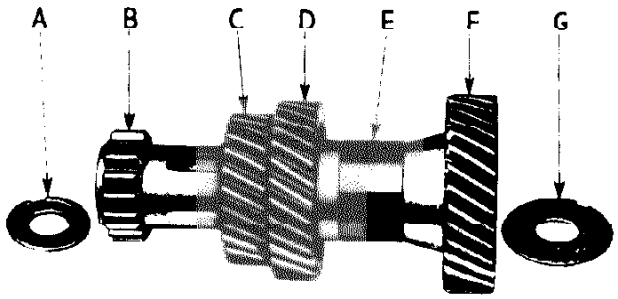


Figure H11
Countershaft gear cluster and thrust washers.

A. Rear (small) thrust washer.
B. First and reverse gear, on the spigotted front end of which all the others are mounted.
C. Second speed gear.
D. Third speed gear.
E. Distance piece.
F. Constant gear.
G. Front (large) thrust washer.

REMOVAL AND REPLACEMENT COUNTERSHAFT GEAR CLUSTER

The countershaft gear cluster must be positioned loosely in the bottom of the gearbox casing before the primary shaft or mainshaft assemblies can be removed. It is one of the first components to receive attention but is the last to be removed. If for any reason the countershaft gear cluster has to be removed it will be necessary to dismantle the complete gearbox unit.

1. REMOVAL

The countershaft gear cluster is removed as detailed above.

2. REPLACEMENT Fig. H12

Locate the large and small thrust washers on the front and rear inside faces of the gearbox casing respectively and the countershaft gear cluster with the needle retainer tube inside positioned in the bottom of the gearbox casing so that the large constant gear is to the front. The mainshaft and primary shafts are then fitted above and the countershaft gear cluster is lifted up to and meshes with the various gears on both upper shafts. The needle roller retaining tool is ejected with the tapered end of the countershaft pilot which in turn is ejected with the countershaft so the plain end of the latter is to the front of the gearbox casing and the flat on its rear end to the top. The reverse gear spindle and countershaft locating pin is fitted through the L.H side of the gearbox so its pointed shank locates the hole in the countershaft.

DISMANTLING AND ASSEMBLING THE COUNTERSHAFT GEAR CLUSTER

1. DISMANTLING

Withdraw the constant gear from the front end of the countershaft gear cluster followed by the distance piece and the third speed countershaft gear. Identify the front face of the second speed countershaft gear and withdraw it from the spigotted end of the first speed countershaft gear. Identify and remove the two end needle roller bearing retainer rings and the twenty four needle rollers from each end of the first speed countershaft gear after ejecting the needle roller bearing retainer tube. Withdraw the two inner roller bearing retainer rings from inside the gear.

2. ASSEMBLING

Press a needle roller retaining ring, chamfer side first, into each end of the spigoted first speed countershaft gear. Locate twenty four needle roller bearing in each end of the gear

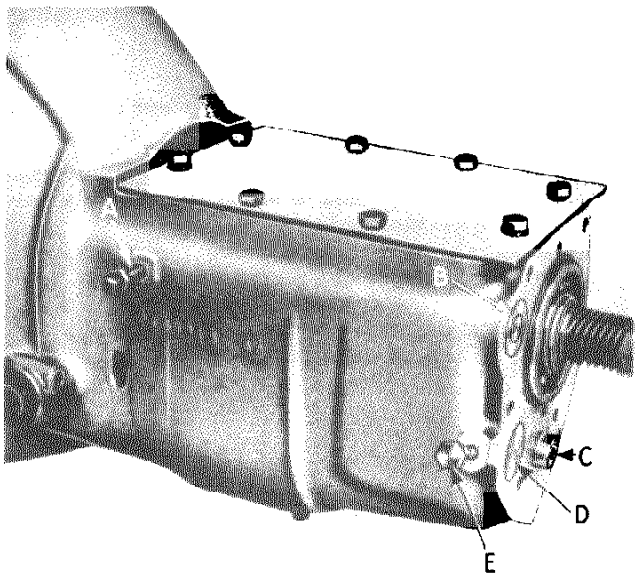


Figure H12
Reverse selector rod and reverse gear spindle and countershaft locating bolts.

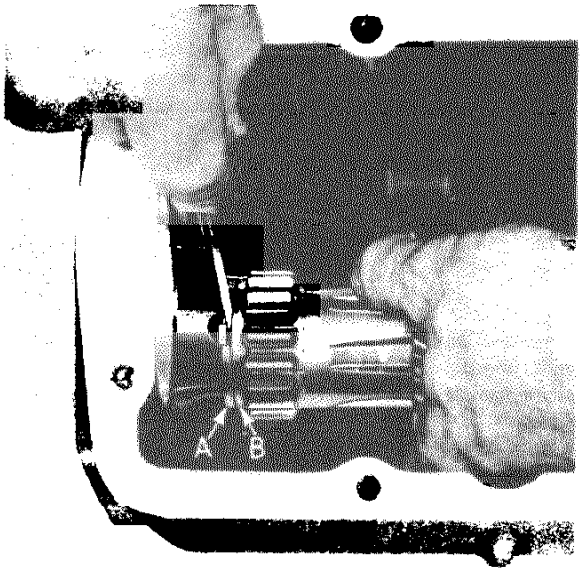
A. Reverse selector rod locating bolt.
B. Reverse selector rod insert.
C. Countershaft flattened and upward.
D. Reverse gear spindle.
E. Reverse gear spindle and countershaft locating bolt.

with grease and follow with a second needle roller retaining ring, chamfer end last. Feed in the countershaft needle roller retainer, fabricated to the dimensions given on page H19.

Feed on the second speed gear followed by the third speed gear, flatter end first, the distance piece and the constant gear, spigot end first.

CHECKING AND ADJUSTING COUNTERSHAFT GEAR CLUSTER END FLOAT Fig. H13

The countershaft thrust washers, large one to the front, are located on the front and rear inside faces of the gearbox with a smear of grease and the countershaft gear cluster positioned between so that the large helical constant gear is at the front end. Insert the countershaft, plain end first, from the rear of the gearbox and eject the needle roller retainer from inside but ensure that the two ends always remain in contact.



Utilizing feeler gauges determine the clearance between the small gear at the rear end of the countershaft gear cluster and the bronze face of the rear thrust washer. When the clearance is too great, thicker thrust washers must be fitted; when the clearance is too little the thickness of the STEEL face of the thrust washers must be reduced. The countershaft is then ejected by the needle roller retainer.

Figure H13. (Left).
Checking countershaft end float at rear end.

