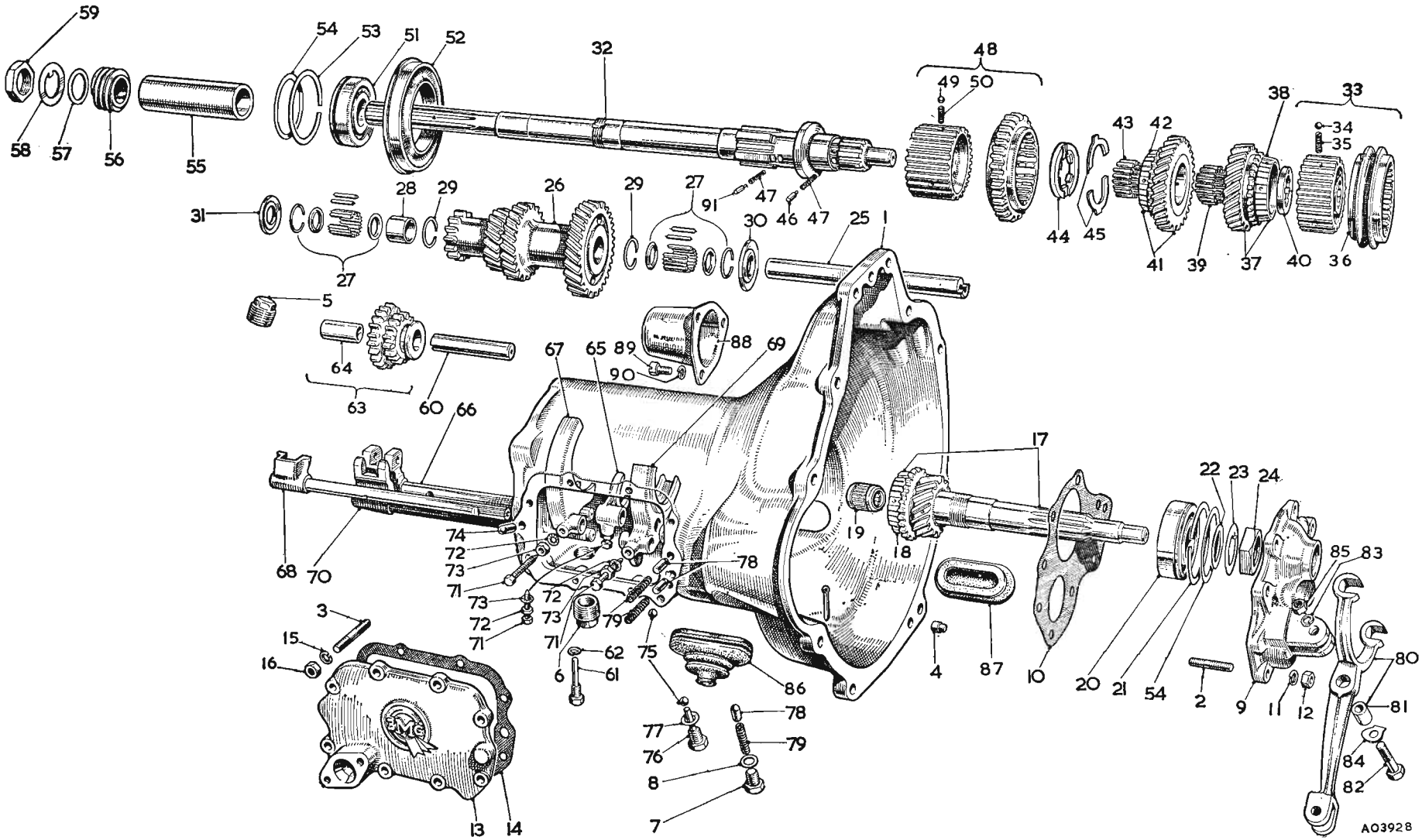
SECTION F

THE GEARBOX

	Section
General description	
First motion shaft	F.4
Gearbox	F.2
Gear synchronizing cones (early cars)	F.6
Laygear assembly	F.5
Lubrication	F.1
Service tools	End of Section
Third motion shaft	
Early cars	F.3
Later cars	F.7

