SECTION F

THE TRANSMISSION

Section F.1

NOTE

●The gear-change remote control shaft lubrication nipple on the differential cover requires attention at major overhaul periods only, when grease should be used.

TRANSMISSION

Dismantling

(1) Remove the transmission casing from the crankcase (Section A.23).

(2) Withdraw the idler gear with its thrust washers.

(3) Remove the differential assembly (Section F.4).

(4) Withdraw the reverse detent plug, plunger, and spring or the reverse light switch and plunger, where fitted.

(5) Remove the clamp and key from the inner end of the gear change operating shaft and pull out the shaft.

(6) Remove the speedometer pinion bush securing screw and withdraw the bush assembly and pinion.

(7) Remove the speedometer gear retaining plate and the gear.

(8) Remove the securing nuts and screws, and pull off the front cover.

(9) Remove the selector interlocking arm.

(10) Disconnect the oil suction pipe from the bracket (where a clip is fitted) and the flange, withdraw the pipe from the strainer.

(11) Extract the circlip and withdraw the first motion shaft roller bearing using Service tool 18G 705 and adaptor 18G 705 C.

(12) Use the selector shafts and lock first and third gears together.

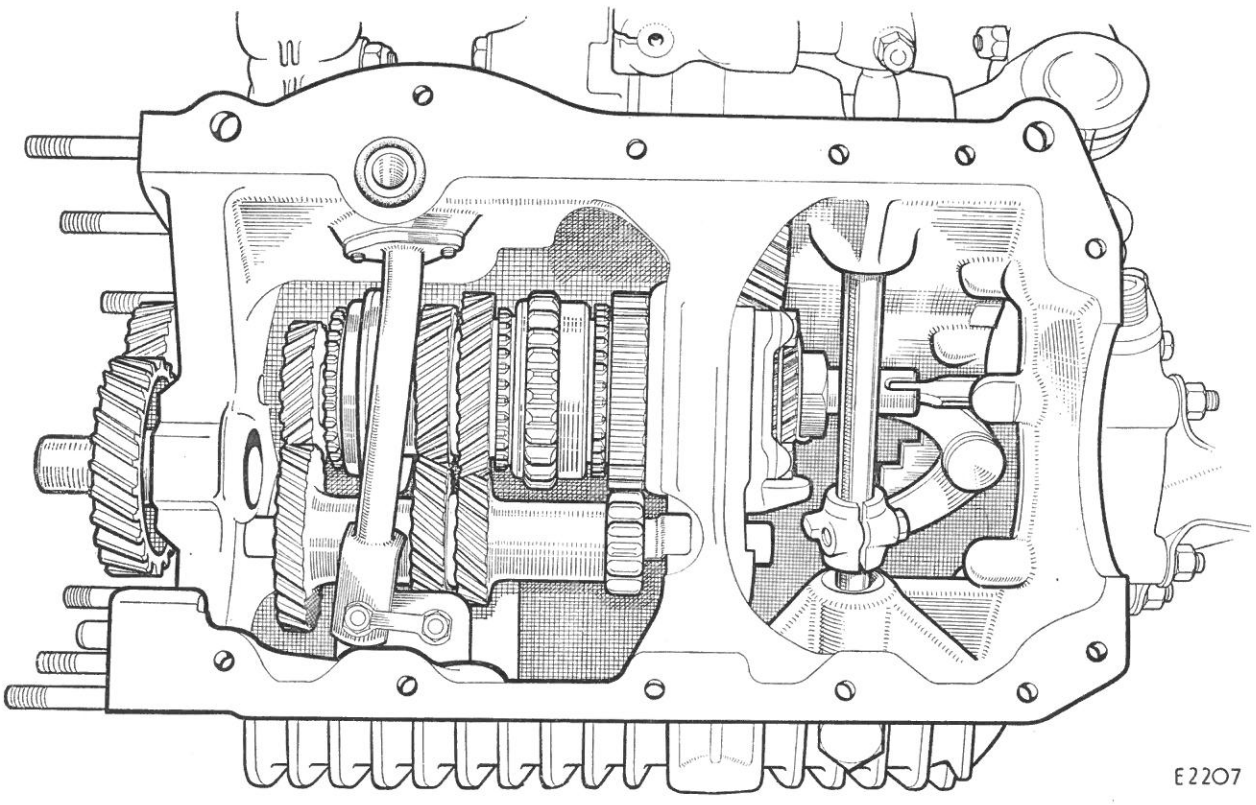
(13) Tap back the locking washers and remove the first motion shaft nut. Use Service tool 18G 587 to remove the final drive gear nut, and withdraw both the input and final drive gears.

(14) Tap back the locking plates, remove the four securing screws and the third motion shaft bearing retainer and packing shims.

(15) Remove the layshaft and reverse shaft locking plate, push the layshaft from the clutch side of the casing and remove the laygear and thrust washers.

(16) Unscrew the plugs from the outside of the casing and withdraw the selector rod interlocking plungers and springs.

(17) Remove the first motion shaft bearing circlip and withdraw the bearing and shaft from the casing with Service tools 18G 284 and 18G 284 B.