A. Thrust washer.
B. Rear end of gear.

COUNTERSHAFT TOOLS

	English	Metric.
COUNTERSHAFT NEEDLE BEARING LOCATOR		
Diameter of tube or rod.	0.7913" 0.7908"	2.0090 mm. 2.0086 mm.
Overall length of tube or rod.	6.560 " 6.550 "	166.624 mm. 166.37 mm.
COUNTERSHAFT NEEDLE BEARING RETAINER RING DRIVER.		
Diameter of rod	1.000 " .990 "	25.4 mm. 25.146 mm.
Diameter of end spigot	0.820 " 0.810 "	20.828 mm. 20.574 mm.
Length of end spigot	0.150 " 0.140 "	3.810 mm. 3.556 mm.
COUNTERSHAFT PILOT TOOL		
Diameter of rod.	0.7913" 0.7908"	2.0090 mm. 2.0086 mm.
Overall length of rod	10.500 " 10.490 "	266.7 mm. 266.446 mm.
Small diameter of taper.	0.350 " 0.340 "	8.89 mm. 8.636 mm.
Length of taper.	1.500 " 1.490 "	38.100 mm. 35.560 mm.
DIMENSIONS, COUNTERSHAFT AND COUNTERSHAFT GEAR CLUSTER		
Bore in gearbox casing for countershaft.	0.7918" 0.7908"	20.1117 mm. 20.0863 mm.
Diameter of countershaft	0.7913" 0.7908"	20.0900 mm. 20.0863 mm.
Bore in first speed countershaft gear for needle roller bearings	1.0289" 1.0284"	26.1340 mm. 26.1213 mm.
Diameter of needle roller bearings	29.8 mm. x 3 mm. dia.	
Internal width of gearbox casing.	6.780 " 6.770 "	172.212 mm. 171.958 mm.
Overall width of countershaft gear cluster and two thrust washers.	6.7671" 6.7559"	171.8843 mm. 171.5999 mm.
Overall end float of countershaft gear cluster	0.010 " 0.006 "	0.2540 mm. 0.1524 mm.
	0.083 " 0.081 "	2.1082 mm. 2.0574 mm.
	0.078 " 0.076 "	1.9812 mm. 1.9304 mm.
Thickness of front (large) thrust washer.	0.073 " 0.071 "	1.8542 mm. 1.8034 mm.
	0.068 " 0.066 "	1.7272 mm. 1.6764 mm.
	0.063 " 0.061 "	1.6002 mm. 1.5494 mm.

Width of primary (front) constant gear.	1.313 " 1.311 "	33.3502 mm. 33.2994 mm.
Width of distance piece.	1.0817" 1.0803"	27.4752 mm. 27.4396 mm.
Width of third speed gear.	1.1880" 1.1860"	30.1752 mm. 30.1244 mm.
Width of second speed gear.	0.7607" 0.7593"	19.3218 mm. 19.2862 mm.
Effective width of first speed gear	2.2487" 2.2473"	57.1170 mm. 57.0814 mm.
Thickness of rear (small) thrust washer.	0.107 " 0.105 "	2.7178 mm. 2.667 mm.

THE REVERSE ACTUATING GEAR

DESCRIPTION Fig. H14.

The reverse actuating gear, which has straight cut teeth and pressed in bush bearings, is a compound gear mounted on a short spindle fitted through the rear face of the gearbox casing so the small gear is toward the front of the gearbox casing. The front end of the spindle is supported in a web cast approximately half way down the gearbox casing while the rear end is located by the same bolt that locates the countershaft.

It is actuated by a selector fork sliding on a rod in the top L.H. side of the gearbox casing. When the gearbox is in any of the other selective positions the reverse actuating is dis-engaged and stationary.

OPERATION

Reverse is obtained by the selector fork sliding the reverse actuating gear into mesh with the straight cut gear at the rear end of the countershaft gear cluster and the reverse and first speed gear machined on the front portion of the first and second speed operating sleeve. During this operation the first and second speed operating sleeve remains in its neutral position on the splined hub due to the action of the three spring loaded synchronising balls and the position of its selector fork.

The reduced ratio is obtained by the compound form of the actuating gear; its large and small gears meshing with the small countershaft gear and the operating sleeve gear respectively. The change of direction is obtained by the introduction of the gear itself. Synchromesh engagement is not required as reverse is always selected when the car and countershaft gear cluster is stationary, the latter due to the dis-engagement of the clutch.

REMOVAL AND REPLACEMENT
REVERSE SELECTOR ROD, FORK AND ACTUATING GEAR Fig. H14.

1. REMOVAL

The removal of the reverse selector rod, fork and actuating gear from the gearbox unit is detailed on page H7 and cannot be effected until the primary and mainshafts have been removed from the gearbox unit.

After the reverse actuating gear has been removed the two bush bearings can be ejected from inside when they are observed to be well worn. No appreciable wear will be observed on its spindle.

2. REPLACEMENT

The replacement of the reverse selector rod fork and actuating gear is the reversal of the removal sequence but particular attention must be given to the following points:

(i) That the bush bearings are pressed into the reverse actuating gear so that their ends are flush with the ends of the bore.

(ii) That the reverse actuating gear is fitted so that the small gear is toward the front of the gearbox casing and its spindle is fed in so that the bore in the end boss aligns with a second in the gearbox casing for the locating screw; the latter can be inserted in its bore to keep the spindle located.

(iii) That the reverse selector fork is offered up so that the open side of the rod bore is toward the inside of the gearbox casing, and the fork locates the groove in the front end of the reverse actuating gear.

(iv) The selector rod is fed in from the rear so the front transverse drilling aligns with the locating screw drilling at the front L.H. side of the gearbox casing followed by the selector rod insert in the rear face of the gearbox casing; the selector rod locating screw is fitted and the locknut tightened.

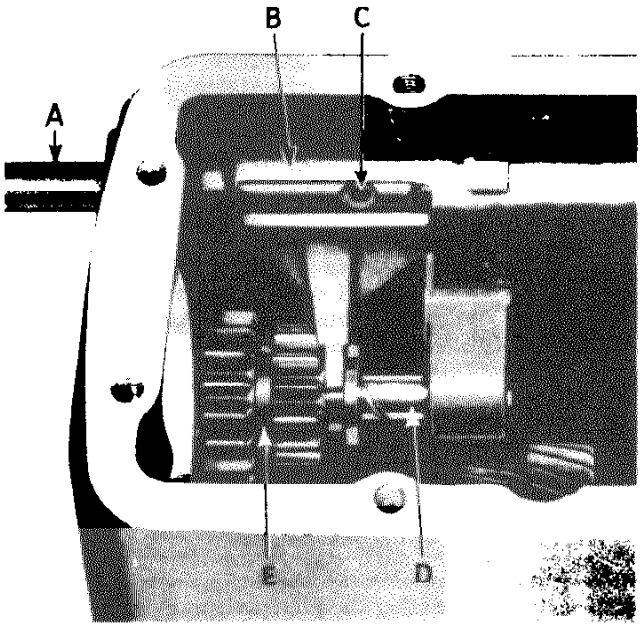


Figure H14
Reverse actuating gear selector fork and rod.

A. Reverse selector rod.
B. Reverse selector fork.
C. Locating bolt hole.
D. Reverse actuating gear spindle.
E. Reverse actuating gear.

DIMENSIONS
REVERSE ACTUATING GEAR

	English	Metric
Bore in reverse actuating gear for bush bearing.	0.6570" 0.6562"	16.6878 mm. 16.71828 mm.
Diameter of bush bearings	0.6590" 0.6582"	16.7386 mm. 16.71828 mm.
Bore of bush bearings for reverse actuating gear spindle.	0.5633" 0.5625"	14.30782 mm. 14.2875 mm.
Diameter for reverse actuating gear spindle.	0.5619" 0.5613"	14.2723 mm. 14.257 mm.
Groove in gear for selector fork.	0.330 " 0.225 "	5.8420 mm. 5.7150 mm.
Width of selector fork.	0.212 " 0.202 "	5.3848 mm. 5.1308 mm.

THE SYNCHRONISING RINGS

DESCRIPTION

Three synchronising rings, all manufactured from an alum bronze material, are fitted in each gearbox unit; one to each side of the top and third speed synchronising unit and one in front of the first and second speed unit.