THE GEARBOX COMPONENTS



KEY TO THE GEARBOX COMPONENTS

No.	Description
1.	Case assembly.
2.	Stud for front cover.
3.	Stud for side cover.
4.	Dowel.
5.	Filler plug.
6.	Drain plug.
7.	Plug for reverse plunger spring.
8.	Washer.
9.	Front cover.
10.	Front cover joint.
11.	Spring washer.
12.	Nut.
13.	Side cover.
14.	Joint for side cover.
15.	Spring washer.
16.	Nut.
17.	First motion shaft with cone.
18.	Synchronizing cone.
19.	Needle-roller bearing.
20.	First motion shaft journal ball bearing
21.	Spring ring.
22.	Washer.
23.	Lock washer.
24.	Nut.
25.	Layshaft.
26.	Laygear.
27.	Needle-roller bearing with spring ring.
28.	Distance piece.
29.	Spring ring.
30.	Thrust washer (front).
31.	Thrust washer (rear).
32.	Third motion shaft.
33.	Third and fourth speed synchronizer.
34.	Ball.
35.	Spring.
36.	Sleeve.
37.	Third speed gear with cone.
38.	Synchronizing cone.
39.	Needle roller.
40.	Third speed gear locking collar.
41.	Second speed gear with cone.
42.	Synchronizing cone.
43.	Needle roller.
44.	Second speed locking collar.
45.	Washer.
46.	Peg for locking collar.
47.	Springs for pegs.
48.	First speed gear assembly.
49.	Ball.
50.	Spring for ball.
51.	Third motion shaft journal ball bearing.
52.	Bearing housing.
53.	Spring ring.
54.	Bearing packing washer.
55.	Third motion shaft distance piece.
56.	Speedometer gear.
57.	Plain washer.
58.	Locking washer.
59.	Third motion shaft nut.
60.	Reverse shaft.
61.	Screw.
62.	Spring washer.
63.	Reverse wheel and bush.
64.	Bush.
65.	Reverse fork.
66.	Reverse fork rod.
67.	First and second speed fork.
68.	First and second speed fork rod.
69.	Third and fourth speed fork.
70.	Third and fourth speed fork rod.
71.	Fork locating screw.
72.	Shakeproof washer.
73.	Nut.
74.	Interlock plunger.
75.	Interlock ball.
76.	Plug.
77.	Washer.
78.	Plunger for fork rod.
79.	Spring.
80.	Clutch withdrawal lever with bush.
81.	Bush.
82.	Bolt.
83.	Spring washer.
84.	Locking washer.
85.	Nut.
86.	Dust cover.
87.	Dust cover for bell housing.
88.	Starter pinion cover.
89.	Screw.
90.	Washer.
91.	Peg for locking collar.

GENERAL DESCRIPTION

The gearbox has four forward speeds and one reverse, and synchromesh is incorporated on second, third, and top gears.

Top gear is a direct drive; third and second are in constant mesh; first and reverse are obtained by sliding spur pinions.

Section F.1

LUBRICATION

The combined lubrication filler and lever plug situated on the gearbox extension is reached by lifting the floor covering from inside the car and removing the rubber plug on the left-hand side of the gearbox cover. The oil must be level with the bottom of the filler hole. The drain plug is situated on the bottom of the gearbox casing.

Section F.2

GEARBOX

Removing

The engine and gearbox may be removed from the vehicle as a complete unit as described in Section A.31 and then separated. The alternative method is first to remove the engine as detailed in Section A.31 and then withdraw the gearbox after completing the following operations.

Remove the self-tapping screws from the change speed lever cover and withdraw the cover from the lever.

Remove the anti-rattle plunger spring and cap from the side of the change speed lever turret. Remove the change speed lever cover set screws and the lever.

Turn back the carpet surrounding the gearbox cover to expose the gearbox rear mountings and remove the securing set screws.

Working beneath the vehicle, remove the speedometer drive cable at its union with the gearbox rear extension.

Remove the clutch slave cylinder as detailed in Section E.4. Disconnect the propeller shaft from the rear axle (see Section G.2). Remove the remaining gearbox rear mounting set screws and lift the gearbox clear of the vehicle.

Dismantling

Unscrew the filler plug. Drain the oil by removing the plug from the bottom of the gearbox. Unscrew and remove the speedometer pinion sleeve with a box spanner from the left-hand side of the gearbox rear extension, and withdraw the speedometer pinion.

Remove the nuts securing the remote control housing and lift the housing off the rear cover.

Unscrew the set screws and spring washers securing the rear cover to the gearbox.

Pull the rear cover back slightly and turn it in an anti-clockwise direction, as viewed from the rear, to enable the control lever to clear the fork rod ends, and then remove the rear cover from the gearbox.

Remove the control shaft locating screw, and screw it into the tapped front end of the control shaft. Slight pressure on the screw will facilitate the removal of the control shaft, which is a push fit in the rear cover. The control lever will slip off the end of the shaft as the shaft is removed.

Remove the one-piece nylon control lever bush from the control lever.

Unscrew the set screws securing the bottom cover to the change speed lever tower. Retain the paper joint washer if undamaged.

Unscrew and remove the change speed lever locating peg and the anti-rattle springs. The latter are removed by unscrewing the caps and then tilting the remote control housing so that the springs and plungers drop out.

Unscrew the set screws securing the change speed lever cover to the top of the change speed lever tower and remove the lever, taking care to retain the thrust button and thrust button spring.

Unscrew the set screws in the front and rear selector levers, remove the core plugs at either end of the remote control housing, and, using a suitable drift, tap out the remote control shaft. The front and rear selector levers can then be removed.