●*Fig. F.1*

The four-speed synchromesh transmission assembly, with all the gears assembled into the casing●

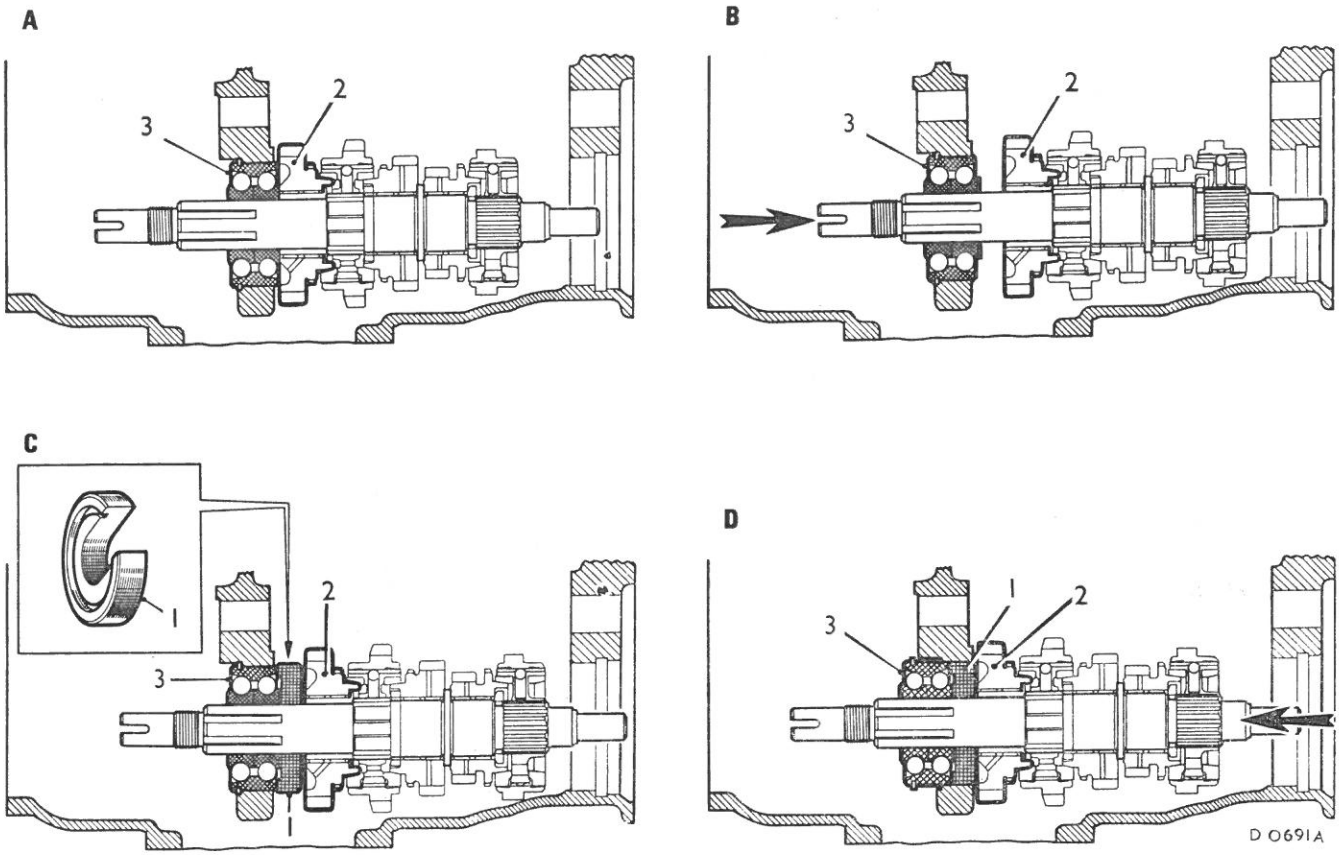


Fig. F.2

Removing the third motion shaft bearing

(18) Refer to Fig. F.2. Drift the third motion shaft backwards, as indicated by the arrow in (B), until a special Service tool (1) can be placed between the first speed gear (2) and the bearing (3), as illustrated in (C). On three-speed synchromesh gearboxes use 18G 613, and on four-speed units 18G 1127 with their relieved side towards the bearing. These two tools must not be interchanged, or the bearing or casing will be damaged. Drift the third motion shaft forward as illustrated in (D), to push the bearing (3) from the web, taking care not to damage the selector forks. Pull the bearing from the shaft, and lift the shaft from the casing.

(19) Remove the strainer assembly.

(20) Withdraw the reverse shaft, gear and selector fork.

The following operations are only necessary if complete stripping of the casing is required.

(21) Unscrew the selector shaft/fork locking screws and withdraw the shafts and forks.

(22) Remove the circlip from the reverse gear shifter lever pivot pin and remove the lever.

Reassembling

(23) If the gearbox has been completely stripped, first refit the reverse gear shifter lever and pivot pin. Push in the selector rods from the front of the casing, engage them with the selector forks, tighten the selector screws, and secure the lock nuts.

(24) Position the reverse gear and fork, and refit the reverse shaft, with the plain end foremost.

(25) Refit the oil strainer and smear some grease onto the sealing ring to assist when fitting the oil suction pipe.

(26) Refer to item (18). Refit the third motion shaft assembly with the slotted end passing through the centre web of the casing. Engage the sliding hubs with the selector forks.

(27) Refer to item (17). Drift the first motion shaft and bearing assembly into the casing using Service tool 18G 579 (modified).

Use Service tool 18G 569 to gauge the correct thickness of circlip required to retain the bearing assembly. Try the thicker side of the gauge first; the two sizes are marked on the handle. Refer to

Fig. F.3, which illustrates this operation, and fit the circlip selected from the chart beneath it.

(28) Refer to item (18). Drift the third motion shaft bearing into the central web using Service tool 18G 579 modified, together with the spacer washer.

