SECTION 5

GEARBOX AND PROPELLER SHAFT

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SERVICE BULLETIN

RECORD SHEET

No.	Subject	Date	Signature
1	"Layrub" propeller shaft.	27. 4. 54.	Cancelled Embodied
2	Fitting remote gear change unit.	27. 4. 54.	Issue #2
3	Gearbox and Propeller Shaft (Type 403)	27. 4. 54.	Cancelled

GEARBOX AND PROPELLER SHAFT

DESCRIPTION

Four types of constant-mesh gearboxes are manufactured. Since all four types are externally identical, the type number is stamped on the right-hand side of the box adjacent to the reverse light switch location.

Types 85A, 85C and C.R./2 have a "Bristol" synchro-mesh mechanism on the 2nd, 3rd and 4th. gears and a freewheel incorporated in the 1st. gear. The three types differ only in gear ratios. The description given in the following paragraphs therefore covers these three "Bristol" type gearboxes. A description of those parts of the latest (B.W.C.R./5) gearbox which differs from the preceeding types (i.e. the "Borg-Warner" synchro-mesh mechanism) is given later in this Section.

The light-alloy casing is split vertically on the bearing centre line, the casing halves being secured together by thirteen bolts, spring washers and nuts. The clutch casing is secured to the front and the gearbox extension to the rear. At the top, the casing is closed by the gearbox cover which houses the gear change lever and encloses the selector shafts.

The gearing comprises three major assemblies, i.e.

The drive shaft group.

The main shaft group.

The layshaft group.

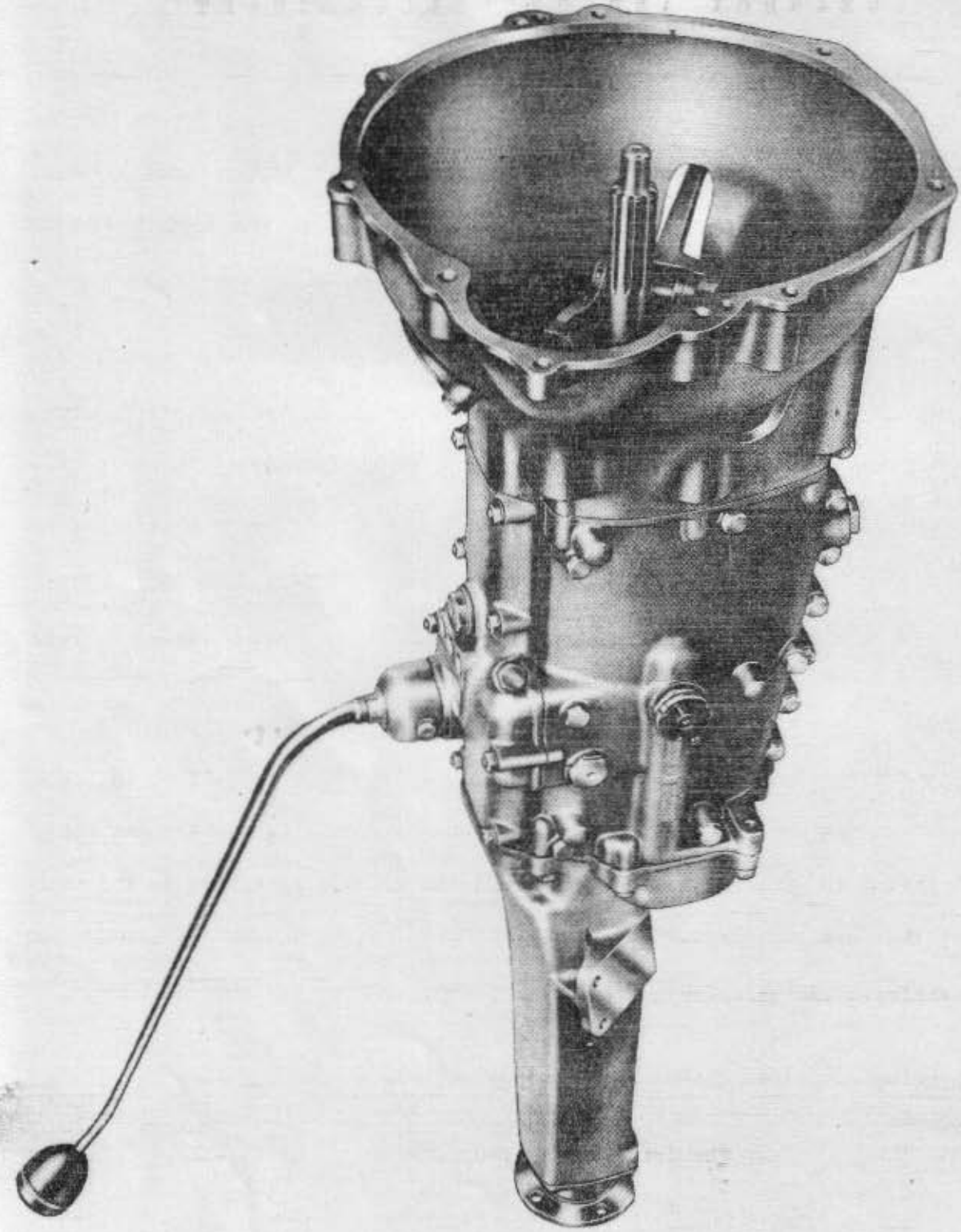


Fig. 1. Gearbox Unit (85C).

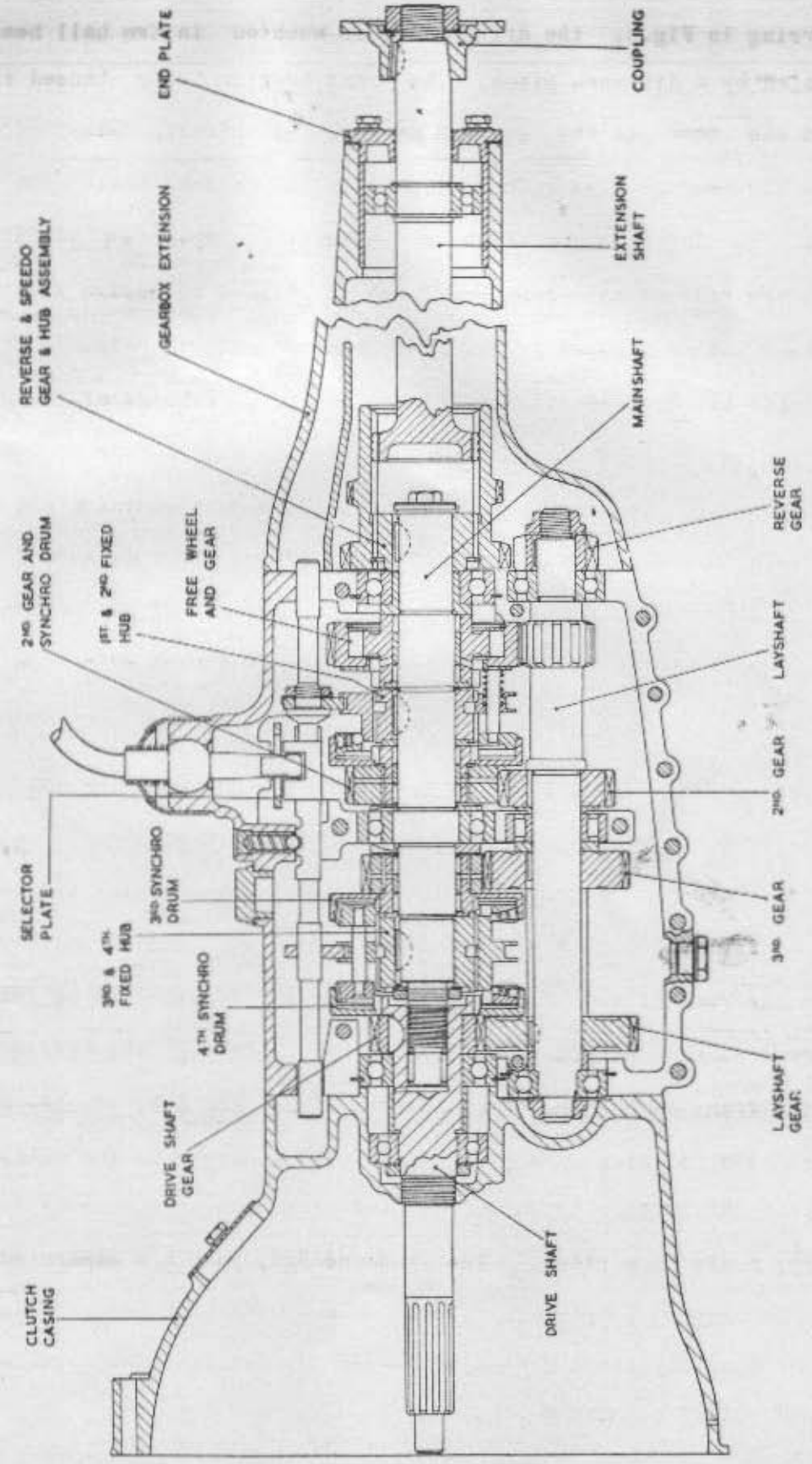


Fig. 2. Section view of 85C Gearbox.

Referring to Fig.2, the drive shaft is mounted in two ball bearings, which are separated by a distance piece, the front bearing being housed in the clutch casing and the rear in the gearbox casing. A circlip which engages mating grooves in the rear bearing outer race and in the casing locates the shaft longitudinally. The forward end of the drive shaft is spigoted to engage the ball bearing in the rear of the crankshaft and is splined to engage the clutch driven plate. Immediately forward of the front bearing, an oil retaining thread in the shaft prevents oil seepage into the clutch casing. Inboard of the rear bearing, the 4th. gear is keyed to the shaft while splines at the rear end mount the 4th. gear synchro drum. The bearings, distance piece and gear are all retained on the shaft by a tabwashered nut at its forward end. The rear end of the shaft is counterbored to accommodate the needle roller bearing of the mainshaft, an oil duct in the drive shaft linking the bearing location with slots in the distance piece.

The mainshaft is supported by a ball bearing in the centre web of the casing, one at the rear of the casing and by the needle roller bearing housed in the counterbore of the drive shaft. It is located longitudinally by a circlip which engages a mating groove in the rear bearing outer race and in the casing. Immediately to the rear of the needle roller bearing location is an integral "quick start" thread which controls the amount of oil entering the bearing. Situated between the front and centre bearings is the 3rd. and 4th. synchro unit assembly, the synchro cone sliding on a fixed hub which is keyed to the mainshaft, while the 3rd. gear and synchro drum are mounted freely on two rows of needle rollers separated by a distance piece. The hub and 3rd. gear are separated by a thrust washer. The centre bearing is located on a raised portion of the shaft and two small steel dowels locate a thrust washer fitted on each side. The thrust washers have radial grooves for bearing lubrication purposes.

Between the centre and rear bearings are mounted the 2nd. gear and synchro drum, the 1st. and 2nd. fixed hub, and the freewheel assembly. The 1st. and 2nd. fixed hub is keyed to the shaft, the 2nd. gear and freewheel assembly being mounted freely on two rows of needle rollers separated by a distance piece. The 1st. and 2nd. synchro cone slides on the splines of the fixed hub and a thrust washer is fitted each side of the hub. The rear bearing is mounted on a flanged locating bush which locates against the rear shoulder of the mainshaft.

Keyed to the mainshaft immediately to the rear of the rear bearing is the reverse and speedo hub, its external splines mounting the reverse and speedo gear which is retained in position by a circlip. This gear is to the rear of the gearbox casing and is enclosed by the gearbox extension unit. All the mainshaft components are secured in position by a tabwashered nut at the front end and a tabwashered set-bolt at the rear.

The layshaft is supported by a ball bearing at the front and rear of the casing and by a roller bearing in the centre web of the casing. Longitudinal location is provided by a circlip which engages mating grooves in the front bearing outer race and in the casing. The layshaft driving gear, 3rd. 2nd. and reverse gears are keyed to the shaft, while the 1st. gear is integral with the shaft. A shoulder on the layshaft, forward of the integral 1st. gear, locates the 2nd. gear while the front and centre bearings and 3rd. gear and layshaft driving gear are positioned in relation to the 2nd. gear by interposed distance pieces, the whole being retained by a tabwashered nut at the forward end of the shaft. The reduced diameter at the rear end of the shaft locates in the rear bearing and extends into the gearbox extension to accommodate the reverse gear which is keyed to the shaft, the gear and bearing being secured to the shaft with a tabwashered nut.

The gearbox casing is closed at the top by the gearbox cover which accommodates the filler cap and gear change lever and encloses the selector mechanism. The slotted ball of the lever locates in a spherical seating in the cover and is enclosed by a ball cover which is secured to the gearbox cover by two spigoted set-bolts. An inner cover is fitted to the lever and locates against the inner face of the ball cover. A spring interposed between the inner cover and the ball of the lever retains the ball in its seating and holds the inner cover against the ball cover, thereby preventing the ingress of foreign matter. The spigots of the cover securing set-bolts locate in the ball slots and prevent rotation of the lever.

The lower end of the lever terminates in a flattened ball-end which locates in the longitudinal slot of a selector plate, the plate being secured to two studs in the cover by ¼in. B.S.F. tabwashered nuts, with distance tubes and washers interposed, and is free to move laterally. To aid engagement of the lever with the selector shafts, a guide block is secured by a set-bolt and spring washer to each side of the slot in the selector plate.

Three selector shafts are housed in bearings in the cover and casing joint faces, each shaft having three locations. The front and rear locations are plain, but the cover portion of each centre location carries a spring-loaded ball which engages with locating slots in the shafts, thereby providing a means of retaining the gear train in the selected position. Mid-way between the centre and front locations of the left-hand shaft, and between the centre and rear locations of the centre shaft, a threaded and shouldered location is provided for the selector forks which operate the synchro units of the 3rd. and 4th. and 1st. and 2nd. gears respectively. Each selector fork is secured to its selector

shaft by a tabwashered retaining nut. The right-hand selector shaft operates the reverse gear and does not carry a selector fork. This is shown in Fig.3 in which the remaining shafts have been removed for clarity. A slot in the side of the shaft engages with a fulcrum lever which is located by a tabwashered pivot pin in the right-hand side of the gearbox casing. The lower end of the fulcrum lever engages in a slot in the reverse selector fork which is carried in two plain locations in the lower right-hand side of the gearbox. The reverse selector fork locates in an annular groove in the bushed reverse idler gear which is mounted on a spindle secured at its forward end to the rear face of the gearbox and supported at its rear end in the gearbox extension. A slot in the right-hand side of the reverse selector fork shaft engages the plunger of the reverse light switch which is mounted centrally on the right-hand side of the gearbox.

