

S E C T I O N 5

G E A R B O X

C O N T E N T S

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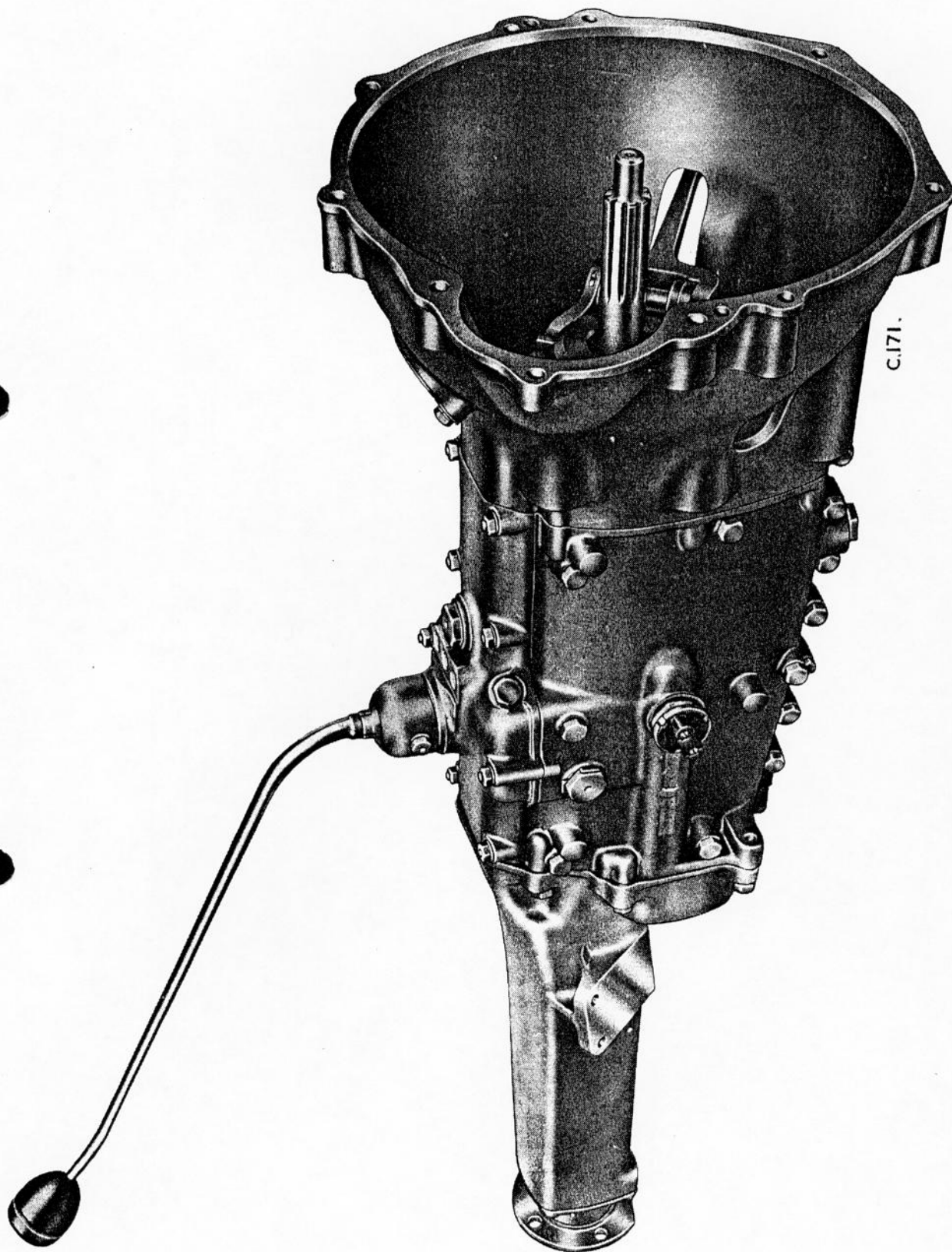


Fig. 1 Gearbox assembly.

G E A R B O X

DESCRIPTION

General

A close ratio 4 speed and reverse gearbox is fitted to the Arnolt-Bristol car. The gearbox unit comprises the clutch casing, the gearbox and the gearbox extension as illustrated in Fig.1. Fig.2 is a section view of the unit. The gearbox casing is of light-alloy and is divided vertically on the centre line, the two halves being bolted together. The clutch casing is secured to the front face of the gearbox casing, and the gearbox extension is secured to the rear. The top of the casing is closed by the gearbox cover which incorporates the top halves of the selector shaft bearings and the gear change ball joint location. A reversing light switch (wired through the ignition switch) is secured to the right-hand side of the box and is operated by the reverse gear selector mechanism. With the exception of 1st. and reverse gear, the "Borg Warner" ring type of synchromesh mechanism is employed for gear engagement. All gears, with the exception of the reverse gear train, are of the helical type and are in constant mesh.

The gearing comprises the following four major assemblies :-

- Drive shaft group.
- Main driving shaft group.
- Layshaft group.
- Reverse gear and extension shaft assembly.

Drive shaft group

The front half of the drive shaft is splined to mount the clutch driven plate. A spigot at the forward end of the shaft is supported in a ball bearing

housed in a recess in the rear of the crankshaft. The assembly is mounted in the front of the gearbox casing by the drive shaft bearing and is located laterally by a circlip which engages a groove in the outer circumference of the bearing outer race and a corresponding groove in its housing. The drive shaft front bearing is supported within the clutch casing, see Fig.2. The rear end of the drive shaft is counterbored to accommodate the main driving shaft front spigot needle roller bearing.

Main driving shaft group

The spigot at the front end of the main driving shaft is mounted in a needle roller bearing in the counterbore at the rear of the drive shaft. An oil scroll machined in the shaft adjacent to the spigot ensures an adequate supply of oil to this bearing. The centre ball bearing is housed in the centre wall of the gearbox casing, and the rear ball bearing in the rear of the gearbox casing. Lateral location is provided by a circlip which engages a groove in the outer circumference of the rear bearing outer race and a corresponding groove in the gearbox casing.

The various components are assembled to the shaft from each end to abut the centre bearing journal, and are retained by a tabwashed nut at the front (inboard of the oil scroll), and a special hexagon-head screw and tabwasher at the rear.

The front thrust washer abuts the centre bearing journal. Fitted immediately forward of the washer is the 3rd gear assembly, which comprises the 3rd gear hub to which the 3rd gear is serrated and peened. The forward portion of the hub circumference has integral dog teeth and the male cone friction face of

the synchro member, see Fig.2. This assembly is mounted on two rows of needle rollers separated by a distance piece, and is therefore free to revolve on the shaft.

Forward of this unit is the 3rd and 4th gear synchro assembly. The assembly comprises the fixed hub (keyed to the shaft), the sliding hub which is mounted on the fixed hub splines, and the 3rd and 4th gear blocker rings. An external groove on the sliding hub circumference receives the 3rd and 4th gear selector fork. Three channel-section shifting plates are located in equidistant longitudinal slots cut below the level of the fixed hub splines. The plates are spring-loaded radially outwards against the sliding hub by a spring wire retaining ring fitted in each end of the fixed hub. A small convex indent in the centre of each shifting plate locates in a groove in the sliding hub internal splines. The 3rd gear blocker ring is fitted in the rear end of this assembly and the 4th gear blocker ring is fitted in the front end. Both blocker rings are identical, being bronze rings with external dog teeth around the periphery and with an internal cone face which is finely-threaded to ensure smooth and positive "take up". Three equidistant notches are cut into the inner faces; these engage the ends of the shifting plates.

Abutting the centre bearing rear thrust ring is the 2nd gear hub, which is similar in construction to the 3rd gear hub described previously. Fitted to the rear of the 2nd. gear hub, with a distance piece interposed, is the 1st and 2nd gear synchro assembly. This is similar to the 3rd and 4th gear assembly with the exception that a distance piece is fitted in place of a blocker ring on the 1st gear side of the assembly. The distance piece has three notches on its in-board face to engage the ends of the shifting plates.

The 1st gear hub unit is freely mounted on two rows of needle rollers separated by a distance piece as shown in Fig.2. The rear end of the main driving shaft protrudes through the rear bearing and mounts the reverse and speedo hub which is keyed to the shaft.

Synchromesh operation

When the gear lever is moved (for example) into the 4th gear position, the selector fork embracing the 3rd and 4th gear sliding hub moves the hub into engagement with the 4th gear hub. During the initial movement, the sliding hub carries with it the shifting plates. The shifting plates push the blocker ring forward until the cone members of the ring and the 4th gear hub engage and the two members revolve together. Subsequent to the initial movement, the sliding hub overrides the shifting plates, which are thus sprung inwards against the pressure of their retaining rings until the splines of the hub engage the dog teeth around the blocker ring. The final portion of the movement pushes the sliding hub over the dog teeth on the cone member of the 4th gear hub and thus locks the drive shaft to the main driving shaft. The operation of the other synchro units is similar.

Layshaft assembly

The layshaft is housed immediately below the main drive shaft and is supported in ball bearings at the front and rear and a roller bearing at the centre. The front bearing is grooved for a circlip which also fits in a corresponding groove in the gearbox casing. Forward of the centre bearing is a spacing washer; the 3rd layshaft gear abuts the washer and is keyed to the shaft. The layshaft driving gear is also keyed to the shaft, a distance piece being

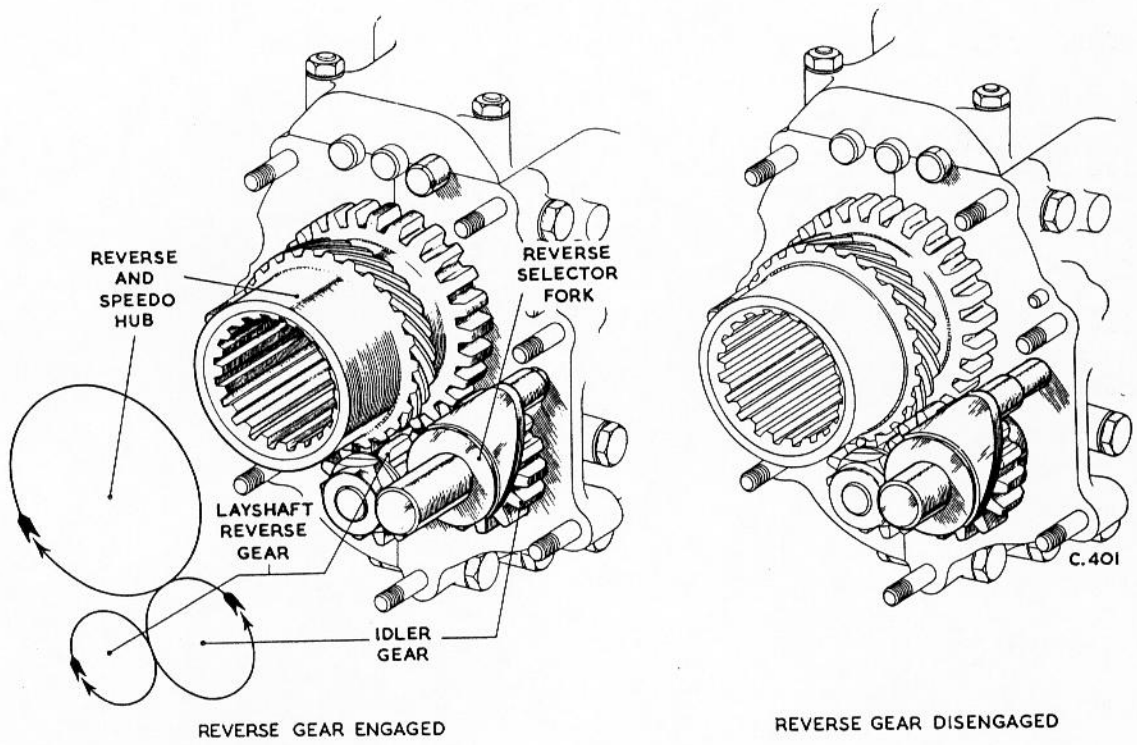


Fig.3 Reverse gear train.

interposed between this gear and the 2nd gear. A short distance piece is fitted forward of the layshaft gear to the rear of the front ball bearing.

Fitted between a spacing washer to the rear of the centre bearing and an integral shoulder on the shaft, the 2nd layshaft gear is keyed to the shaft. The 1st gear is integral with the shaft. The layshaft reverse gear is keyed to the rear end of the layshaft which protrudes from the rear bearing in the rear face of the gearbox casing. The layshaft assembly is retained in its bearings by tabwashed special nuts. All gears are located adjacent to a bearing to minimise bending strain on the shaft.

Reverse gear and extension shaft assembly

The reverse gear train is on the exterior of the gearbox rear face, being enclosed by the gearbox extension; it comprises 3 gears, i.e. the layshaft reverse gear, an idler gear and the reverse and speedo hub assembly which is keyed to the rear end of the main driving shaft, see Fig. 3. When reverse gear is engaged, the drive is transmitted from the layshaft reverse gear, which meshes with the idler gear, which in turn meshes with the reverse and speedo hub assembly. The idler gear has an integral collar engaged by the reverse selector fork and can be moved longitudinally on its supporting spindle to provide the third wheel in the train between the layshaft and the main driving shaft and so reverse the rotation of the latter.

The reverse and speedo hub has integral spur teeth for the reverse train and helical teeth for the speedometer drive. Internal splines at the rear of its bore receive the front splines of the extension shaft, which can thus slide telescopically. Pressed into the rear end of the gearbox extension, an accurately

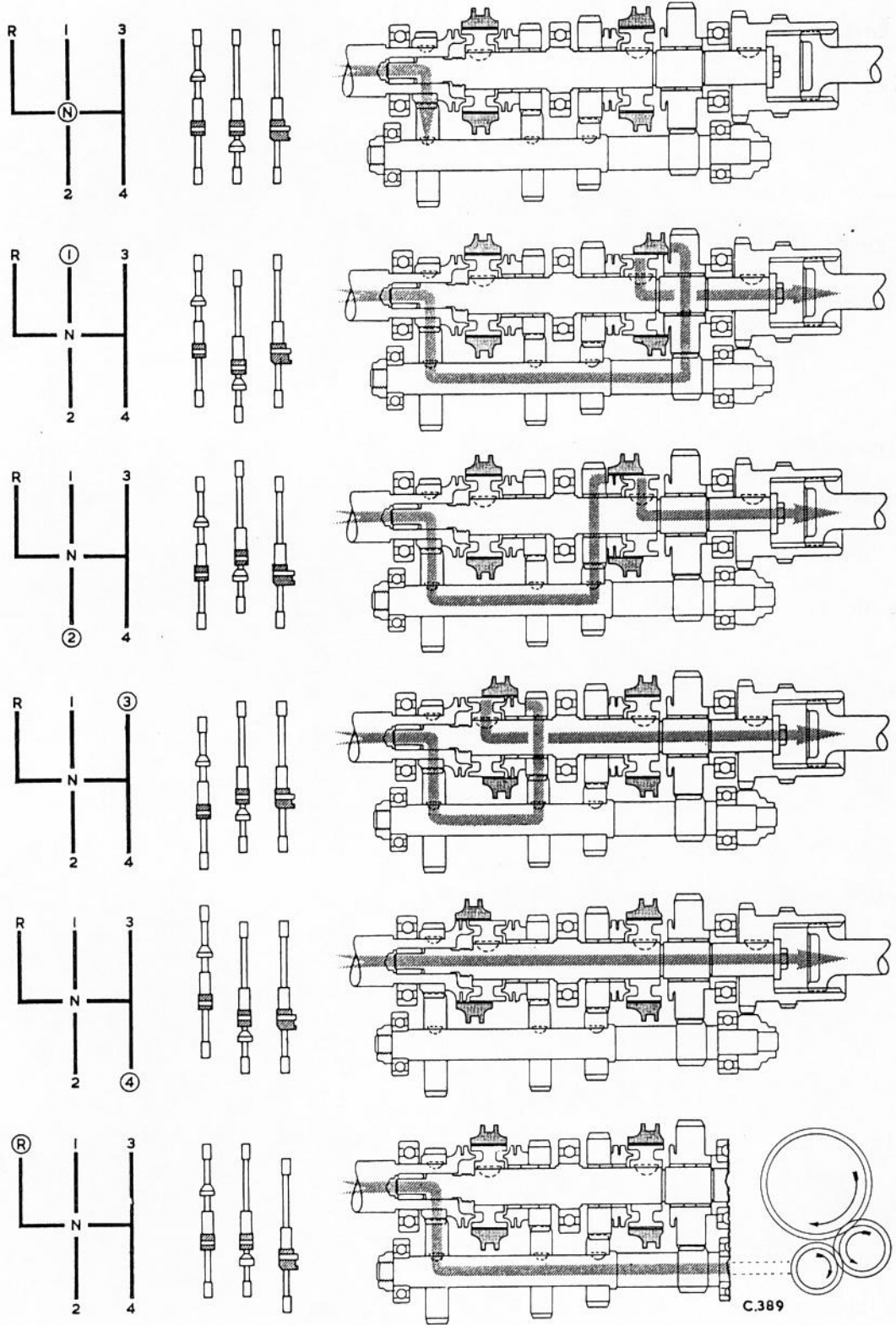


Fig.4 Positions of selector shafts and gear trains.

ground hardened steel sleeve houses a ball bearing positioned by circlips on the extension shaft, the outer race of the bearing being a sliding fit within this sleeve. The end of the extension is closed by an end plate with an internal oil-return scroll to prevent the escape of oil, see Fig.2, and to the tapered end of the shaft is keyed the universal joint companion flange which is retained by a nut and tabwasher.