(29) Refit the laygear with the standard sized thrust washer at one end, and measure the gap at the other. Refer to the chart (Fig. F.4) to select the correct variable thrust washer, to give an end clearance of between ·002 and ·006 in. (·05 and ·15 mm.). On three-speed synchromesh gearboxes the small thrust washer is of a standard size, the large one selective, and vica versa on four-speed synchromesh gearboxes.

Use the dummy layshaft, Service tool 18G 471 to position the thrust washer, and refit the layshaft from the clutch side, with its slotted end positioned horizontally and towards that of the reverse shaft. Refit the layshaft and reverse shaft locking plate.

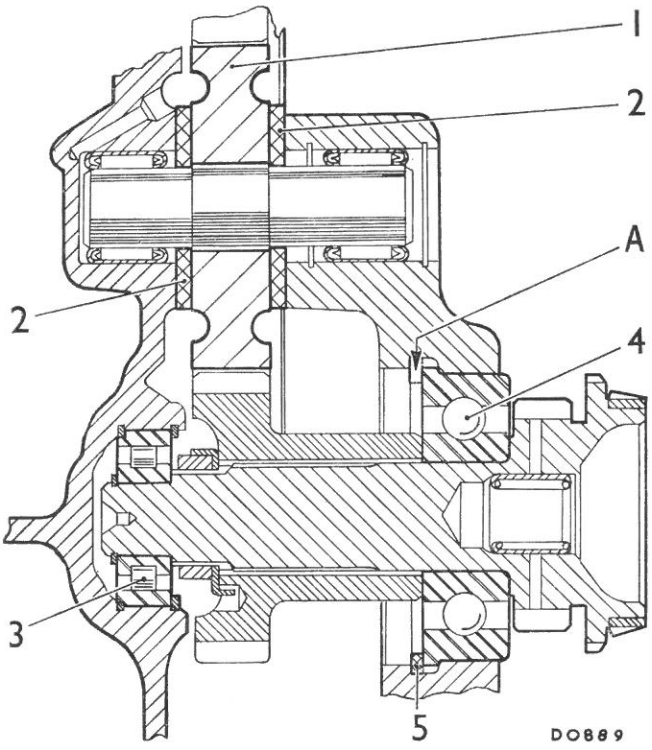


Fig. F.3

A section through the idler gear and first motion shaft. Measure the gap 'A' between the bearing face and register with Service tool 18G 569, and fit the appropriate circlip as indicated by the chart below

1. Idler gear.
2. Idler gear thrust washers.
3. First motion shaft roller bearing.
4. First motion shaft ball bearing.
5. First motion shaft circlip.

When gap is	*Use circlip Part No.*
·096 to ·098 in. (2·43 to 2·48 mm.)	2A 3710
·098 to ·100 in. (2·48 to 2·54 mm.)	2A 3711

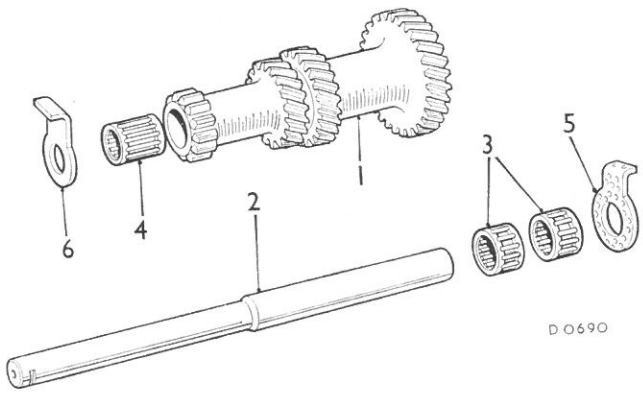


Fig. F.4

The laygear assembly. With the standard-sized thrust washer fitted, use the table below to select the correct size of variable washer. The part numbers of the thrust washers available for the three-speed and four-speed synchromesh gearboxes are given in columns 'A' and 'B' respectively

1. Laygear
2. Layshaft (un-stepped on three-speed synchromesh units).
3. Needle-roller bearings (one only on three-speed synchromesh units).
4. Needle-roller bearing.
5. Large thrust washer.
6. Small thrust washer.

Early three-speed synchromesh gearboxes were fitted with uncaged needle-roller bearings, with which the later caged type are interchangeable.

When gap is	A	B
·125 to ·127 in. (3·18 to 3·22 mm.)	88G 325	22G 856
·128 to ·130 in. (3·25 to 3·30 mm.)	88G 326	22G 857
·131 to ·133 in. (3·32 to 3·37 mm.)	88G 327	22G 858
·134 in. (3·41 mm.)	88G 328	22G 859

(30) Refit the third motion shaft bearing retainer without any shims, lightly tighten the bolts and measure the gap, see Fig. F.5. Fit the shims required (see chart), ensure that they are fitted under the layshaft and reverse shaft locking plate, and finally tighten the bolts and turn over the tab washers.

(31) Refer to item (10). Insert the oil suction pipe into the oil strainer assembly, and tighten first the external flange securing bolts and then the bracket retaining bolts. Take care not to displace the oil seal from the strainer.

(32) Fit new idler gear needle-roller bearings if required. Engage the expandable collets of Service tool 18G 581 with each old bearing and screw up the nut on the tool to extract them, after removing the outer circlip (when fitted) from the transmission casing boss.