To remove the reverse selector plunger first unscrew the reverse plunger cap and remove the detent spring and ball, then remove the locating pin.

Remove the clutch release bearing by levering out the two retaining springs.

To remove the clutch withdrawal lever tap back the locking washer and remove the nut and washer. The bolt may then be unscrewed. Do not attempt to knock the bolt out, as it is threaded into the support bracket. Unscrew and remove the bolt and lock washer.

Remove from the front cover the nuts and washers situated within the clutch bell housing. The front cover may then be withdrawn by gripping the clutch withdrawal lever brackets with the finger and thumb and pulling. Remove the paper joints and packing shim.

Release the set screws in the side cover. Remove the side cover and joint washer. Remove the two springs from the front edge of the side cover joining face. Turn the gearbox on its side so that the two plungers fall out of the holes from which the springs were removed.

Remove the plugs situated near the clutch bell housing on the side cover side of the gearbox casing. They each have a fibre washer, and the lower of the plugs covers the reverse plunger and springs, which may be removed by tilting the gearbox on its side. The other plug, which has a long shank, blocks the hole through which the interlock ball between the first and second and third and fourth selector rods is inserted.

Select neutral by aligning the slots in the rear ends of the selector rods. Working on the gearbox, with the side cover facing upwards, unlock and remove the reverse fork locating screw, locknut, and shakeproof washer through the drain plug hole. Similarly, remove the locating screw locknut and shakeproof washer from the first and second and third and fourth speed forks.

Tap the third and fourth speed selector rod from the

front end and draw it out through the back of the gearbox. Similarly, remove the first and second speed selector rod (nearest side cover) and then the reverse selector rod.

As the selector rods are being drawn out take care to remove the two interlock balls from the front end of the gearbox casing. Also the double-ended interlock plunger should be removed from the back end of the gearbox casing. The three selector forks may now be lifted out of the gearbox.

Tap the layshaft out of the front of the gearbox with a bronze drift. On removing the drift the laygear cluster and thrust washers will drop into the bottom of the gearbox.

Draw the third motion shaft assembly rearwards out of the gearbox case.

Insert a long, soft-metal drift through the mainshaft opening in the rear of the casing and drive the first motion shaft forwards out of the gearbox. The laygear cluster and thrust washers may now be removed.

Remove the reverse shaft locking screw. Place a screwdriver on the slotted end of the reverse shaft and push it into the gearbox with a turning motion. The reverse shaft and gear may now be removed.

Reassembling

Reverse the sequence of operations detailed for dismantling, but note the following important points:

(1) If a new front or rear cover washer is to be fitted, compress it by bolting the cover and washer in position before any other component is fitted; remove the cover and washer.

(2) When refitting the laygear use 18G 471 for shaft alignment, see Section F.5, subsection **'Laygear thrust washers'**.

(3) To ensure oil-tight joints and the correct fitting of the end covers shims are fitted. The method of determining their thickness is as follows.

End cover shims

Although a ·006 in. (·15 mm.) shim is usually found to be sufficient, use the following method to shim the front and rear covers. Measure the depth of the front cover recess and the amount by which the bearing outer race protrudes from the casing, and tighten the cover with only the paper joint washer in position to allow it to be compressed. Take off the cover and remove the paper joint washer and measure its thickness. Add the thickness of the joint washer to the depth of the cover recess and subtract the amount by which the bearing protrudes from the casing. The result gives the thickness of shims to be used. Use the least possible number of shims to arrive at the correct thickness.

Shims are also available in thicknesses of ·004 in. (·10 mm.) and ·010 in. (·25 mm.). Tighten the rear cover (evenly by diametrical selection) with the nine long set pins and spring washers. Correct shimming is done in exactly the same way as for the front cover.

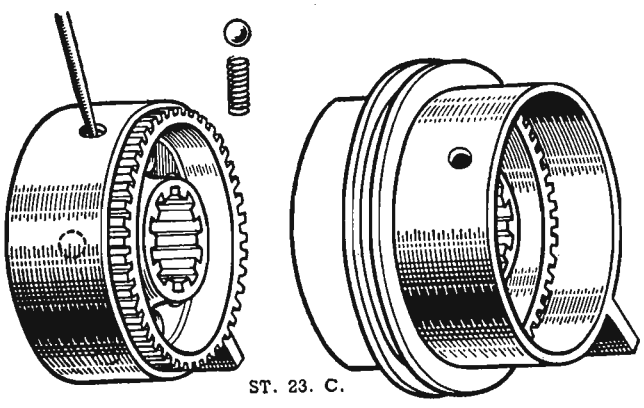


Fig. F.1

Using Service tool 18G 144 to assemble the spring-loaded balls to a coupling sleeve and synchronizer