One side face has six lugs machined thereon, three large and three small. The three large lugs locate slots in the side face of the splined hub and these lugs are so dimensioned that they will allow a specific amount of radial movement, approximately ½ tooth clockwise or anti-clockwise. While the three small lugs contact the splined hub face between the slots facilitating the radial movement of the synchronising ring.

A female cone face is machined in the bore of the synchronising ring, the face being relieved by a spiral groove and this surface mates with the male cone clutch face on the adjacent constant drive gear. The purpose of the spiral groove is to assist the breaking up of the oil film during the engagement of the cone clutch faces.

Machined on the outside periphery of the synchronising ring are a series of dog teeth of the same pitch and diameter as the internal and external splines of the operating sleeve and splined hub respectively. The end faces of the dog teeth, adjacent to the operating sleeve are chamfered on both corners to facilitate the sliding movement of the latter during gear selection.

In their new condition the synchronising rings are interchangeable and their purpose is to decrease the speed of the adjacent drive gear to that of the mainshaft to which the synchronising ring is attached through the splined hub and so permit an easy and silent passage of the operating sleeve.

During the fitting of the synchronising rings the gaps between the two sets of dog teeth, one set on the constant drive gear and the second on the synchronising ring, is checked and it is brought between the dimensions specified by selective assembly. When the determined gap is below the specified dimension no useful purpose is served by rubbing down the flat face adjacent to the female cone.

OPERATION

When the operating sleeve moves towards the adjacent constant drive gear the coned clutch surface of the synchronising ring will rotate to the extent of the clearance between its lugs and the slots in the splined hub.

The dog teeth of the synchronising ring will now be in the path of the advancing operating sleeve and the latter will apply pressure to clutch action increasing the frictional drag which will reduce the speed of the constant drive gear to that of the synchronising ring.

Continued travel of the operating sleeve will cause the chamfer on the ends of its splines and the chamfer on the ends of the synchronising ring dog teeth to act upon one another resulting in the synchronising ring moving back to align with the splines of its splined hub and operating sleeve permitting the latter to move forward and engage the ring of dog teeth on the constant drive gear.

REMOVAL AND REPLACEMENT
SYNCHRONISING RINGS

1. REMOVAL Fig. H15

Before removing the primary or mainshafts the gap between the two sets of dog teeth must be checked both in their free and engaged positions, as this will give an indication of their condition. They must be identified to their respective and circumferential positions.

2. REPLACEMENT

The synchronising rings must be fitted to their appropriate constant drive gears in accordance with their identification marks, they are not interchangeable in their used condition and when a new constant drive gear is fitted a new synchronising ring must also be fitted.

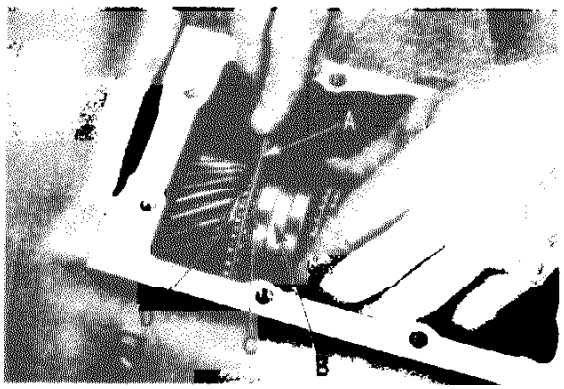


Figure H15
Checking engaged gap between synchronising ring and dog teeth on drive gear.

A. Feeler gauge.
B. Top and third operating sleeve.
C. Top synchronising ring.
D. Dog teeth on primary shaft.

The synchronising ring must be offered up to the constant drive gear and the gap between the dog teeth ascertained and compared with those dimensions specified before either is fitted to the gearbox and then it is rechecked in the fully assembled gearbox. This is effected in two attitudes once when the synchronising ring is free and again when it is closed to the male cone.

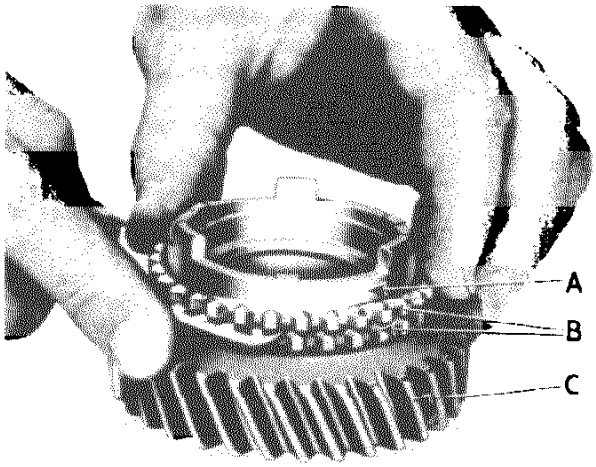


Figure H16
Measuring gap between synchronising ring and dog teeth of drive gear before assembling to gearbox.

A. Synchronising ring.
B. Dog teeth on synchronising ring and drive gear.
C. Drive Gear.

(i) When the gearbox is assembled, ensure that it is in neutral position and move the synchronising ring toward the operating sleeve and utilizing feeler gauges ascertain the gap between the two sets of dog teeth.

(ii) When the gearbox is assembled, ensure that it is in the neutral position and move the synchronising ring toward the male cone on the side face of the adjacent constant drive gear, utilizing feeler gauges ascertain the gap between the two sets of dog teeth.

SYNCHRONISING RING GAPS

	English	Metric
Synchronising ring and constant drive gear dog teeth gap Free.	0.075" 0.060"	1.005 mm. 1.524 mm.
Synchronising ring and constant drive gear dog teeth gap Engaged.	0.040" 0.035"	1.016 mm. 0.889 mm.

THE FIRST AND SECOND SPEED UNIT

DESCRIPTION

The first and second speed unit is mounted on the large mainshaft splines situated at the rear end of the gearbox casing. It consists of three main components.

(i) A splined hub, having internal splines locating those inside the operating sleeve.

(ii) An operating sleeve, having internal splines locating those on the splined hub, a groove on its outer periphery to locate the selector fork and the straight cut teeth of the first speed gear. The outer ends of the splines are chamfered to facilitate their sliding movement over the two sets of dog teeth on the synchronising ring and constant drive gear.

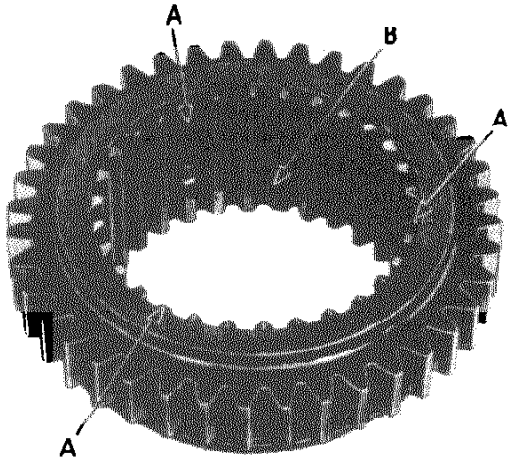


Figure H17
First and second gear operating sleeve showing front face and relieved splines.

A. Three splines relieved for synchronising.
B. One spline relieved for interlocking ball and plunger.

(iii) A synchronising ring as detailed on page H22 is fitted to the front face of the splined hub.

Between the operating sleeve and the splined hub are three spring loaded balls located in the blind bores of the splined hub and the inner ends of the three splines inside the operating sleeve are relieved in such a manner that when the operating sleeve slides rearward they offer no resistance to its travel. These balls have a specific axial loading.