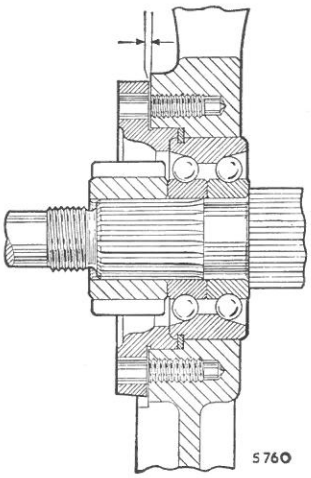


Fig. F.5

A section through the third motion shaft bearing and retainer. Use the following table to ensure that the correct thickness of shim is used

When gap is	*Use shims totalling*
·005 to ·006 in. (·13 to ·15 mm.)	·005 in. (·13 mm.)
·006 to ·008 in. (·15 to ·20 mm.)	·007 in. (·18 mm.)
·008 to ·010 in. (·20 to ·25 mm.)	·009 in. (·23 mm.)
·010 to ·012 in. (·25 to ·30 mm.)	·011 in. (·28 mm.)
·012 to ·014 in. (·30 to ·35 mm.)	·013 in. (·33 mm.)
·014 to ·015 in. (·35 to ·38 mm.)	·015 in. (·38 mm.)

Use Service tool 18G 582 (three-speed synchromesh) or 18G 1126 (four-speed synchromesh) to fit the new bearings. Use the collar supplied with each tool to control the depth to which the bearing is pressed into the flywheel housing, the boss of which must be well supported during this operation. These collars are not required when fitting the transmission casing bearing, since each tool's shoulder governs the depth to which it is pressed. Replace the outer circlip, if fitted.

(33) Refer to items (12) and (13). Refit the input and final drive gears, and, using new lock washers tighten the first motion shaft and final drive gear nuts, using Service tool 18G 587 for the latter; the torque figures are given in **'GENERAL DATA'.**

(34) Refit the first motion shaft roller bearing and circlip.

(35) Reverse the instructions in item (16).

(36) Refit the selector interlocking arm, the front cover, the speedometer gear and cover, pinion, bush, and pinion housing. Push in the gear change operating shaft, refit its key and clamp, and replace the reverse detent plunger and spring, or the reverse light switch (if fitted).

(37) Refit the differential and check adjustment as given in Section F.4.

(38) Refit the idler gear and thrust washers, with the chamferred side of each washer against the gear.

(39) Refit the flywheel housing with a new joint washer and tighten to the torque figure given in **'GENERAL DATA'.**

Check with feeler gauges that the idler gear has an end-float of between ·003 and ·008 in. (·08 and ·2 mm.), see Fig. F.3. Thrust washers ranging in thickness from ·132 to ·139 in. (3·34 to 3·54 mm.) are available for adjustment.

(40) Remove the flywheel housing and gasket, and refit the transmission unit to the engine as detailed in Section A.23, using a new housing gasket to replace the one used for the idler gear end-float check.

Section F.2

THIRD MOTION SHAFT

Three-speed synchromesh transmission

The baulk ring synchromesh is fitted to Mk. I cars from Engine Nos. 8WR–U–H6288, 8WR–Fa–H818 and to all Mk. II and III models. The dismantling and reassembling sequences for the early type transmission are the same as detailed below except that the second and third/top gear synchronizers are not fitted with baulk rings.

Removing

(1) Remove the third motion shaft assembly from the transmission as detailed in Section F.1.

Dismantling

(2) Remove the first speed gear, hub and baulk ring from the rear of the shaft, and the top and third gear synchromesh hub and baulk rings from the front of the shaft.

(3) Remove the front thrust washer by pressing down the spring-loaded locating plunger and rotating the washer until the splines register with those on the shaft. Withdraw the thrust washer and third speed gear, complete with needle-roller bearings on later type gears, and take out the plunger and spring.

Early type gears. Withdraw the third gear bush and interlocking ring, followed by the second speed gear and bush and the rear thrust washer.

Later type gears. Depress the spring-loaded pegs, turn and remove the second speed gear locking collar and take out the two split washers. Pull the gear from the rear of the shaft, and remove the needle-roller bearings from their journal.

If it is necessary to separate the second or third and fourth speed striking dog from its synchromesh hub and cone assembly, press the assembly into Service tool 18G 572, to retain the three balls and springs which are located in each hub.

Reassembling

Early type gears

(4) Fit the rear thrust washer, then the plain half of the split bush with its flat end towards the thrust washer.

(5) Fit the second speed gear, with the synchronizer cone facing the rear of the shaft, the interlocking ring and the splined half of the split bush. Engage the dogs of the split bushes with the slots in the interlocking ring. New bushes must be fitted, since the interference fit of the old ones will have been lost when they were removed. Heat the bushes to a temperature of 180 to 200° C. (356 to 392° F.), to allow them to be fitted without force, and to obtain a permanent 'shrink fit' on cooling.

(6) Refit and depress the spring and locking plunger, refit the third speed gear, plain side first, and the front thrust washer. Turn the thrust washer until the plunger engages the spline and locks the washer.

Later type gears

(7) Slide the second speed gear on from the rear of the shaft, plain side first, after sticking the needle-roller bearings to their journal with grease. Replace the two split washers, depress the two spring loaded locking pegs, and refit the locking collar, turning it until the pegs are heard to engage the splines.

(8) From the front of the shaft refit the third speed gear, plain side first, with its needle-roller bearings. Slide on the front thrust washer and turn it until the spring loaded peg is heard to lock it.