The gearbox extension is located by two 3/16in. dowels and is secured by seven nuts and washers, a joint washer being fitted between the joint faces. The rear end of the extension is closed by an endplate with a joint washer interposed, the endplate being secured by four set-bolts. A spiral groove in the bore of the endplate acts as an oil retainer. The bore of the gearbox extension rear end is sleeved to carry the extension shaft single row ball bearing which is secured to the shaft by two bearing retainers (circlips) which locate in grooves in the shaft. The bearing is free to slide in the gearbox extension sleeve. The splined front end of the shaft engages in the internal splines of the reverse and speedo hub and is free to slide in a fore and aft direction. At the tapered rear end of the shaft, the propeller shaft companion flange is keyed and secured by a tabwashered retaining nut.

On the left-hand side of the extension adjacent to the gearbox mating face, vertical and longitudinal housings carry the speedometer gear unit. The vertical housing contains the 1st. reduction driven gear which is driven by the speedo gear of the reverse and speedo hubs, and carries a keyed worm gear. The upper end of the driven gear shaft bears in a cover screwed into the extension and the lower end bears on a thrust pad in the extension casting. The 2nd. reduction driven gear locates in the longitudinal housing and engages with the worm gear. The rear end of the gear shaft bears on a thrust pad in the extension casting and, at its forward end, the shaft is housed in a union screwed into the extension, and is located by a shoulder on the gear shaft which bears against the inner end face of the union. The forward end of the gear shaft is bored and slotted to accommodate the speedometer flexible drive.

An inclined mounting face on each side of the extension carries a rubber mounting block unit which is secured by two bolts, spring washers and nuts. These blocks form the rear support of the engine and gearbox assembly.

The clutch casing is secured by six nuts and spring washers; the studs pass through the rear wall into the casing interior. A joint washer is fitted between the joint faces. The clutch casing rear wall encloses the front bearings of the gearbox and provides a housing which carries the front ball bearing of the drive shaft. A fulcrum block mounted on the front face of the clutch casing rear wall carries the bushed clutch operating lever. The forked or spherical end of the operating lever (dependent upon the type of clutch release bearing) protrudes through a slot in the side of the casing. An inspection port on the top of the clutch casing is closed by a cover which is secured by two set-bolts and spring washers.

GENERAL DATA

Type...	Synchromesh
Number of speeds...	Four forward - one reverse
Synchromesh in	2nd. 3rd. and 4th. gears.
Freewheel in	1st. gear.
Oil capacity	3 pints.

Gear ratios

		Gear	85A	85C	CR/2 and BWCR/5
GEAR TOOTH RATIO	Drive shaft gear / Layshaft gear	-	19/28	19/28	21/26
	Layshaft gear / Mainshaft gear	1	12/35	12/35	12/35
	Layshaft gear / Mainshaft gear	2	19/28	19/28	19/28
	Layshaft gear / Mainshaft gear	3	25/22	24/23	23/24
	Layshaft gear / Mainshaft gear	R	12/28	12/28	12/28
Gearbox Ratio		1	4.3 to 1	4.3 to 1	3.16 to 1
		2	2.172 to 1	2.172 to 1	1.825 to 1
		3	1.295 to 1	1.41 to 1	1.292 to 1
		4	Direct	Direct	Direct
		R	3.44 to 1	3.44 to 1	2.89 to 1
Over-all Gear Ratio (engine to road wheels)		1	16.8 to 1	16.8 to 1	14 to 1
		2	8.47 to 1	8.47 to 1	7.12 to 1
		3	5.06 to 1	5.5 to 1	5.05 to 1
		4	3.9 to 1	3.9 to 1	3.9 to 1
		R	13.4 to 1	13.4 to 1	11.22 to 1

The following backlash, 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. maximum.
	3rd.	0.120in. maximum.
	4th.	0.060in. maximum.
Backlash between (a) sliding and fixed hubs		0.002in.
(b) sliding and gear hubs		0.004in.
Backlash between mating layshaft and mainshaft gears...		0.005in.
Desired fit of bearings of shafts		+0.0003 to -0.007in.
Desired fit of bearings in casings		
Mainshaft front and rear		-0.0014 to -0.0029in.
Mainshaft centre...		-0.0009 to -0.0024in.
Layshaft front		-0.0007 to -0.0022in.
Layshaft centre and rear		-0.0002 to -0.0017in.
Maximum eccentricity of freewheel		0.0015in. (0.003in. clock reading).
Minimum clearance over freewheel pawls		0.0015in.
Maximum clearance of extension shaft bearing in sleeve		0.0026in.
Maximum running clearance of hubs on mainshaft needle rollers		0.002in.
Maximum permissible end-float of gear hubs		0.006in.
Maximum clearance of selector forks in		
(a) sliding hubs...		0.018in.
(b) reverse idler gear...		0.002in.
Backlash of speedometer gear		
1st. Reduction gears		0.011in.
2nd. Reduction gears		0.007in.

MAINTENANCE

After the first 500 miles (800 km.) and at each subsequent 6,000 miles (10,000 km.) the gearbox should be drained of oil and refilled to the level plug

with clean approved oil. At every 3,000 miles (5,000 km.) the level of oil in the gearbox should be checked and, if necessary, replenished. The location of the drain, level and filler plugs is 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 AND REFITTING GEARBOX

1. Raise the right-hand side of the bonnet and disconnect the battery leads.

2. Remove the front seats and floor covering.

3a. (Type 400) Detach the clutch, brake and accelerator pedals from their operating levers.

3b. (Type 401) Detach the clutch and brake pedals from their operating levers then slacken the accelerator pedal clamp screw and swing it clear.

4. Remove the gearbox tunnel covers, floorboards and toeboards.

5. Disengage the clutch return spring from its anchorage bolt and the clutch operating rod from the operating lever fork end.

6. Drain the oil from the gearbox.

7. Disconnect the speedometer flexible drive from the gearbox and the wiring from the reverse light switch.

8. Assemble the engine lifting slings to the engine in the manner described in Section 1, (Removing the engine) and take the weight of the engine. It will be necessary to support the engine until the gearbox is refitted. The engine can be supported at the rear end of the sump by a jack with a suitable piece of wood interposed to spread the load, the jack being left in position until the gearbox is refitted.

9. Disconnect the extension shaft coupling from the flange of the propeller shaft.

10. Detach the gearbox extension from the rear mounting blocks then remove the blocks from the cross-member of the chassis.

11. Raise the rear end of the engine-gearbox assembly sufficiently to clear the flange of the propeller shaft tunnel then adjust the jack fitted beneath the rear end of the sump to hold the parts in this position.

12. Remove the set-screws and bolts securing the clutch casing to engine and the starter to the clutch casing; remove the starter.

13. Withdraw the gearbox unit towards the rear of the car to withdraw the drive shaft from the clutch plate splines. The gearbox unit must not be tilted in relation to the engine during withdrawal; failure to observe this precaution may result in distortion of the clutch plate. Check that the clutch casing locating dowels remain in the rear face of the engine cylinder block. Remove the gearbox.

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

1. 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. Secure the clutch casing to the engine and the starter to the clutch casing with the bolts and set-screws. Lower the jack beneath the sump to align the companion flanges of the extension and propeller shafts.

2. Refit the two rear mounting blocks to the inclined brackets of the chassis cross-member then secure them to the gearbox extension.

3. Engage the spigot of the propeller shaft flange in the recess of the extension shaft coupling then secure the flange to the coupling with bolts, shake-proof washers, nuts and split pins.

4. Remove the engine lifting slings and/or supports.

5. Connect the speedometer flexible drive to the gearbox, and the wiring to the reverse light switch, see Fig.4.

6. Connect the clutch operating rod to the operating lever and refit the return spring to the anchorage bolt. Check the adjustment as described in Section 4.

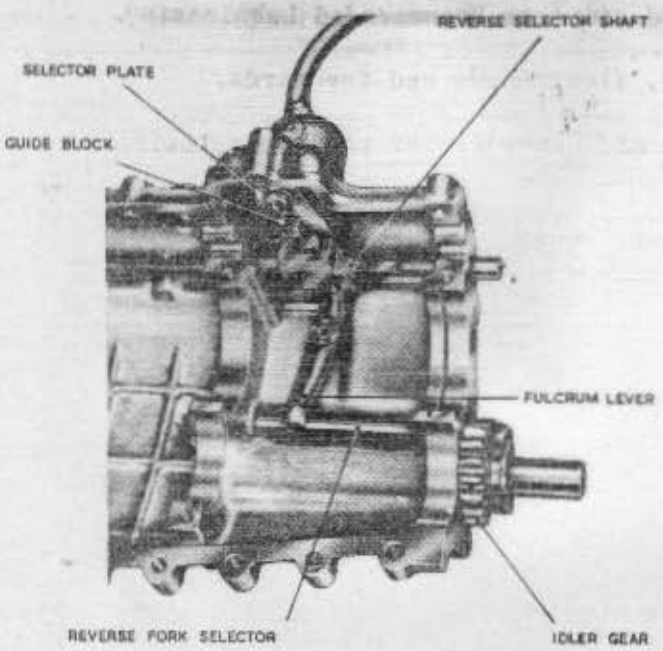


Fig. 3. Reverse Mechanism.

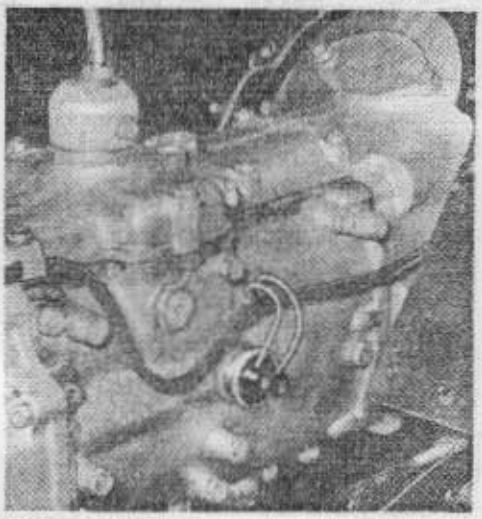


Fig. 4. Reverse Light Switch Wiring.

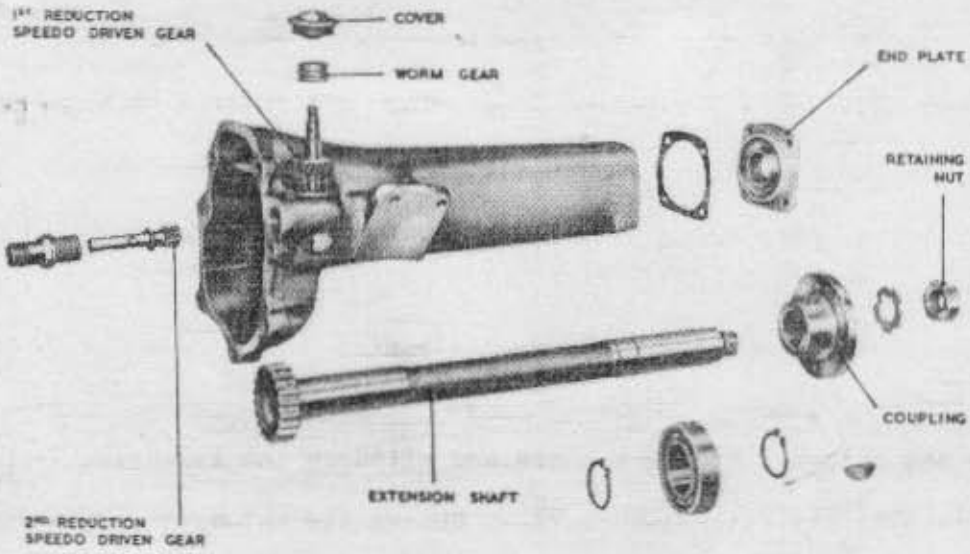


Fig. 5. Gearbox Extension Components.

7. Refill the gearbox with approved oil (see Recommended Lubricants).

8. Refit the gearbox tunnel covers, floorboards and toeboards.

9. Re-assemble the clutch, brake and accelerator pedals to their operating levers.

10. Refit the floor covering and front seats.

11. Reconnect the battery leads.

12. Refit the bonnet.

DISMANTLING ("BRISTOL" TYPE)

Clutch casing

Remove the release bearing from the clutch operating lever as detailed in Section 4, page 9. 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 and remove the pin from the block; remove the lever. Release the tabwasher and remove the set-bolt securing the fulcrum block; 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 from the gearbox, complete with its extension shaft. Remove the set-bolts and spring washers and withdraw the endplate and extension shaft from the extension. Release the tabwasher, remove the retaining nut then withdraw the extension shaft coupling; remove the key and endplate from the shaft. Remove the bearing retainers (circlips) and slide the bearing from the shaft.

Unscrew the speedometer drive union and withdraw the 2nd. reduction speedo-driven gear from the extension. Unscrew the cover and withdraw the 1st. reduction speedo-driven gear complete with its worm gear from its location; 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 spigoted set-bolts securing the ball cover and detach the ball cover, inner cover, retaining spring and lever.

If it is desired to remove these parts from the gear lever, the knob must first be unscrewed from its upper end and the parts passed along and removed at that end of the lever.

Release the tabwashers, remove the nuts and detach the selector plate and its distance pieces and tubes from the gearbox cover. Lift the reverse selector shaft from its half-bearings in the gearbox.

Gearbox

Remove the nuts and bolts then lift off the left-hand side of the gearbox. Remove the layshaft from the gearbox then release the tabwashers and remove the retaining nuts at each end of the shaft. 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 No.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. Press the 2nd. layshaft gear, rear spacing washer and the layshaft centre bearing from the shaft as described for the layshaft driving gear, but using the split bush No. T.178319, then remove its key from the shaft. Reverse the layshaft in the press and, using the drift No.T.178322 and split bush No. T.178321, press the shaft carefully until the rear face of the rear inner race abuts the key in the shaft. Press the rear bearing back into its original position against the shoulder of the shaft then fit the split bush No. T.188283 in the gap which has been made between the reverse gear and the bearing, and remove the gear. Remove the key from the shaft then press off the rear bearing.

Remove the 1st. and 2nd. and the 3rd. and 4th. selector shafts from the gearbox. Lift the drive shaft and mainshaft groups from the gearbox and withdraw the drive shaft from the front end of the mainshaft.