Selector assembly

Three selector shafts are located in half bearings in the front, centre and rear walls of the gearbox and in the cover. Fig.4. shows the relative positions of the selector shafts and their relationship to gear selection. These positions are the reverse of those of the gear lever due to the ball joint mounting of the gear lever.

The left-hand shaft carries the 3rd and 4th gear selector fork on the front half, while the centre shaft carries the 1st and 2nd selector fork on its rear half. The right-hand shaft however has a slot in its right-hand face to engage a fulcrum lever pivoted to the right-hand side of the gearbox; the lower end of this lever fits into a similar slot in the reverse selector fork spindle which is housed as shown in Fig.5.

"V" notches are cut in the top of the selector shaft centre bearing surfaces, three in each of the two forward speed shafts and two in the reverse shaft. These engage with spring-loaded ball assemblies screwed into the cover just forward of the gear lever mounting to give positive location of the shafts in the neutral and engaged positions.

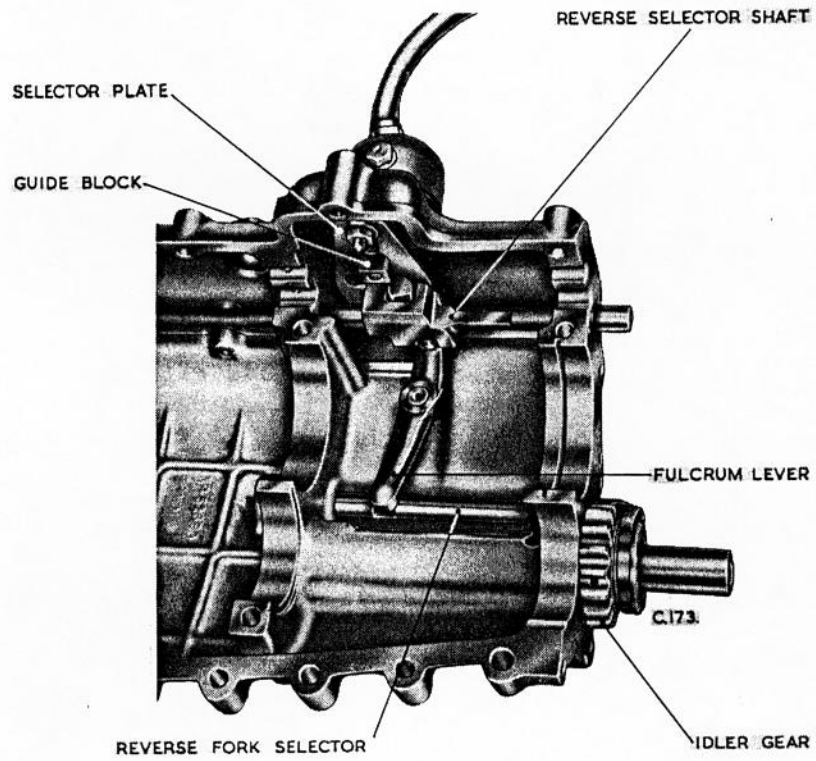
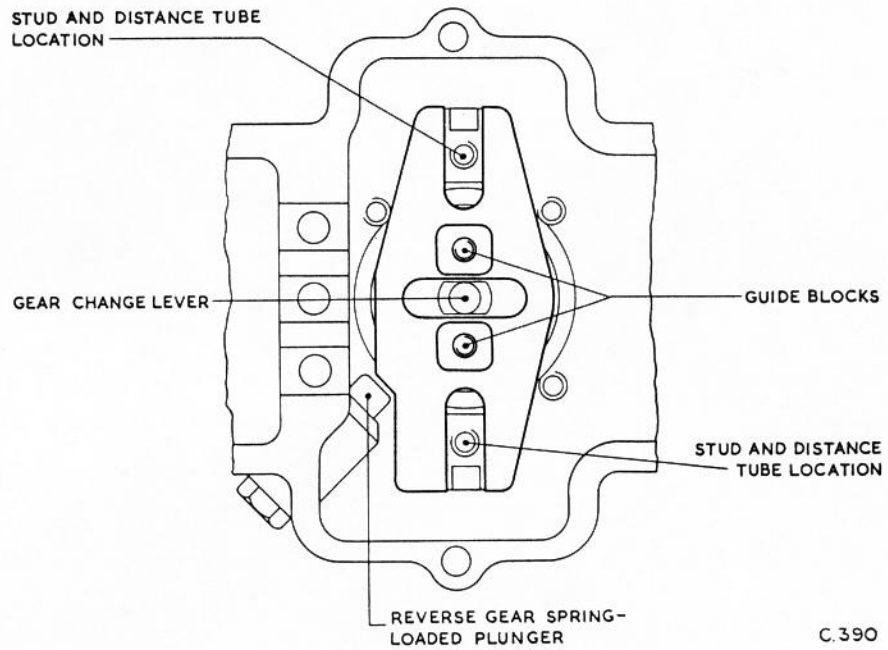


Fig. 5 Reverse selector mechanism.



C.390

Fig. 6 Selector plate.

Immediately behind the notches is a "U"-shaped slot in each shaft to receive the lower end of the gear lever.

Gearbox cover and gear change mechanism

Within the gearbox cover is the selector plate, which is a locking device to ensure that not more than one gear can be engaged at the same moment. This is shown in Fig.6. The plate is mounted on two studs with distance tubes to allow lateral movement of the plate. On the underside of the plate (on each side of the centre slot in the plate) is bolted a guide block.

On the outer top face of the cover is the integrally-cast socket for the ball joint of the lever. The ball on the lever has a slot cut in each side which receive the pilots of two pivot screws in the cover. These prevent rotation of the lever but permit lateral and fore-and-aft movement. The pivot screws also serve to retain the outer ball cover, inside of which is the inner ball cover and a compression spring. With the gear lever in position, the extension below the mounting ball passes through the centre slot of the selector plate and terminates in a flattened ball to engage the "U"-shaped slots in the selector shafts.

Operation of the selector plate.

With the gear lever in "neutral", the "U"-shaped slots in the top of the selector shafts are in line across the box, and the lower extremity of the gear change lever can be passed from side to side carrying the selector plate with it. When (for example) 1st gear is engaged, two distinct actions are required.

1. The gear lever is moved to the left, moving the selector plate and the inner gear lever extension to the right to engage the slot of the centre selector shaft. At the same time, one of the guide blocks on the plate engages the vacant slot of the 3rd/4th gear selector shaft and locks it positively in neutral.
2. The lever is then moved forward, which moves the 1st/2nd gear selector shaft to the rear to engage 1st gear.

To prevent accidental engagement of reverse gear, a "step" in the front edge of the selector plate abuts a spring-loaded plunger screwed into the right-hand side (towards the front) of the gear lever mounting. Thus, to move the lever sideways so that it engages the slot of the reverse selector, the spring plunger must be depressed by greater manual pressure on the lever.

GENERAL DATA

Type	BW/CR/9 - Borg Warner type synchromesh, constant mesh helical gears.
Number of speeds	Four forward - one reverse.
Synchromesh in	2nd, 3rd and 4th gears.
1st gear	Fixed.
Oil capacity..	3 pints (1.7 litres).
Speedometer gear ratio	0.433 to 1.

Gear ratios

<u>Drive shaft gear</u> <u>Layshaft gear</u>		$\frac{21}{26}$		Constant drive	
Gear	R	1	2	3	4
<u>Layshaft gear</u> Mainshaft gear	$\frac{12}{28}$	$\frac{14}{33}$	$\frac{19}{28}$	$\frac{23}{24}$	Direct
Gearbox ratio. Drive shaft to extension shaft	2.890 to 1	2.920 to 1	1.825 to 1	1.292 to 1	Direct
Overall ratio. Engine to road wheels	11.22 to 1	11.40 to 1	7.12 to 1	5.05 to 1	3.90 to 1

The following backlash figures and fits and clearance dimensions are those to which the gearbox is manufactured, and are quoted for use as a guide during overhaul.

Desired backlash of assembled gear trains (using 5in. radius arm) ...	...	2nd. ... 0.120in. (3 m.m.) maximum. 3rd. ... 0.120in. (3 m.m.) maximum. 4th. ... 0.060in. (1.5 m.m.) maximum.
Backlash between		
(a) sliding and fixed hubs. ...	...	0.002in. (0.05 m.m.).
(b) sliding and gear hubs.. ...	....	0.004in. (0.1 m.m.).
Backlash between layshaft and main driving shaft gears ...	...	0.005in. (0.13 m.m.).
Desired fit of bearings on shafts ...	...	+0.0003in. to -0.0007in. (+0.008 m.m. to -0.018 m.m.).

Desired fit of bearings in casings			
Main driving shaft, front and rear			-0.0014in. to -0.0029in. (-0.035 m.m. to -0.073 m.m.).
Main driving shaft, centre..	...		-0.0009in. to -0.0024in. (-0.023 m.m. to -0.06 m.m.).
Layshaft, front.	...	...	-0.0007in. to -0.0022in. (-0.018 m.m. to -0.055 m.m.).
Layshaft, centre and rear...	...		-0.0002in. to -0.0017in. (-0.005 m.m. to -0.043 m.m.).
Maximum clearance of extension shaft bearing in sleeve..	...	...	0.0026in. (0.07 m.m.).
Maximum running clearance of hubs on main driving shaft needle rollers	...	...	0.002in. (0.05 m.m.).
Maximum permissible end-float of gear hubs	...	...	0.006in. (0.15 m.m.).
Maximum side clearance of selector forks in			
(a) sliding hubs	...	...	0.018in. (0.45 m.m.).
(b) reverse idler gear	...	...	0.002in. (0.05 m.m.).
Backlash of speedometer gear			
1st. reduction gears..	...	...	0.011in. (0.28 m.m.).
2nd. reduction gears..	...	...	0.007in. (0.18 m.m.).
Torque loading of gearbox securing nuts	...	...	7 to 9 lb.ft. (10.42 to 13.4 kg/m.).

MAINTENANCE

After first 500 miles

Drain gearbox and refill to level plug.

After every 3,000 miles

Check level of oil in gearbox and replenish if necessary.

After every 6,000 miles

Drain gearbox and refill to level plug.

The locations of the drain, level and filler plugs are as follows:-

Drain plug	...	...	...	...	...	At the bottom of the right-hand side of the gearbox.
Level plug	...	...	...	...	...	In the left-hand side of the gearbox.
Filler plug	...	...	...	...	...	In the gearbox cover, forward of the gear change lever.

REMOVING THE GEARBOX

1. Remove the drain plug and allow the oil to drain.
2. Remove the bonnet to enable the lifting sling to be used.
3. Remove the seats and floor covering.
4. Remove the clutch and brake pedal pads from their respective stems. Slacken the accelerator pedal clamp screw and swing the pedal upward clear of the toe board.
5. Remove the gearbox tunnel covers, floor boards and toe board.
6. Disengage the clutch pedal return spring from its anchor bracket and the clutch operating rod from the eye of the clutch lever.
7. Disconnect the speedometer flexible drive from its drive housing in the gearbox extension and the two cables from the reverse lamp switch. These cables are not "live" so long as the ignition is switched off.
8. Assemble the engine sling to the engine as described in Section 1 (Removing the engine) and take the weight of the engine.
9. Disconnect the companion flange of the extension shaft from the propeller shaft universal joint, then push the extension shaft into its casing clear of the propeller shaft.

10. Remove the two bolts, nuts and spring washers securing each side of the gearbox extension to the rubber mounting.
11. Refit the drain plug after ensuring that the oil has drained, then raise the power unit sufficiently to take the load off the rear mountings. Remove the two nuts and washers securing each rear mounting block to the chassis cross member, then remove the blocks.
12. Remove the cable from the starter motor, then remove the two bolts, nuts and spring washers from the starter motor flange and remove the motor.
13. Remove the remaining set-screws, bolts, nuts and spring washers around the flange of the clutch casing, but leave the top set-screw tight until the last; when removing this screw support the gearbox unit so that it cannot "droop" and cause internal damage to the clutch. Remove the bracket from the exhaust pipe clips.
14. Withdraw the gearbox unit rearwards; ensure that it is held in line with the engine during the process or warping of the centre clutch plate may result. Remove the gearbox unit from the car.
15. Place a suitable baulk of timber beneath the lower edge of the flywheel housing flange and lower the sling until the engine is supported thereon. Take care not to distort the air scoop beneath the sump; it is also advisable to support the scoop since its rear end is now unsupported.

REFITTING THE GEARBOX

Before refitting the gearbox, ensure that the joint faces of the clutch casing and flywheel housing are clean and undamaged and that the locating dowels are positioned correctly in the cylinder block flange then proceed in the following manner.

1. Raise the engine by the lifting sling to clear the timber support beneath the flywheel housing flange.
2. Lift the gearbox into the car and slide it forward over the clutch unit, engaging the drive shaft with the splines of the clutch plate until the clutch casing is positioned correctly on the rear face of the cylinder block; ensure that the gearbox is not tilted in relation to the engine during assembly. First fit and tighten the topmost set-screw with its spring washer,

supporting the gearbox in position during the operation. Fit the remaining set-screws, bolts, nuts and spring washers, and the starter motor. Do not forget to attach the exhaust pipe clips and bracket to the lower right-hand bolt and nut, and the torque buffer bracket, sump scoop and clutch spring anchor bracket to the lower bolts. Connect the cable to the starter motor.

3. Refit the two rear mounting blocks to the inclined brackets of the chassis cross-member, lower the power unit until the bolt holes in the blocks and the extension casing pads coincide, then secure them to the gearbox extension.
4. Engage the spigot of the propeller shaft companion flange in the recess of the extension shaft companion flange, then secure the flanges with bolts, shake-proof washers, nuts and split pins.
5. Remove the engine lifting sling and/or supports.
6. Connect the speedometer flexible drive to the gearbox extension and the wiring to the reverse light switch, see Fig.7.
7. Connect the clutch operating rod to the eye of the operating lever and refit the return spring to the anchorage bracket. Check the adjustment as described in Section 4.
8. Re-fill the gearbox with approved oil (see Recommended Lubricants) to the correct level.
9. Refit the gearbox tunnel covers, floorboards and toeboards.
10. Re-assemble the clutch and brake pedal pads to the pedal stems.
11. Refit the floor coverings. Set the accelerator pedal so that it is just clear of the floor at the fully open setting of the carburettor throttles and tighten the clamp screw.
12. Refit the seats.
13. Refit the bonnet.

DISMANTLING

Clutch casing

It is advisable first to remove the release bearing assembly from the clutch

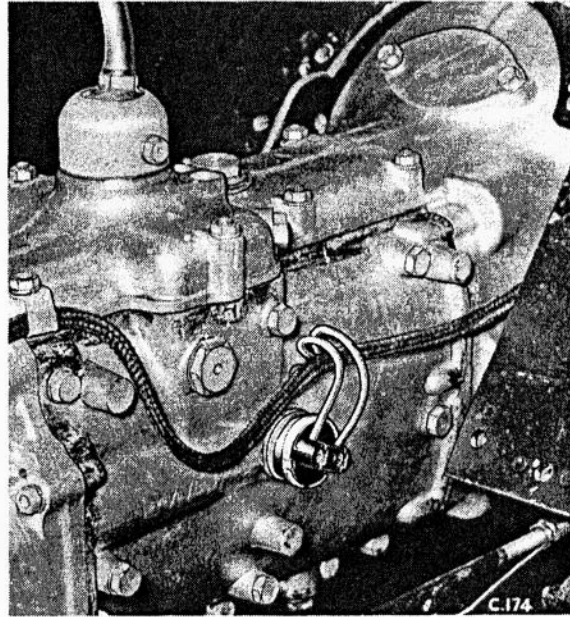


Fig.7 Reverse light switch wiring.