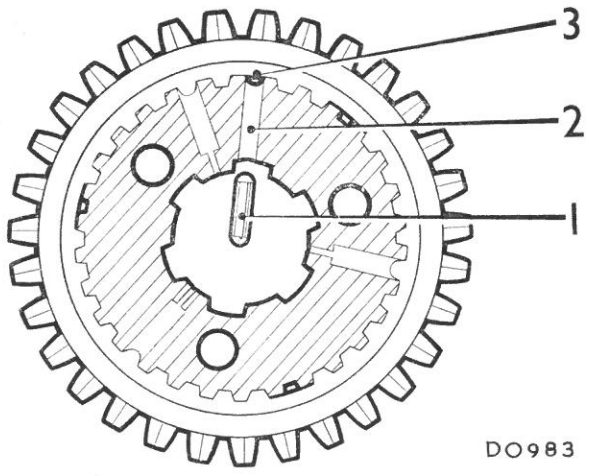


Fig. F.6

The three-speed synchromesh first and second speed gear assembly, showing the plunger (1) *in its drilling in the hub* (2) *aligned with the cut-away tooth* (3) *in the gear assembly*

Early and later type gears

(9) The end-float of both the second and third speed gears when assembled on the third motion shaft must be between ·0035 and ·0055 in. (·09 and ·13 mm.).

(10) Refit the top and third speed synchromesh hub and baulk rings, with the plain side of the hub towards the rear of the shaft.

(11) Refit the first speed gear, hub, and baulk ring, with the cone end of the hub towards the front of the shaft.

Should the first and second speed gear assembly have been dismantled, the gear must be correctly repositioned on the hub, otherwise selection of second gear will be impossible. Ensure that the plunger in the hub aligns with the cut-away tooth in the gear assembly (see Fig. F.6), and that the cone end of the hub and the tapered side of the gear teeth are on opposite sides of the assembly.

Section F.3

THIRD MOTION SHAFT

Four-speed synchromesh transmission

Removing

(1) Remove the shaft assembly from the transmission as detailed in Section F.1.

Dismantling

(2) Withdraw the top and third gear synchromesh hub and baulk rings from the front end of the shaft.

(3) Press the front thrust washer plunger, and turn the washer until its splines register with those on the shaft, enabling it to be removed, complete with plunger and spring. Remove the third speed gear, with its caged needle-roller bearing.

(4) Remove the first speed gear, baulk ring, and caged needle-roller bearing from the opposite end of the shaft.

(5) Carefully lever the needle-roller bearing journal backwards sufficiently to fit Service tool 18G 2 and pull the journal from the shaft.

(6) Remove the reverse mainshaft wheel and first/second speed synchronizer assembly, and the baulk ring.

(7) Press in the two plungers securing the rear thrust washer, turn it to align it with the shaft splines and withdraw it from the shaft. Remove the second speed gear, and the split caged needle-roller bearing.

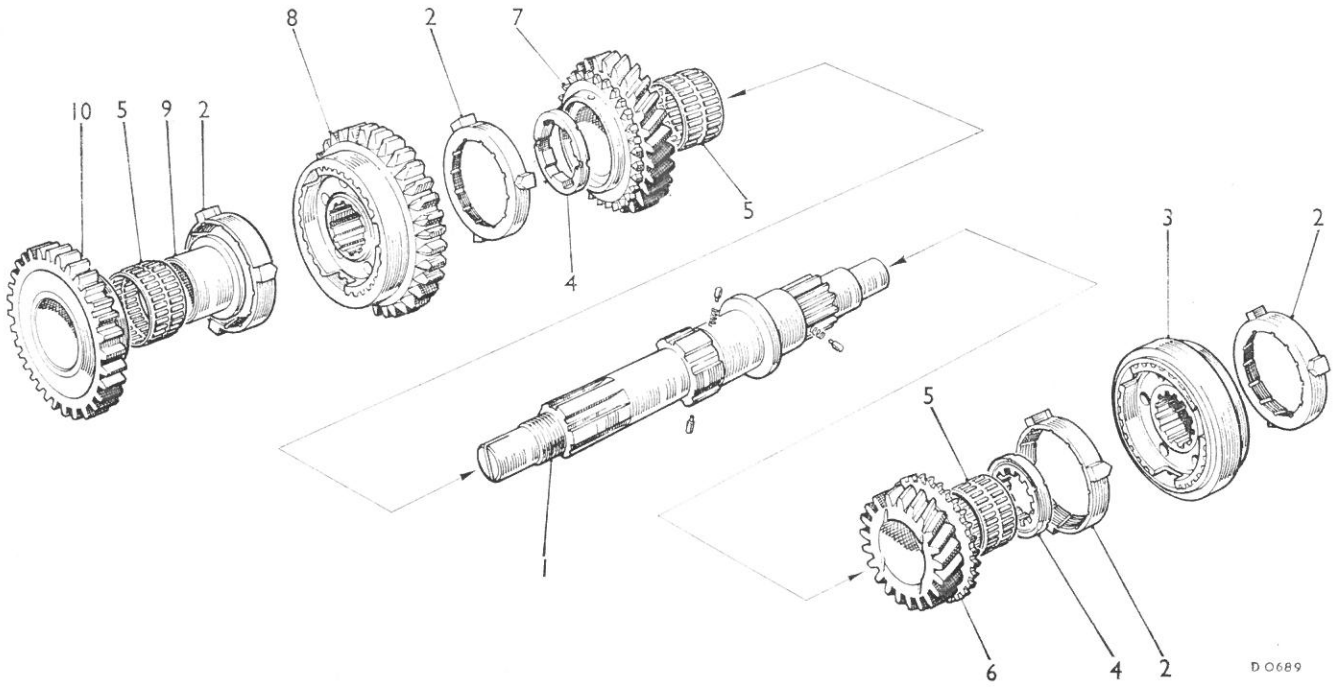


Fig. F.7

The third motion shaft assembly (four-speed synchromesh transmission)

1. Third motion shaft.
2. Baulk rings.
3. 3rd and 4th speed synchronizer.
4. Thrust washers.
5. Needle-roller bearings.
6. Third speed gears.
7. Second speed gear.
8. Reverse mainshaft gear and 1st and 2nd speed synchronizer.
9. Needle-roller bearing journal.
10. First speed gear.