Between the splined hub and the mainshaft is an interlocking ball and plunger. It is operated by an internal spline of the operating sleeve immediately it moves rearward from its neutral position but the rear half of the spline is relieved so that it offers no resistance when it moves forward from its neutral position.

OPERATION

There is no synchromesh engagement on first speed and none is required as this gear is selected only when the car is stationary, the second speed ratio and the power of the engine are sufficient to meet all other requirements.

To select first speed, the operating sleeve is moved rearward along its splined hub and immediately the interlocking plunger is pressed into an annular groove in the mainshaft by the single operating sleeve spline applying pressure to the steel ball interposed between; hence the splined hub is locked to the mainshaft. Further rearward travel is necessary before the straight cut gear, machined at the front end of the operating sleeve, meshes with the stationary similarly cut gear at the rear end of the countershaft gear cluster below until it is fully engaged as determined by the plunger in the gearbox top cover locating an indentation in the selector rod. The engagement of these two gears is assisted by a chamfer on the rear end of the operating sleeve

gear and the front end of the countershaft gear.

To select second speed from first, the operating sleeve is moved forward out of engagement with the countershaft gear but the splined hub remains locked to the mainshaft until the neutral position is reached. No further locking of the splined hub will occur as the rearward portion of the spline is relieved and applies no pressure to the steel ball and plunger.

As the operating sleeve slides forward from the neutral position, the three spring loaded synchronising balls located between the operating sleeve and the splined hub causes the latter, which is now free to slide on the mainshaft, to slide momentarily forward with the operating sleeve. This forward movement brings the female cone face of the synchronising ring into contact with the cone clutch face machined on the rear end of the second speed drive gear causing it to rotate to the extent of the clearance between the synchronising ring lugs and the slots in the front face of the splined hub, which is approximately half a tooth each side of the external splines of the splined hub. The dog teeth of the synchronising ring will now be in the path of the forward sliding operating sleeve which will endeavour to push the synchronising ring out of the way. This pressure on the synchronising ring and the second speed drive gear cone clutch face increases the frictional drag which slows the drive gear to that of the synchronising ring and mainshaft. The frictional drag will reduce to zero as the speed of the constant gear becomes that of the synchronising ring. The chamfered edges of the operating sleeve splines will act upon the similarly chamfered dog teeth of the synchronising ring aligning the latter to the operating sleeve splines; similarly the dog teeth of the second speed drive gear will also align to the advancing operating sleeve and second speed will be fully engaged. The spring loaded synchronising balls have now ridden up the three splines, relieving the forwardwise pressure on the splined hub and slide freely along the rear portion of the spline. This relief of pressure, frees the synchronising ring and allows itself to be rotated by the chamfers on the operating sleeve splines.

It will be understood from the foregoing that the splined hub is positively locked to the mainshaft splines during the whole of the first speed engagement and release. Without this locking, during second speed selection from the first speed selection from the first speed position, premature synchromesh action would occur due to the forward movement of the splined hub, causing unwarranted and excessive wear of the second speed cone clutch faces. No synchromesh action can occur, however, until the first speed is fully released due to the locking of the splined hub to the mainshaft.

REMOVAL AND REPLACEMENT
FIRST AND SECOND SPEED UNIT

1. REMOVAL

The first and second speed unit is withdrawn from the mainshaft and gearbox unit as detailed on page H14.

2. REPLACEMENT

The replacement of the first and second speed unit is the reversal of the removal sequence but particular attention must be given to the following points:

(i) That the interlocking steel ball and plunger should be positioned toward the bottom of the gearbox although it is locating in its bore by a smear of grease.

(ii) That the first and second speed unit is positioned in the gearbox so that the flat side of the splined hub is toward the rear of the gearbox casing and with the gear, machined on the operating sleeve toward the front of the gearbox.

(iii) That when the first and second speed unit is fitted in the gearbox, the operating sleeve should always be left in its neutral position in order to avoid any liklihood of the inadvertant release of the spring loaded synchronising balls.

DISMANTLING AND ASSEMBLING
FIRST AND SECOND SPEED UNIT

1. DISMANTLING

Identify the circumferential position of the synchronising ring and eject the splined hub from the centre of the operating sleeve exercising care to control the run of the spring loaded

synchronising balls and remove any shims from inside the three blind drilling in the splined hub. Eject the interlocking plunger and ball from the through splined hub drilling. Both these operations are best carried out in an open topped box.

2. ASSEMBLING

The assembling of the first and second speed synchronising unit is the reversal of the removal sequence but particular attention must be given to the following points:

(i) That the splined hub is fitted inside the operating sleeve so the annular groove in the latter is toward the flat face of the splined hub and the axial release loading is checked as detailed below.

(ii) That the interlocking ball and plunger is fed into the through bore of the splined hub so the rounded end of the plunger is nearer the mainshaft splines.

CHECKING AND ADJUSTING
AXIAL RELEASE LOADING

1. CHECKING

Offer up the operating sleeve to the splined hub in the following manner.

(i) That the gear machined on its outer periphery is toward the slotted side of the splined hub.

(ii) That the three splines having their front ends relieved are positioned over the blind bores in the splined hub.

(iii) That the single spline having its rear half relieved is positioned over the through bore in the splined hub.

The shims are located in the bottom of the three blind bores as found during the dismantling sequence followed by the three springs. The steel balls are located on top of the three springs and depressed into the bores utilizing a band of steel fabricated to resemble a piston ring compressor; the splined hub is then pressed into the operating sleeve.

The first and second speed unit is then mounted on a cupped shaped cylinder, so that it is only supported by the operating sleeve, gear uppermost and a spring balance is fitted to the splined hub so that a downward pressure can be effected and observed. The connection from the splined hub to spring balance will pass through the cylinder supporting the operating sleeve and by making this aperture as small as practical it will assist in controlling the run of the three spring loaded steel synchronising balls. The spring balance is moved downward while the scale is observed and the poundage at the moment of release is noted.

2. ADJUSTING

When it is observed that the spring balance reading is greater than that specified, shims must be removed from below the synchronising spring.

Conversely, when it is observed that the spring balance reading is less than that specified, shims must be added below the synchronising spring

AXIAL RELEASE LOADING
SECOND SPEED SYNCHRONISING UNIT

	English	Metric
Axial release loading of second speed unit.	27lbs. 25lbs.	12.247 kgs. 11.340 kgs.
Free length of axial release loading springs.	0.500"	12.700 mm.

THE SECOND AND THIRD SPEED CONSTANT DRIVE GEAR AND BUSH BEARINGS

DESCRIPTION

The second and third speed drive gears are of the single helical cut type and are freely mounted on bush bearings between the front and centre mainshaft splines, they are in constant mesh with two gears of the countershaft gear cluster below and the third speed is of a smaller size than the second speed in order to produce the different ratios as detailed on page H5.

The bush bearing for the second speed constant drive gear has a flanged front end while that of the third speed constant drive gear is of the plain cylinderical type. Situated at the rear end of the two bush bearings is a spigoted shaped thrust washer the rear face of which locates three of the grooves between the centre mainshaft splines and at the front end there is a flat thrust washer having internal projections locating all the grooves between the front mainshaft splines.

During the assembly of the gearbox these bush bearings are positioned inside their respective gear and the gear end float checked and adjusted. then they are fitted on the mainshaft without their gears but with the first and second gear thrust washers; the end float of the bush bearings is then checked and adjusted.