Remove the 3rd. and 4th. synchro from the mainshaft then release the tab-washers and remove the lock-nut from the front end and the special retaining bolt from the rear end of the shaft. Using the drift No.T.178316, base No.T.178317, and split bush No.T.178318, withdraw the assembled reverse and speedo gear and hub from the rear end of the shaft; do not attempt to dismantle these parts. Remove the hub key from the shaft. Assemble the shaft (rear end uppermost) in a press with the split bush No. T.178315 located beneath the front face of the freewheel; press the freewheel, freewheel hub, bearing locating bush and the rear bearing from the shaft. It is recommended that a suitable tray is placed beneath the assembly when this operation is carried out to catch the needle rollers as they are released when the hub is withdrawn. Remove the needle

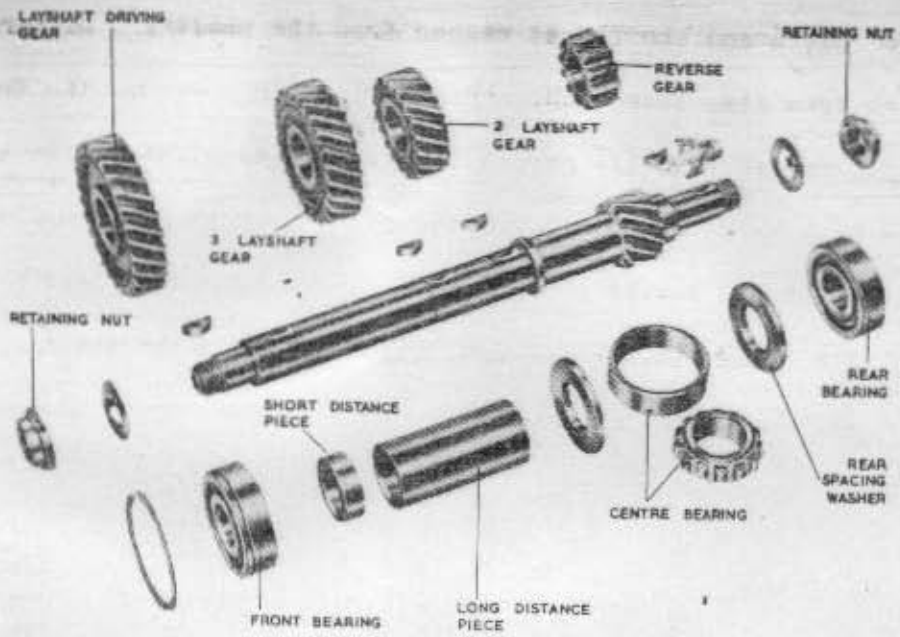


Fig. 6. Layshaft Components

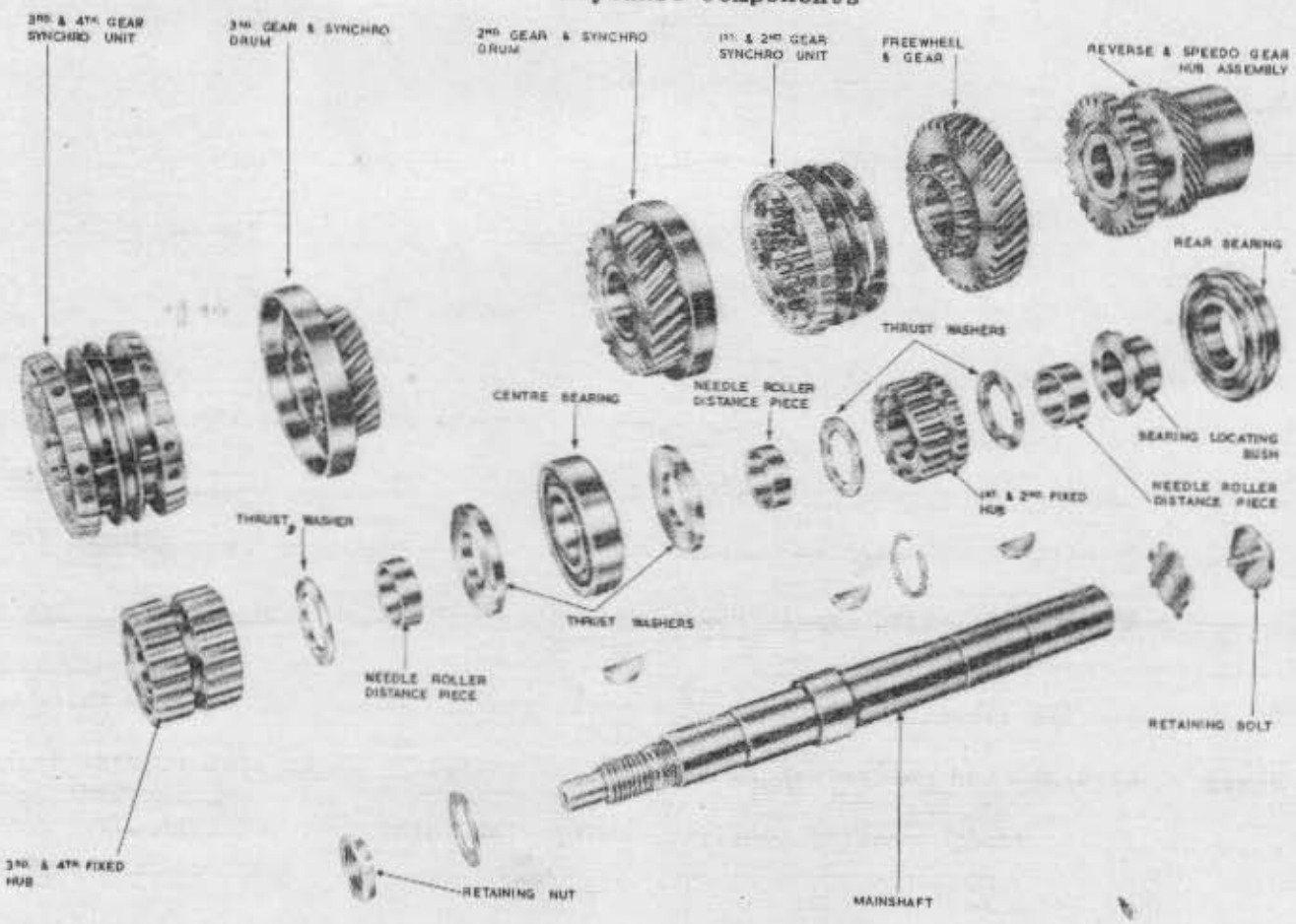


Fig. 7. Mainshaft Components.

roller distance piece and the thrust washer from the shaft and withdraw the 1st. and 2nd. synchro from its fixed hub. Press the hub towards the front of the shaft to relieve pressure on the mainshaft circlip, then remove the circlip and, using the split bush No.T.178319, press the fixed hub from the shaft. Remove the fixed hub key then, 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 mainshaft in the press, locate the split bush No.T.178319 in the recess of the 3rd. and 4th. speed fixed hub and press the hub from the shaft; 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 the loss of needle rollers during this operation.

Withdraw the needle roller bearing from the bore of the drive shaft. Release the tabwasher and remove the bearing retaining nut from the front end of the drive shaft. Using the split bush No.T.178319, press off the front bearing, remove the distance piece and press off the rear bearing with the split bush No.T.178320. Do not remove the 4th. speed gear or 4th. synchro drum from the drive shaft unless the gear is unserviceable. The method to be employed for this procedure is detailed under "Replacements".

Release the tabwasher, unscrew the pivot pin and remove the reverse fulcrum lever. Unscrew and remove the reverse light switch. Slide the reverse fork selector to the rear, simultaneously removing the idler gear and bush from the idler gear spindle; separate the gear from the fork and withdraw the fork selector from the gearbox.

REPLACEMENTS

All gearbox components should be examined carefully and checked for wear on their essential locations. Particular attention should be given to the mating splines of the fixed, sliding and gear unit hubs. Excessive wear at these locations will result in the accumulated backlash of the respective gear trains being beyond the designed limits. Recommended maximum fits for the essential components are quoted in the General Data; for maximum efficiency these fits should not be exceeded.

All bearings should be cleaned thoroughly in paraffin, then lubricated lightly and spun by hand to test for harshness in running. Bearings in which harshness is found or which have excessive wear should be renewed.

It should be noted, however, that certain gear units are subject to selective assembly due to the mating of sliding and fixed hubs and can be supplied only as units. These are as follows :-

(a) 3rd. and 4th. synchro unit, comprising :-

3rd. and 4th. sliding hub

3rd. and 4th. fixed hub

3rd. free hub

3rd. mainshaft gear

3rd. and 4th. synchro drums

Drive shaft

4th. speed gear

Key.

3/16in. diameter balls (20 off)

Springs (20 off)

Grub-screws (20 off)

3rd. and 4th. synchro cones

Distance pieces

(b) 1st. and 2nd. synchro unit, comprising :-

1st. and 2nd. sliding hub

1st. and 2nd. fixed hub

2nd. free hub

2nd. mainshaft gear

2nd. synchro drum

2nd. synchro cone

Distance pieces

3/16in. diameter balls (10 off)

Springs (10 off)

Grub-screws (10 off)

Support ring (2nd. synchro cone)

2nd. sliding hub springs

(c) Reverse and speedo drive, comprising :-

Extension shaft

Hub

Gear

Retaining ring

Where a part of a selective assembly needs replacement, it is recommended that the whole selective assembly should be returned to the manufacturers; e.g. should the 2nd. or 3rd. gear be unserviceable, a replacement gear cannot be

supplied as the gear forms part of a selective assembly. If, however, the selective assembly containing the defective gear is returned to the manufacturer, the gear can be renewed and the assembly returned to the owner in a serviceable condition. As previously stated, no attempt should be made by an owner or agent to remove a gear from its synchro drum. Should a sliding or fixed hub require replacement the whole selective assembly should be returned to the manufacturer.

The layshaft centre bearing of early type gearboxes is of the single row ball bearing type. It is recommended that this bearing should be replaced at overhaul by a roller bearing as fitted to later type gearboxes. The fitment of the new bearing entails replacement of the thrust washers interposed between the bearing and the 2nd. and 3rd. layshaft gears. It is also recommended that if it is necessary to replace a freewheel roller or rollers, a new set of rollers should be fitted to preserve the concentricity of the assembly.

If the 4th. speed gear fitted to the drive shaft is unserviceable it should be removed, and a new gear fitted, in the following manner. Scribe a line across the rear face of the drive shaft serrations and the 4th. synchro drum. This will provide a means of ensuring that, after removal, the synchro drum is re-fitted to the shaft in its original position. Using a suitable hollow drift, located over the drive shaft serrations and against the rear face of the synchro drum adjacent to the serrations, press the synchro drum and 4th. speed gear from the shaft; remove the 4th. speed gear key from the shaft. Ensure that the shaft, key and synchro drum are free from damage marks etc. then refit the synchro drum to its serrations with the scribed line aligned. Fit the key to its keyway then, using a suitable hollow drift, press the new 4th. speed gear into position on the shaft. Check with a 0.0015in. feeler gauge that the front face of the synchro drum and the rear face of the new gear are in full contact.

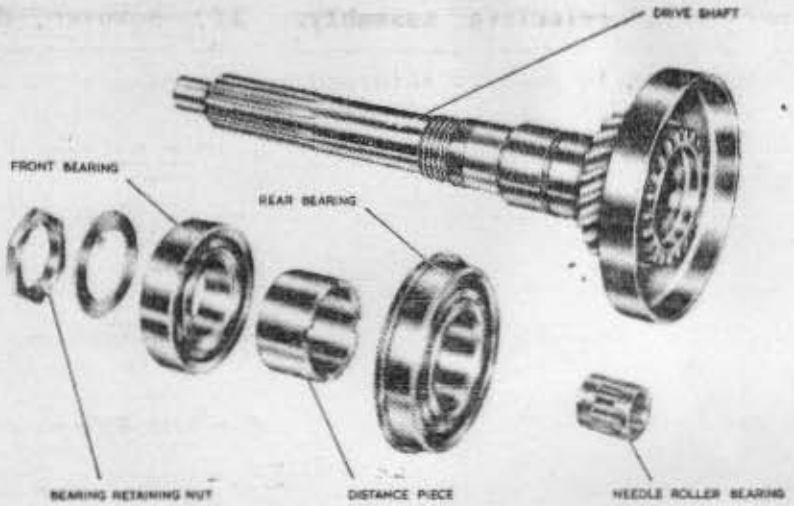


Fig. 8. Drive Shaft Components.

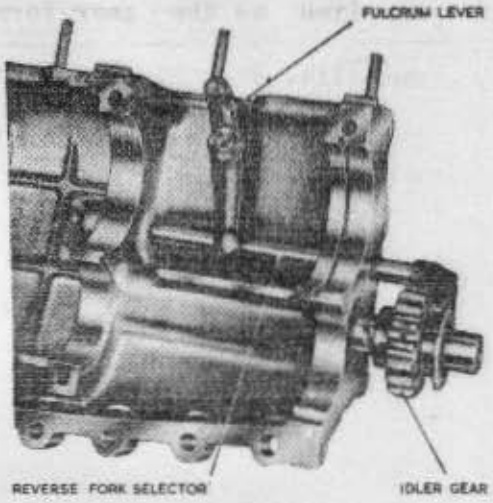


Fig. 9. Reverse Selector Mechanism.

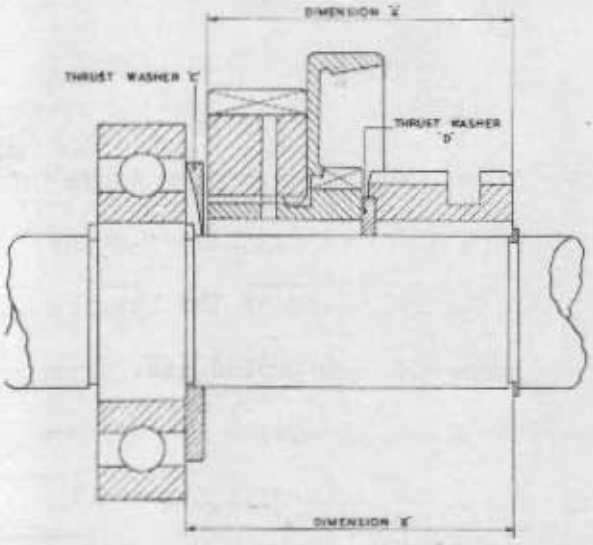


Fig.10. 2nd Gear Adjustment.

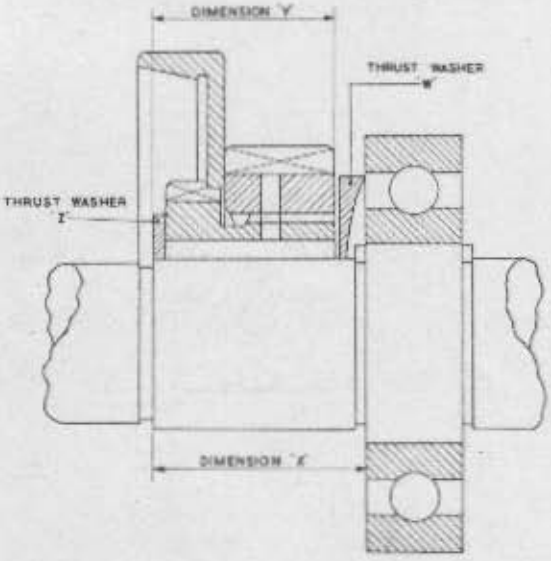


Fig.11. 3rd Gear Adjustment.

RE-ASSEMBLING

Ensure that all parts are serviceable and clean, then proceed to assemble the gearbox in the following manner.