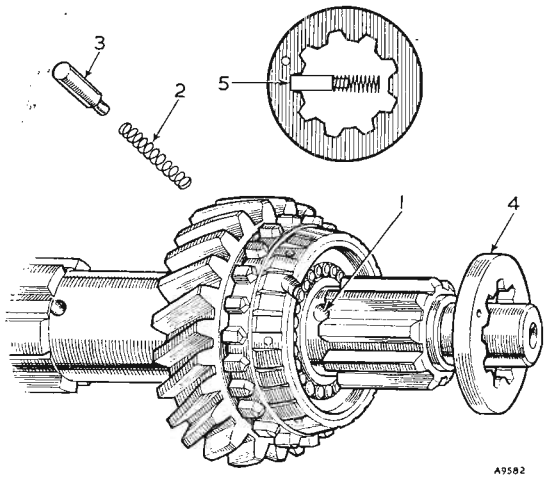


Fig. F.2

Securing the third motion shaft gears

1. Hole in shaft for locking plunger.
2. Spring.
3. Locking plunger.
4. Locking washer.
5. Locking washer with plunger engaged.

Refitting

Refitting is the reverse of the dismantling procedure.

Section F.3

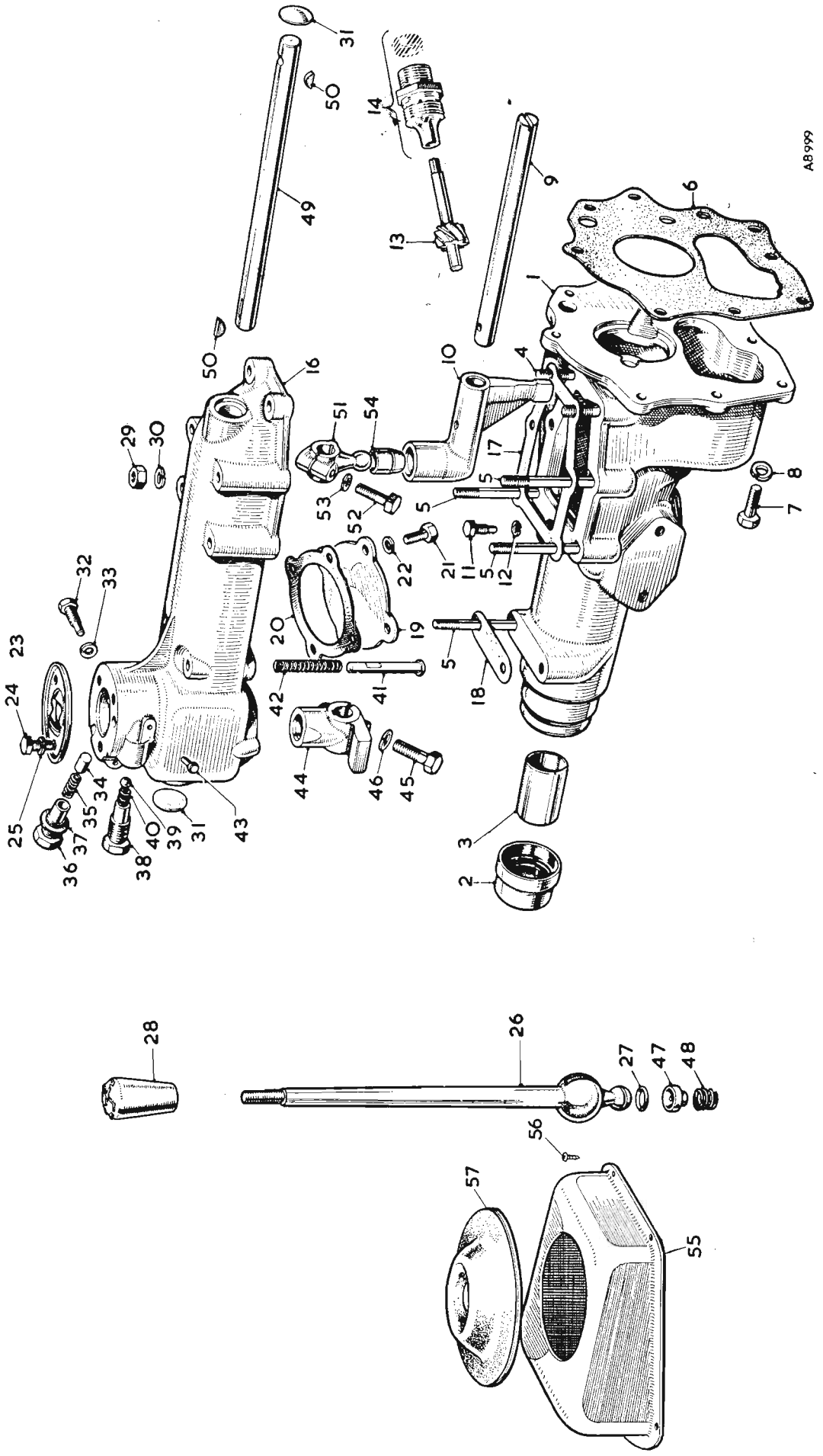
THIRD MOTION SHAFT

Dismantling

Remove the third and fourth speed synchronizer assemblies. Depress the spring-loaded plunger which locks the front splined ring at the end of the third motion shaft. Turn the ring so that one of its splines covers the plunger (a peg spanner is useful for turning the splined ring). Slide the splined ring and third speed gear off the end of the shaft and remove the plunger and spring. The third speed gear has needle-roller bearings.