Reassembling

(8) Carry out the dismantling instructions, but note items (9) to (11).

(9) Use Service tool 18G 572 to prevent the balls and springs from being lost, should it be necessary to separate the striking dogs from the synchromesh hub and cone assemblies. When reassembling the synchronizers, ensure that the long boss on both the sleeve and the hubs are on the same side.

(10) When refitting the third and top speed synchronizer assembly, the long boss on the synchronizer sleeve must face the first motion shaft bearing. The first and second speed synchronizer assembly must be fitted with the long boss towards the first speed gear, or second speed synchromesh action will be lost.

(11) Use Service tool 18G 186 to drift the first speed gear needle-roller bearing journal onto the third motion shaft.

Section F.4

DIFFERENTIAL ASSEMBLY

Removing

(1) Remove the engine and transmission as detailed in Section A.34.

(2) Remove the transmission from the engine as detailed in Section A.23 **only** if it is necessary to fit a new final drive pinion into the transmission, or if the differential components have suffered damage with the result that swarf has been introduced into the transmission unit.

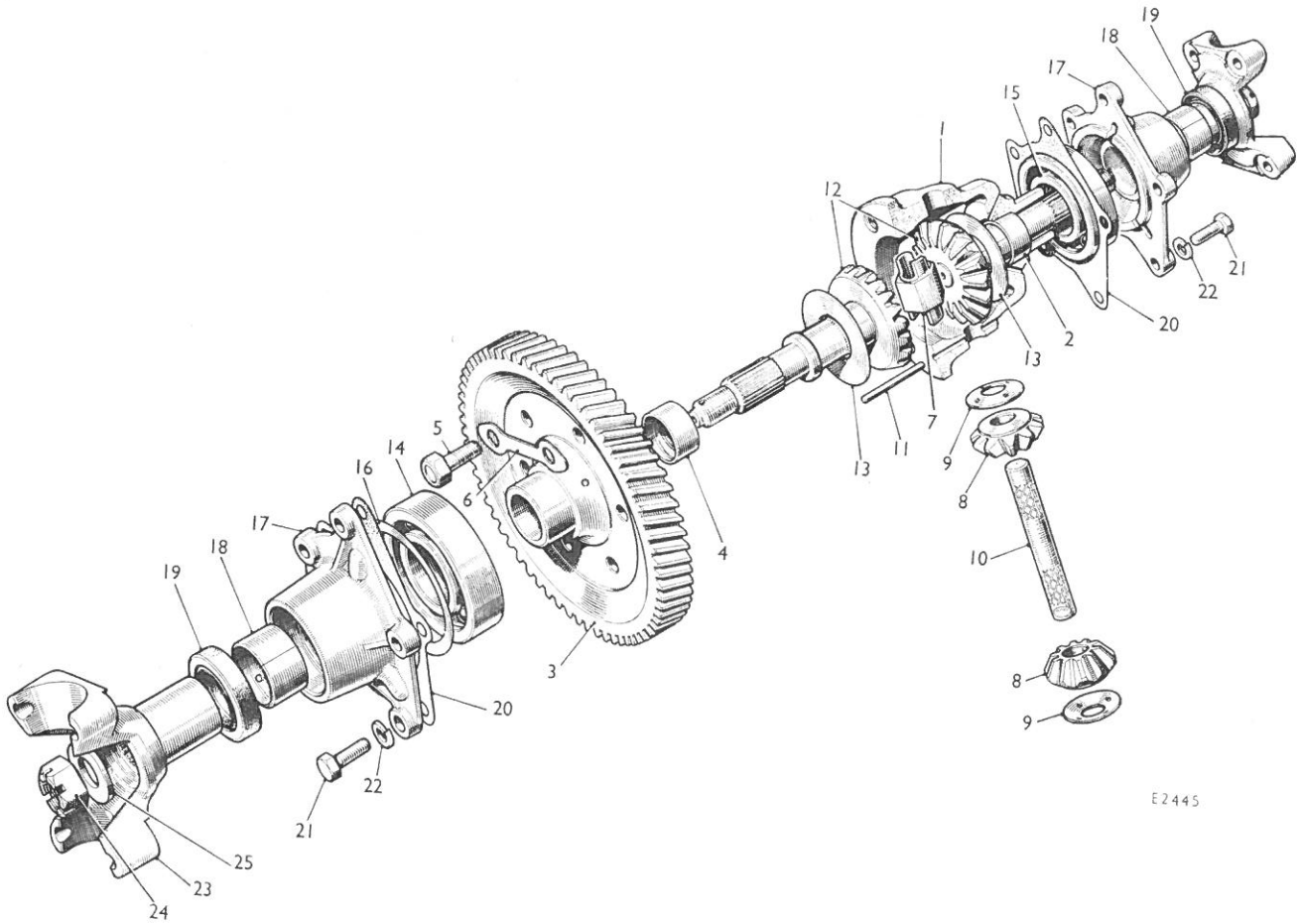
(3) Remove the gear-change extension bottom cover plate.

(4) Release the control shaft lever from the top of the remote control shaft, which can now be withdrawn.