Mainshaft

Mount the mainshaft front ball bearing in the base No.T.178300, and, using the drift, press the mainshaft into position. Check that the bearing is mounted centrally on the raised portion of the shaft. Referring to Fig.10, measure the combined length of the 2nd. gear hub, 1st. and 2nd. gear fixed hub and their interposed thrust washer "D" (dimension "A"). Fit the mainshaft circlip in its groove and, with the circlip bearing against the rear face of the groove, measure the distance between the circlip front face and the rear face of the bearing location of the shaft (dimension "B"). Remove the circlip from the shaft. Add to dimension "A" the desired clearance (0.003in.), then subtract this new dimension from dimension "B". The resulting dimension will be the thickness of the thrust washer "C".

Example :- Dimension "B" - (Dimension "A" + 0.003in.) = Thrust Washer Thickness

Dimension "B" =		2.531in.
Dimension "A" = 2.332in. + 0.003in.	=	2.335in.
Thrust washer thickness ("C")	=	0.196in.

Select a thrust washer of the required size and assemble it to the shaft, locating its slot over the locating pin. Apply sufficient approved grease to the needle roller location of 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 first) over the shaft, and position it on the rollers. Fit the thrust washer "D" to the shaft then insert the fixed hub key. Using the press and the base and drift No. T.178300, align the key with the keyway of the fixed hub and press the shaft into position in the hub. Fit the mainshaft circlip in its groove and pull the fixed hub towards the rear of the shaft so that there is no clearance between its rear face and the circlip. This will ensure that the desired clearance is available between the end face of the gear hub and its thrust washer.

Assemble the 2nd. gear synchro (cone first) to the fixed hub. Fit the 1st. fixed hub thrust washer (recess first) over the end of the shaft and locate it against the circlip. Grease the shaft and fit two rows of 40 needle rollers as described previously with the long distance piece interposed, then assemble the freewheel unit (hub teeth first) to the rollers. If the mainshaft rear bearing has been renewed, press its bearing locating bush into position with the retaining ring groove 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 and the base and drift No.T.178300. Fit the bearing locating ring to the bearing.

Referring to Fig.11, fit the 3rd. gear hub unit in the following manner. Measure the distance between the front face of the raised bearing location of the shaft and the 3rd. and 4th. fixed hub locating shoulder (dimension "X"). Next, measure the combined length of the 3rd. gear hub unit and the thrust washer "Z" (dimension "Y") and add to this dimension the desired clearance (0.003in.). Subtract this new dimension ("Y" + 0.003in.) from dimension "X"; the resulting

dimension will be the thickness of the thrust washer "W". Select a thrust washer of this size and assemble it to the shaft, locating its slot over the locating pin. Assemble the needle rollers and short distance piece to the shaft as described previously, then fit the 3rd. gear hub unit (gear first) to the rollers, followed by the thrust washer "Z". Fit the key to the shaft then, using the press and the base and drift No.T.178550, align the keyway of the 3rd.and 4th. fixed hub with the key and press the shaft into the hub. Secure the hub in position with its tabwashered lock-nut.

Reverse the shaft and fit the key to the keyway in the rear end. Align the keyway of the reverse and speedo hub with the key then press the assembled reverse and speedo gear unit on the shaft and secure in position with the special tab-washered retaining bolt.

Drive shaft

Using the base and drift No.T.178299, press the large diameter drive shaft rear bearing on the drive shaft with its retaining ring groove uppermost. Fit the distance piece (slotted end first) then press the front bearing into position and secure the parts with the tabwashered retaining nut. Fit the retaining ring to the rear bearing.

Layshaft

Fit the 2nd. layshaft gear key to its keyway in the shaft and, using the drift and base No.T.178296, press the shaft into the gear ensuring that its key-way is aligned with the key. Assemble a spacing washer to the shaft as shown in Fig.2 then press on the layshaft roller bearing; fit the second spacing washer then fit the 3rd. layshaft gear key to its keyway in the shaft. Align

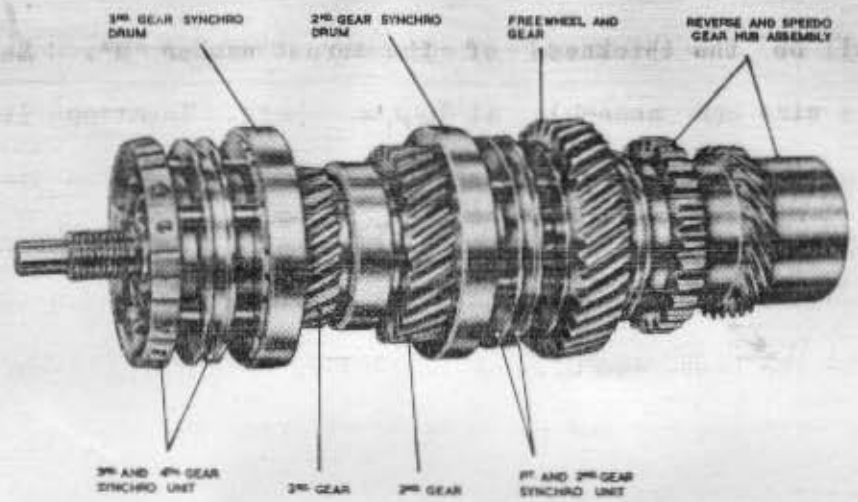


Fig.12. Mainshaft Assembly.

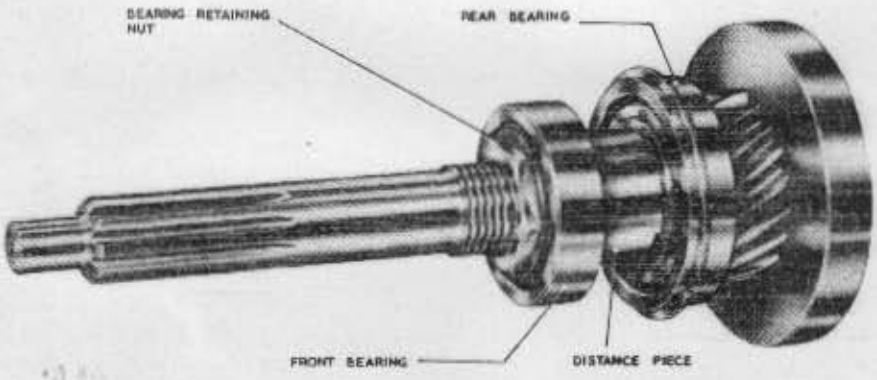


Fig.13. Drive Shaft Assembly.

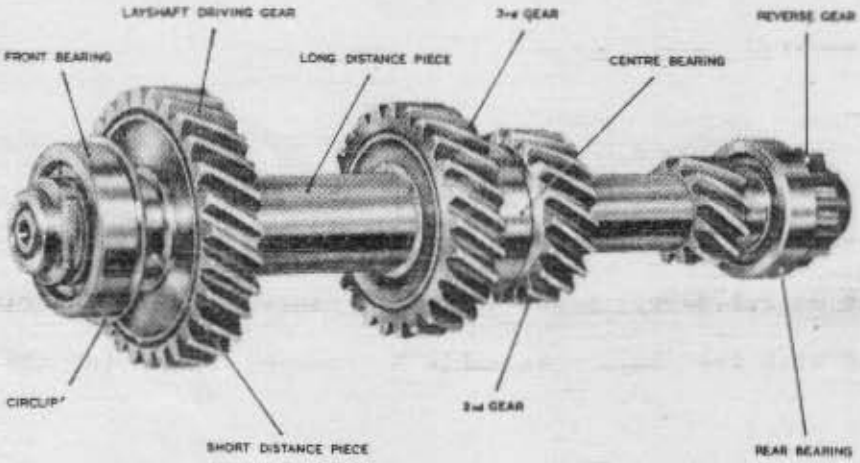


Fig.14. Layshaft Assembly.

the keyway of the gear with the key then press on the 3rd. layshaft gear. Assemble the long distance piece and fit the layshaft driving gear key to its keyway. Align the keyway and key and press on the layshaft driving gear, using the drift No. T.178297. Fit the short distance piece to the shaft, followed by the layshaft front bearing, retaining ring groove first. Secure the assembled bearings, gears and distance pieces with the tabwashered retaining nut. Fit the retaining ring to the front bearing outer race. Using the base No. T.178298 and the drift No.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 tabwashered retaining nut.

Reverse selector mechanism

Fit the fork of the reverse fork selector in its groove in the reverse idler gear, then assemble the selector to the right-hand gearbox casing and fit its bushed idler gear to its spindle, see Fig.9. Screw the reverse light switch into position in the casing with its fibre joint washer interposed. Fit the tabwashered pivot pin to the casing then assemble the reverse fulcrum lever to the pin, engaging its lower end in the slot in the reverse fork selector.

Gearbox

Fit the 3rd. and 4th. synchro and sliding hub assembly to the 3rd. and 4th. fixed hub of the mainshaft then assemble the needle roller bearing to the front end of the shaft. Insert the mainshaft in the bore of the drive shaft, then fit the drive shaft and mainshaft assemblies in position in the right-hand half of the gearbox casing, locating the bearing retaining rings in their grooves. Fit the layshaft assembly to the casing, meshing its gears with those of the main and

drive shafts and engaging the retaining ring of its front bearing in the groove in the casing. Hold the gear shafts firmly in position in the casing and, using feeler gauges, check the backlash between all mating gears.

Refit the 1st. and 2nd. and the 3rd. and 4th. selector shafts to the gearbox and engage their selector forks in the slots of the sliding hubs. Apply a thin even coating of jointing compound to the mating gearbox joint faces then assemble the left-hand gearbox casing to the gearbox, ensuring that the bearing retaining rings are located correctly in their grooves. Fit the gearbox securing bolts, washers and nuts and tighten the nuts to a torque-loading of 7 to 9 lb.ft. Fit the reverse selector shaft in position in the gearbox and engage it with the upper end of the reverse fulcrum lever.

If the gear-change lever and gearbox cover have been dismantled, rebuild them in the following manner. Fit a distance washer and distance tube over each selector plate securing stud, then assemble the selector plate to the studs with the straight shank of the plate fitted to the reverse selector shaft side of the cover, see Fig.16. Fit another distance piece to each stud and secure the assembly with tabwashered nuts. Assemble the gear-change lever to the cover, locating its ball in the cover seating and its lower end in 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 set-bolts in the ball cover with the inserts in the gearbox cover and secure the assembly by fitting the two set-bolts and spring washers, ensuring that the set-bolt spigots engage in the slots of the gear-change lever ball. Arrange the selector shafts in the neutral position and 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.

Gearbox extension

Fit the keyway of the 1st. reduction speedo driven gear shaft and fit the worm gear in position. Position the assembled gears in their extension locations with the lower end of the gear shaft bearing on its thrust pad; screw the cover into position to locate and retain the gear. Assemble the 2nd. reduction speedo driven gear to its drive union then screw the union into position in the extension and ensure that the gear teeth engage correctly with those of the worm gear.

Assemble the extension shaft bearing to the shaft and secure it in position with its two retaining rings. Fit the endplate to the shaft then fit the coupling key and assemble the coupling to the tapered end of the shaft. Secure the coupling with its tabwashered retaining nut which must be tightened 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 endplate with four set-bolts and spring washers. Fit a new joint washer to the rear face of the gearbox, then taking care to ensure that the teeth of the extension shaft and 1st. reduction speedo gear engage correctly with the mating teeth of the reverse and speedo gear, 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, then position the clutch operating lever in the block and insert the fulcrum pin; secure the pin with a new split pin.

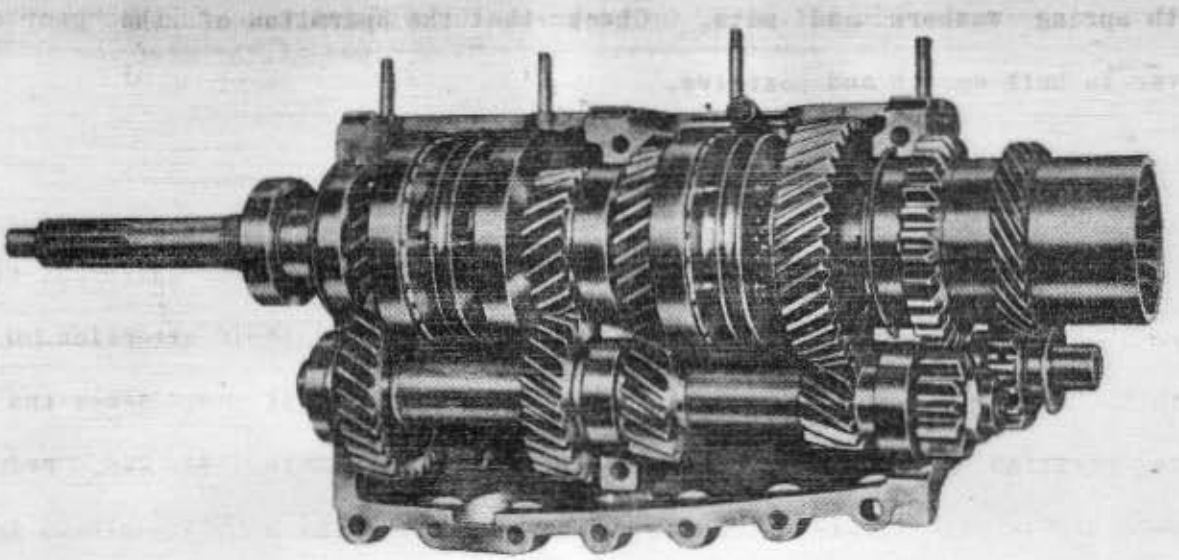


Fig.15. Gears assembled in R.H. Gear Casing.

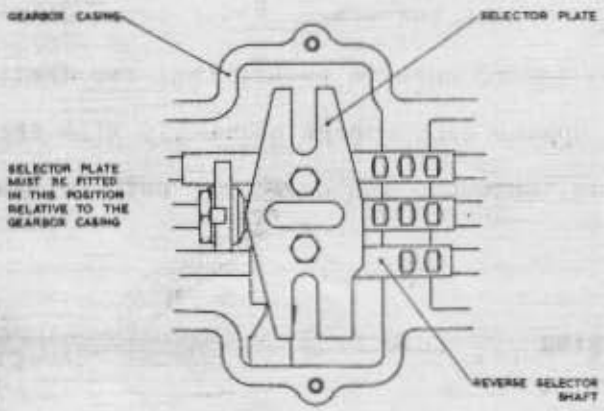


Fig.16. Position of Selector Plate.

