Service Instruction Manual

E

GEARBOX

SECTION E

GEARBOX

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GEARBOX

ILLUSTRATIONS

GEARBOX

Dimensions and Tolerances

PARTS AND DESCRIPTION	DIMENSIONS NEW	CLEARANCE	REMARKS
Constant Pinion Shaft			
Spigot External Diameter	.494″ .492″	.0058″ to .0085″	
Crankshaft Bush Internal Diameter	.5005″ .4998″		
Mainshaft			
Spigot External Diameter	.6875″ .6870″	.0005″ to .0017″	
Internal Diameter of Constant Pinion Bush	.6887″ .6880″		
Mainshaft Bushes			
Diameter of Mainshaft	1.2488″ 1.2481″	.0007″ to .0026″	
Internal Diameter of 2nd Gear Bush	1.2507″ 1.2495″		
Internal Diameter of 3rd Gear Bush	1.2495″ 1.2488″	.0000″ to .0014″	
Mainshaft Bush Float			
Length of 2nd Gear Bush (measured without flange)	1.162″ 1.160″	.004″ to .008″	End float of .004″ to .006″ obtained by selective assembly.
Length of 2nd Gear	1.156″ 1.154″		
Length of 3rd Gear Bush	1.225″ 1.223″	.004″ to .008″	End float of .004″ to .006″ obtained by selective assembly.
Length of 3rd Gear	1.219″ 1.217″		
Overall Float of Bushes			
Overall Length of Mainshaft Bushes	2.511″ 2.505″		2nd gear bush has .124″—.122″ flange.
Thickness of 2nd Gear Thrust Washer	.122″ .120″		
Thickness of 3rd Gear Thrust Washer	.124″ .122″		
Overall Float of Bushes		.000″ .015″	End float of .007″ to .012″ obtained by selective assembly.

GEARBOX

Dimensions and Tolerances

PARTS AND DESCRIPTION	DIMENSIONS NEW	CLEARANCE	REMARKS
Countershaft			
External Diameter of Countershaft	.7913″ .7908″		
Internal Diameter of Countershaft Gear	.8983″ .8978″		
Needle Roller Diameter	.119″		
Countershaft Gear End Float			
Internal Width of Casing	6.771″ 6.769″		
Affected Length of 1st Countershaft Gear	2.2487″ 2.2473″		
Width of Constant Gear	1.3132″ 1.3118″		
Width of Third Gear	1.1882″ 1.1868″		
Width of Second Gear	.7607″ .7593″		
1st Thrust Washer Thickness	.068″ .066″		
Rear Thrust Washer Thickness	.107″ .105″		
Distance Piece	1.0817″ 1.0803″		
Overall Width of :—			
Countershaft Gears and Two Thrust Washers	6.7675″ 6.7565″		
Overall Float of Countershaft Gears	.0015″ .0145″		Select parts to provide .006″—.010″ end float.
Reverse Idler Shaft			
Diameter of Shaft	.5618″ .5613″	.0007″ to .0012″	
Internal Diameter of Bushes	.5625″		

GEARBOX

Dimensions and Tolerances

PARTS AND DESCRIPTION	DIMENSIONS NEW	CLEARANCE	REMARKS
Gearbox Top Cover			
Selector Shaft External Diameter	.4985″ .4972″	.0010″	
Bore in Cover for Selector Shaft.	.5005″ .4995″	to .0033″	
Gear Synchronisation and Loading Details			
2nd Speed Synchro Axial Load for Release		25 to 27 lbs.	
3rd and Top Synchro Axial Load for Release		19 to 21 lbs.	
Gap between Baulk Ring Dog Teeth and Cone Dog Teeth on Mainshaft Synchro Gears		.035″ to .040″ Engaged. .060″ to .075″ Free.	
Selector Rod Loading			
Selector Rod Axial Load for Release		1st and 2nd 3rd and TOP Reverse	32 to 34 lbs. 17 to 20 lbs. 21 to 23 lbs.
Load required at Gear Change Knob to Select :—			
1st and 2nd Gear		7 to 9 lbs.	
3rd and TOP Gear		4 to 6 lbs.	
Reverse Gear		6 to 7 lbs.	