(5) Extract the split pin from the slotted nuts securing both right- and left-hand driving flanges to the differential gear shafts, using Service tool 18G 669 to hold each driving flange in turn, remove the nuts and withdraw the flanges. **Do not under any circumstances use the transmission casing as a stop or leverage point when removing the driving flange nut or other components of the transmission. Serious damage to the casing can easily result from misuse in this way.**

(6) Unscrew the five set screws from each of the final drive end covers, and remove them from the differential housing. Note the number of shims fitted between the differential bearing and the housing.

THE DIFFERENTIAL COMPONENTS



No.	Description
1.	Differential case.
2.	Case bush.
3.	Drive gear.
4.	Gear bush.
5.	Gear bolt.
6.	Lock washer.
7.	Thrust block.
8.	Differential pinion.
9.	Pinion thrust washer.

No.	Description
10.	Centre pin.
11.	Pin peg.
12.	Differential gear.
13.	Gear thrust washer.
14.	Drive gear bearing.
15.	Case bearing.
16.	Bearing shim.
17.	End cover.

No.	Description
18.	Cover bush.
19.	Oil seal.
20.	Cover joint.
21.	End cover screw.
22.	Washer.
23.	Driving flange.
24.	Flange nut.
25.	Washer.

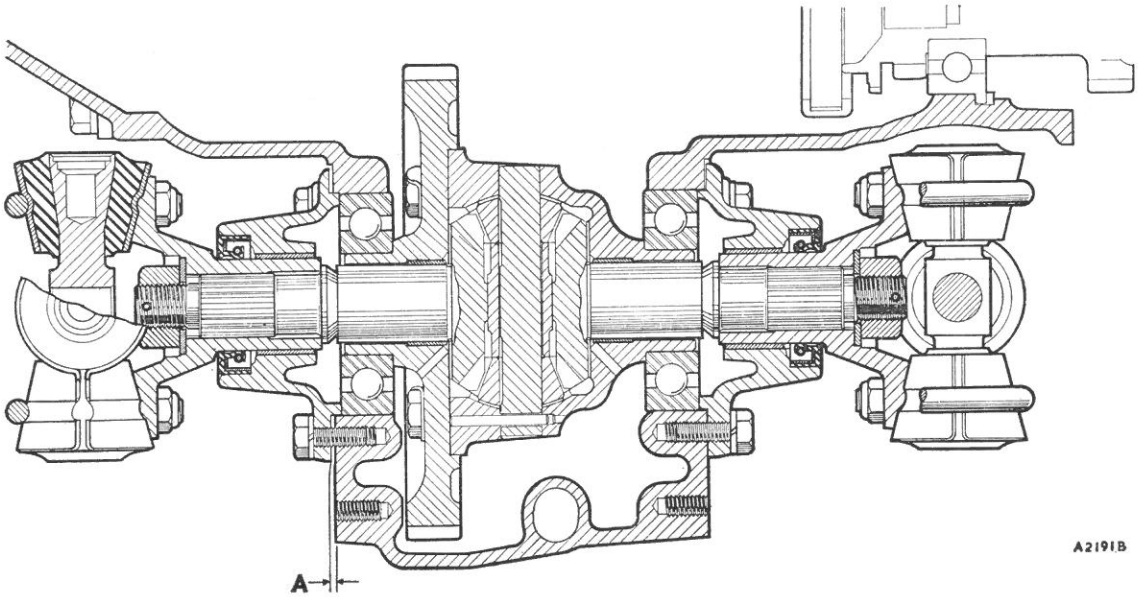


Fig. F.8

With the left-hand drive cover fitted without its joint washer, measure the gap at point 'A', and fit shims between the bearing and cover to obtain the required pre-load

(7) Remove the differential housing stud nuts, withdraw the housing from the transmission case and remove the differential assembly.

Dismantling

(8) Withdraw the two differential bearings, using Service tool 18G 2. Knock back the locking plate tabs and remove the six set bolts securing the driving gear to the cage, which may now be separated after marking them to assist in refitting them in their original positions. Extract the differential gear and thrust washer from the bore of the driving gear.

(9) Tap out the taper pin peg to release the pinion centre pin, the thrust block, both differential pinions and thrust washers and the other differential gear and washer.

Reassembling

(10) Reverse the dismantling sequence, making sure that the gear thrust washers are replaced with their chamfered bores against the machined face of the differential gears, and that all parts are replaced in their original positions.

Refitting

(11) Place the differential assembly in the transmission casing with a slight bias towards the flywheel side. Refit the differential housing with its joint washers, and nip up the nuts sufficiently to hold the bearings, yet still allowing the assembly to be moved sideways.

(12) Refit the right-hand drive end cover together with its joint washer. Then carefully and evenly tighten up the set screws, to displace the differential assembly away from the flywheel side and ensuring full contact between the register on the inner face of the cover and the differential bearing.

Fit the left-hand final drive cover, without its joint washer, the compressed thickness of which is ·007 in. (·18 mm.). Tighten the set screws sufficiently for the cover register to nip the bearing outer race: overtightening will distort the cover flange. The required preload on the bearings is ·001 to ·002 in. (·025 to ·05 mm.), hence the gap between the cover flange and the differential housing and transmission casing must be between ·008 to ·009 in. (·2 to ·23 mm.). Measure this gap ('A' in Fig. F.8) with feeler gauges, and correct it as necessary by fitting shims between the bearing and the register on the cover. For example if the gap as measured is ·005 in. (·13 mm.) a shim of ·003 in. (·076 mm.) is required. Measure the gap in several places: any deviations will indicate that the end cover set screws have not been tightened evenly.