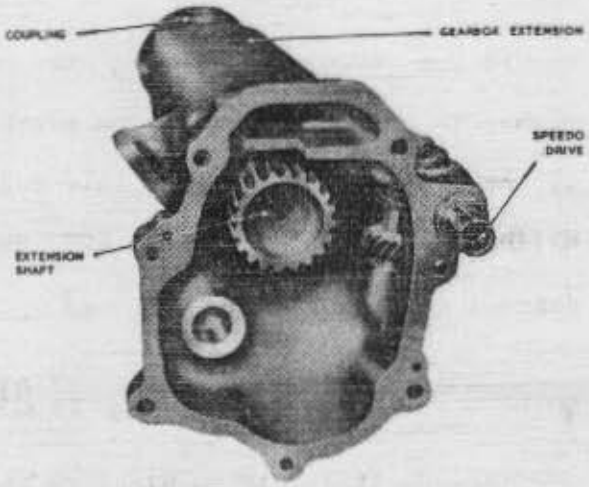


Fig.17. Gearbox Extension.

Note :- On left-hand drive cars, the fulcrum block should be mounted on the left-hand side of the clutch casing rear wall and the operating lever should protrude through the aperture in the left-hand side of the casing. The part should be fitted to the right-hand side and protrude through the right-hand aperture when the car has a right-hand drive.

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, and secure the casing to the gearbox with nuts and spring washers.

Secure a suitable radius arm to the extension shaft coupling and check the backlash in the 2nd, 3rd, and 4th. gears. This should be done in the following manner.

Select the appropriate 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 a 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.

"BORG-WARNER" C.R./5 GEARBOX

With the exception of the synchro-mesh mechanism, the "Borg-Warner" C.R./5 gearbox is identical to the "Bristol" C.R./2 gearbox. This section therefore covers the "Borg-Warner" synchro-mesh system only, and should be read in conjunction with the preceding information for the "Bristol" gearboxes.

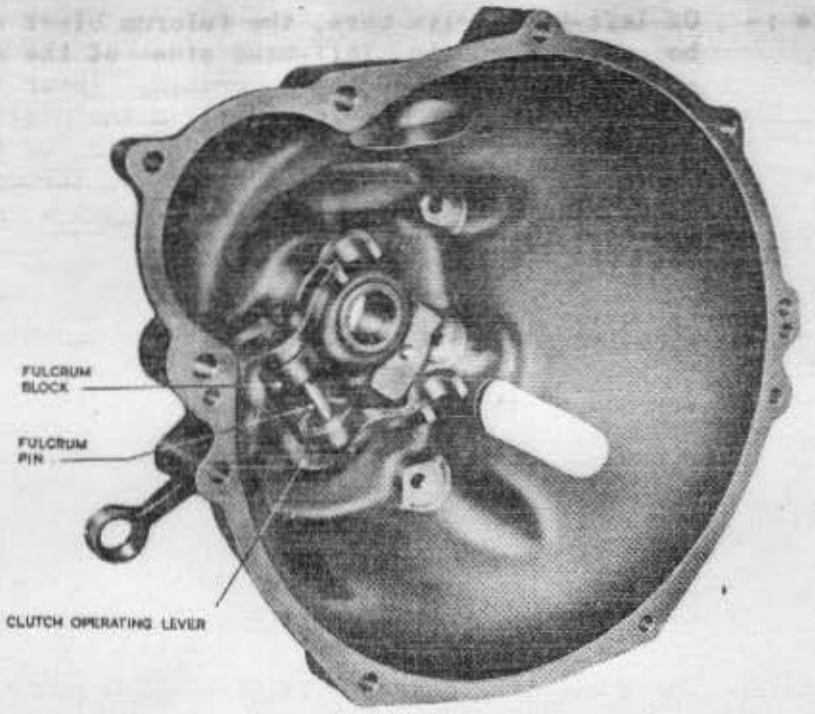


Fig.18. Clutch Casing.

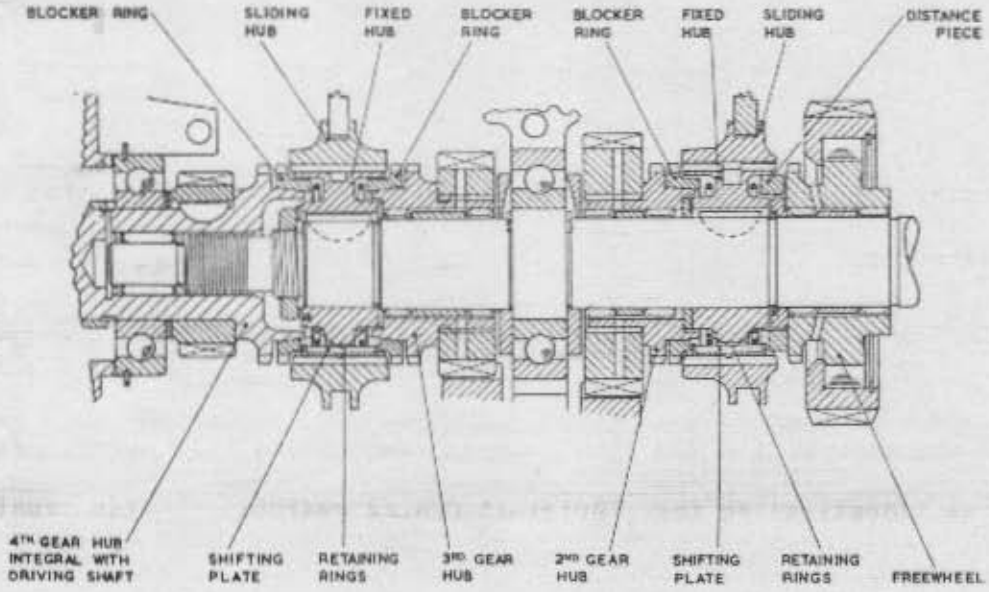


Fig.19. Main and Drive Shaft Assemblies.
(B.W.C.R./5 Gearbox)

Description

The "Borg-Warner" synchro-mesh mechanism comprises a fixed hub which is keyed to the mainshaft and which is splined on its external diameter to engage the mating splines of a sliding hub. Three longitudinal slots on the exterior diameter of the fixed hub provide a location for shifting plates. A small raised portion in each shifting plate locates in a slot in the sliding hub and the plates are held in position against the sliding hub by two retaining rings. The front and rear ends of each shifting plate locate in recesses in the inner faces of externally splined blocker rings. The bore of each blocker ring is tapered to locate on the tapered seating of its mating gear hub. Two blocker rings are fitted to the 3rd. and 4th. gear synchro mechanism and one blocker ring and a parallel distance piece are fitted to the 1st. and 2nd. gear synchro mechanism. The method of operation is as follows. When a gear is selected by operation of the gear lever, e.g. 4th. gear, the selector shaft fork operating in the groove of the 3rd. and 4th. sliding hub, moves the hub towards the 4th. gear hub. The shifting plates are carried forward with the hub and the taper of the 4th. gear blocker ring is brought into engagement with the mating taper of the 4th. gear hub. The continued movement of the sliding hub causes the raised portion of each shifting plate to be lifted from its slot against the pressure of the retaining rings, and the inner splines of the sliding hub move into engagement with the exterior splines of the blocker ring and the 4th. gear hub (driving shaft) thereby completing the gear change.

Dismantling

Dismantle the gearbox in the manner described for the "Bristol" gearboxes but when separating the drive shaft from the mainshaft, remove the 4th. gear

blocker ring, one retaining ring and the shifting plates and withdraw the sliding hub from the 3rd. and 4th. fixed hub. Continue to dismantle the assembly as described previously then, after removing the freewheel assembly, withdraw the 1st. and 2nd. sliding hub, distance piece, shifting plates and retaining ring. Remove the 3rd. and 4th. and the 1st. and 2nd. fixed hubs in a press, using the split bush No.TFN.8699, and remove the remaining blocker rings and retaining rings. Complete the dismantling as described previously.

Replacements

This gearbox is not subject to the amount of selective assembly necessary with the "Bristol" gearbox. The only selective assemblies are the 2nd. and 3rd. gear units and the reverse and speedo unit.

Re-assembling

With the exception of the mainshaft and drive shaft assemblies and the forward speed selector forks, the gearbox assembly procedure is as described for the "Bristol" gearbox.

Fit the mainshaft centre bearing and the 1st. and 2nd. gear hubs and synchro in the manner detailed for the "Bristol" gearbox then proceed as follows. It is necessary to assemble the "slave" fixed hub No.TFN.8793 to the mainshaft and to secure it in position with the hub lock-nut; with the slave hub assembled, measure dimension "A", see Fig.20.

Measure dimension "B" on the 3rd. gear hub unit. Remove the "slave" hub from the mainshaft then assemble the 3rd. gear hub unit, blocker ring and "slave" hub and secure with the lock-nut. Press the 3rd. gear hub unit forward so that

the cones of the blocker ring and hub are in contact then measure dimension "C". Add dimension "B" to dimension "C" and subtract the result from dimension "A". This will give dimension "D". Select a washer "X" to the nearest size smaller 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. below dimension "E", for fitment at "C".

Example :-

Dimension "A"...	1.750in.
Dimension "B"... ... ... 1.388in.	
Dimension "C"... ... ... 0.215in.	
Dimension "B" + "C"...	1.603in.
Dimension "D"...	0.147in.
Dimension "A"...	1.750in.
Dimension "B"... ... ... 1.388in.	
Washer "X" ... ... 0.145in.	
Dimension "B" + Washer "X"..	1.533in.
Dimension "B"...	0.217in.
Minus 0.003in. to 0.007in. - say 0.005in.	0.005in.
Thickness of Washer "Y"	0.212in.

Assemble the selected thrust washer "Y" to the front face of the centre bearing, locating its slot over the locating pin. Apply sufficient approved grease to the needle roller location of the shaft to retain the rollers then fit 40 needle rollers, followed by a long distance piece and a further 40 needle

rollers. Fit the 3rd. gear hub unit (gear first) to the rollers followed by the thrust washer "X", the 3rd. gear blocker ring and the "slave" hub, then secure the parts temporarily with the lock-nut.

Referring to Fig.21, measure dimension "A" in the gearbox casing, then measure dimension "B" on the bearing. Subtract dimension "B" from dimension "A" and obtain dimension "C". Fit the bearing to the drive shaft so that it bears against the front face of the gear, then assemble the needle roller bearing to the mainshaft and the 4th. gear blocker ring to the drive shaft. Fit the mainshaft to the drive shaft and assemble them to the gearbox, locating the rear bearing retaining ring in the groove of the rear bearing location. Press the drive shaft rearwards until the 3rd. and 4th. gear blocker rings are just contacting their respective drums then measure dimension "D", i.e. the distance from the front face of the gearbox to the front face of the front bearing outer race. Remove the mainshaft and drive shaft assemblies from the gearbox and remove the drive shaft bearings. Subtract dimension "C" from dimension "D" and obtain "F", the thickness of washers required between the rear face of the drive shaft bearing and the drive shaft gear. Washers 0.010in. thick and 0.020in. thick are available; it will not always be possible to fit the exact thickness of washers at this location so fit washers to the nearest dimension obtainable below dimension "F", i.e. if "F" is 0.075in., fit washers 0.070in. thick (3 off 0.020in.and 1 off 0.010in. washers).

Fit the selected washers to the drive shaft then press on the drive shaft rear bearing followed by the distance piece, front bearing, tabwasher and lock-nut; tighten the lock-nut and secure with the tabwasher.

Remove the lock-nut and "slave" hub from the mainshaft then fit the fixed hub key to the shaft keyway. Fit the rear retaining ring to the fixed hub then align the hub keyway with the mainshaft key and using the split bush No.TFN.8699, and a suitable drift, press on the hub; secure the hub with its tabwashered lock-nut. Fit the shifting plates and front retaining ring to the fixed hub then fit the sliding hub. Fit the 4th. gear blocker ring to the drive shaft then assemble the shaft to the mainshaft and fit the assembly to the left-hand gearbox casing, locating the bearing retaining rings in the appropriate grooves.

Fit the selector fork and its original adjusting washers to the 3rd. and 4th. selector shaft and secure temporarily, then position the shaft and fork in the gearbox. Fit the gearbox cover, complete with gear-change lever etc., to the left-hand side of the gearbox casing and secure it to the casing studs. Operate the gear-change lever to select the 3rd. and 4th. gears in turn and check the engagement of the sliding hub with the drive shaft and 3rd. gear hub, see Fig.22. Add or remove distance washers between the selector fork and the collar of the selector shaft, as necessary, to equalise the engagement, then secure the selector fork by tightening its lock-nut and applying the tabwasher lock-tab.

A similar check should next be made on the 1st. and 2nd. speed gears to ensure adequate engagement of the sliding hub with the 2nd. gear hub. Full engagement of the hub with the 1st. gear hub is assured under all conditions of assembly.

Remove the gearbox cover assembly when these checks have been completed satisfactorily, then complete the gearbox re-assembly in the manner detailed for the "Bristol" gearboxes.

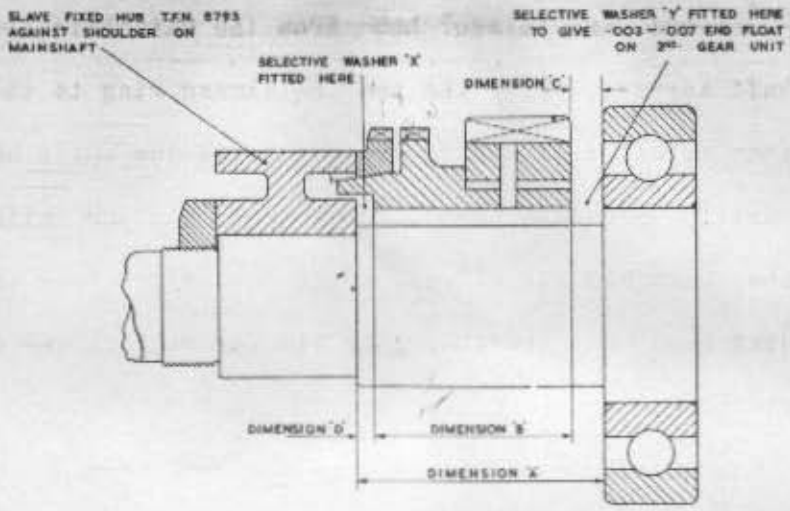


Fig.20. Method of assembling 3rd and 4th Synchro Unit (Borg-Warner).

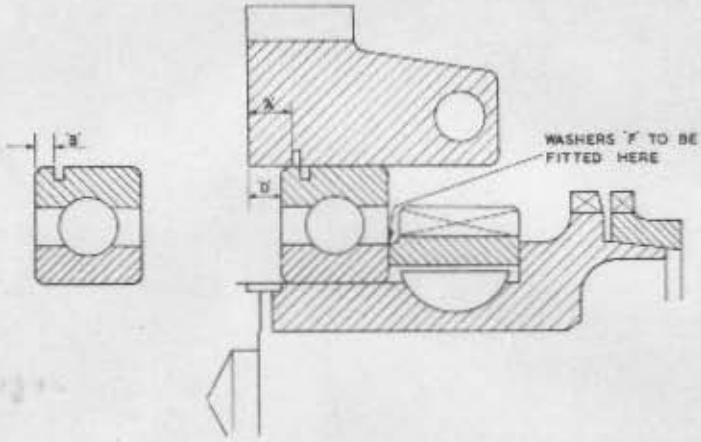


Fig.21. Adjusting 3rd and 4th Gear Blocker Ring Engagement.