NOTE : To convert lbs. to Kgs. divide by 2.204.
„ „ ins. to Millimetres multiply by 25.4.

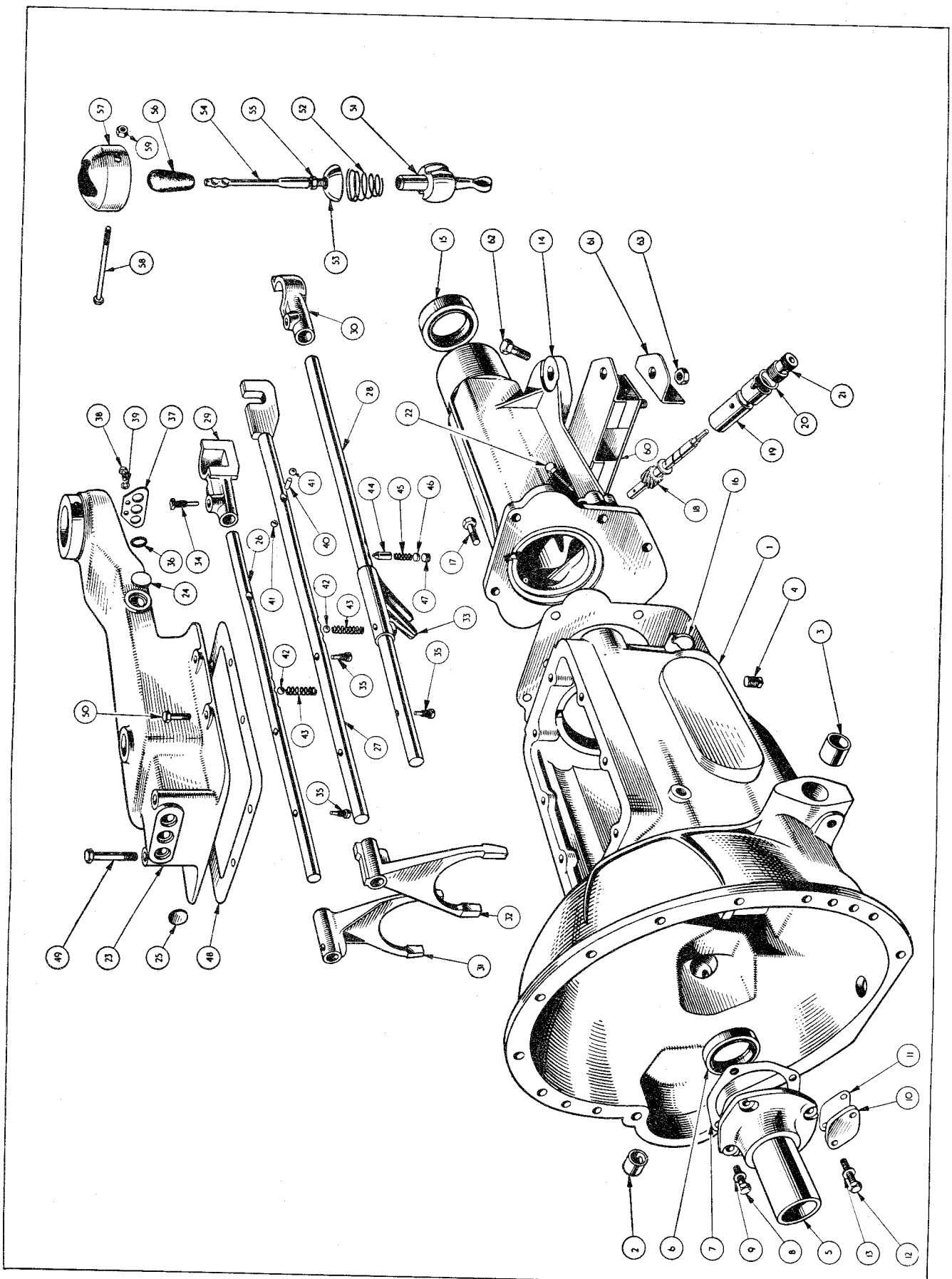

Fig. 1 Exploded view of Gearbox Casing, Extension Housing, Top Cover and Selector Mechanism.