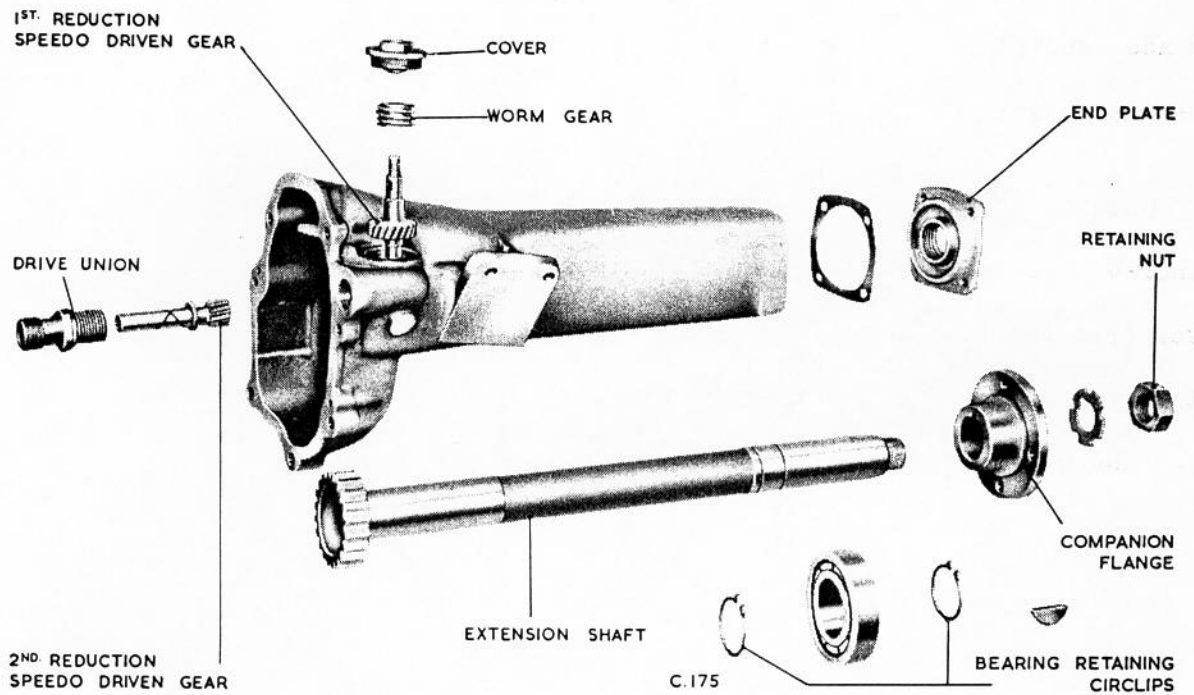


Fig.8 Gearbox extension components.

operating lever as detailed in Section 4, page 12 to avoid damage to the carbon bearing. Remove the fulcrum block from the front face of the clutch casing rear wall, in the following manner. Withdraw the split pin from the fulcrum pin, tap the pin from the block and remove the operating lever. Release the tabwasher, remove the set-bolt securing the fulcrum block and remove the block. Remove the six securing nuts and spring washers from within the clutch casing and withdraw the casing from the gearbox.

Gearbox extension

Remove the nuts and spring washers and withdraw the extension unit from the gearbox, complete with its extension shaft. Remove the set-bolts and plain and spring washers then withdraw the end plate together with the extension shaft from the casing. At the rear end of the shaft release the tabwasher, remove the retaining nut, "break" the taper then withdraw the companion flange; remove the key and end plate from the shaft. Remove the bearing locating circlips and press the bearing from the shaft.

Unscrew the speedometer drive union from the front face of the casing and withdraw the 2nd reduction speedo-driven gear from its housing. Unscrew the cover from the top and withdraw the 1st reduction speedo-driven gear complete with its worm gear upwards; withdraw the worm gear from the shaft and remove the key. Do not remove the thrust pads.

Gearbox cover

Remove the eight nuts and spring washers and lift the gearbox cover from the gearbox, complete with the gear lever. Remove the two pivot screws securing the

ball cover and detach the ball cover, inner cover, retaining spring and lever. If these parts are to be removed from the gear lever, first unscrew the knob from its upper end and pass the parts over the upper end of the lever.

Release the tabwashers, remove the nuts and detach the selector plate, its distance washers and distance tubes from inside the cover.

Gearbox

General

Lift out the reverse selector shaft (right-hand side) from the top of the gearbox casing. Remove the nuts and bolts securing the two halves of the casing then lift away the left-hand casing. Remove the layshaft from the other half casing then release the tabwashers and remove the retaining nuts at each end of the shaft.

Remove the 1st/2nd and the 3rd/4th speed selector shafts from the gearbox casing. Lift the drive shaft and main driving shaft groups from the gearbox casing and withdraw the main driving shaft from the rear end of the drive shaft.

Layshaft

Using a suitable press and split bushes, remove the layshaft gears and bearings in the following manner. Place the shaft in the press with its front end uppermost and the split bush T.178320 located beneath the rear face of the layshaft driving gear; press the front bearing, short distance piece and gear from the shaft. Remove the key from the shaft then remove the long distance piece. Press off the 3rd layshaft gear in a similar manner then remove its key from the shaft and detach the front spacing washer.

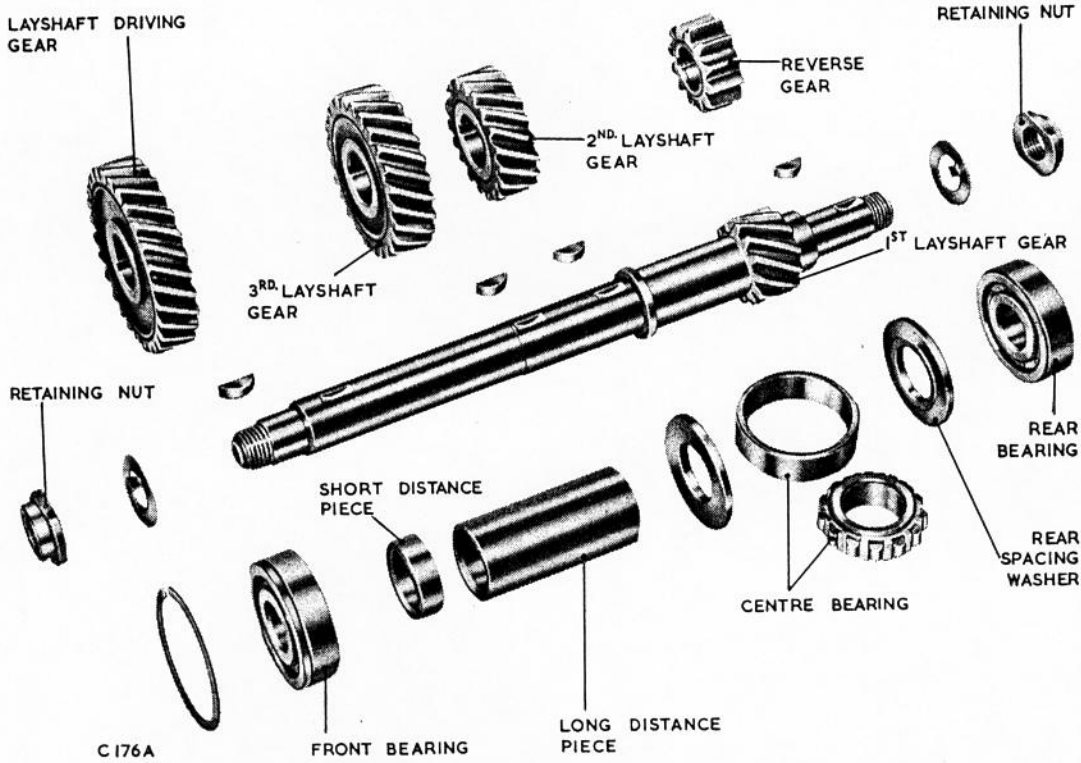


Fig.9 Layshaft components.

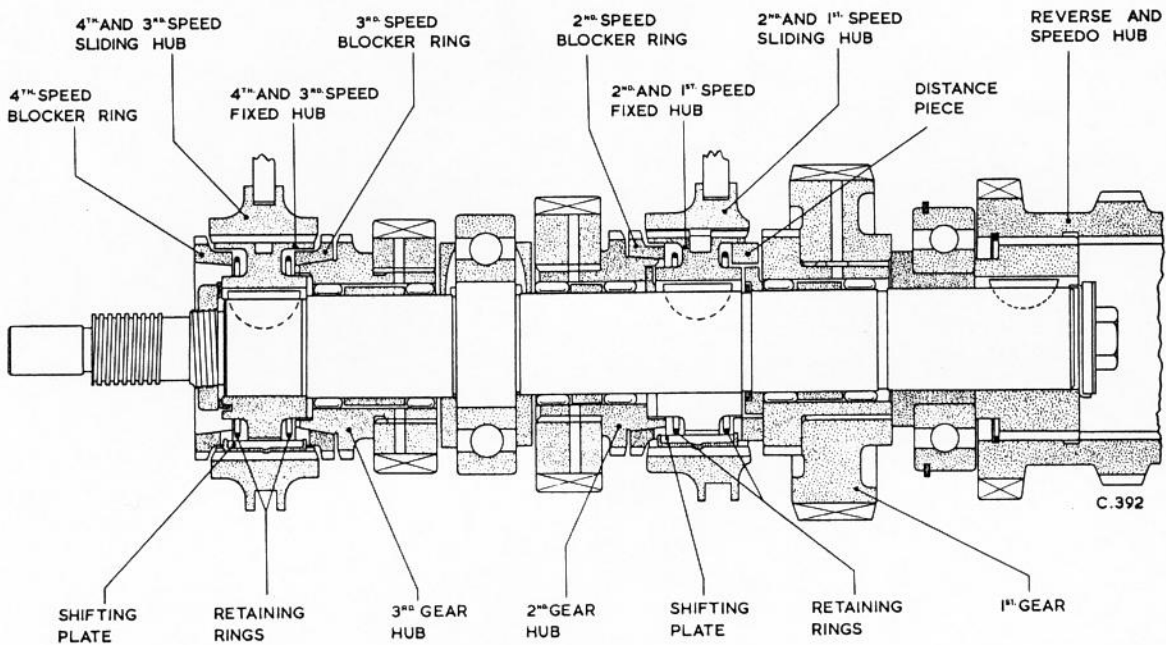


Fig.10 Main driving shaft.

Using the split bush TFN.8699, press the 2nd layshaft gear, rear spacing washer and the centre bearing from the shaft as described for the layshaft driving gear, then remove the key from the shaft. Reverse the layshaft in the press and, using the drift T.178322 and split bush T.178321, press the shaft carefully until the rear face of the rear bearing inner race abuts the key in the rear end of the shaft in order to provide a space for the split bush T.188283. Press the rear bearing back into its original position against the shoulder of the shaft then fit the split bush T.188283 in the gap between the reverse gear and the bearing, then remove the gear. Remove the key from the shaft then press off the rear bearing.

Main driving shaft

During the dismantling procedure, label the synchro mechanism blocker rings to ensure correct re-assembly. Referring to Fig. 10. lift out the 4th speed blocker ring from the 3rd/4th gear synchro unit and withdraw the sliding hub; the three shifting plates will spring out as they are released. Remove the exposed retaining ring from the recess in the fixed hub.

Release the tabwasher at each end of the shaft, remove the locknut from the front half of the shaft and the special bolt from the rear end. Using the drift T.178316, base T.178317 and split bush T.178318, withdraw the integral reverse and speedo gear hub from the rear end of the shaft. Remove the hub key from the shaft. Assemble the shaft (rear end uppermost) in a press with the split bush T.178315 located beneath the front face of the 1st gear; press on the shaft to release the 1st gear hub, the bearing locating bush and the rear bearing from the shaft. Place a suitable tray beneath the assembly during this operation to catch the needle rollers as they are released when the hub is withdrawn.

Remove the needle roller distance piece, the thrust washer and the distance washer from the shaft then withdraw the 1st/2nd gear sliding hub from the fixed hub of the synchro assembly; the three shifting plates will spring out as they are released. Remove the exposed spring retaining ring from the recess in the fixed hub. Press the hub towards the front of the shaft to relieve pressure on the main driving shaft circlip, then remove the circlip and, locating the split bush TFN.8699 in the recess, press the fixed hub from the shaft. Lift out the 2nd speed blocker ring then remove the fixed hub key. Taking precautions to prevent the loss of the needle rollers, slide the thrust washer and 2nd gear hub from the shaft. Remove the needle roller distance piece and the centre bearing rear thrust washer.

Reverse the main driving shaft in the press, locate the split bush TFN.8699 in the recess of the 3rd/4th speed fixed hub and press the hub from the shaft; lift out the 3rd speed blocker ring, then remove the hub key. Slide the thrust washer and 3rd gear hub from the shaft followed by the needle roller distance piece and the centre bearing front thrust washer. Take the necessary precautions to prevent dropping the needle rollers during this operation. Press the centre ball bearing from the shaft.

Drive shaft

Referring to Fig.2. withdraw the needle roller bearing from the bore at the rear end of the drive shaft. Release the tabwasher and remove the bearing retaining nut from the front of the front ball bearing. Using the split bush TFN.8699, press off the front bearing, remove the distance piece and press off the rear bearing with the split bush T.178320. Do not remove the constant drive gear from the shaft unless the shaft or the gear is unserviceable. If removal is necessary, press off the gear with the split bush TFN.8699 and remove the key from the shaft.

Reverse selector mechanism

Referring to Fig.5, lift out the reverse fulcrum lever from inside the right-hand casing and, if necessary, release the tabwasher, unscrew the pivot pin bolt and remove it from the outside. Unscrew and remove the reverse light switch. Slide the reverse selector fork to the rear, simultaneously removing the idler gear from its spindle, separate the gear from the fork and withdraw the selector fork from the gearbox.

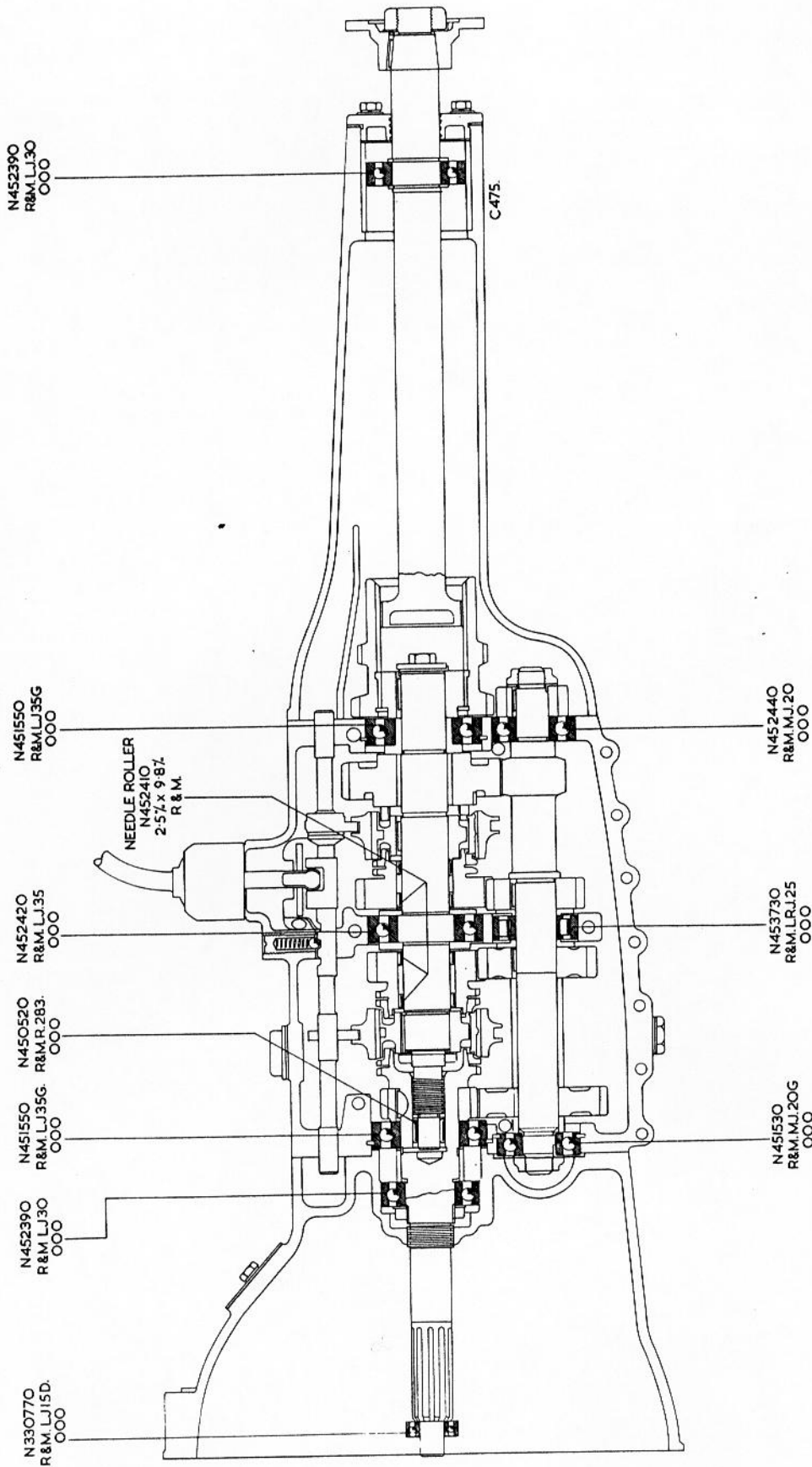
Inspection and replacements

Carefully examine all components and check them for wear on their essential locations. Pay particular attention to the mating splines of the fixed and sliding hubs, and the dog teeth of the gear wheel units. Excessive wear at these locations will result in accumulated and undesirable backlash of the respective gear trains beyond the designed limits. Recommended maximum fits for the essential components are quoted in the General Data, and the various bearings are shown in Fig.11.