Machined on one side face of each gear, the rear of the second speed and the front of the third speed as they are mounted on the mainshaft, are dog teeth of the same pitch and diameter as those of the synchronising ring and external splines of the splined hub and a male cone clutch face, opposite to that of the synchronising ring. Both of these are necessary for the synchromesh engagement and the outer face of the dog teeth is chamfered on both sides while the clutch cone has a ground and polished operating face.

The end float check of the bush bearings on the mainshaft is best effected on the bare shaft.

OPERATION

The second and third constant speed drive gears provide the drive for the second and third speed, they are in constant mesh with the second and third countershaft gears in the countershaft gear cluster below and being of different sizes rotate at different speed therefore producing two different ratios.

REMOVAL AND REPLACEMENT
SECOND AND THIRD SPEED CONSTANT DRIVE GEARS

1. REMOVAL

The removal of the second and third speed constant drive gears and bushes is fully detailed on page H14.

2. REPLACEMENT

The replacement of the second and third constant drive gears is the reversal of the removal sequence but particular attention must be given to the following points:

(i) That the end float of the constant drive gears on their bush bearings and the end float of the two bush bearings on the mainshaft is checked as detailed on page H20.

(ii) That when fitting the second speed thrust washer ensure that it goes right home between the large mainshaft splines.

(iii) That when fitting the third speed thrust washer ensure that it is fitted oil scrolled surface toward the third speed constant drive gear and the second face is clear of the groove for the circlip.

(iv) That the mainshaft circlip is fitted in its groove located in the front mainshaft splines utilizing the fitting tools fabricated locally as detailed on page H30 when the mainshaft has been assembled in the gearbox.

CHECKING AND ADJUSTING END FLOAT SECOND AND THIRD CONSTANT DRIVE GEARS AND BUSH BEARING.

1. SECOND SPEED CONSTANT DRIVE GEAR END FLOAT

Position the second speed bush bearing, flanged face downward on a surface plate and feed on the second speed constant drive gear flat side first. Utilizing a depth gauge determine the protrusion of the bush bearing above the surface of the gear inside the cone clutch. When the protrusion is less than that specified, a bush bearing having a longer spigot must be selected, but when the protrusion is greater than that specified, the spigot length can be reduced by rubbing it down on a piece of emery paper laid on a surface plate.

2. THIRD SPEED CONSTANT DRIVE GEAR END FLOAT Fig. H18.

The third speed constant drive gear end float is determined and corrected in a similar manner.

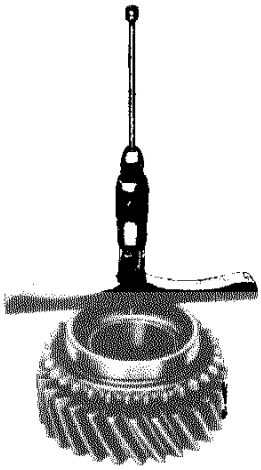


Figure H18

Checking third speed gear and bush bearing end float with depth gauge.

3. SECOND AND THIRD SPEED BUSH BEARING AND MAINSHAFT CLEARANCE Fig. H19.

Feed the second speed gear thrust washer onto the bare mainshaft, spigoted face first, ensuring that they locate in alternate spline grooves, this is important. Follow with the second speed gear bush bearing, spigot first, the third speed gear bush bearing and the third speed gear thrust washer ensuring that its inner projections locate in alternate spline grooves. Fit the used mainshaft circlip or a large portion of it should it have broken during removal. Utilizing feeler gauges ascertain the clearance between the bushes and the two thrust washers. When the end float is too great a second speed bush bearing having a thicker flange must be selected and in this instance the second speed gear end float must be checked. When the clearance is too little it can be increased by reducing the thickness of the second speed bush flange by rubbing it down on a sheet of emery paper laid on a surface plate.

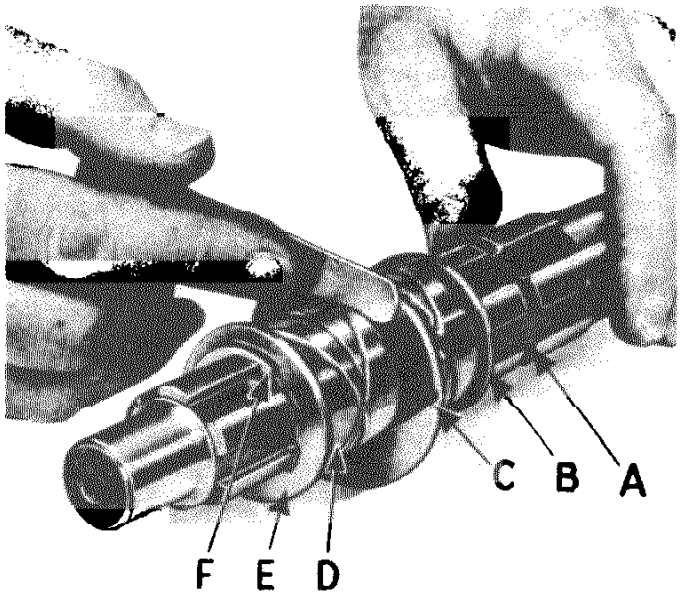


Figure H19

Checking third and second bush bearing and float.

A. Groove in mainshaft for interlocking ball and plunger.
B. Second speed thrust washer.
C. Second speed gear bush bearing.
D. Third speed gear bush bearing.
E. Third speed gear thrust washer.
F. Used circlip.

DIMENSIONS
THIRD SPEED CONSTANT GEAR AND BUSH BEARING

	English	Metric
Bore in third speed drive gear	1.5007"	38.1178 mm.
	1.4993"	38.0822 mm.
Diameter of third speed bush bearing.	1.4979"	38.0466 mm.
	1.4965"	38.0111 mm.
Bore in third speed gear bush bearing.	1.2506"	31.7652 mm.
	1.2494"	31.7348 mm.
Diameter of mainshaft journal.	1.2482"	31.70428 mm.
	1.2470"	31.6738 mm.
Length of third speed gear bush bearing.	1.225 "	31.115 mm.
	1.223 "	31.0642 mm.
Length of third speed constant gear bore.	1.216 "	30.8864 mm.
	1.214 "	30.8356 mm.
End float of gear on bush bearing.	0.007 "	1.778 mm.
	0.006 "	1.524 mm.

DIMENSIONS
SECOND SPEED CONSTANT GEAR AND BUSH BEARING

	English	Metric
Bore in second speed constant gear.	1.5007"	38.1178 mm.
	1.4993"	38.0822 mm.
Diameter of bush bearing.	1.4979"	38.0466 mm.
	1.4965"	38.0111 mm.
Bore in second speed gear bush bearing.	1.2506"	31.76524 mm.
	1.2494"	31.73476 mm.
Diameter of mainshaft journal.	1.2482"	31.7043 mm.
	1.2470"	31.6738 mm.
Length of second speed gear bush excluding flange.	1.162 "	29.5148 mm.
	1.160 "	29.464 mm.
Length of second speed constant gear bore.	1.156 "	29.3624 mm.
	1.154 "	29.3116 mm.
End float of gear on bush bearing.	0.006 "	1.524 mm.
	0.004 "	1.016 mm.

SECOND AND THIRD CONSTANT GEAR BUSH BEARING END FLOAT

Effective length of mainshaft between front end of first and second unit splines and rear face of mainshaft circlip groove	2.870 "	72.898 mm.
	2.868 "	72.8742 mm.
Effective thickness of second speed gear thrust washer.	0.122 "	3.0988 mm.
	0.120 "	3.048 mm.
Thickness of third speed gear thrust washer	0.122 "	3.0988 mm.
	0.120 "	3.048 mm.
End float of second and third speed bush bearings on mainshaft.	0.012 "	3.048 mm.
	0.007 "	1.778 mm.