Remove and refit the end cover with its joint washer and the selected shims, tighten the cover screws and differential housing nuts.

NOTE.—Later assemblies are fitted with increased thrust capacity bearings, which must be fitted with the identification word 'THRUST' facing the outside, towards the end cover. Since the pre-load is increased to ·004 in. (·1 mm.), adjust the gap 'A' (see Fig. F.8) with shims until it is ·011 in. (·28 mm.) before the joint washer is fitted.

(13) Refit the driving flanges, making reference to item (4). The torque tightening figure is given in **'GENERAL DATA'.**

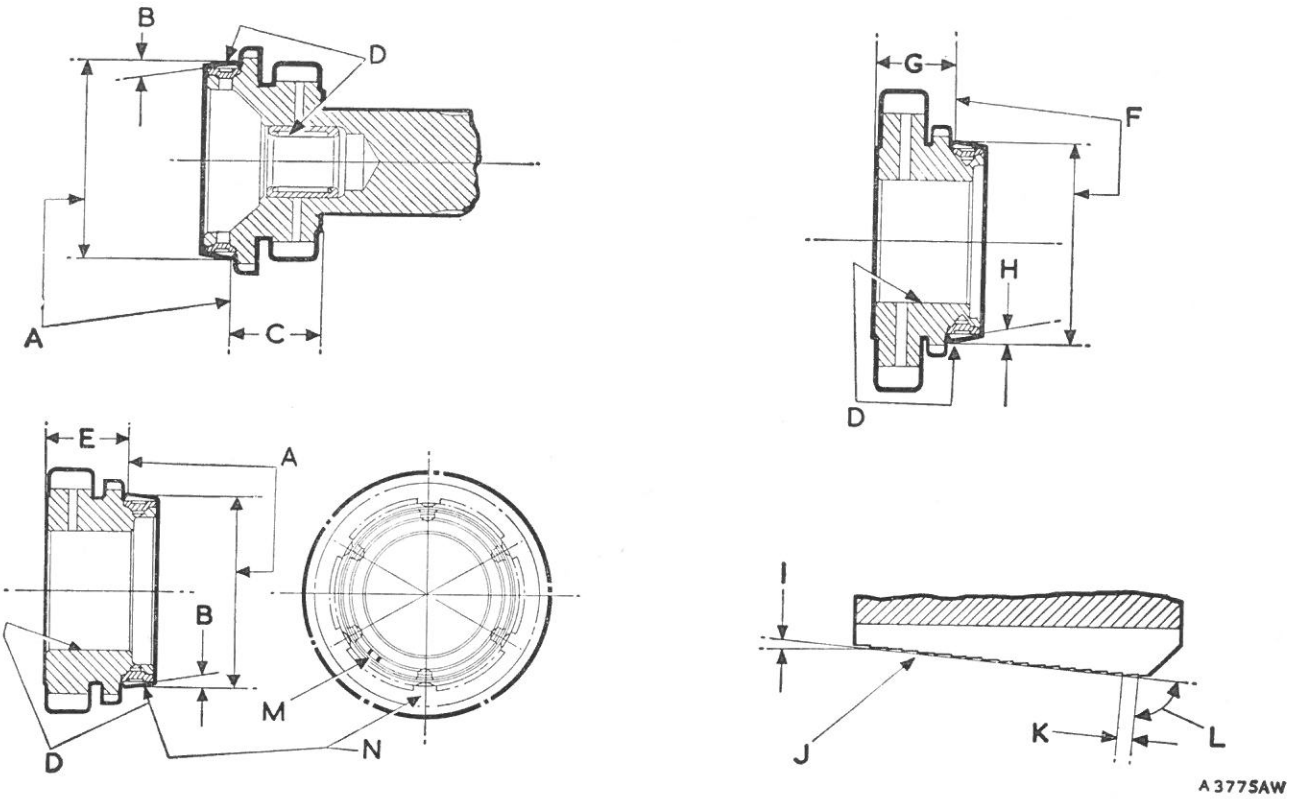


Fig. F.9

Top left: first motion shaft. Lower left: third speed mainshaft gear. Top right: second speed mainshaft gear. Lower right: Cone

Dimensions

A. Taper 2·150 in. (54·61 mm.) dia. at this line to gauge.

B. Taper 10° 30′, to be true and concentric with bore to ·001 in. (·025 mm.).

C. ·909 to ·912 in. (23·09 to 23·16 mm.).

D. Taper to be true and concentric with bore to ·001 in. (·025 mm.).

E. ·862 to ·865 in. (21·8 to 21·9 mm.).

F. Taper 2·150 in. (54·61 mm.) dia. at this line to gauge.

G. ·837 to ·840 in. (21·254 to 21·335 mm.).

H. 8° 30′.

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.

(14) Make certain that both drive shafts are equally free to rotate, otherwise the vehicle's steering may pull to one side.

(15) Refer to item (3). Position the remote control shaft lever on the ball end of the operating lever, insert the remote control shaft from underneath and engage it with the splined bore of the former. Insert the set screw after checking that the drilling in the boss and the recess in the shaft are in alignment.

(16) Reassemble the transmission, clutch assembly and housing to the engine (if removed, see item (2)).

(17) Refit the power unit into the car and reassemble the gearchange to the transmission (or refit the remote control assembly).

Section F.5

GEAR SYNCHRONIZING CONES

(Non-baulk-ring Transmission)

Cones may be shrunk onto the second, third, and fourth gears by heating in oil to 121° C. (250° F.) and quenching in cold water when in position.

See Fig. F.9 for machining dimensions.