Clean all bearings thoroughly in paraffin, spin by hand to test for harshness in running, then lubricate them lightly to prevent corrosion pending re-assembly. Renew bearings in which harshness is noted or which have excessive wear.

Note:- On no account spin a ball or roller bearing at high speed in an air blast, since any foreign matter will damage the surface finish of the balls, rollers and tracks.

Practically all reconditioning is by unit replacement which is dealt with when re-assembling. Selective assembly is employed for such items as thrust washers; this is covered in the various checks.



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R&M.LJ35G
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R&M.LJ35
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N450520
R&M.R.283.
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N451550
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N452390
R&M.LJ30
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N330770
R&M.LJ15D.
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NEEDLE ROLLER
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2.57 x 9.87.
R & M.

C475

N451530
R&M.MJ20G
000

N453730
R&M.LJ.25
000

N452440
R&M.MJ.20
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NOTE. N451550 DENOTES BRISTOL PART NUMBER

Fig. 11 Gearbox bearing diagram.

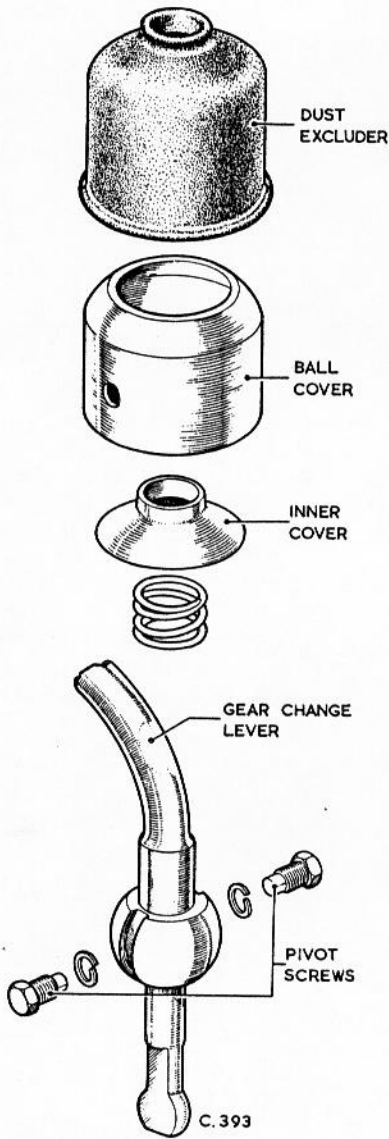


Fig. 12 Gear change lever components

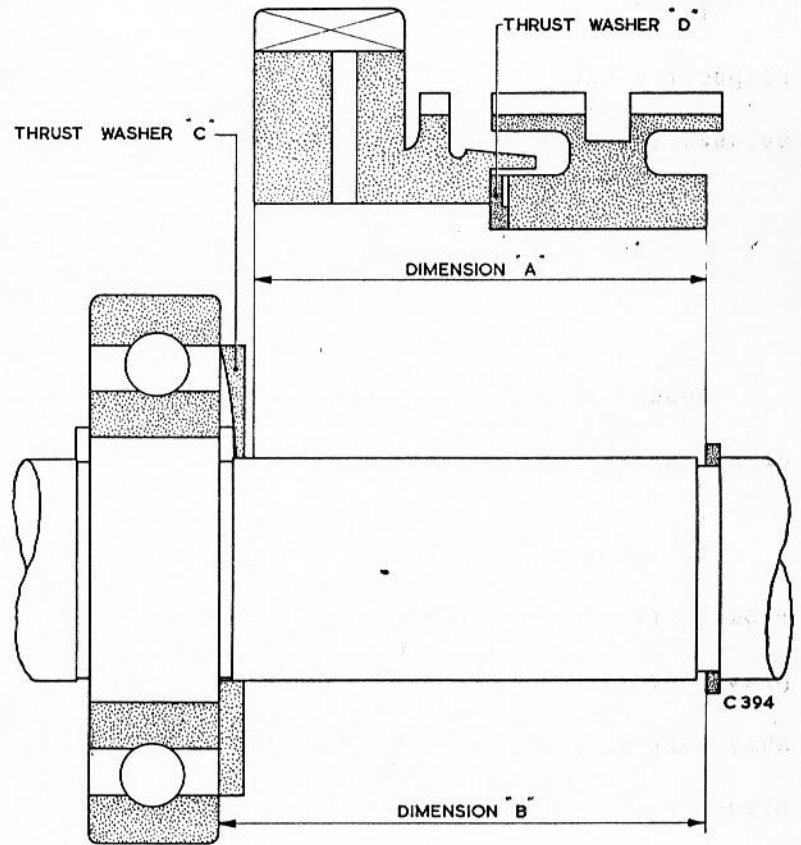


Fig. 13 Checking 2nd speed blocker ring engagement.

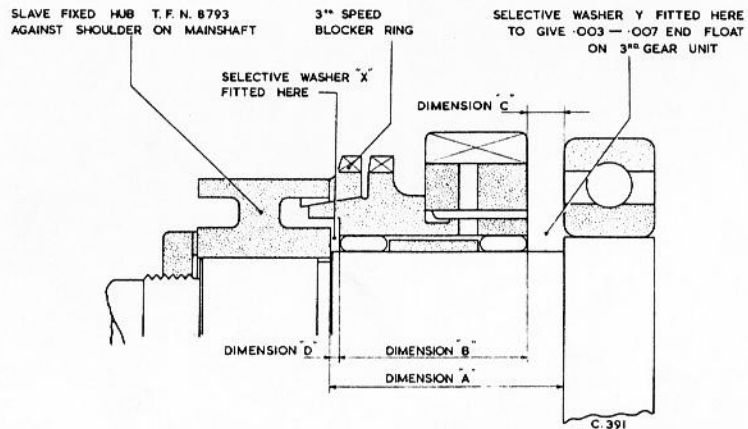


Fig. 14 Checking engagement of 3rd speed blocker ring.

The 3rd gear wheel and the 2nd gear wheel are a serrated fit, peened to their respective hubs; do not attempt to part them. If slackness or fretting is noted between the gear wheel and hub, replace the complete assembly.

RE-ASSEMBLING

General

Ensure that all parts are serviceable and clean, and that the bench is clear of all extraneous matter.

If the gear change lever mechanism in the gearbox cover has been dismantled, rebuild it in the following manner. Fit a distance tube over each selector plate securing stud, then assemble the selector plate to the studs with the cut-away edge of the plate facing the front of the cover, see Fig.6. Fit a distance piece to each stud and secure the assembly with tabwashed nuts. Insert the ball joint of the gear change lever into its socket on the outside top face of the cover with its lower end passing through the slot of the selector plate. Pass the retaining spring, inner cover and ball cover over the upper end of the lever, in that order, then align the pivot screw holes in the ball cover with the inserts in the socket mounting and secure the assembly with the two pivot screws and spring washers, ensuring that the pivot screw spigots engage in the slots of the gear-change lever ball, see Fig.12.

Main driving shaft

Mount the centre ball bearing in the base T.178300 and, using the drift, press the shaft into position in the inner race of the bearing. Check that the bearing is mounted centrally on the raised journal of the shaft; this is most important. In order to obtain the correct engagement of the 2nd speed blocker

ring, it is necessary for the thrust washer to be of the correct thickness. Check this as follows. Fit the 2nd gear hub, the 1st/2nd gear fixed hub and the thrust washer "D" together then measure the overall length of the assembly. This is shown as dimension "A" in Fig. 13.

Fit the circlip in its groove in the shaft. With the circlip abutting the rear face of the groove, measure the distance between the circlip front face and the rear face of the bearing on the shaft (dimension "B"). Remove the circlip from the shaft. Add to dimension "A" the desired clearance 0.003in. (0.08 mm) then subtract this figure from dimension "B". The resulting dimension will be the thickness of the thrust washer "C".

Example :-	Dimension "B" =	2.531in. (64.29m.m.)
	Dimension "A" =	2.332in. + 0.003in. = 2.335in. (59.31m.m.)
		(59.23 + 0.08m.m.)
	∴ Thrust washer thickness ("C")	= 0.196in. (4.99 m.m.)

Select a thrust washer of the required thickness and assemble it to the shaft as shown at "C", locating its slot over the locating pin fitted to the shaft. Apply sufficient approved grease to the needle roller journal on the shaft to retain the rollers, then fit 40 needle rollers followed by one of the short distance pieces and a further 40 needle rollers. Assemble the 2nd gear hub (gear wheel first) over the shaft, and position it on the rollers. Fit the thrust washer "D" (Fig.13) so that it abuts the face of the hub just fitted then insert the fixed hub key. Fit the 2nd speed blocker ring on to the cone face of the 2nd gear hub.

Fit a retaining ring to the front recess of the synchro fixed hub, so that one tongue of the ring engages one of the slots for the shifting plates. (The

other tongue of the ring will rest against the recess in the hub). Fit the hub over the shaft (retaining ring end first), align the keyway in the hub to the key in the shaft and, using the split bush TFN.8699 and the drift, press the hub on to its journal until it abuts the thrust washer. Fit the circlip to the groove in the shaft now exposed behind the hub then, using the split bush TFN.8699, press the hub back against the circlip. This is necessary to ensure that the requisite clearance is produced between the front face of the 2nd gear wheel and its thrust washer.

Fit the second retaining ring to the rear recess in the fixed hub, but ensure that the tongue of the ring does not engage the same shifting plate slot as the front ring. Fit and temporarily retain by hand the three shifting plates, turning the 2nd speed blocker ring as necessary so that the shifting plate notches in the blocker ring engage the ends of the shifting plates, press the shifting plates down into their slots in the fixed hub and fit the sliding hub (long end first) over the assembly and centralise it on the fixed hub. The central position can be felt by the shifting plates locating in the internal groove of the sliding hub.

Fit the 1st speed distance piece into the recess of the fixed hub, mating the notches to the ends of the shifting plates. Fit the 1st gear wheel thrust washer (recess first) over the end of the shaft and locate it over the circlip on the shaft. Grease the shaft and fit two rows of 40 needle rollers as described previously with the long distance piece interposed, then assemble the 1st gear wheel (dog teeth first) over the rollers. Press the main driving shaft rear bearing location bush into position into the rear bearing, with the retaining ring in the outer race located adjacent to the flange of the bush. Press

the assembled bearing and locating bush (flange first) into position on the shaft, using the press, base and drift of the tool T.178300.

In order to check the engagement of the 3rd speed blocker ring, it is necessary to check the thickness of the thrust washers in the following manner. Referring to Fig. 14. assemble the "slave" fixed hub TFN.8793 to the front section of the main driving shaft and secure it in position against the shoulder of the shaft with the hub locknut; with the slave hub assembled, measure dimension "A". Remove the "slave" hub.

Measure and note dimension "B" on the 3rd gear hub unit. Assemble the 3rd gear hub unit (with its needle rollers and distance piece), blocker ring and "slave" hub to the shaft and secure them with the locknut. Press the 3rd gear hub unit forward by hand so that the cones of the blocker ring and hub are in contact with the tongues of the slave hub (engaging the slots in the blocker ring) then measure dimension "C". Add dimension "B" to dimension "C" and subtract the result from dimension "A". This will give dimension "D". Select a thrust washer "X" to the nearest thickness less than dimension "D".

Add dimension "B" to the thickness of the selected washer "X" and subtract the total from dimension "A"; this gives a new dimension "E". Select a thrust washer "Y", 0.003in. to 0.007in. (0.08 to 0.18 m.m.) less than dimension "E", for fitment at "C".

Example for thrust washer "X"

Dimension "A"...	...	...	...	1.750in. (44.45m.m.)
Dimension "B"...	...	...	...	1.388in. (35.25 m.m.)
Dimension "C"...	...	...	...	0.215in. (5.46 m.m.)
Dimension "B" + "C"...	...	...	...	<u>1.603in. (40.72m.m.)</u>
Dimension "D"...	...	...	...	<u>0.147in. (3.73m.m.)</u>

Example for thrust washer "Y"

Dimension "A"...	...	...	...	1.750in. (44.45m.m.)
Dimension "B"...	...	...	...	1.388in. (35.25m.m.)
Washer "X" ...	...	...	...	0.145in. (3.68 m.m.)
Dimension "B" + Washer "X"...	...	...	...	<u>1.533in. (38.94m.m.)</u>
Dimension "B"...	...	...	...	0.217in. (5.51 m.m.)
Minus 0.003in. to 0.007in. - say 0.005in.				<u>0.005in. (0.13 m.m.)</u>
(0.08m.m. to 0.18 m.m. - say 0.13m.m.)				
Thickness of washer "Y" ...	...	...	...	<u>0.212in. (5.38 m.m.)</u>

Remove the components from the shaft.

It is now necessary to check the engagement of the 4th speed blocker ring. Proceed as follows. Fit the "slave" hub TFN.8793 as shown in Fig.15. then secure it temporarily with the locknut.

Referring to Fig. 15, measure dimension "A" at the drive shaft rear bearing housing in the gearbox casing, then remove the circlip and measure dimension "B" on the bearing. Subtract dimension "B" from dimension "A" to obtain a dimension "C". Fit the rear bearing to the drive shaft so that it bears against the front face of the gear wheel then fit the 4th speed blocker ring to its mating cone on the shaft. Fit the needle roller bearing assembly to the spigot on the main driving shaft, and fit the main driving shaft to the drive shaft and assemble them to the gearbox half-casing. Press the drive shaft rearwards until, with the tongues of the slave hub engaging the slots in the blocker ring, the blocker ring contacts its cone, then measure dimension "D", i.e. the distance from the front face of the gearbox to the front face of the rear bearing outer race. Remove the main driving shaft and drive shaft assemblies from the gearbox and remove the drive shaft bearing. Subtract the dimension "C" from dimension "D" to obtain the clearance "F", i.e. the thickness of thrust washers required between the rear face of the drive shaft bearing and the drive shaft gear.

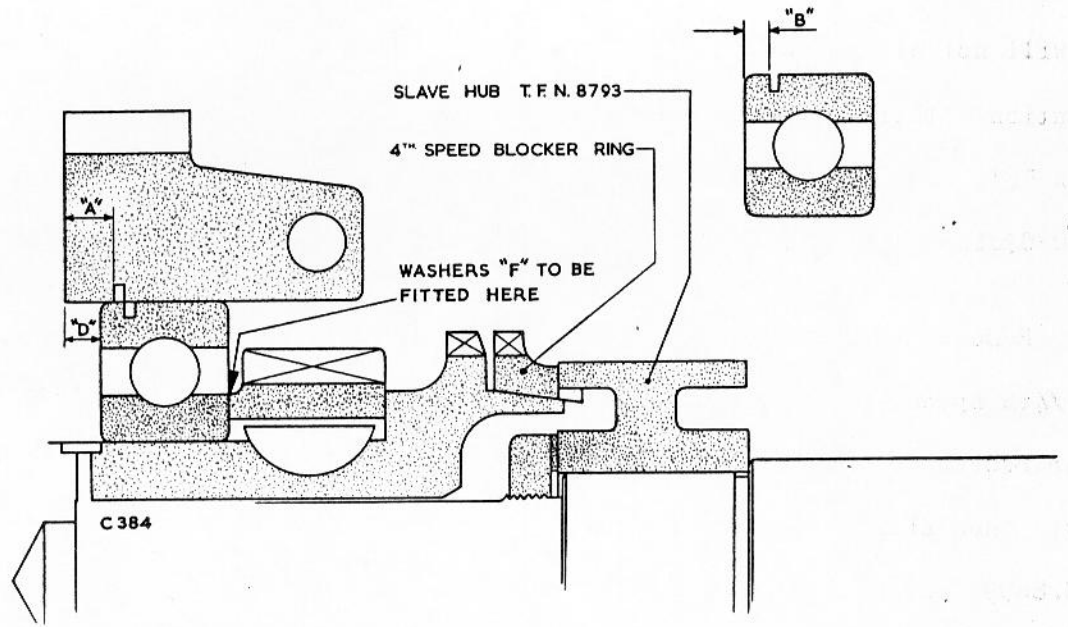


Fig. 15 Checking engagement of 4th speed blocker ring.