THE SECOND AND THIRD SPEED THRUST WASHERS

1. SECOND SPEED THRUST WASHER

The second speed thrust washer is situated at the rear end of the long journal at the front end of the mainshaft. It has three projections or spigots in its rear face which locate in alternate grooves between the large mainshaft splines situated in the centre of the mainshaft. When fitting this thrust washer it is important to ensure that it goes right home. Its front face, which contacts the second speed bush bearing and gear inside the cone clutch, has two parallel grooves to assist lubrication.

2. THIRD SPEED THRUST WASHER

The third speed thrust washer is situated at the front end of the long journal at the front end of the mainshaft, it is located by the front mainshaft splines and held in position by the mainshaft circlip. Its rear face, which contacts the front end of the third speed bush bearing and gear inside the cone clutch, is scrolled to assist lubrication and therefore must always be positioned with this surface toward the rear of the mainshaft.

THE MAINSHIFT CIRCLIP

The mainshift circlip is situated on the front end of the mainshaft approximately half way along the front splines. Its inner periphery however does not touch the bottom of the spline groove and this facilitates its removal. Its dimensions are such that some force is required to lift it out of its groove and to ensure efficient operation of the gearbox a replacement circlip is always fitted when finally assembling the gearbox unit. However, the used circlip, even if it is broken, is not immediately discarded as it can be used during the assembling sequence to facilitate the checking of the bush bearing end float. Special tools, fabricated locally to the dimensions detailed below, are utilized to fit this circlip.

REMOVAL AND REPLACEMENT
MAINSHAFT CIRCLIP

1. REMOVAL

Lift one end of the mainshaft circlip from its groove in the mainshaft by positioning a lever between its inner periphery and the bottom of the spline grooves. Utilizing a second lever, move the end of the circlip away from the face of the thrust washer, leaving this lever in position and withdraw the first. Repeat the foregoing by inserting the first lever in an adjacent spline groove until the circlip is removed from its groove. The circlip is then drawn off the front end of the mainshaft. Examine the mainshaft splines for "burrs" and clean up if necessary when the mainshaft has been removed from the gearbox casing.

2. REPLACEMENT

The second and third speed constant drive gears, bushes and thrust washers are in position, as detailed on page H27 . Fit the tapered sleeve, fabricated locally to the dimensions below, to the front end of the mainshaft and grease its tapered face. Locate the circlip on the tapered face and press the circlip into its position utilizing the circlip thrust tube.

MAINSHAFT CIRCLIP FITTING TOOL

	English	Metric
Large diameter of tapered sleeve	1.480" 1.475"	37.592 mm. 37.465 mm.
Small diameter of tapered sleeve.	1.125" 1.115"	28.575 mm. 28.321 mm.
Overall length of tapered sleeve tapered sleeve.	2.000 1.990"	50.8 mm. 50.546 mm.

Bore in tapered tool for mainshaft spigot.	0.875"	22.225	mm.
	0.874"	22.1996	mm.
Bore in circlip thrust tube.	1.495"	37.973	mm.
	1.485"	37.719	mm.
Thickness of circlip thrust tube.	1.500"	38.1	mm.
	1.490"	37.846	mm.
Overall length of circlip thrust tube.	7.000"	177.8	mm.
	6.990"	177.546	mm.

THE TOP AND THIRD SPEED SYNCHRONISING UNIT.

DESCRIPTION Fig. H20.

The top and third synchronising unit is mounted on the mainshaft splines on the front end of the mainshaft. It is similar in construction to the first and second speed unit but has synchronising rings in each end face. The splined hub is freely mounted on the front mainshaft splines and the three spring loaded synchronising balls locate in an annular groove machined in the centre of the operating sleeve splines, so the specific positioning of the splined hub inside the operating sleeve is not necessary.

The third speed is selected by sliding the operating sleeve rearward to engage the dog teeth of the third speed constant drive freely mounted on the mainshaft behind while top is selected by sliding the operating sleeve forward to engage the dog teeth machined on the rear end of the primary shaft transmitting the engine speed to the mainshaft.

OPERATION

To select third speed the operating sleeve slides rearward along the splined hub to engage the dog teeth machined on the front end of the third speed constant drive gear which is freely mounted on the mainshaft.

As the operating sleeve slides rearward the spring loaded synchronising balls situated between the operating sleeve and splined hub causes the latter to also slide endwise with the operating sleeve. This endwise movement brings the female cone face of the synchronising ring into contact with the cone clutch face machined on the front face of the third speed constant drive gear causing it to rotate to the extent of the clearance between the synchronising ring lugs and the slots in the side face of the splined hub, which is approximately half a tooth each side of the external splines of the splined hub and so the dog teeth of the synchronising ring will now be in the path of the sliding operating sleeve.

The advance of the sliding operating sleeve will apply pressure to the synchronising ring and third speed cone clutch faces and so increasing the frictional drag which slows the drive gear to that of the synchronising ring and hence the mainshaft, the frictional drag will become zero and the speed of the drive gear will be that of the synchronising ring. The chamfered ends of the operating sleeve splines, will force the similarly chamfered dog teeth of the synchronising ring out of the way and this occurrence will be repeated with the dog teeth on the constant drive gear and the operating sleeve will be in full engagement with the dog teeth of the constant drive gear. The spring loaded synchronising balls are now out of their groove in the operating sleeve and are inoperative.

To select top the operating sleeve is moved forward to engage the dog teeth machined in the rear end of the primary shaft. In doing so it will be disengaged from the dog teeth on the third speed constant drive gear and the three spring loaded synchronising ball will locate the groove inside the operating sleeve when it attains its neutral position and the synchronising operation will be repeated as detailed in the earlier paragraphs of this OPERATION sequence and transmit the speed of the engine to the mainshaft.

REMOVAL AND REPLACEMENT
TOP AND THIRD SPEED SYNCHRONISING UNIT.

1. REMOVAL

The removal of the top and third speed synchronising unit from the mainshaft is detailed on

page H13 . See also synchronising rings on page H22.

2. REPLACEMENT

The replacement of the top and third speed synchronising unit is the reversal of the removal sequence but particular attention must be given to the following points:-

(i) That it is effected before the front mainshaft bearing is pressed into position and the front end of the mainshaft tilted upward.

(ii) That the short portion of the splined hub is toward the rear of the gearbox.

DISMANTLING AND ASSEMBLING
TOP AND THIRD SPEED SYNCHRONISING UNIT Fig. H20.

1. DISMANTLING

Identify the circumferential position of the synchronising rings and the operating sleeve. Eject the splined hub from the centre of the splined hub exercising care to control the run of the spring loaded synchronising balls and remove any shims from inside the three blind drillings of the splined hub.

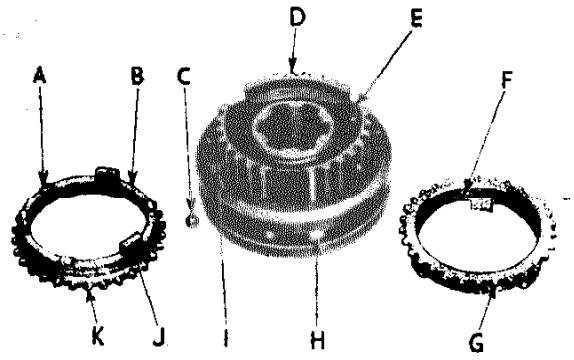


Figure H20
Third and top synchronising unit.