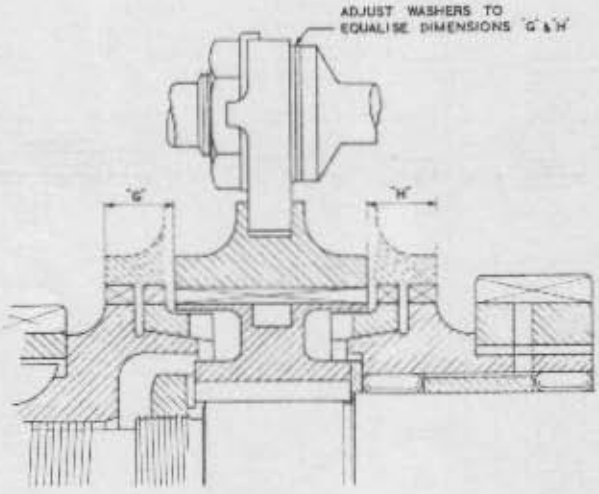


Fig.22. Adjusting 3rd and 4th Gear Sliding Hub Engagement.

PROPELLER SHAFT

Description

The propeller shaft is of tubular steel construction and links the extension shaft companion flange with the companion flange of the differential driving pinion. At each end of the shaft is an integral yoke which engages with two opposite arms of a four arm journal assembly. An enclosed needle bearing assembly fitted to each arm locates in the bore of the yoke arm 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 hollow arms of the journal. A flanged yoke is fitted to the remaining arms of each journal assembly in a similar manner and is secured to the extension shaft companion flange, or to the driving pinion companion flange, by four bolts, shake-proof washers, slotted nuts and split pins.

All type 400 and 402 cars and early type 401 cars are fitted with a 2in. diameter propeller shaft but later type 401 cars are fitted with a 2¼in. diameter propeller shaft. Either shaft will fit any of the "Bristol" cars providing that the companion flanges on the gearbox and differential unit are of the correct type, i.e. larger companion flanges are fitted with the 2¼in. diameter propeller shaft. It is important that when a replacement gearbox or differential unit is to be fitted, a check should be made to ensure that the correct diameter companion flanges are fitted.

Removing and refitting

Working from beneath the car, withdraw the split pins and remove the nuts and bolts securing the companion flanges of the propeller shaft to those of the

gearbox and differential unit. Push the gearbox extension shaft companion flange forward to break the joint with the propeller shaft front companion flange then pull the propeller shaft forward to break the rear joint with the differential unit companion flange; remove the propeller shaft.

Refit the propeller shaft in the following manner. Ensure that the joint faces and spigots of all the companion flanges are cleaned and undamaged then fit the rear flange to the companion flange of the differential unit, align the bolt holes and secure the flanges with four bolts, shake-proof washers, nuts and split pins. Ensure that the extension shaft of the gearbox is pushed as far as possible into the gearbox extension then raise the forward end of the propeller shaft and align its companion flange with that of the extension shaft. Push the extension shaft rearwards to engage its companion flange with that of the propeller shaft then secure the flanges with four bolts, shake-proof washers, nuts and split pins.

Dismantling

Remove the circlips from the yokes of the propeller shaft and companion flanges then support one yoke arm of the propeller shaft on a hollow wood block and using a suitable metal drift tap the opposite bearing cap into the yoke thereby forcing the other bearing cap out of its location in the yoke arm. Remove the displaced bearing cap and rollers. Reverse the assembly, tap out the other bearing cap and remove the cap and rollers. The coupling journal may then be removed by pushing one journal arm into its bearing cap aperture in the yoke arm and turning the journal sufficiently to clear the opposite yoke arm. Remove the remaining bearing caps and rollers in a similar manner.

Note :- As the removal of the bearing caps invariably results in damage being caused to the parts it is recommended that the propeller shaft couplings are only dismantled if known to be defective. It is also recommended that a new journal, bearing caps and roller assembly is fitted and that new parts should not be intermixed with old.

Re-assembling

Assemble the journal complete with its oil retaining collars to the yoke arms of its companion flange. Coat the inside of each bearing cap with approved grease and assemble the needle rollers to the cap. Smear a small quantity of the same grease in the bore of the yoke arm and on the exterior of the bearing cap then, holding the journal so that one arm projects through the yoke, fit the bearing cap/roller assembly to the arm, ensuring that the rollers are not displaced. Using a suitable drift and a hand-press, press the bearing cap into position in the yoke arm. Press the remaining bearing caps into position in a similar manner then secure each cap by fitting a new circlip.

When all bearing caps and circlips have been fitted, tap the shoulders of each yoke sharply with a hide mallet so that the bearing caps are brought to bear against the inner faces of the circlips. Test the joint for freedom of movement then lubricate the assembly with approved grease (see Recommended Lubricants) via the lubricator fitted to the journal.

Rebuild the other universal joint in a similar manner.

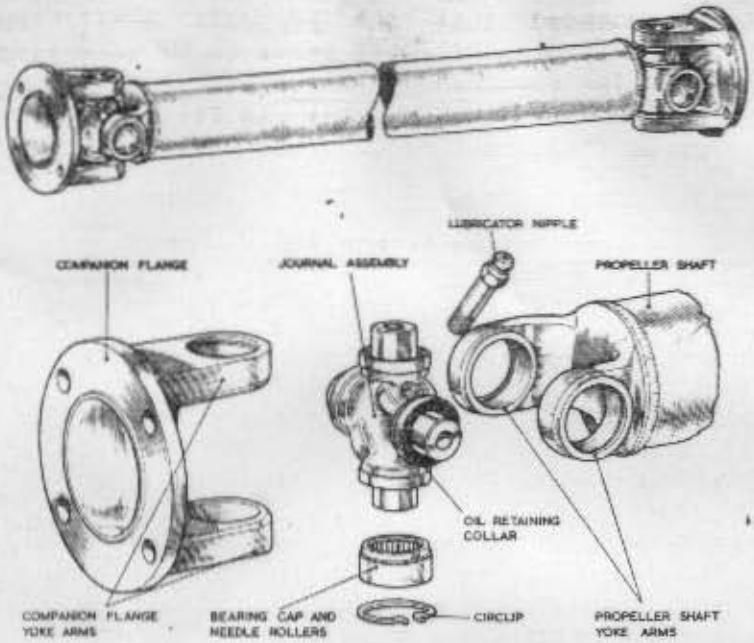
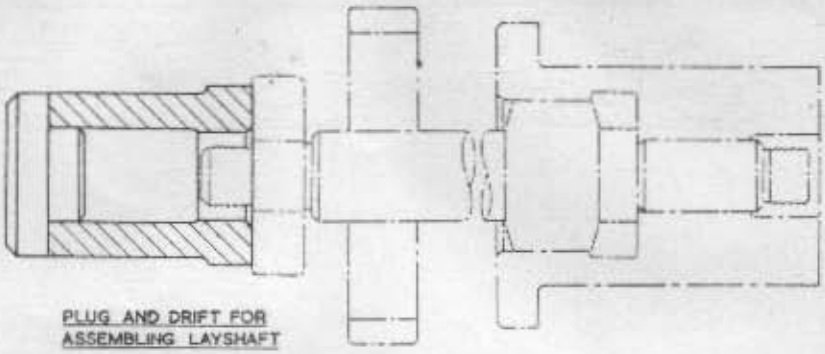


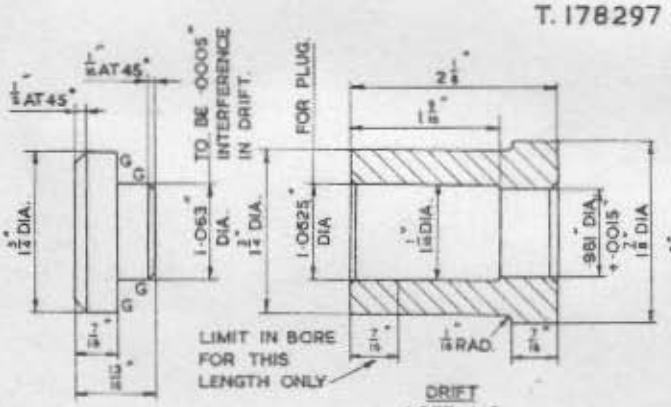
Fig. 23. Propeller shaft

SPECIAL TOOLS

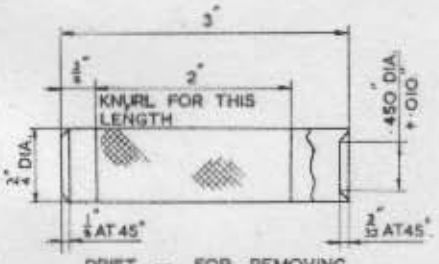


PLUG AND DRIFT FOR ASSEMBLING LAYSHAFT

T. 178297



DRIFT
1 OFF - M.S.

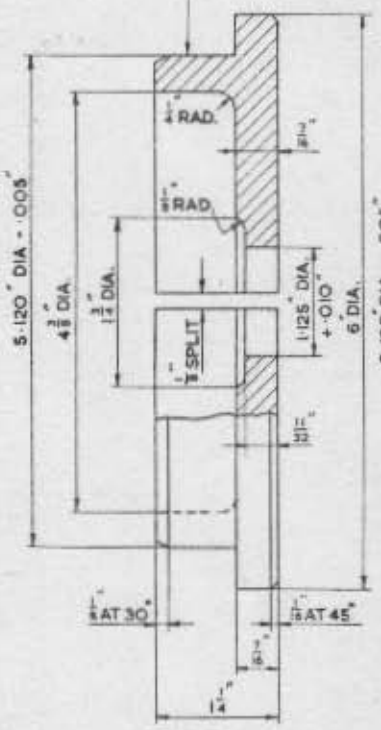


DRIFT — FOR REMOVING REAR BEARING FROM LAYSHAFT. — 1 OFF-M.S.

T. 178322

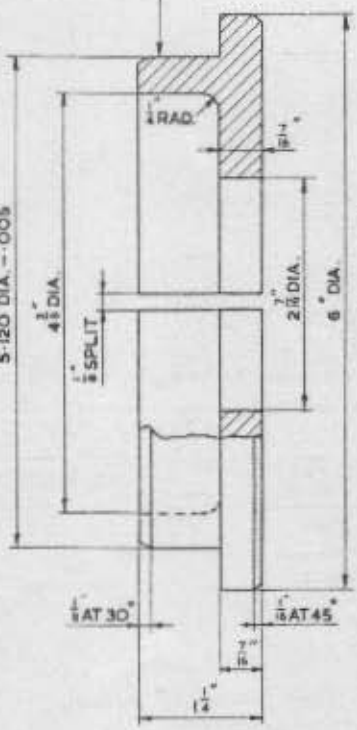
PLUG
1 OFF - UBAS C/HD. AND GROUND.

SPLIT BUSH — FOR REMOVING REAR BEARING FROM LAYSHAFT. - 1 OFF-M.S.



T. 178321

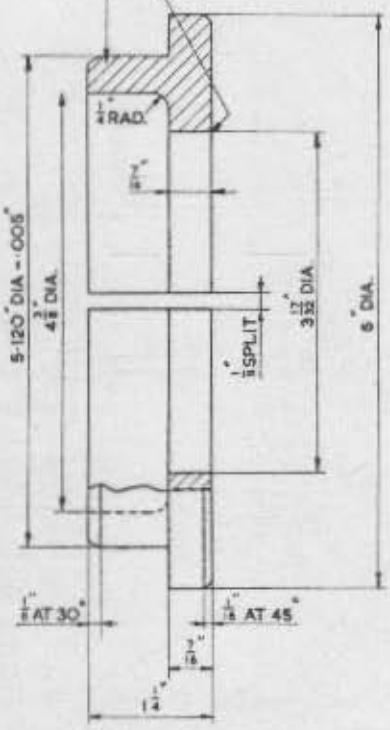
SPLIT BUSH — FOR REMOVING REAR RACE AND DRIVING GEAR. 1 OFF-M.S.



T. 178320

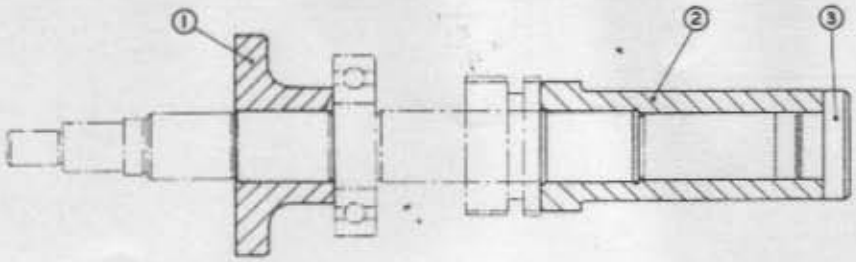
SPLIT BUSH — FOR REMOVING REAR RACE - 1 OFF-M.S.

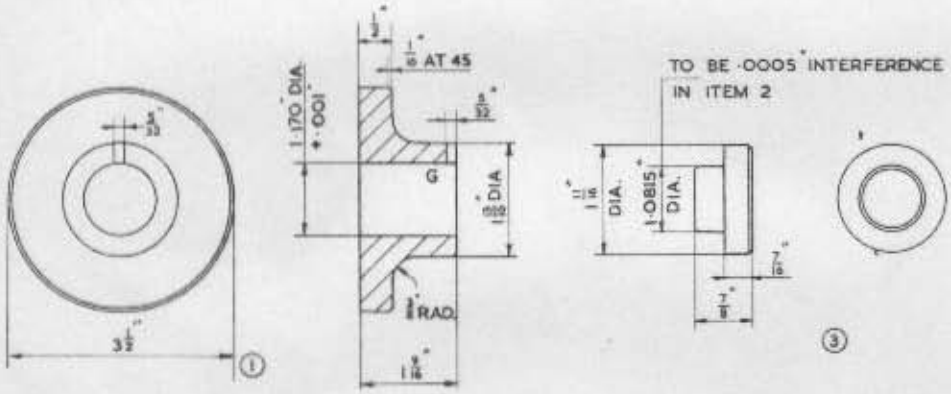
REMOVE SHARP CORNER

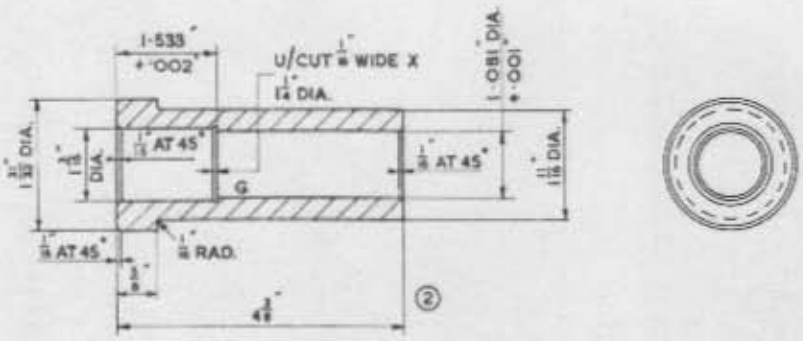


T. 178315

SPECIAL TOOLS



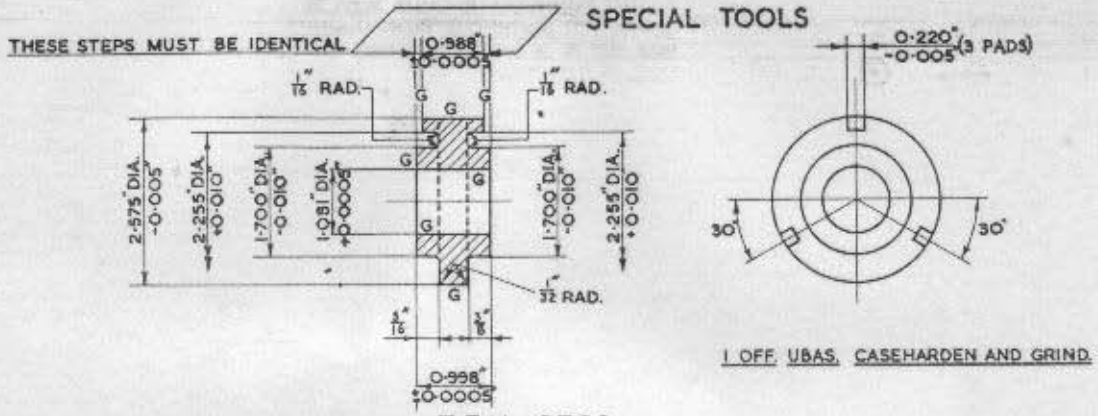




ITEM No.	DESCRIPTION	No. OFF	MATERIAL
1	BASE	1	MILD STEEL
2	DRIFT	1	MILD STEEL
3	PLUG	1	UBAS C/HD. AND GROUND.