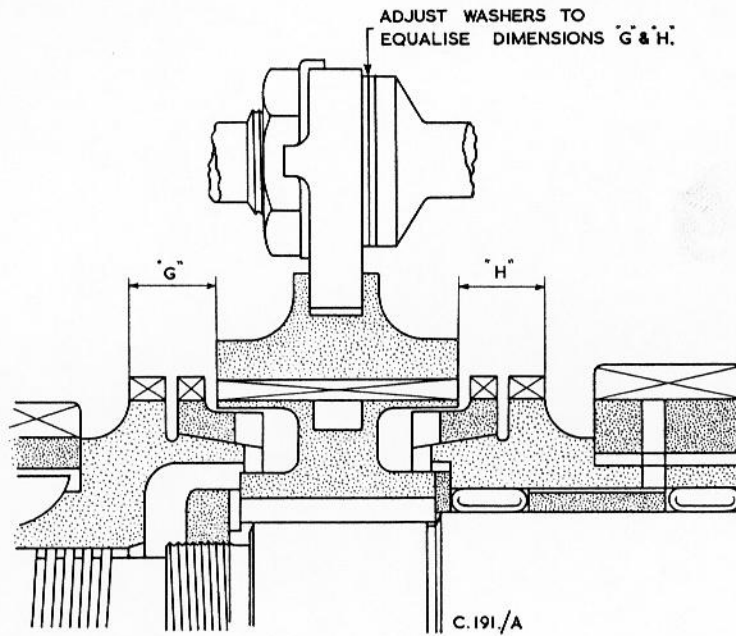


Fig. 16 Adjusting 3rd and 4th speed sliding hub engagement.

Thrust washers of 0.010in. (0.25m.m.) and 0.020in. (0.5m.m.) thickness are available; it will not always be possible to fit the exact thickness of washers at this location, therefore fit washers to the nearest dimension obtainable below dimension "F", e.g. if "F" is 0.075in. (1.93 m.m.), fit washers to make up a thickness of 0.070in. (1.8m.m.) (3 off 0.020in. (0.5m.m.) and 1 off 0.010in. (0.025m.m.)).

Remove the locknut and "slave" hub from the main drive shaft then fit the 3rd/4th speed fixed hub key to the shaft keyway. Fit a retaining ring to the rear recess of the fixed hub in the manner described for the 1st/2nd speed assembly, then align the hub keyway with the shaft key and, using the split bush TFN.8699 and a suitable drift, press on the hub and secure it with its tab-washed locknut.

Note:- The rear face of this hub (i.e. that which is to face the centre bearing) has a slight counter-bore to the shaft bore. The 3rd/4th and the 1st/2nd speed fixed hub are not therefore interchangeable.

Fit the shifting plates and front retaining ring to the fixed hub, then fit the sliding hub as described for the 3rd/4th speed hub. Reverse the shaft and fit the key to the keyway in the rear end journal. Align the keyway of the reverse and speedometer hub with the key, then press on the hub unit and secure it with the tabwasher and special bolt.

Drive shaft

If the gear has been removed, fit the key to the shaft then place the split bush TFN.8699 beneath the gear and, aligning the key with the keyway in the gear, press the shaft into position.

Fit the selected washers to the drive shaft then, using the drift T 178299, press on the drive shaft rear bearing (circlip groove to the front of the shaft) followed by the distance piece, front bearing, tabwasher and locknut; tighten the locknut and secure the assembly with the tabwasher. Fit the circlip to the external groove in the outer race of the bearing.

Checking drive shaft and main driving shaft

Fit the 4th speed blocker ring to the drive shaft then assemble this shaft to the main driving shaft, ensuring that the notches in the face of the blocker ring engage the ends of the shifting plates, then fit the complete assembly to the left-hand half of the gearbox casing, locating the bearing circlips in the relevant grooves.

Fit the selector fork and its original adjusting washers to the 3rd/4th speed selector shaft and secure them temporarily with the fork retaining nut, then position the shaft and fork in the casing. Fit the gearbox cover, complete with gear-change lever and selector plate, to the top of the gearbox half casing and secure it to the casing studs. Operate the gear-change lever to engage the 3rd and 4th speeds in turn and check the engagement of the sliding hub with the drive shaft and 3rd gear hub. Add or remove distance washers between the selector fork and the collar of the selector shaft, as necessary, to equalise the engagement (see Fig.16), then secure the selector fork by tightening its retaining nut and locking it with the tabwasher.

Fit the 1st and 2nd speed selector shaft in a similar manner then check the 1st/2nd speed assembly to ensure adequate engagement of the sliding hub with the 2nd gear hub. Full engagement of the hub with the 1st gear hub is then assured

under all conditions of assembly. Exercise care in this instance since the selector shaft can only be set in half its bearing, the other half being in the right-hand side of the casing.

Remove the gearbox cover assembly followed by the drive shaft/main driving shaft assembly from the gearbox casing when these checks have been completed satisfactorily.

Layshaft

Where the original gears are being refitted, it is important to refit the gears the correct way round to mate the established tooth bearing surfaces with those of the opposite gears.

Fit the 2nd layshaft gear key to its keyway in the shaft, (i.e. adjacent to the shoulder) and, using the drift and base T.178296, press the shaft into the gear ensuring that its keyway is aligned with the key. Assemble a spacing washer to the shaft with its larger face against the gear as shown in Fig.17, then press on the inner race and roller assembly of the layshaft centre (roller) bearing and fit the outer race over the roller assembly. Fit the second spacing washer with its smaller face against the bearing then fit the 3rd layshaft gear key to its keyway in the shaft. Align the keyway of the gear with the key then press on the 3rd layshaft gear. Assemble the long distance parts to the shaft then fit the layshaft driving gear key to its keyway. Align the keyway and key and press on the layshaft driving gear, using the drift T.178297. Fit the short distance piece to the shaft, followed by the layshaft front bearing with its circlip towards the gear wheel. Secure the assembled bearings, gears and distance pieces with the tabwashed retaining nut.

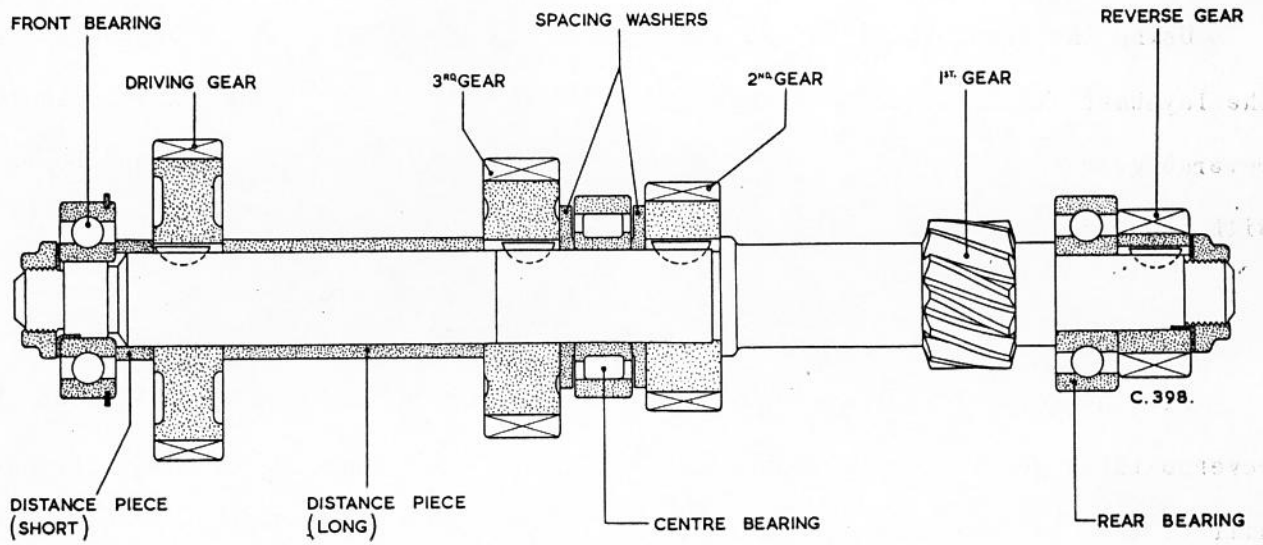


Fig. 17 Layshaft assembly.

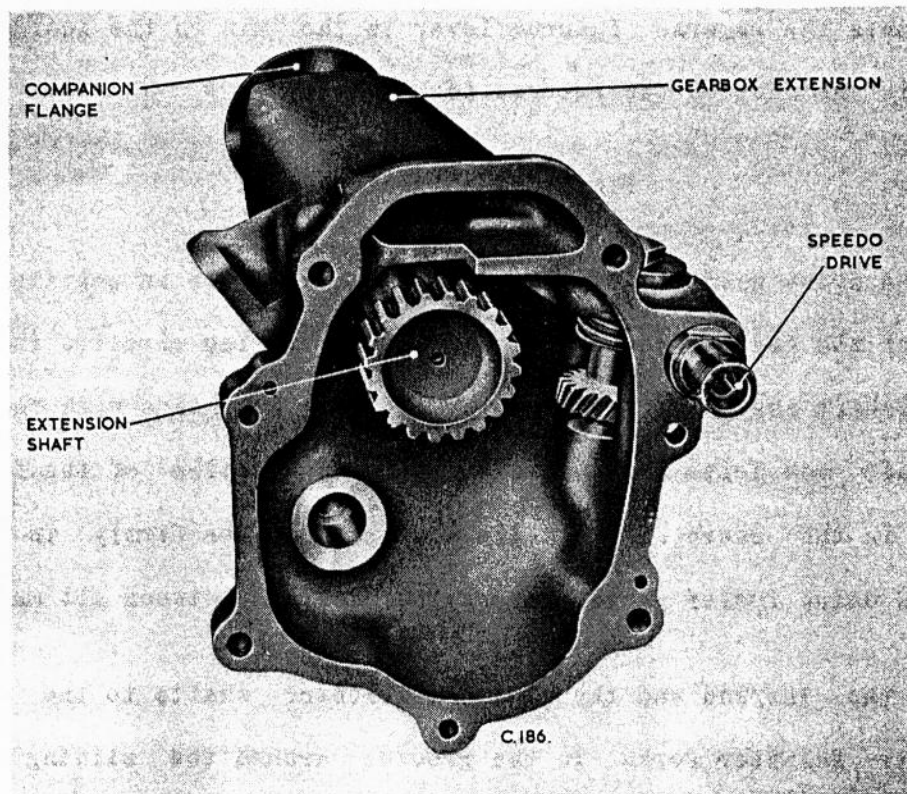


Fig. 18 Gearbox extension.

Using the base T.178298 and the drift T.178297, press the rear bearing on the layshaft then fit the layshaft reverse gear key. Align the keyway in the reverse gear with the key then press on the gear and retain the gear and bearing with the tabwashed retaining nut.

Reverse selector mechanism

Fit the fork of the reverse selector fork unit in its grooved collar on the reverse idler gear, then assemble the selector to the rear end of the right-hand half of the gearbox casing, fitting the idler gear to its spindle, see Fig.5. Screw the reverse light switch into position in the casing, with its fibre joint washer interposed. Fit the tabwashed pivot pin to the casing from the outside then assemble the reverse fulcrum lever to the pin on the inside, engaging its lower end in the slot in the reverse fork selector.

Final assembly of gearbox

Fit the drive shaft/main driving shaft assemblies in position in the right-hand half of the gearbox casing, locating the bearing circlips in their grooves. Fit the layshaft assembly to the casing, meshing its gears with those of the main driving shaft and drive shafts and engaging the circlip of the front bearing in the groove in the casing. Hold the shaft assemblies firmly in position in the casing, and using feeler gauges, check the backlash between all mating gears.

Refit the 1st/2nd and the 3rd/4th selector shafts to the half casing and engage their selector forks in the grooves around the sliding hubs. Fit the reverse selector shaft in position in the vacant location and engage it with the upper end of the reverse fulcrum lever. Apply a thin even coating of jointing

compound to the mating gearbox joint faces then offer the left-hand half of the gearbox casing to the assembly, ensuring that the bearing circlips are located correctly in their grooves. Fit the gearbox securing bolts, washers and nuts and tighten the nuts to the torque-loading given in the General Data.

Gear change mechanism

Check that the selector shafts are in the neutral position, centralise the gear-change lever then, using jointing compound, assemble the gearbox cover unit to the studs of the gearbox and secure in position with spring washers and nuts. Check that the operation of the gear-change lever is both smooth and positive, then fit the gear lever knob.

Gearbox extension

Fit the key to the 1st reduction speedo driven gear and fit the worm gear in position. Insert the assembled gears through the top of the housing in the extension casing with the lower end of the gear bearing on its thrust pad; screw the cover into position on top to locate and retain the assembly. Fit the 2nd reduction speedo driven gear to its drive union, then screw the union into position in the forward facing extension and ensure that the gear teeth engage correctly with those of the worm gear.

Fit the extension shaft bearing to the shaft and secure it in position with its two retaining rings. Fit the end-plate to the shaft, then fit the key and assemble the companion flange to the tapered end of the shaft. Secure the companion flange with its tabwashed retaining nut, tightening it securely with a spanner and mallet before securing with the tabwasher. Fit a new joint washer to the rear end of the extension then insert the extension shaft and secure the

end-plate with the four set-bolts and spring washers. Fit a new joint washer to the rear face of the gearbox, then taking care that the teeth of the extension shaft and 1st reduction speedo gear engage correctly with the relevant teeth of the reverse and speedo gear hub, assemble the extension unit to the gearbox and secure with nuts and spring washers.

Clutch casing

Secure the fulcrum block to the front face of the clutch casing rear wall. Position the clutch operating lever in the fulcrum block and insert the fulcrum pin; secure the pin with a new split pin. Make sure that this assembly is on the correct side of the casing, i.e. to the left.

Fit a new joint washer to the front face of the gearbox and assemble the clutch casing over the end of the drive shaft, locating the drive shaft front bearing in its housing. Fit the clutch lever fulcrum block in position, securing it temporarily with its set-bolt. Secure the casing to the gearbox with the nuts and spring washers, and tighten and lock the fulcrum block set-bolt.

Insert the clutch lever through the left-hand aperture of the clutch housing, position it relative to the fulcrum block, then fit the fulcrum pin and secure with a split pin. Assemble the clutch release bearing assembly to the clutch lever then secure with the loop springs, inserting their spigots into the holes in the bearing trunnions and in the clutch lever.

Secure a suitable radius arm to the extension shaft coupling and check the backlash in the 1st, 2nd and 3rd gears and 4th gear dog engagement in the following manner.

Engage the selected gear with the gear-change lever and secure the gearbox drive shaft against rotation. Secure a dial indicator to the extension and arrange it so that its button contacts the radius arm at 5in. radius. Record the variation in clock reading between the extremes of travel of the arm and compare the result with the original maximum limits of backlash quoted in the General Data. To obtain maximum efficiency, it is recommended that these limits are not exceeded.

PROPELLER SHAFT

Description

The propeller shaft is of tubular steel construction. At each end of the shaft is an integral yoke which engages two opposite arms of a four-arm journal assembly. The other two arms mount the flange yoke see Fig. 19. An enclosed needle bearing assembly is housed in the bore of each yoke arm and flange yoke and is retained by a circlip. A lubricator nipple is fitted to the centre of the journal assembly and provides lubrication to each bearing assembly via the drilled arms of the journal. The flange yokes are secured to the extension shaft companion flange at the front, and to the driving pinion companion flange at the rear. Each companion flange is secured by four bolts, shake-proof washers, slotted nuts and split pins (see Fig. 19.).

Removing

Working from beneath the car, withdraw the split pins and remove the shake-proof washers and bolts securing the flange yokes of the propeller shaft to those of the gearbox and differential units. Push the gearbox extension shaft

companion flange forward to break the joint with the propeller shaft front flange yoke then pull the propeller shaft forward to break the rear joint with the differential unit companion flange; remove the propeller shaft. It is advisable to mark the front and rear flange yokes to ensure that each is returned to its mate on re-assembly.