A. Projection to contact splined hub.
B. Synchronising ring.
C. Synchronising ball.
D. Splined hub.
E. Slot in splined hub, for synchronising ring lug.
F. Female cone clutch face with spiral gear.
G. Dog teeth.
H. Selector fork groove.
I. Synchronising spring.
J. Synchronising ring lug to locate splined hub.
K. Chamfer on synchronising ring dog teeth.

2. ASSEMBLING

The assembling of the top and third speed unit is similar to that of the first and second speed unit with two exceptions.

(i) That the two identified side faces are replaced with due regard to their markings.

(ii) That reference to the interlocking ball and plunger is disregarded.

CHECKING AND ADJUSTING
AXIAL RELEASE LOADING
TOP AND THIRD SPEED SYNCHRONISING UNIT Fig. H21.

The sequence for checking and adjusting the release loading is similar to that for the first and second speed unit but in this instance the loading is different.

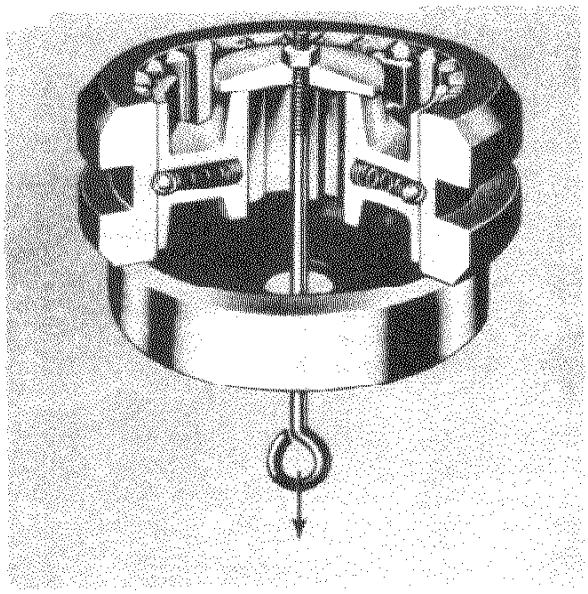


Figure H21

Testing the axial loading of synchronising balls.

AXIAL RELEASE LOADINGS
TOP AND THIRD SPEED SYNCHRONISING UNIT

	English	Metric
Axial release loading of top and third speed unit.	21lbs. 19lbs.	9.525 kgs. 8.818 kgs.
Free length of axial release	0.500"	12.700 mm.

THE PRIMARY SHAFT

DESCRIPTION Fig. H22.

The primary shaft while transmitting the power from the engine to the gearbox also provides the drive gear for the highest ratio and this is effected by providing a ring of dog teeth and a male cone clutch surface at its rear end. It is mounted on two bearings, one in the rear end of the crankshaft, which locates the spigoted front end of the primary shaft and a ball race mounted in the front face of the gearbox.

The oil sealing is effected by positioning an oil thrower disc between the rear face of the bearing and the gear of the primary shaft and a lip type oil seal pressed into the front cover.

OPERATION

Mounted on the splines toward the front end of the primary shaft are the splines for the clutch driven plate and so transmit the engine power to the gearbox. A gear machined toward the rear end of the primary shaft meshes with the constant gear mounted on the front end of the countershaft gear cluster below and so transfers the engine speed to the countershaft gears which in turn transmits the power to the second and third speed constant drive gears.

The primary shaft also incorporates the male cone clutch and dog teeth for the synchromesh top speed and when top is selected the engine speed is transferred from the primary shaft to the mainshaft.

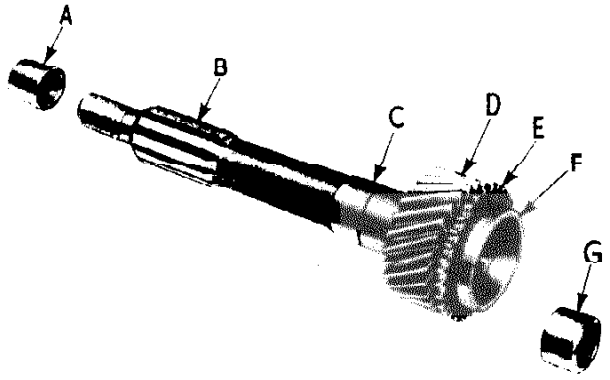


Figure H22
Primary shaft and bearings.

A. Bush bearing fitted in rear end of crankshaft.
B. Splines for clutch driven plate.
C. Oil seal face.
D. Constant gear.
E. Dog teeth, chamfered rearward.
F. Male cone clutch face.
G. Torrington bearing.

REMOVAL AND REPLACEMENT
PRIMARY SHAFT

1. REMOVAL

This cannot be effected until the countershaft gear cluster is positioned in the bottom of the gearbox and is fully detailed on page H17.

2. REPLACEMENT

The fitting of the primary shaft is the reversal of the removal sequence but particular attention must be given to the following points:-

(i) That the primary shaft and ball bearing race are fitted to the front face of the gearbox casing so that the gap in the large circlip aligns with the hole at the R.H. side of the gearbox front face.

(ii) That when the front cover is fitted the primary shaft splines are covered so they will not disturb the lips of the oil seal.

DISMANTLING AND ASSEMBLING
PRIMARY SHAFT ASSEMBLY

1. DISMANTLING

Withdraw the needle roller assembly from the rear end of the primary shaft. Remove the small circlip and washer from the front end of the primary shaft exercising care not to disturb the polished face for the oil seal. Remove the large circlip from the outer race of the ball bearing, eject the primary shaft through the ball race and remove the oil baffle.

2. ASSEMBLING

The assembling of the primary shaft assembly is the reversal of the dismantling sequence but particular attention must be given to the following points:

(i) That the oil baffle is located on the face of the primary shaft gear with a smear of grease and then the ball bearing race is pressed on so that the groove for the large circlip is toward the front of the primary shaft.

(ii) That when the small circlip is fitted to the front of the primary shaft ensure that it does not disturb the polished surface for the oil seal.

DIMENSIONS
PRIMARY SHAFT

	English	Metric
Bore in crankshaft bush bearing	0.7505" 0.7495"	19.0627 mm. 10.0373 mm.
Diameter of primary shaft spigot.	0.7485" 0.7475"	19.0119 mm. 18.9865 mm.
Bore in rear end of primary shaft.	1.125 " 1.124 "	28.575 mm. 28.5476 mm.
Diameter of Torrington needle roller assembly.	1.125 "	28.575 mm.
Diameter of mainshaft spigot.	0.8740" 0.8735"	22.1996 mm. 22.0976 mm.

THE SPEEDOMETER DRIVE

It should be noted that the speedometer drive must be removed before the rear casing is detached from the main gearbox casing.

REMOVAL AND REPLACEMENT Fig. H23.

1. SEATS AND TRANSMISSION COVER

Remove the seats and transmission cover from the cockpit of the car as detailed in THE BODY, SECTION Q.

2. SPEEDOMETER CABLE AND DRIVE

Position a suitable receptacle beneath the speedometer drive connection in the rear casing to trap any escaping oil. Withdraw the speedometer drive cable from the R.H. side of the rear casing by detaching the knurled nut. Remove the speedometer body and driven gear from the R.H. side of the rear casing by withdrawing the locating screw; remove the rubber "O" ring from the groove in the body. Withdraw the speedometer driven gear and thrust washer from the speedometer body and then the thrust washer from the driven gear. Drill out the Mills pin (1/16" dia.) and unscrew the adaptor. Eject the bush bearing and oil seal when they are well worn.