NOTATION FOR FIG. 1

Ref. No.	Description
1	Clutch and Gearbox Casing.
2	Bush for Clutch Shaft.
3	Bush for Clutch Shaft.
4	Drain Plug.
5	Front End Cover.
6	Oil Seal.
7	Joint Washer.
8	Setscrew for Cover.
9	Plain Washer for 8.
10	Countershaft Cover.
11	Joint Washer.
12	Setscrew.
13	Plain Washer.
14	Gearbox Extension.
15	Oil Seal.
16	Joint Washer.
17	Extension Attachment Bolt.
18	Speedometer Drive.
19	Speedometer Bearing.
20	Washer.
21	Screwed Adaptor.
22	Locating Screw.
23	Top Cover.
24	Core Plug.
25	Selector Shaft Welch Washer.
26	Selector Shaft (1st and 2nd Gear).
27	Selector Shaft (Top and 3rd Gear).
28	Reverse Selector Shaft.
29	1st/2nd Gear Selector.
30	Reverse Gear Selector.
31	1st/2nd Selector Fork.
32	3rd/Top Selector Fork.
33	Reverse Selector.
34	Taper Screw.
35	Stop Screw.
36	Sealing Ring.
37	Cover Plate.
38	Setscrew for Cover Plate.
39	Lock Washer.
40	Interlock Roller 3rd/Top.
41	Interlock Balls.
42	Selector Shaft Ball.
43	Spring for Ball.
44	Reverse Shaft Plunger.
45	Spring for Plunger.
46	Distance Piece.
47	Plug.
48	Joint Washer.
49	Attachment Bolt (long). } Top cover.
50	Attachment Bolt (short). }
51	Ball End.
52	Spring.
53	Spring Retainer.
54	Lever Assembly.
55	Lever Locknut.
56	Knob.
57	Cap.
58	Bolt.
59	Nyloc Nut.
60	Rear Mounting.
61	Steady Bracket.
62	Bolt.
63	Nut.