Refitting

Refit the propeller shaft in the following manner. Ensure that the joint faces and spigots of the companion flanges and flange yokes are clean and undamaged then fit the rear flange yoke to the companion flange of the differential unit as marked on dismantling; align the bolt holes and secure the flanges with four bolts, shake-proof washers and nuts. Tighten the nuts diagonally until secure, then fit the split pins. Push the extension shaft of the gearbox into the gearbox extension then raise the forward end of the propeller shaft and align its flange yoke with the extension shaft companion flange. Pull the extension shaft rearwards to engage its flange yoke with the propeller shaft companion flange then secure the flanges with four bolts, shake-proof washers and nuts. Tighten the nuts diagonally until secure, then fit the split pins.

Dismantling

With the propeller shaft removed from the car, and referring to Fig. 19, remove the circlips from the propeller shaft and flange yoke arms then support one yoke arm of the propeller shaft on a hollow wood block and, using a metal drift, tap the opposite bearing cap into the bore of the yoke, thereby forcing the opposite bearing out of its location in the yoke arm. Remove the displaced bearing assembly. Turn the assembly over and tap the exposed journal until the

opposite bearing assembly is driven out. Remove the flange yoke by pushing one journal arm into its bearing housing in the yoke arm and turning the flange yoke sufficiently to clear the opposite yoke arm. Remove the remaining bearing assemblies in a similar manner.

Note:- Removal of the universal joint assemblies invariably damages the bearing caps; therefore, never attempt to dismantle them unless they are faulty, in which case discard the removed assembly and refit a new assembly. Do not attempt to fit new components to those that have been in service.

Re-assembling

The universal joint is supplied only as a complete assembly, together with new circlips, ready to be fitted to the flange yokes. To fit them, proceed as follows:-

1. Ensure that the bearing cap housings in the yoke arms are perfectly clean and free from scores.
2. Carefully withdraw the four caps, with the rollers inside, from the arms of the journal, and place to one side.
3. Fit the journal with two opposing arms into position between the yoke arms of the propeller shaft, and place the assembly on a press with the yoke arms vertically one above the other.
4. Enter one bearing cap into its location in the upper arm and press it carefully about half way.
5. Lift the journal assembly so that the top journal enters the roller assembly inside the cap.
6. Holding the journal inside the cap, continue to press on the cap until the circlip groove is just clear.
7. Carefully turn the assembly over through 180° and enter the second cap into the opposite housing and press it half way in.
8. Lift the journal assembly so that the top journal enters the roller assembly inside the cap, but be careful not to withdraw the lower assembly from its roller bearing, then press in the cap until its circlip groove is clear.

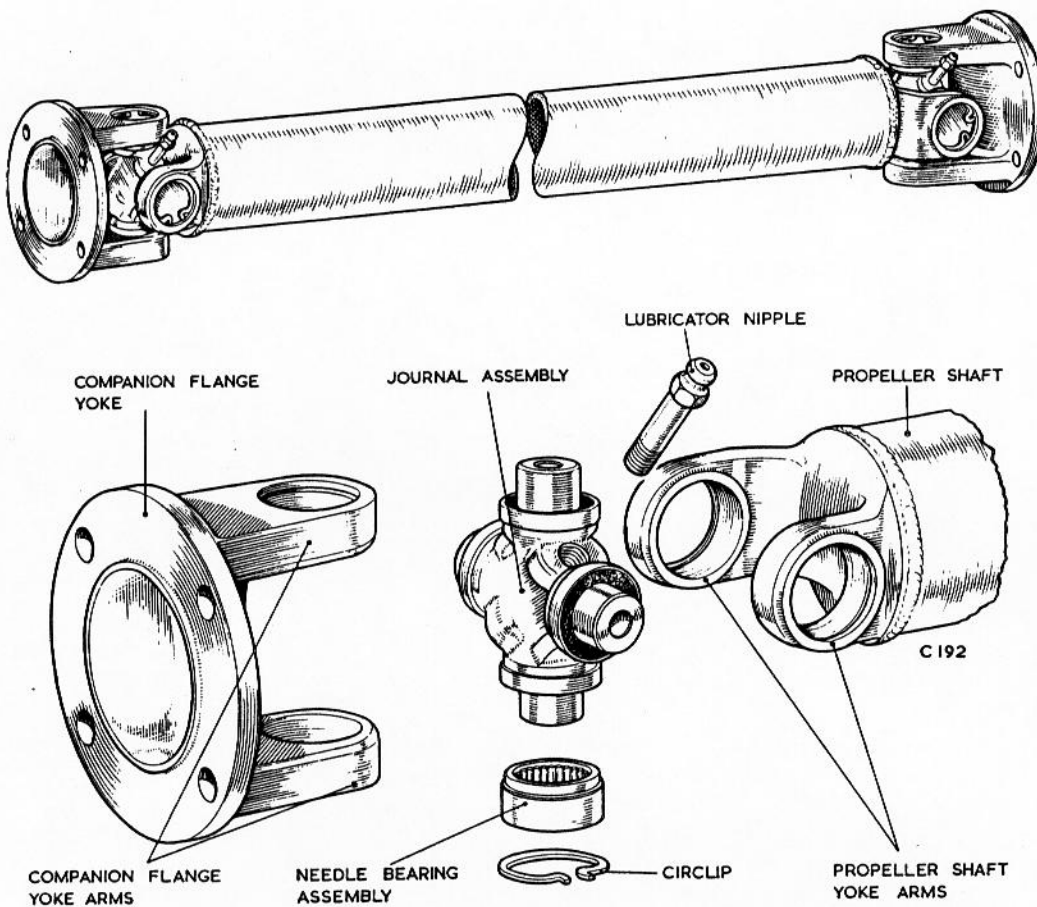


Fig.19 Universal joint components.

9. Fit the companion flange yoke arms over the two vacant arms of the journal assembly just fitted to the propeller shaft.
10. With the flange yoke arms vertically one above the other beneath the press, enter a bearing cap (with the rollers inside) into the upper arm location and press it about half-way in; lift the propeller shaft so that the upper journal enters the cap.
11. Holding the assembly thus, press in the cap until the circlip groove is just clear.
12. Carefully turn the assembly over through 180° and fit the fourth bearing cap in the same manner.

Caution:- Care must be exercised to see that no rollers are dislodged during the foregoing process, since any displaced rollers may cause damage; also removal of the cap to rectify the defect may render the assembly unserviceable.

13. Fit all four circlips to the yoke arm grooves, and ensure that they are right home around the complete circle.
14. With a hide mallet, tap the yoke arms of the flange yoke so that each bearing cap is brought to bear against its circlip. This is to ensure perfect centralisation of the assembly.

REMOTE GEAR CHANGE UNIT

This unit is illustrated in Fig. 20. and is available for fitment to Arnolt-Bristol cars. The following work is entailed:-

1. Removal and modification of the front gearbox tunnel assembly.
2. Removal of the gearbox selector cover and the fitment of the new assembly.

Preparation

1. Detach the front tunnel assembly and the clutch housing cover plate.
2. Remove the eight retaining nuts and washers and lift off the gearbox cover.

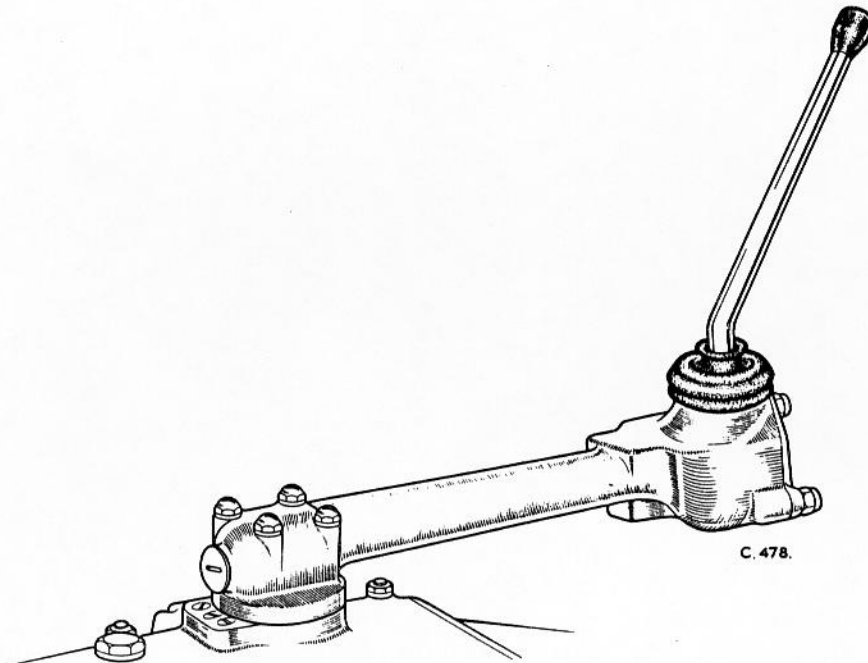


Fig.20 Remote gear change.

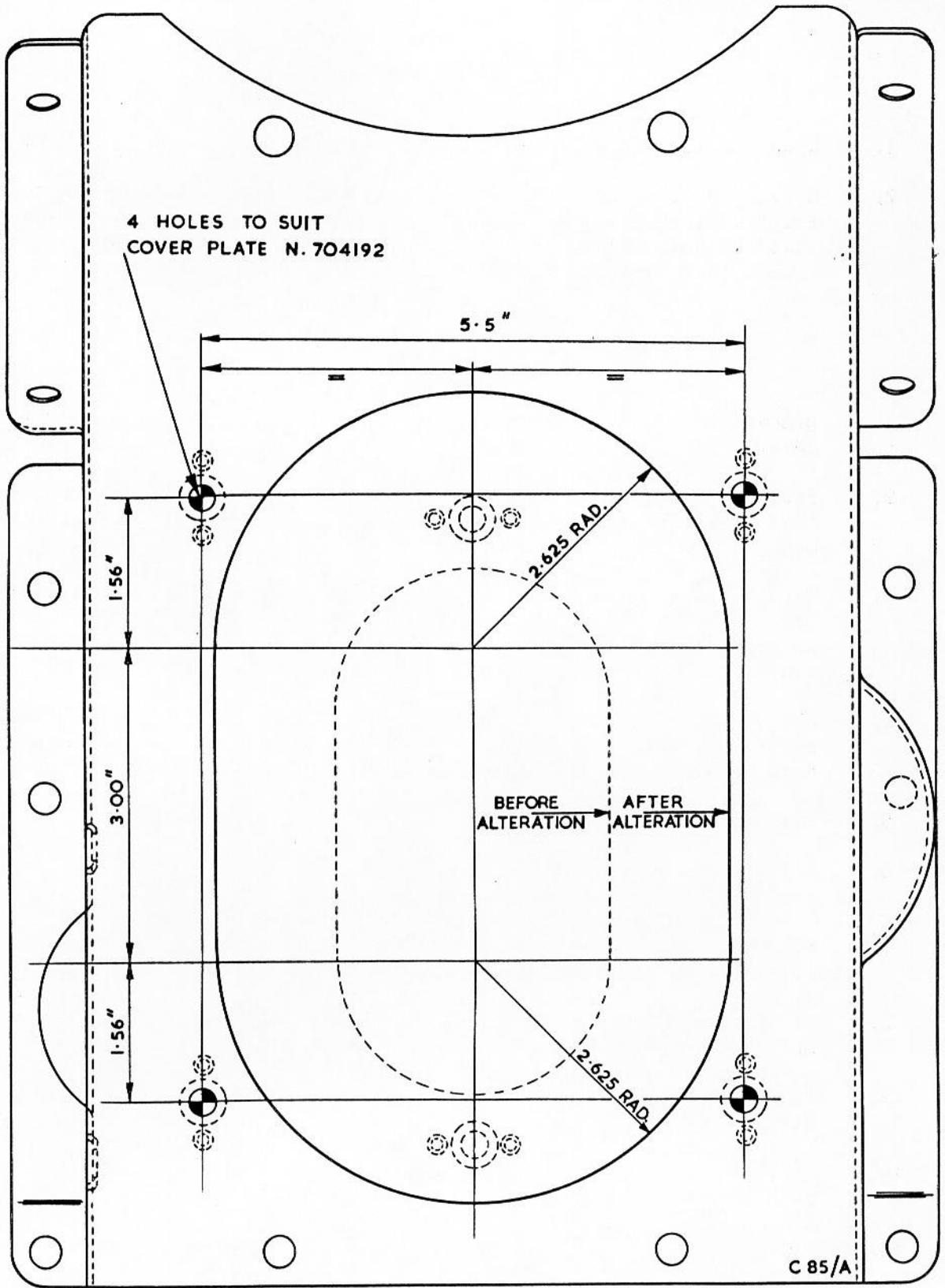


Fig.21 Alteration to gearbox tunnel.

Modification to tunnel

1. Open out the existing aperture to the dimension shown in Fig.21.
2. Rivet the four nut cages (item 11) to the underside of the modified tunnel at the position shown in Fig.21. Make sure that the nuts (item 12) are in position in the cages before the rivets (item 13) are fitted.

Modification to gearbox

1. Remove the filler plug and its copper washer from the gearbox cover.
2. From the location to the left of the filler plug orifice, remove the set-screw (spring reverse plunger) and withdraw the spring and plunger.
3. Turn the cover over and release the tabwashers on the selector plate nuts, then remove the nuts, tabwashers, top distance washers, selector plate, distance tubes, bottom distance washers and the two studs.
4. Refit the two studs, bottom distance washers, distance tubes, selector plate, top distance washers, tabwashers (item 6) and nuts to the new cover (item 3), leaving the nuts unlocked.
5. Fit the filler plug and its copper washer to the new cover.
6. Cut two coils from the reverse plunger spring then fit the reverse plunger, spring and set-screw to the cover.
7. Fit the new selector ball unit (stamped "R") (item 4) in position relative to the reverse shaft i.e. nearest the reverse plunger.
8. Fit the two other new selector ball units (item 5); the shoulders must not penetrate into the shaft housings.
9. Fit the four studs (item 7) to the gear change unit face of the new cover.
10. Temporarily fit the cover to the gearbox and secure with two nuts and washers on each side.
11. Trial fit the gear change unit (item 1); check that its operating lever locates in the selector plate and that the dowel is in position and located correctly, then fit the four washers and domed nuts (item 9).

12. Check that all gears can be selected by movement of the gear lever and that the spring of the selector ball unit concerned can be felt when the lever is moved past its normal position i.e. further into the gear; if this position is unobtainable, elongate the slot in the selector plate as required.
13. Recheck the operation of the gear lever. Eliminate any tightness on the selector shafts by removing the cover and easing the high spots on the bearing surfaces.
14. Check the gear lever for movement across the gate. If there is any obstruction, adjust the selector plate, moving it in either direction in relation to the centre line of the gearbox.
15. When this is satisfactory, remove the cover, tighten and lock the selector plate nuts, remove the gear change unit from the cover andpeen the selector ball units in the approved manner then refit the cover only to the gearbox using jointing compound. Fit the washers (item 8) and nuts and tighten firmly.