3. REPLACEMENT

The replacement of the speedometer drive is the reversal of the removal sequence but particular attention must be given to the following points:-

(i) That the speedometer driven gear and bush bearing assembly is fed into the rear casing so that the side bore in its cylinderical form aligns with that of the locating screw.

(ii) That the gearbox oil level is checked and topped up as detailed on page H15 .

DIMENSIONS
SPEEDOMETER DRIVE

	English	Metric
Bore in rear casing	1.0006" 0.9994"	25.41524 mm. 25.3848 mm.
Diameter of speedometer bush bearing	0.9994"	25.3848 mm.
Bore in speedometer bush bearing	0.5004" 0.4996"	12.7102 mm. 12.6898 mm.

Diameter of speedometer driven gear.	0.4994"	12.6898 mm.
	0.4982"	12.6543 mm.

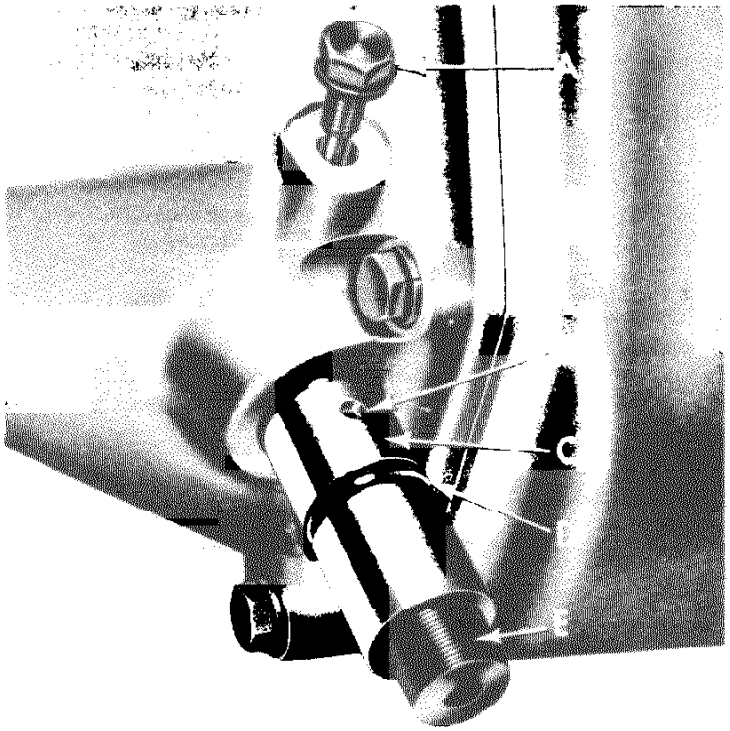


Figure H23
Speedometer locating bolt and drive assembly.

A. Locating bolt.
B. Locating bolt hole.
C. Body of speedometer drive.
D. Oil seal.
E. Screwed adaptor.

THE GEARBOX MOUNTINGS

The gearbox unit is attached to the rear of the cylinder block as detailed in the previous paragraph and then both are mounted as a combined unit in the chassis frame. The front end of the combined unit is mounted as detailed in the ENGINE UNIT, SECTION D, and the rear casing of the gearbox is supported on a short cross member attached to a front portion of the chassis frame cruciform.

Interposed between the rear casing and the gearbox mounting cross member are two metal and rubber bonded pads, one each side, which is secured to the gearbox rear casing by bolts and to the gearbox mounting cross member by nuts.

REMOVAL AND REPLACEMENT
GEARBOX MOUNTINGS

1. SEATS AND TRANSMISSION COVER

Remove the seats and transmission cover from the cockpit of the car as detailed in THE BODY, SECTION Q.

2. GEARBOX MOUNTINGS

Detach the two gearbox mountings from the short gearbox chassis cross member by removing one nut each, and from the gearbox rear casing by withdrawing two bolts each. Utilizing a jack beneath the rear of the gearbox, lift the latter upward to remove the two metal and rubber bonded pads from between rear casing and chassis cross member.

3. REPLACEMENT

The replacement of the gearbox mountings is the reversal of the removal sequence.

THE GEARBOX OIL SEALS

DESCRIPTION

The gearbox unit is oil sealed at each end by a lip type oil seal, the front one being pressed into the primary shaft cover and the rear one pressed into the extreme end of the gearbox rear casing. In both instances the lip of the seal is toward the gears in the gearbox.

The gearbox top cover also has oil seals at both ends which seal the bores of the three selector rods; the fronts are welch washer plugs and the rear are rubber "O" rings through which the selector rods protrude.

The reverse selector rod, mounted in the top L.H. side of the gearbox casing, is sealed inside the clutch bell housing, by a welch washer plug and at its rear end by the gearbox.

REMOVAL AND REPLACEMENT
FRONT AND REAR OIL SEALS

1. FRONT OIL SEAL

Remove the gearbox unit from the car as detailed on page H9 . Detach the clutch release bearing from the top of the forked lever and free the forked lever from the clutch actuating shaft as detailed in THE CLUTCH UNIT, SECTION E. Withdraw the primary shaft cover from inside the clutch bell housing by removing four nuts and prise out the oil seal. The replacement is pressed in the rear face of the primary shaft cover so that the seal lip is toward the gearbox fitting face. The splines of the primary shaft must be covered in such a manner that they will not damage the oil seal lip and the primary cover replaced and the gearbox unit fitted to the car by reversing the removal sequence.

2. REAR OIL SEAL

Remove the seats and transmission cover from the cockpit of the car as detailed in THE BODY, SECTION Q. Detach the front end of the propeller shaft as detailed in THE PROPELLER SHAFT, SECTION I. Remove the propeller shaft coupling flange from the rear end of the main shaft by removing a nut and prising out the oil seal. Press in the replacement oil seal exercising care not to foul its lips on the rear mainshaft splines. The components are then replaced by reversal of the removal sequence.

DIMENSIONS
FRONT AND REAR OIL SEAL.

	English	Metric	
Bore in rear face of primary shaft cover	1.998 " 1.996 "	50.7492 50.6984	mm. mm.
Diameter of primary shaft oil seal	2.000"	50.8	mm.
Bore in rear end of rear casing.	2.4996" 2.4990"	63.48984 63.4746	mm mm.
Diameter of rear mainshaft oil seal	2.500 "	63.5	mm.
Front oil seal identification number	Gaco Mis 14.		
Rear oil seal identification number	Superfect 256 116. Burtonwood 160-256.		

THE GEARBOX BREATHER

During normal use a slight pressure is built up in the gearbox and this is relieved by a small drilling in the top of the rear casing beneath the gear selector lever. This will require no attention but during an overhaul a twist drill should be fed through to ensure it is not obstructed.

THE GEARBOX PRIMARY, MAIN AND COUNTER SHAFT BEARINGS.

BALL BEARING RACE ASSEMBLIES

Primary and front mainshaft	Hoffman MS.12K.V2. 00 fit.
Rear mainshaft	Hoffman LS.11 00 fit.

NEEDLE ROLLER BEARINGS

End of primary shaft.	Torrington B.1412
Each end of countershaft gear cluster	Hoffman 29.8 mm. x 3 mm. dia. 48 off.