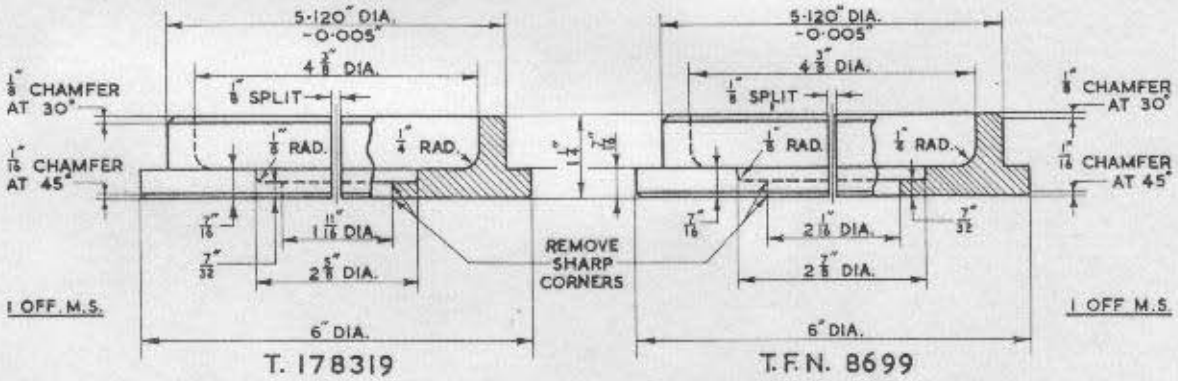
BASE, DRIFT & PLUG FOR ASSEMBLY MAIN DRIVE SHAFT
T. 178300

SPECIAL TOOLS



T.F.N. 8793

SLAVE FIXED HUB FOR ASSEMBLING GEARBOX (BORG WARNER)

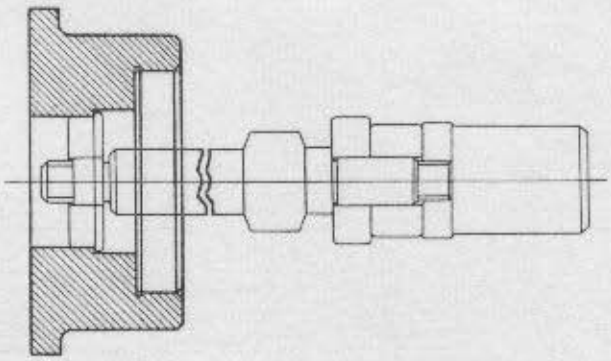


T. 178319

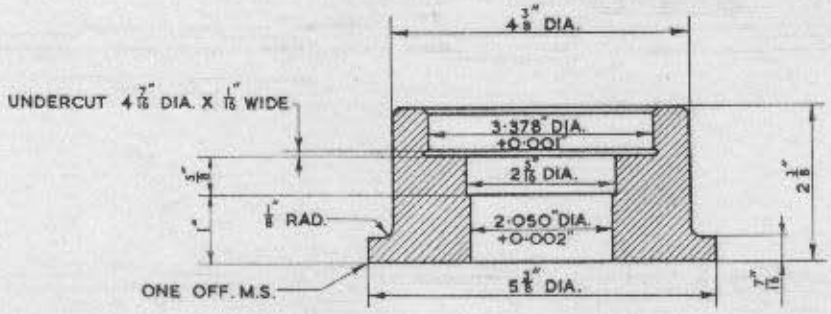
SPLIT BUSH FOR DISMANTLING FIXED HUBS AND FRONT RACE (BRISTOL)

T.F.N. 8699

SPLIT BUSH FOR DISMANTLING FIXED HUBS AND FRONT RACE (BORG WARNER)



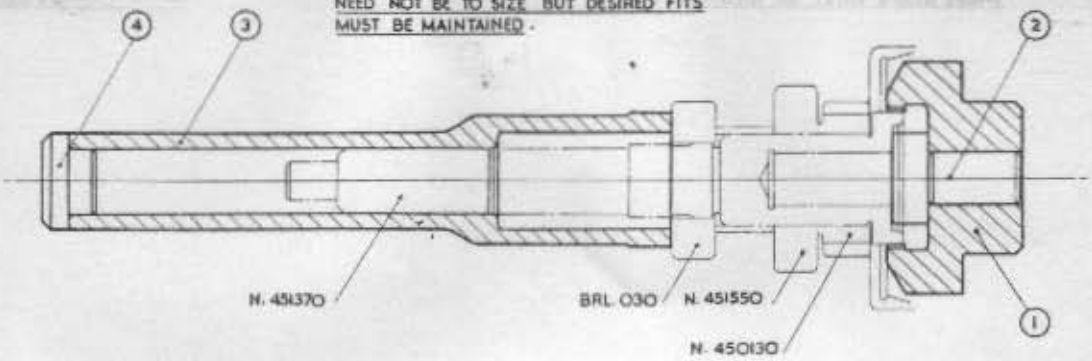
T. 178298

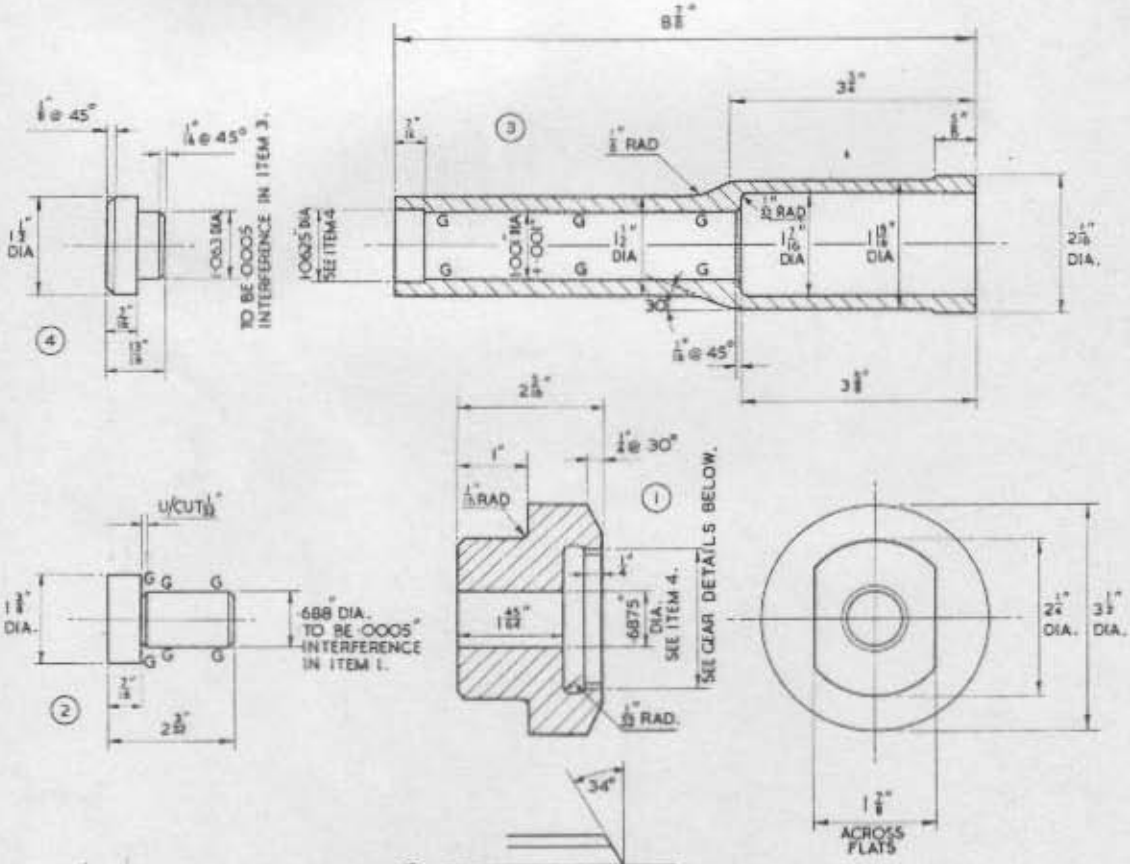


BASE FOR ASSEMBLING LAYSHAFT

SPECIAL TOOLS

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

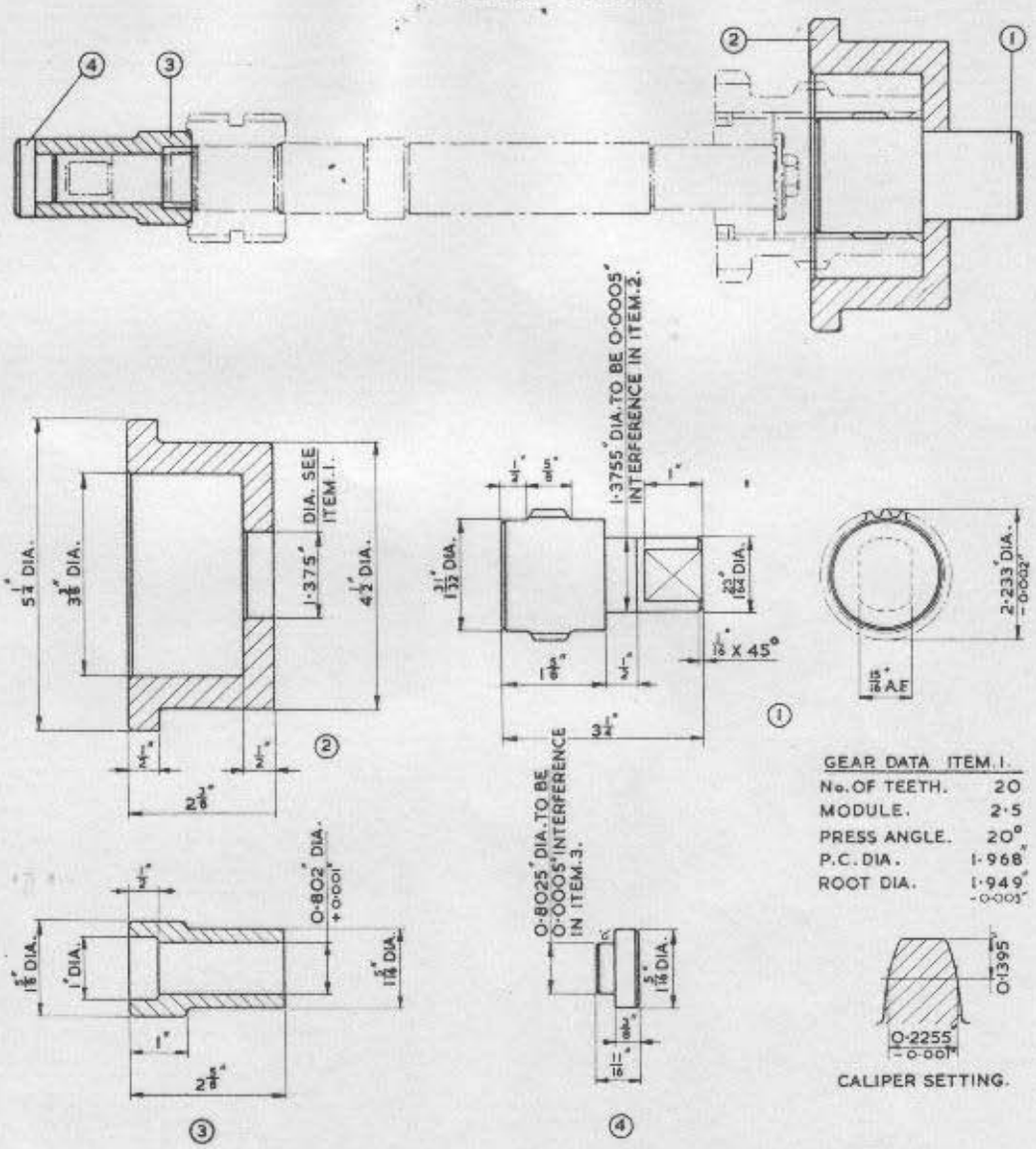




ITEM Nº	DESCRIPTION	Nº OFF	MATERIAL
1	ADAPTOR	1	M.S.
2	PAD	1	M.S.
3	DRIFT	1	M.S.
4	PLUG	1	UBAS C/HD & GD

VICE ADAPTOR & DRIFT FOR ASSEMBLY FRONT DRIVE-SHAFT T.178299

SPECIAL TOOLS

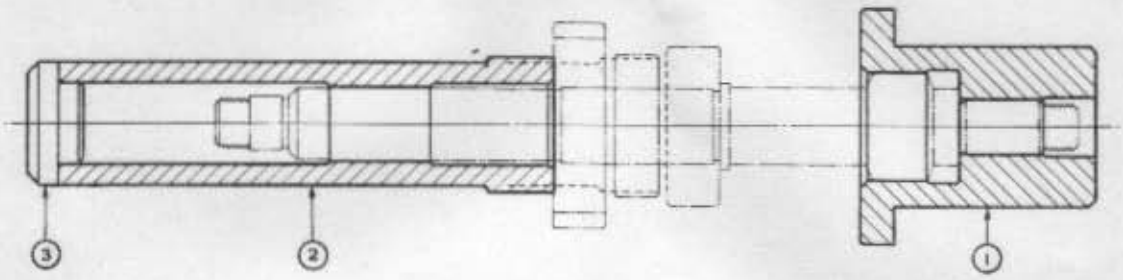


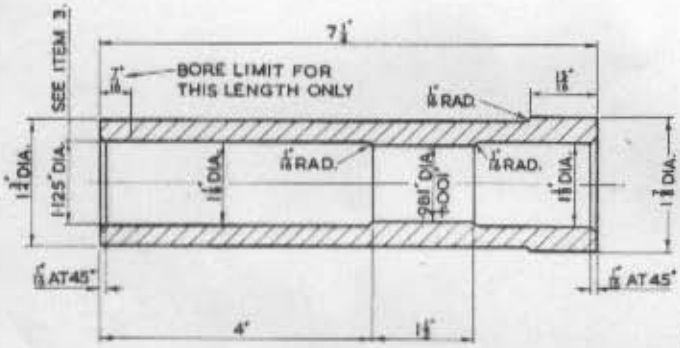
DECIMAL DIMENSIONS IN LIMITS MUST BE MAINTAINED: DIMENSIONS IN DECIMALS WITHOUT LIMITS NEED NOT BE TO SIZE: BUT DESIRED FITS MUST BE MAINTAINED.