At the other end of the shaft knock back the locking washer and unscrew the securing nut. The lock washer, washer, speedometer wheel, and distance piece may now be removed. Draw the ball journal bearing off the end of the shaft with its housing, and then drift the bearing out of the housing. Draw the first speed gear and

THE REAR EXTENSION COMPONENTS



KEY TO THE REAR EXTENSION COMPONENTS

No.	*Description*
1.	Rear extension.
2.	Oil seal.
3.	Sliding joint bush.
4.	Extension short stud.
5.	Extension long stud.
6.	Joint.
7.	Screw.
8.	Spring washer.
9.	Control shaft.
10.	Control lever.
11.	Control lever locating peg.
12.	Spring washer.
13.	Speedometer pinion.
14.	Speedometer pinion oil seal assembly.
16.	Remote control casing.
17.	Extension front joint.
18.	Extension rear joint.
19.	Lever tower bottom cover.
20.	Joint.
21.	Screw.
22.	Spring washer.
23.	Lever seat cover.
24.	Screw.
25.	Spring washer.
26.	Change speed lever.
27.	Ring (rubber).
28.	Knob.
29.	Stud nut.
30.	Spring washer.
31.	Welch plug.
32.	Lever locating peg.
33.	Spring washer.
34.	Control shaft damper plunger.
35.	Spring.
36.	Spring retaining cap.
37.	Washer.
38.	Reverse selector detent plug.
39.	Ball.
40.	Spring.
41.	Reverse selector plunger.
42.	Spring.
43.	Reverse selector plunger locating pin.
44.	Rear selector lever.
45.	Screw.
46.	Spring washer.
47.	Thrust button.
48.	Spring.
49.	Remote control shaft.
50.	Key.
51.	Front selector lever.
52.	Screw.
53.	Spring washer.
54.	Front selector lever bush.
55.	Remote control cover.
56.	Screw.
57.	Grommet.

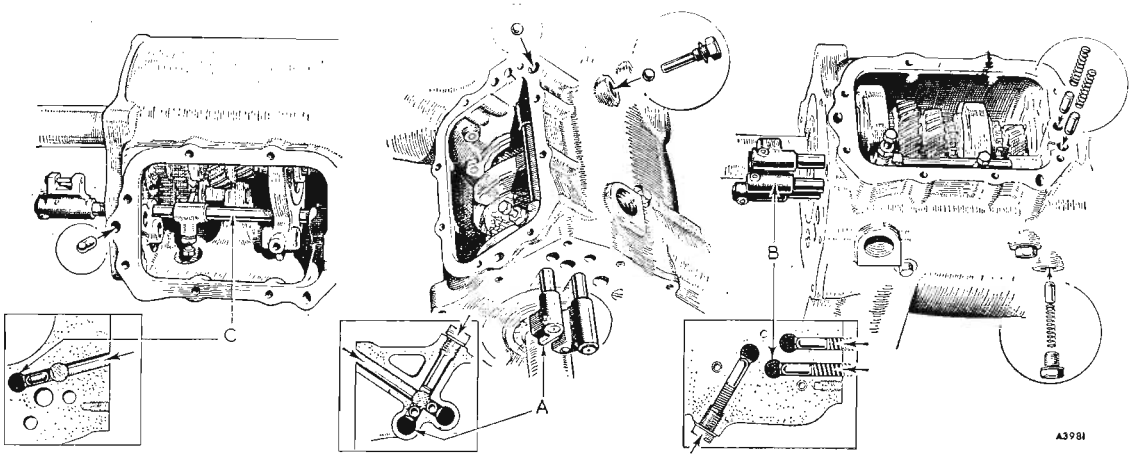


Fig. F.3

The location and correct assembly of the selector locking balls, plungers and springs

A. First and second gear fork rod in place (gearbox upside-down). B. Third and fourth gear fork rod in place.

C. Reverse gear fork rod in place.

synchronizer assembly off the shaft. Depress the spring-loaded plunger which locks the rear splined ring at the end of the third motion shaft. Turn the ring so that one of its splines covers the plunger and slide the splined ring off the shaft. Remove the plunger and spring and lift the two halves of the washer for the splined ring off the shaft. Slide the second speed gear off the shaft, taking care to retain the needle rollers.