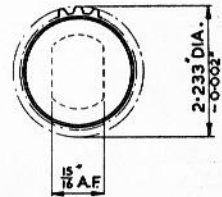
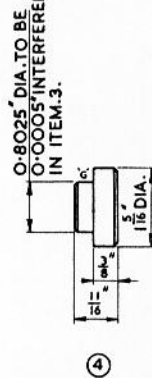
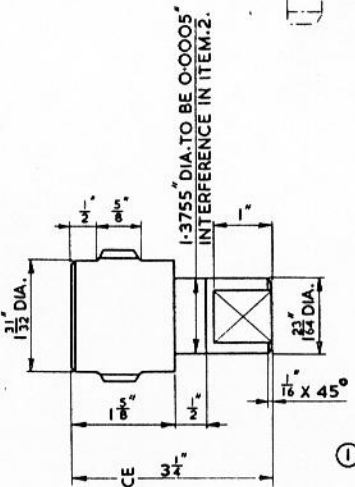
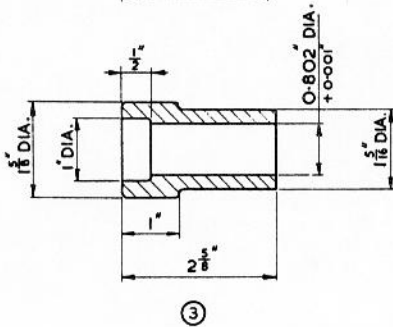
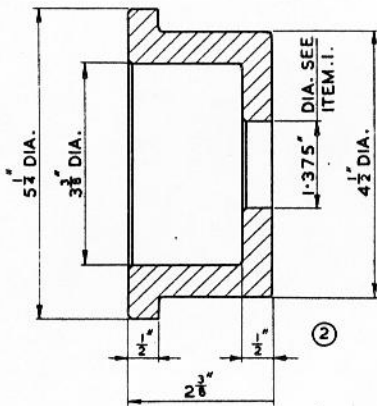
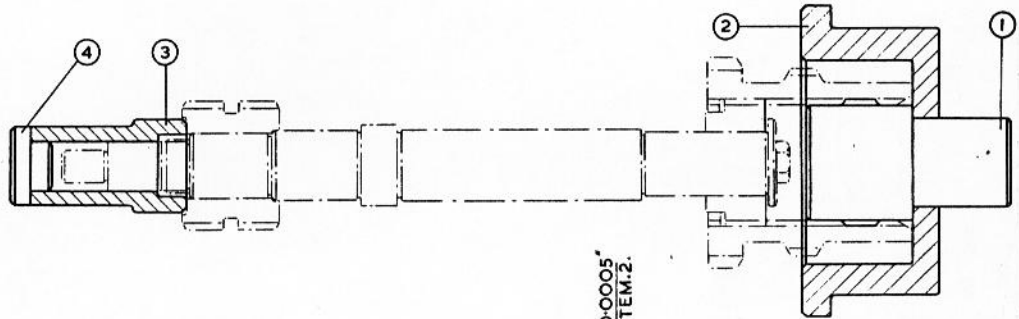
Re-assembling

1. Fit the front tunnel and clutch housing cover plate, interposing the felt strip around its forward edge.
2. Fit the cover plate (item 10) over the gear change unit with the lip of the rubber grommet facing upwards then, with new gasket (item 2) interposed, fit the gear change unit to the gearbox and secure with its four washers and domed nuts.
3. Secure the cover plate over the gear change unit to the front channel, using screws (item 14).
4. Fit the gear lever knob removed from the existing gear lever.

Parts required for fitting the
remote gear change unit

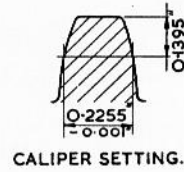
<u>Item No.</u>	<u>Description</u>	<u>Part No.</u>	<u>No. Supplied</u>
1.	Remote gear change unit, including the following parts:-	N.454600	1
2.	Joint washer.	N.454550)	1
3.	Gearbox cover.	N.453830)	1
4.	Selector ball unit (reverse, stamped "R").	N.452750)	1
5.	Selector ball unit.	N.450470)	2
6.	Tabwasher.	N.450590)	2
7.	Stud.	N.454540)	4
8.	$\frac{1}{4}$ in. spring washer.	AGS. 585/D)	4
9.	Dome nut.	N.454250)	4
10.	Cover plate.	N.704192	1
11.	Nut cage.	N.591951	4
12.	Nut $\frac{1}{4}$ in. Whit. square-forged.	-	4
13.	Rivets $\frac{3}{32}$ in. dia. cs'k.	-	8
14.	Screw $\frac{1}{4}$ in. Whit. x $\frac{5}{8}$ in. long, mushroom head, M.S.	-	4

SPECIAL TOOLS



GEAR DATA ITEM 1.

No. OF TEETH.	20
MODULE.	2.5
PRESS ANGLE.	20°
P.C. DIA.	1.968"
ROOT DIA.	1.949" -0.005"



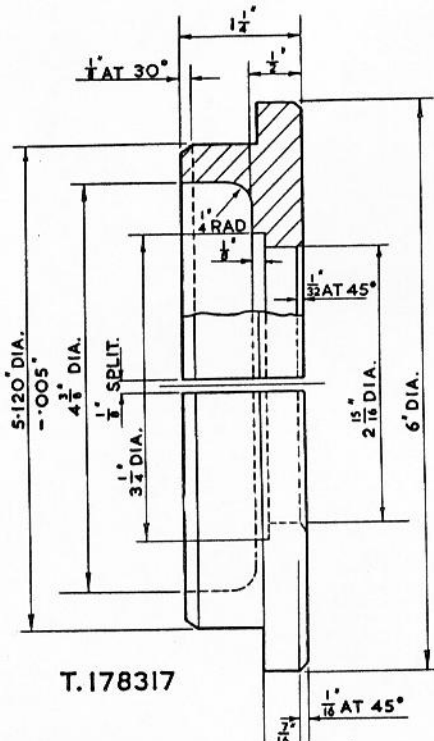
DECIMAL DIMENSIONS IN LIMITS MUST BE MAINTAINED: DIMENSIONS IN DECIMALS WITHOUT LIMITS NEED NOT BE TO SIZE: BUT DESIRED FITS MUST BE MAINTAINED.

C 402/1

T.178550

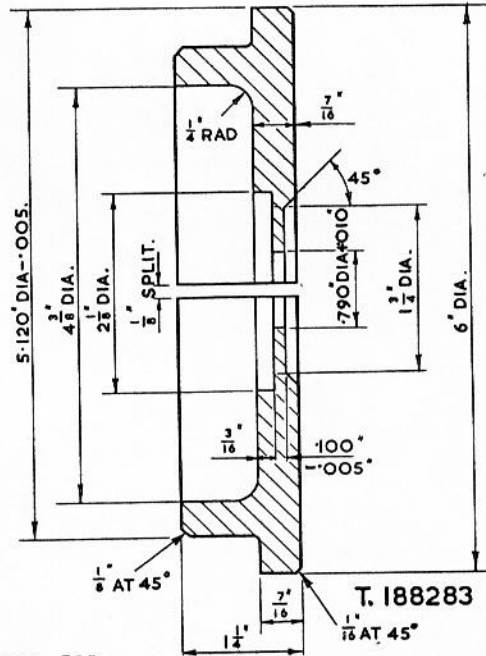
ITEM No.	DESCRIPTION	No. OFF	MATERIAL
1	ADAPTOR	1	MILD STEEL
2	SUPPORT	1	MILD STEEL
3	DRIFT	1	MILD STEEL
4	PLUG	1	UBAS C/HD.&GD.

DRIFT & VICE-ADAPTOR FOR ASSEMBLING MAIN DRIVING SHAFT



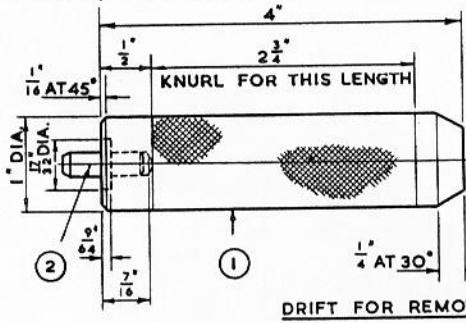
T.178317

SPLIT BUSH FOR
DISMANTLING REVERSE GEAR. 1 OFF-M.S.



T.188283

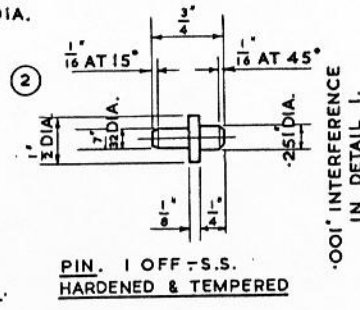
SPLIT BUSH FOR
REMOVING REVERSE GEAR FROM LAYSHAFT. 1 OFF-M.S.



DRILL & REAM .250 DIA.
SEE DETAIL 2.

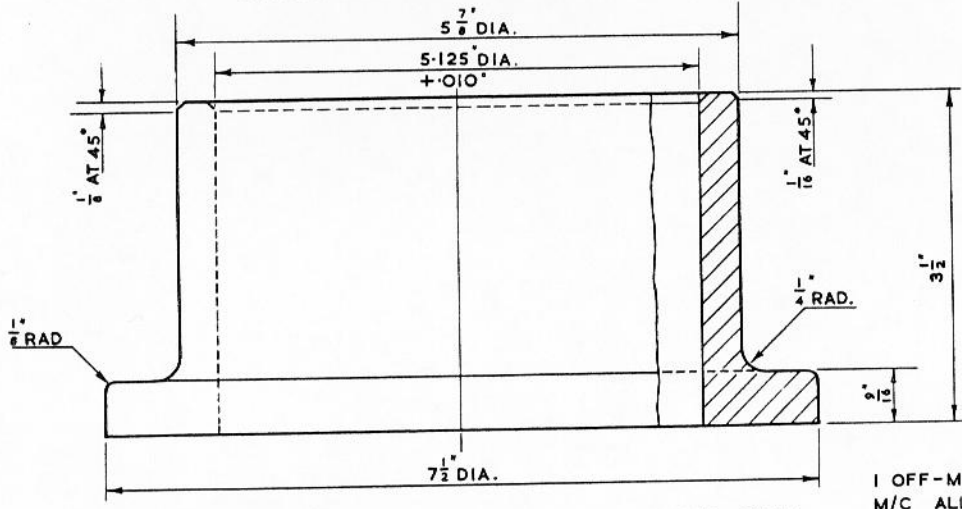
T.178316

1 OFF-UBAS
DRIFT FOR REMOVING REVERSE GEAR.



PIN. 1 OFF-T.S.S.
HARDENED & TEMPERED

.001" INTERFERENCE
IN DETAIL 1.

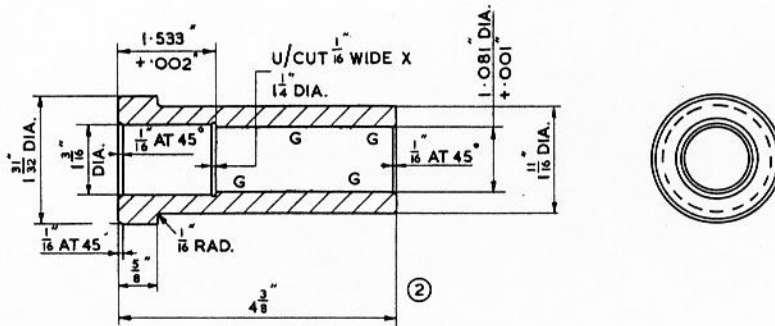
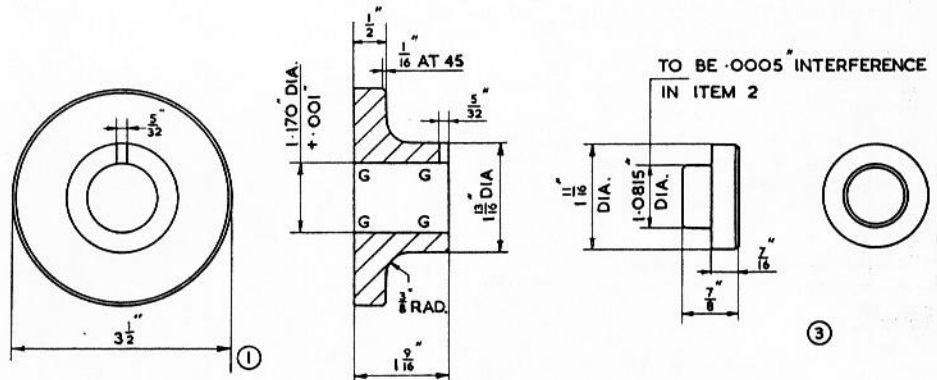
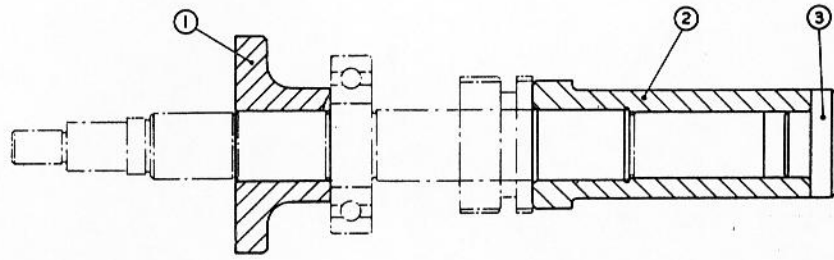


BASE FOR REMOVING REVERSE GEAR FROM MAIN DRIVE SHAFT.

1 OFF-M.S. OR C.I.
M/C ALL OVER.

T.178318

C402/2

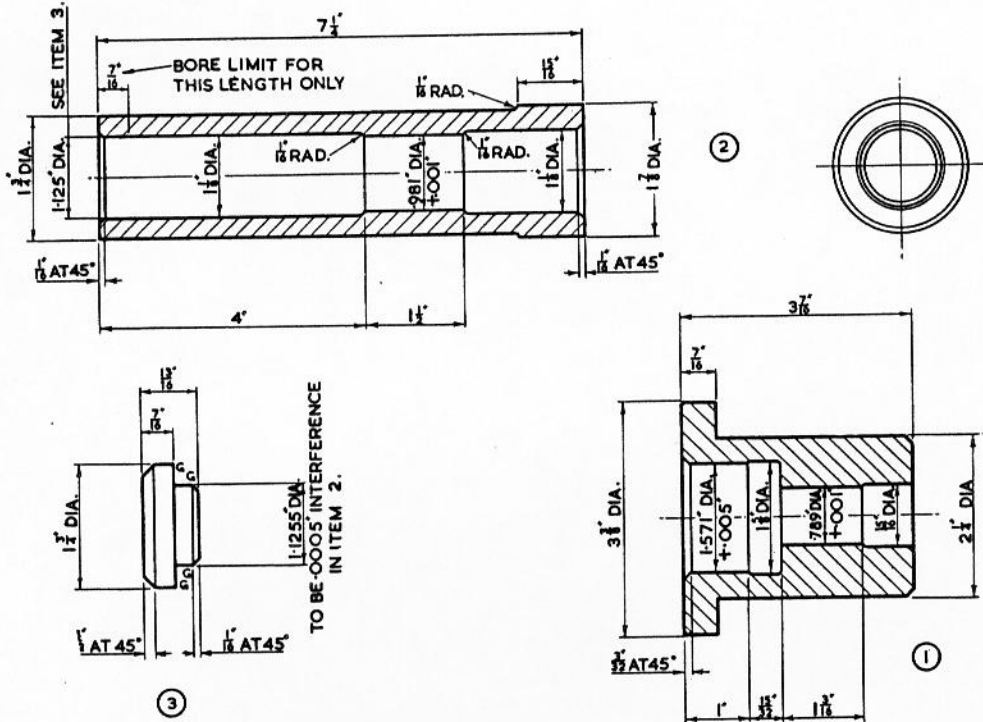
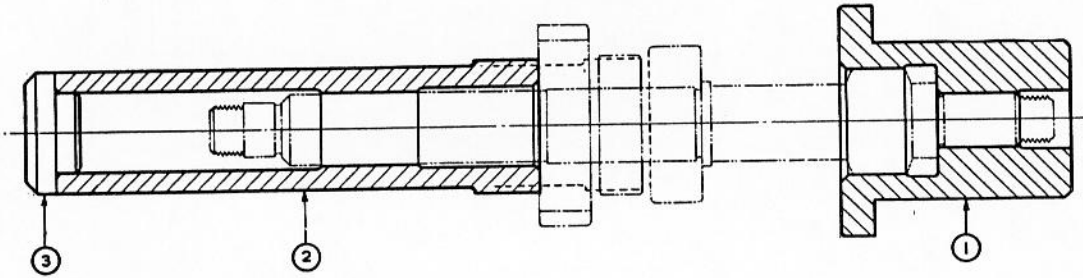


ITEM N ^o .	DESCRIPTION	N ^o OFF	MATERIAL
1	BASE	1	MILD STEEL
2	DRIFT	1	MILD STEEL
3	PLUG	1	UBAS C/HD. AND GROUND.

BASE DRIFT AND PLUG FOR ASSEMBLING MAIN DRIVE SHAFT COMPONENTS

T.178300

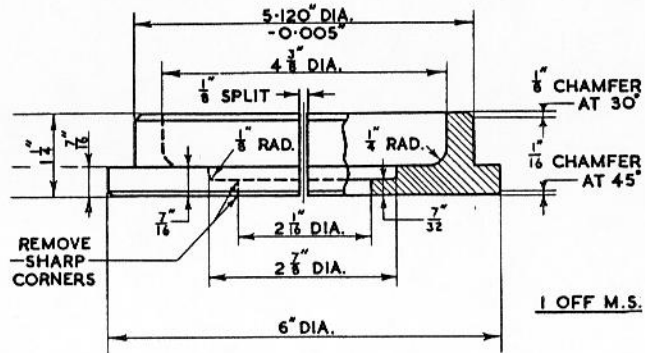
C 402/3



ITEM NO.	DESCRIPTION	Nº OFF	MATERIAL
1	BASE	1	MILD STEEL
2	DRIFT	1	MILD STEEL
3	PLUG	1	UBAS C.H.D. & GD.