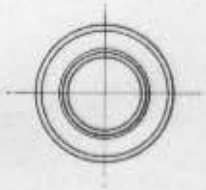
ITEM No.	DESCRIPTION	No. OFF	MATERIAL
1	ADAPTOR	1	MILD STEEL
2	SUPPORT	1	MILD STEEL
3	DRIFT	1	MILD STEEL
4	PLUG	1	UBAS C/HD.& GD.

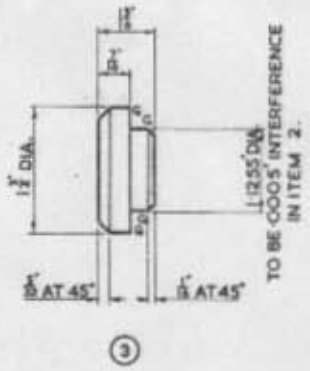
DRIFT & VICE ADAPTOR FOR ASSEMBLING MAIN DRIVE SHAFT T.178550

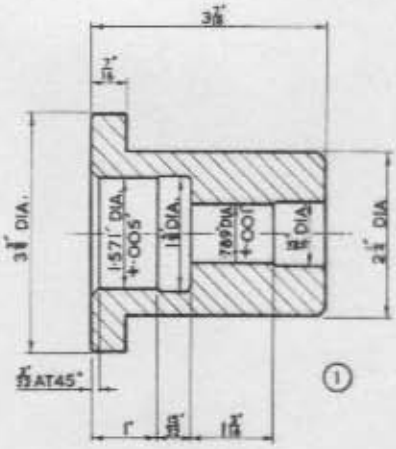
SPECIAL TOOLS







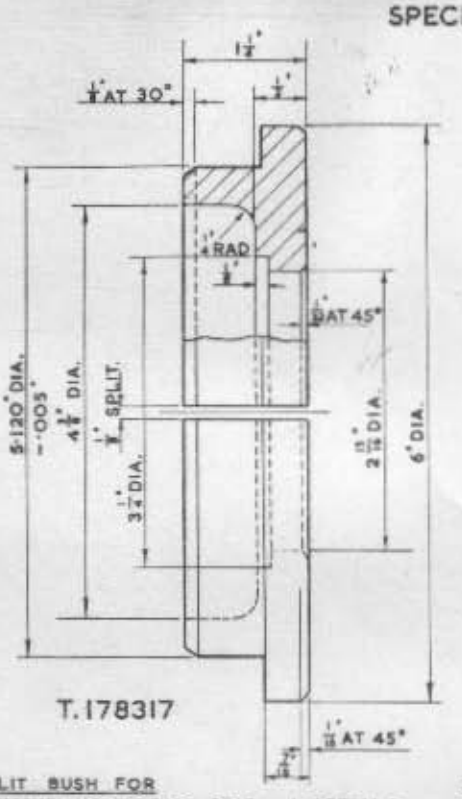




ITEM Nº	DESCRIPTION	Nº OFF	MATERIAL
1	BASE	1	MILD STEEL
2	DRIFT	1	MILD STEEL
3	PLUG	1	UBAS C.HD. & GD.

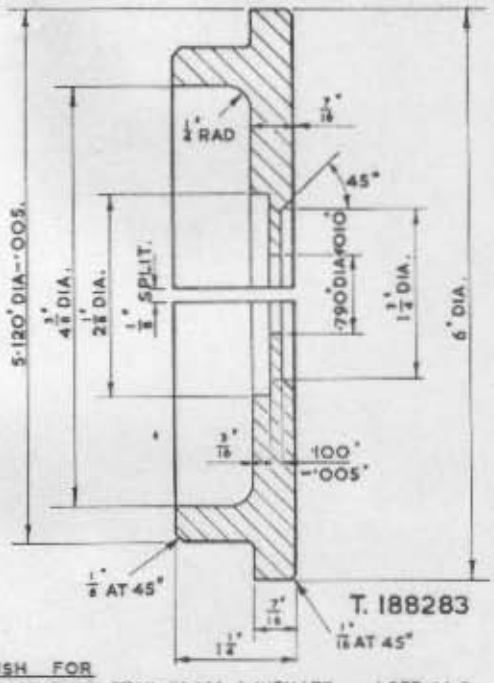
ASSEMBLY TOOL T.178296

SPECIAL TOOLS



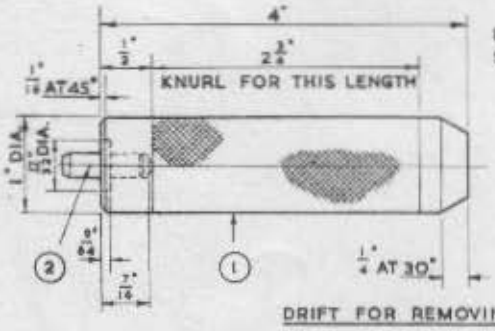
T. 178317

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



T. 188283

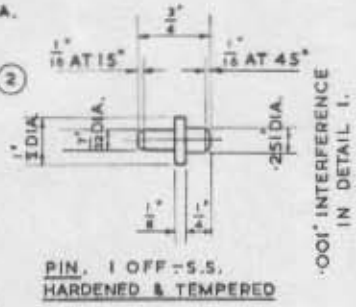
SPLIT BUSH FOR REMOVING REVERSE GEAR FROM LAYSHAFT. 1 OFF-M.S.



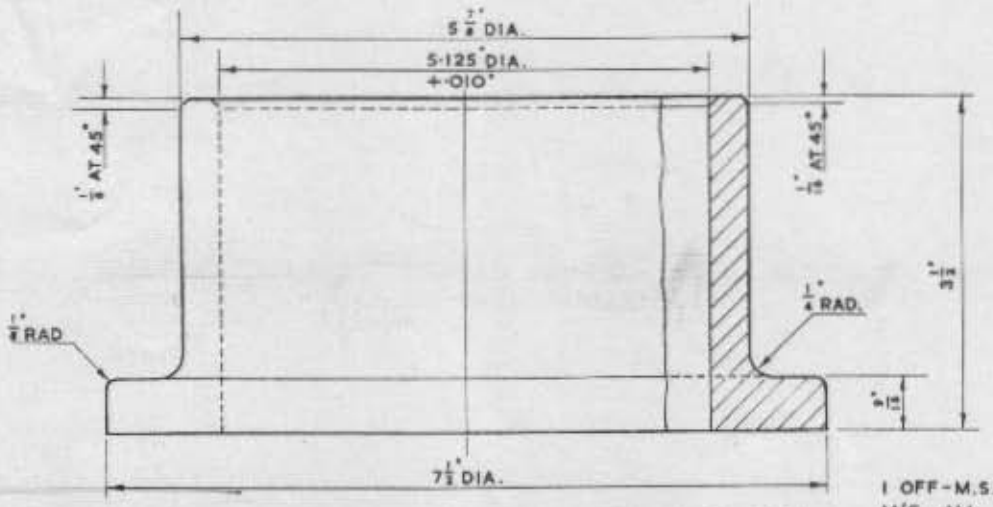
DRIFT FOR REMOVING REVERSE GEAR.

T. 178316

1 OFF-UBAS



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



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

BASE FOR REMOVING REVERSE GEAR FROM MAIN DRIVE SHAFT.

T. 178318

WORKSHOP MANUAL

Section:- 5

Bulletin No:- 2
Issue No. 2

Subject:- FITTING REMOTE GEAR CHANGE UNIT TO TYPE 401 (FROM CHASSIS NO. 1006 ONWARDS) AND TYPE 403 CARS.

INTRODUCTION

This unit should only be fitted to the above mentioned cars which have a gearbox with "Borg Warner" type synchromesh. All previous cars have a gearbox fitted with "Bristol" synchromesh and for these the remote control is not recommended.

All gearboxes fitted with "Borg Warner" synchromesh are stamped with the prefix BW. eg. BW.CR/5.

The modification entails the following work:-

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

PREPARATION

1. Remove the front seats as described in Section 14 of the manual.
2. Remove the front carpet.
3. Detach the front tunnel assembly and the clutch housing cover plate.
4. Remove the eight retaining nuts and washers and lift off the gearbox cover. Blank off the gearbox aperture to prevent the entry of foreign bodies.

MODIFICATION TO TUNNEL

1. Open out the existing aperture to the dimension shown in Fig. 1.
2. Rivet the four nut cages (item 11) to the underside of the modified tunnel at the positions shown in Fig. 1. 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 and peen 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 a 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 17).

4. Fit the "Sorbo" rubber cover (item 14) over the gear change unit assembly.

5. Fit the gear lever knob removed from the existing gear lever.

MODIFICATION TO CARPETS

Type 403 cars

1. Cut the stitches around the centre of the carpet and remove the portion covering the gearbox tunnel.

2. Fit the front carpet into place together with the new portion (item 15) and if satisfactory, remove and stitch together.

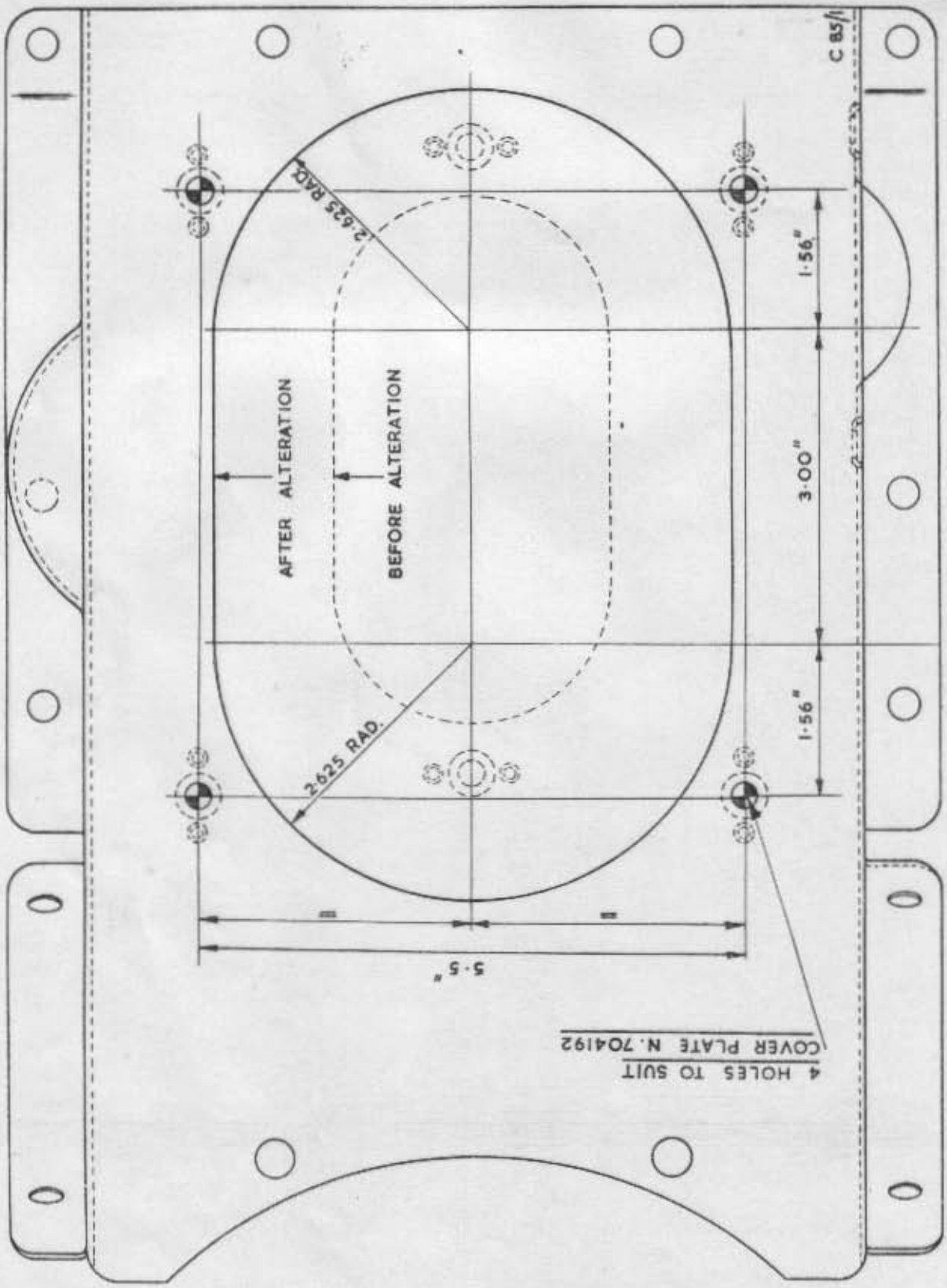
Type 401 cars (from chassis No. 1006 onwards)

From the carpet supplied (item 16), cut and trim to suit.

Finally refit the seats.

PARTS REQUIRED FOR FITTING THE REMOTE GEAR CHANGE UNIT

Item No.	Description	Part No.	No. Supplied
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.	¼in. 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 ¼ in. Whit. square-forged.	-	4
13.	Rivets 3/32 in. dia. cs'k	-	8
14.	"Sorbo" rubber jacket.	-	1
15.	Section-front carpet (403 cars).	-	1
16.	Length of carpet, 48 in. x 27 in. (401 cars from chassis No. 1006 onwards)	-	1
17.	Screw ¼ in. Whit. x ⅝ in. long, mushroom head, M.S.	-	4


C 85/1
2·625 RAD.
2·625 RAD.
AFTER ALTERATION
BEFORE ALTERATION
1·56"
3·00"
1·56"
5·5"
4 HOLES TO SUIT
COVER PLATE N. 704192