Reassembling

The third motion shaft ball journal bearing outer race is grooved to take a spring ring. This spring ring registers in a recess in the bearing housing. Press the bearing into the flanged end of the housing so that the spring ring end of the bearing is trailing. Assemble the needle rollers on the shaft and fit the second speed gear. Place the two halves of the washer for the splined ring on the shaft behind the second speed gear. Ensure that the two halves of the washer are assembled with the locking pegs registered in the correct position in the splined ring. Assemble the spring and plunger in the hole in the shaft and refit the splined ring. Slide the first speed gear and synchronizer assembly onto the shaft with the protruding end of the synchronizer towards the bearing. Press the bearing and its housing onto the shaft so that the flange of the bearing housing (when fitted) is towards the rear of the shaft. Refit the distance piece, speedometer drive, plain washer, lock washer, and locknut in position.

From the opposite end of the shaft assemble the needle-roller bearing and refit the third speed gear assembly. Place the spring and plunger in the hole in the shaft and refit the splined ring. Slide the third and fourth speed synchronizer onto the shaft with the boss on the synchronizer hub, away from the splined ring.

Section F.4

FIRST MOTION SHAFT

Dismantling

Unlock and remove the securing nut and withdraw the lock washer and packing shim.

Press the bearing from the shaft and remove the circlip from the bearing.

Reassembling

Reverse the dismantling procedure, ensuring that the inner tag of the lock washer, which engages the keyway in the shaft, is turned away from the bearing.

Section F.5

LAYGEAR ASSEMBLY

Dismantling

Needle-roller bearings are fitted in each end of the laygear. The needles are held in position in their races (one at each end) by spring rings.

Remove the spring rings from their locating grooves and extract the outer race needle rollers and the inner race. Remove the inner spring ring from its groove in the large end of the laygear and the distance piece and spring ring from the small end of the laygear.

Laygear thrust washers

These washers are designed to permit a laygear end-float of ·001 to ·003 in. (·0254 to ·0762 mm.). If the end-float exceeds this amount, the thrust washers must be renewed. The smaller thrust washer, at the rear, is made in varying thicknesses to allow correct end-float to be obtained. Thrust washers for the laygear small-end are available in thicknesses of ·123 to ·124 in. (3·124 to 3·150 mm.), ·125 to ·126 in. (3·175 to 3·200 mm.), ·127 to ·128 in. (3·226 to 3·250 mm.), and ·130 to ·131 in. (3·302 to 3·327 mm.) to obtain the required end-float.

Reassembling

Reverse the dismantling procedure. Use Service tool 18G 471 for layshaft gear alignment.

Section F.6

GEAR SYNCHRONIZING CONES
(Early Cars)

These cones are 'shrunk on' to the second, third, and fourth speed gears and are normally supplied as a complete unit for spares purposes. Where facilities exist for shrinking on and finally machining the cones, they can be supplied separately. If the gear is to operate satisfactorily, however, care must be taken in fitting them.

The internal machining of the cone is calculated to allow for a shrinkage fit onto the gear, and the cone must be heat-expanded before it can be fitted.

When heated in oil to approximately 121·1° C. (250° F.) expansion will allow the cone to be pressed home onto the gear without damage.

NOTE.—The six large recesses on the perimeter of the cone must line up with the hole in the boss of the gear.

After shrinking on, the unit should be immediately quenched in water to prevent the gear itself being softened. Punch-mark the cone in each of the six recesses. This ensures resistance to displacement when changing gear.

When the cone is in position the final machining can be done in accordance with the dimensions given in Fig. F.4.