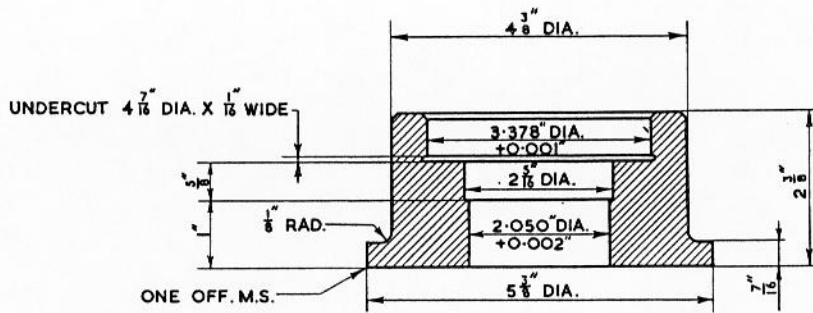
C 402/4

T.178296
TOOL FOR LAYSHAFT ASSEMBLY



SPLIT BUSH FOR DISMANTLING
FIXED HUBS AND FRONT RACE
FROM THE MAIN SHAFT

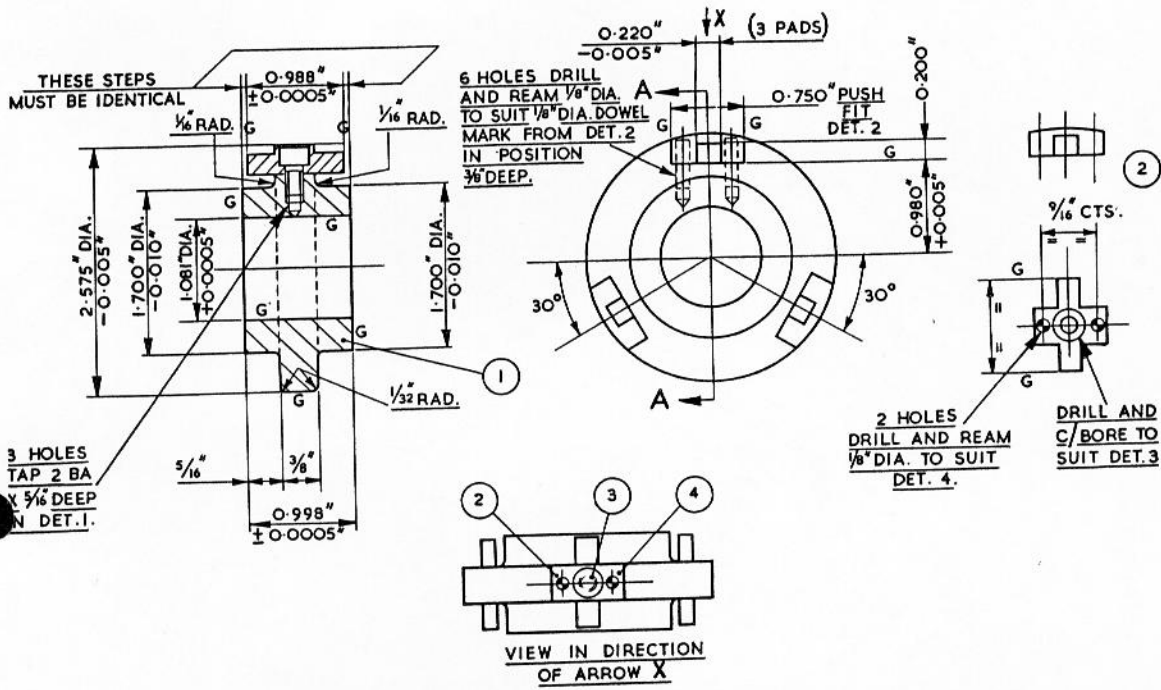
T.F.N. 8699



BASE FOR ASSEMBLING
LAYSHAFT

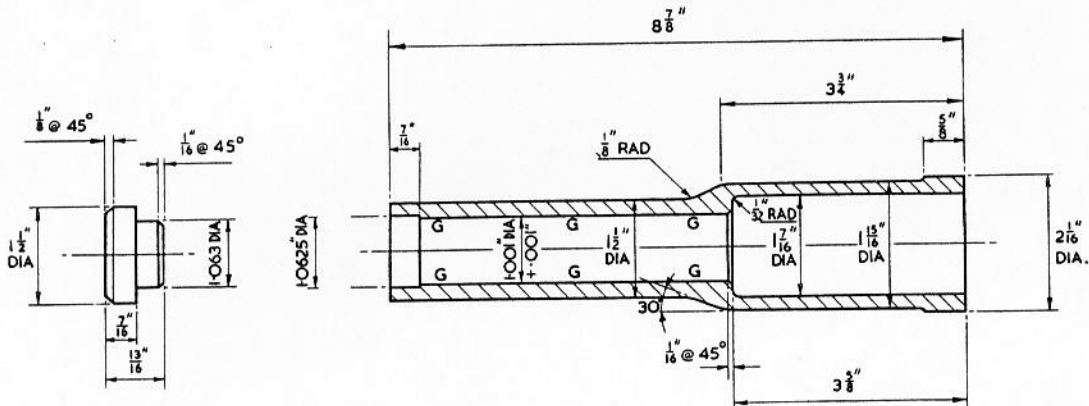
C402/5

T.178298



ITEM	DESCRIPTION	NO. OFF	MATERIALS
1	SLAVE HUB	1	UBAS. C'HD. & GD.
2	LOCATING PAD	3	UBAS C'HD. & GD.
3	CAP HEAD SCREW	3	STD UNBRAKO.
4	DOWEL	6	SILVER STEEL 1/8" DIA.

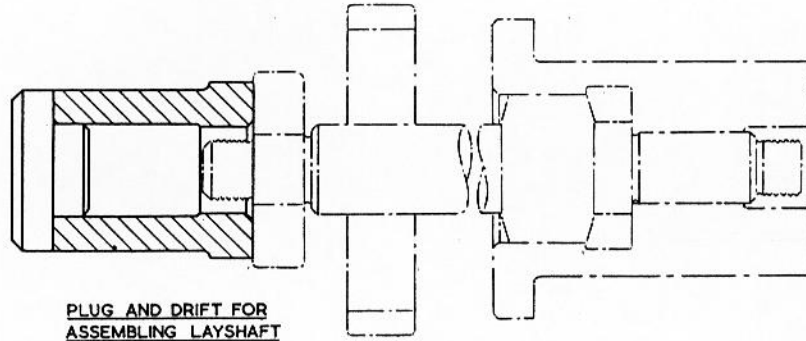
SLAVE FIXED HUB FOR SETTING SYNCHRO ASSEMBLY ON MAIN SHAFT. TFN.8793.



C402/6

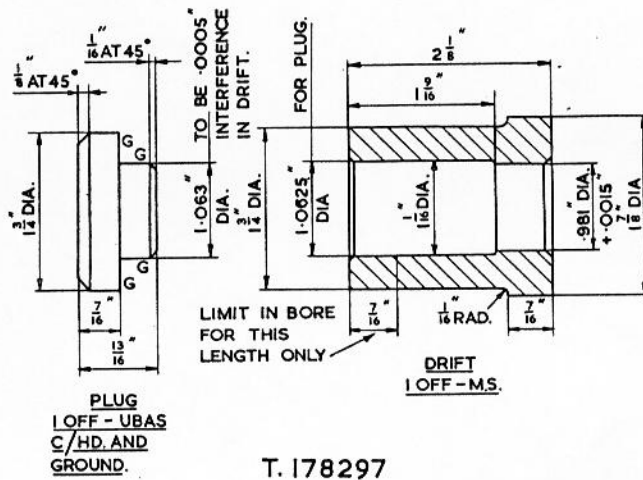
SLAVE FIXING HUB FOR GEARBOX.

T. 178299.

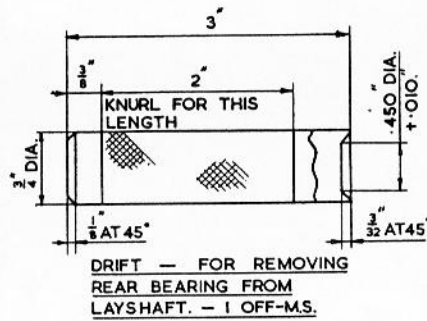


PLUG AND DRIFT FOR ASSEMBLING LAYSHAFT

T. 178297

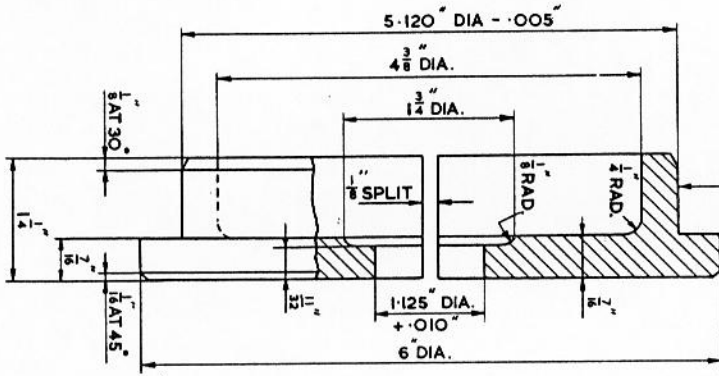


T. 178297



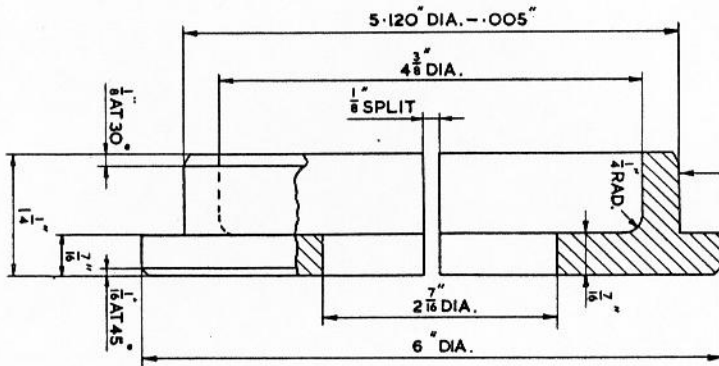
C402/7

T. 178322



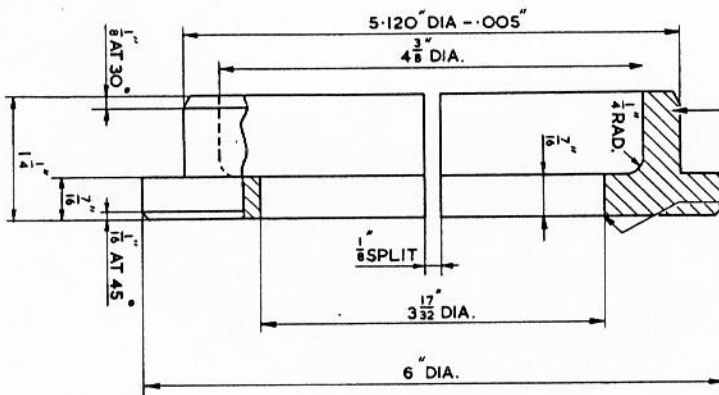
T.178321

SPLIT BUSH — FOR
REMOVING REAR BEARING
FROM LAYSHAFT, -1 OFF-MS.



T.178320

SPLIT BUSH — FOR
REMOVING REAR RACE AND
DRIVING GEAR FROM
LAYSHAFT AND REAR
BEARING FROM DRIVESHAFT
1 OFF-MS.

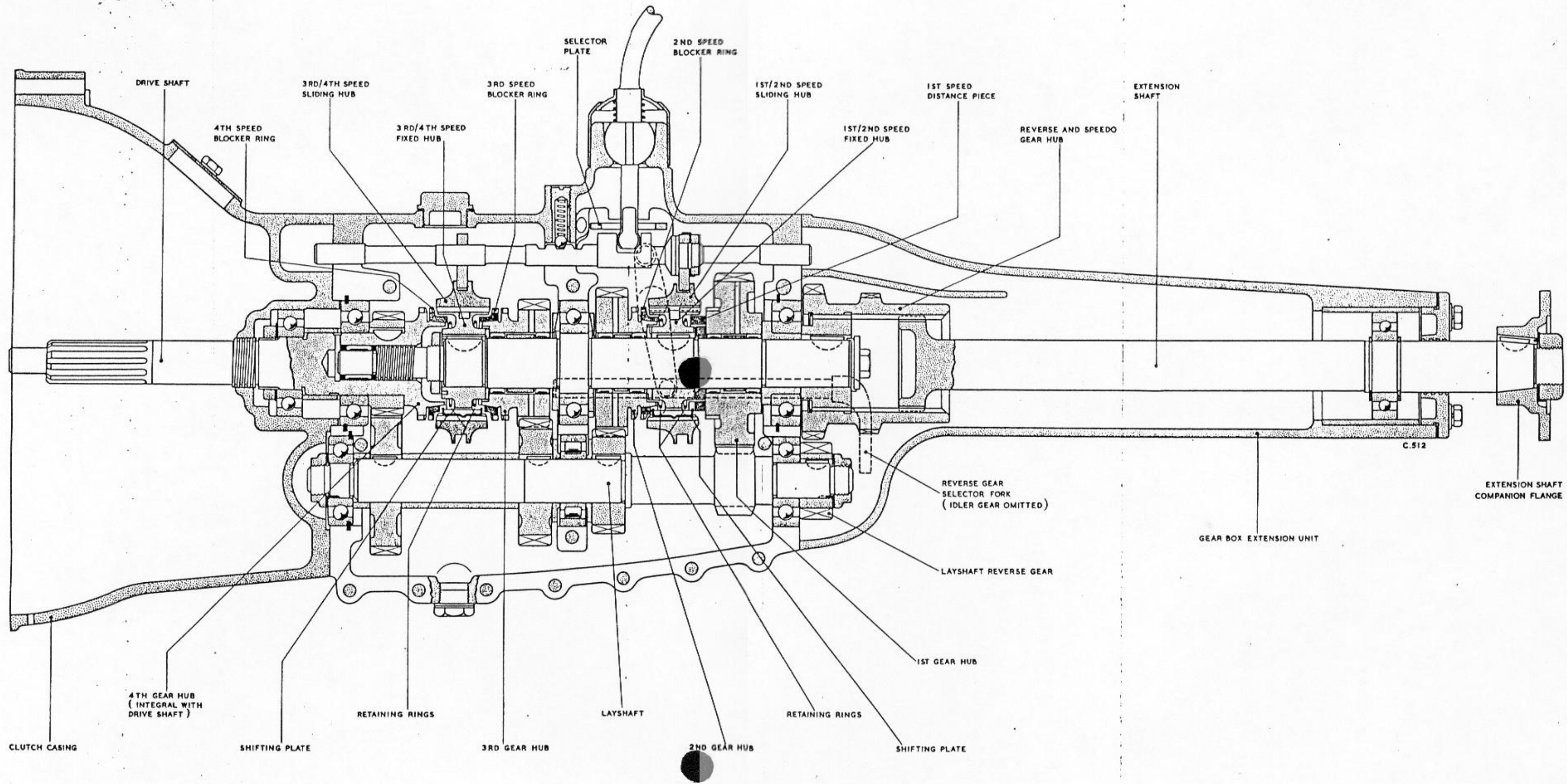


T.178315

SPLIT BUSH — FOR REMOVING
THE 1ST. GEAR, BEARING
LOCATING BUSH AND REAR
BEARING FROM MAINSHAFT.

REMOVE SHARP CORNER

C 402/8



DRIVE SHAFT

3RD/4TH SPEED SLIDING HUB

3RD SPEED BLOCKER RING

SELECTOR PLATE

2ND SPEED BLOCKER RING

1ST/2ND SPEED SLIDING HUB

1ST SPEED DISTANCE PIECE

EXTENSION SHAFT

4TH SPEED BLOCKER RING

3RD/4TH SPEED FIXED HUB

1ST/2ND SPEED FIXED HUB

REVERSE AND SPEED GEAR HUB

C.512

REVERSE GEAR SELECTOR FORK (IDLER GEAR OMITTED)

EXTENSION SHAFT COMPANION FLANGE

GEAR BOX EXTENSION UNIT

LAYSHAFT REVERSE GEAR

1ST GEAR HUB

CLUTCH CASING

4TH GEAR HUB (INTEGRAL WITH DRIVE SHAFT)

SHIFTING PLATE

RETAINING RINGS

3RD GEAR HUB

LAYSHAFT

2ND GEAR HUB

RETAINING RINGS

SHIFTING PLATE