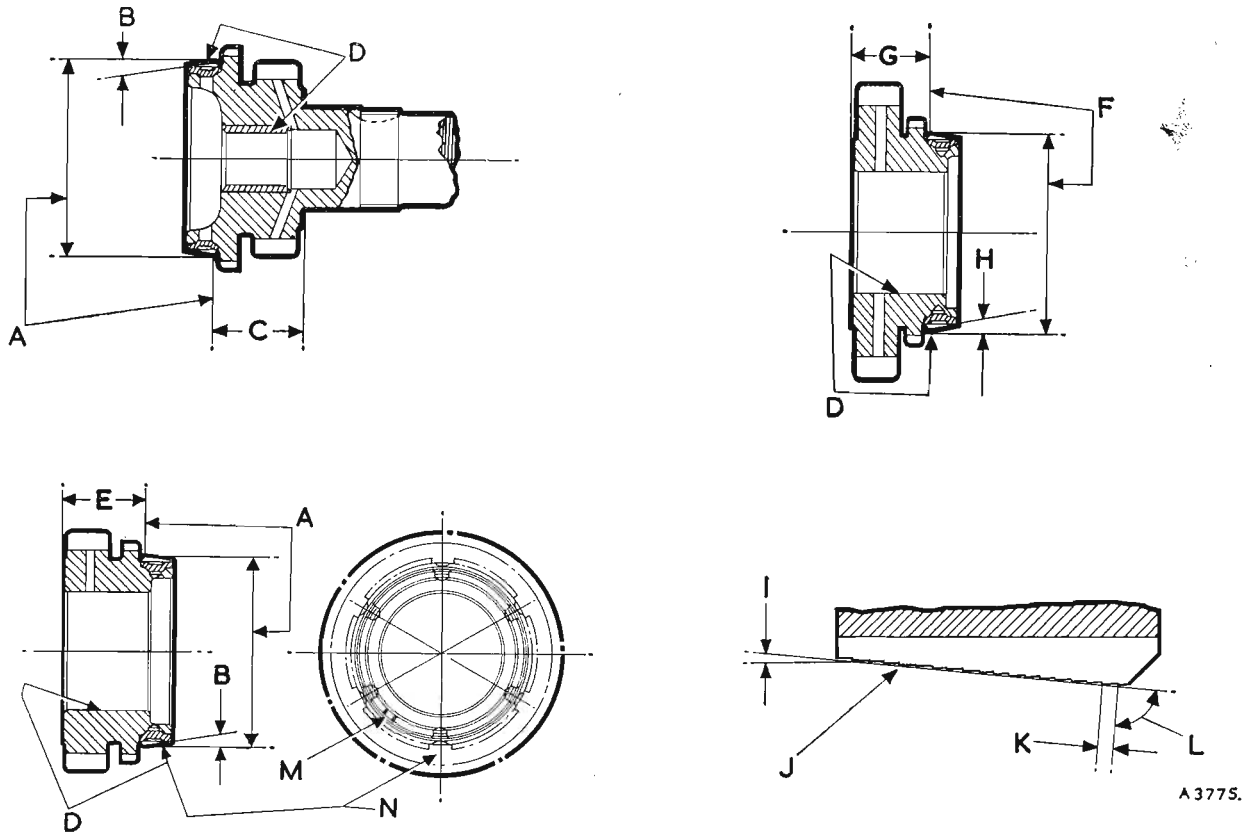


Fig. F.4

Top left: First motion shaft. Lower left: Third speed mainshaft gear. Top right: Second speed mainshaft gear. Lower right: Cone

Dimensions

A. Taper 1·997 in. (50·72 mm.) dia. at this line to gauge.
B. Taper 10° 10′, to be true and concentric with bore to ·001 in. (·025 mm.).
C. ·909/·912 in. (23·09/23·16 mm.).
D. Taper to be true and concentric with bore to ·001 in. (·025 mm.).
E. ·862/·865 in. (21·8/21·9 mm.).
F. Taper 1·966 in. (49·9 mm.) dia. at this line to gauge.
G. ·810/·813 in. (20·57/20·65 mm.).
H. 8° 20′.
I. 6°.
J. Coarse turning may be either right- or left-hand.
K. ·015 in. (·38 mm.).
L. 90°.
M. One notch to be ground in position shown relative to grooves with indentations.
N. Synchronizing cone to be heated in oil, shrunk onto gear, and punched into holes as shown with centre line of holes and spaces in cone in line.

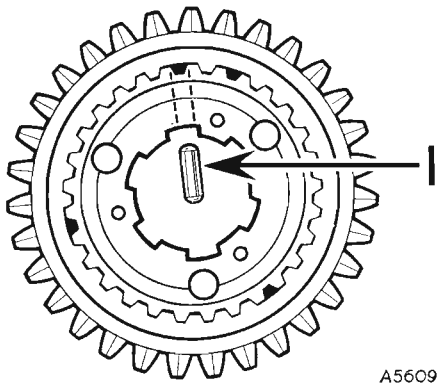


Fig. F.5

The first and second speed gear assembly, showing the gear and hub correctly assembled (later cars). The plunger is shown at (1)

Section F.7

THIRD MOTION SHAFT
(Later Cars)

Dismantling and reassembling

The dismantling and reassembling sequences are the same as detailed in Section F.3 except that the second and third/top gear synchronizers are fitted with baulk rings (see Fig. F.6).

NOTE.—Should the first and second speed gear assembly have been dismantled, the correct position of the gear on the hub when reassembling is most important. Should the gear be incorrectly assembled on the hub, selection of first gear will be impossible.

When reassembling the gear to the hub ensure that the plunger in the hub aligns with the cut-away tooth in the gear assembly (see Fig. F.5).

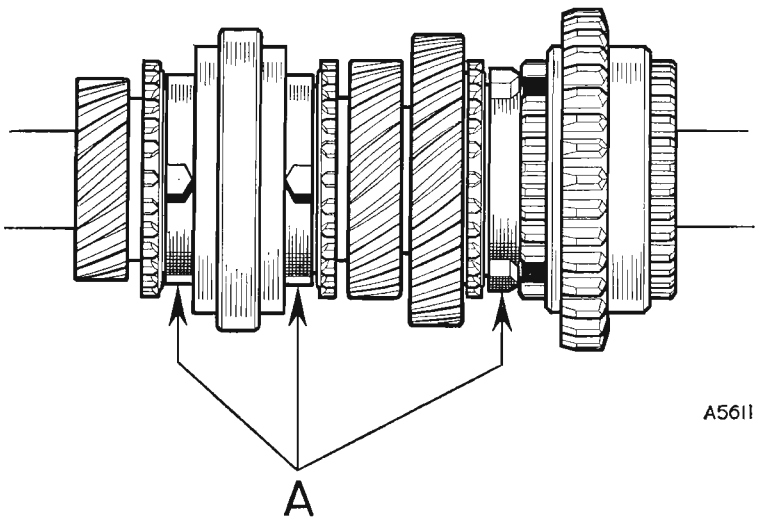


Fig. F.6

The mainshaft, showing (A) *the baulk rings (later cars)*

(*For* **'SERVICE TOOLS'** *see page F.11*)

SERVICE TOOLS

18G 134. Bearing and Oil Seal Replacer (basic tool)

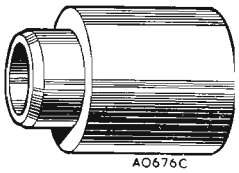
For use with 18G 134 B, 18G 134 C, 18G 134 L, and 18G 134 Q.



18G 134

18G 134 L. Gearbox Rear Oil Seal Replacer Adaptor

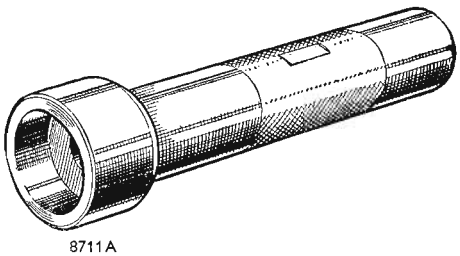
For replacement of gearbox extension oil seals. Use with handle 18G 134.



18G 134 L

18G 140. First Motion Shaft Assembly Replacer

When threaded over the first motion shaft this tool registers with the outer race of the bearing, which then can be driven home without damage.



18G 140

18G 144. Synchromesh Assembly Ring

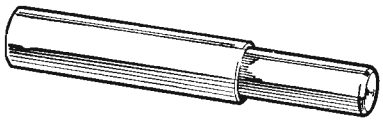
This tool retains the balls and springs in the synchronizer while it is being pushed into the sleeve or first speed wheel.



18G 144

18G 194. Needle-roller Bearing Replacer

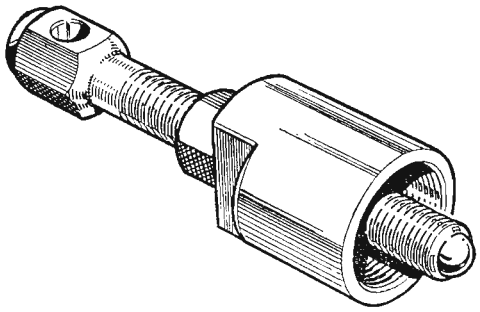
The replacement of needle-roller bearings in the laygear is greatly speeded up by the use of this replacing tool. It can also be used to fit the spring ring after the rollers have been fitted.



18G 194

18G 389. Gearbox Rear Oil Seal Remover (basic tool)

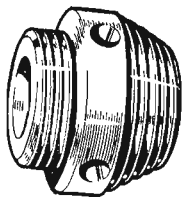
This basic tool, together with the appropriate adaptor, is essential for removing the gearbox extension oil seal easily and without damage to the extension.



18G 389

18G 389 A. Gearbox Rear Oil Seal Remover Adaptor

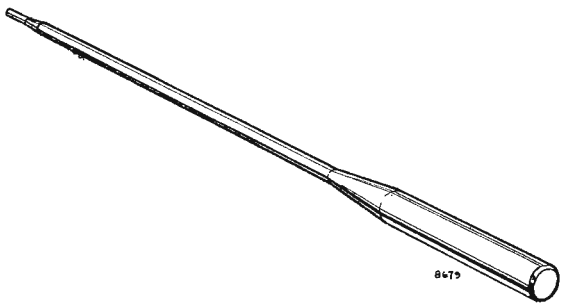
Use with basic tool 18G 389.



18G 389 A

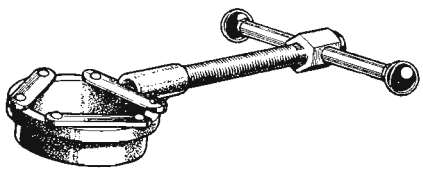
18G 471. Dummy Layshaft

The fitting of a layshaft to the laygear is simplified by the use of this tool.



18G 471

18G 488. Gearbox Oil Seal Clinching Tool



18G 488