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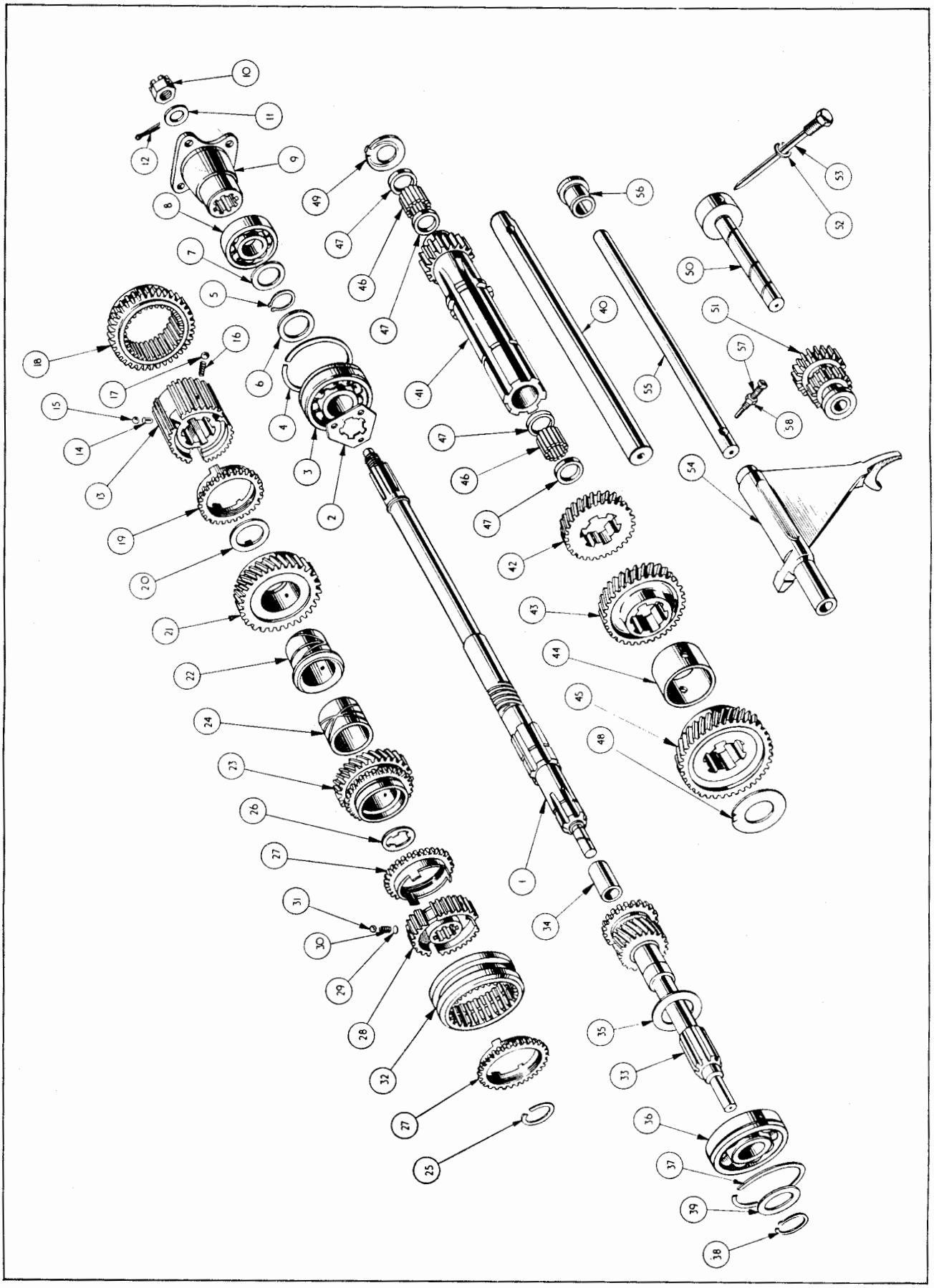

Fig. 2. Exploded view of Gears.

NOTATION FOR FIG. 2			
Ref. No.	Description	Ref. No.	Description
1	Mainshaft.	30	Synchro Spring.
2	Triangular Washer.	31	Synchro Ball.
3	Centre Bearing (Interchangeable with 36).	32	3rd and TOP Gear Sychronising Sleeve.
4	Outer Circlip for Centre Bearing (Interchangeable with 37).	33	Constant Pinion Shaft.
5	Circlip for Centre Bearing.	34	Constant Pinion Bush.
6	Washer for Centre Bearing.	35	Oil Thrower.
7	Washer for Rear Bearing.	36	Ball Bearing.
8	Rear Bearing.	37	Outer Circlip for Constant Pinion Bearing.
9	Driving Flange.	38	Circlip.
10	Slotted Nut.	39	Washer between Bearing and Circlip.
11	Plain Washer.	40	Countershaft.
12	Split Pin.	41	1st Speed Countershaft Gear.
13	1st Gear Synchro Hub.	42	2nd Speed Countershaft Gear.
14	Interlock Plunger.	43	3rd Speed Countershaft Gear.
15	Interlock Ball.	44	Distance Piece Countershaft Gear.
16	Synchro Spring.	45	Constant Gear.
17	Synchro Ball.	46	Needle Rollers.
18	1st Gear Synchronising Sleeve.	47	Retaining Ring for 46.
19	2nd Speed Synchronising Cup.	48	Front Thrust Washer.
20	Washer.	49	Rear Thrust Washer.
21	2nd Gear.	50	Reverse Spindle.
22	2nd Speed Bush.	51	Reverse Wheel.
23	3rd Speed Gear.	52	Lock Washer.
24	3rd Speed Bush.	53	Countershaft Retaining Screw.
25	Circlip.	54	Reverse Operating Fork.
26	Washer.	55	Operating Rod.
27	3rd and TOP Gear Synchronising Cup.	56	Bush on rear end of Rod.
28	3rd and TOP Gear Synchronising Hub.	57	Rod Retaining Screw.
29	Synchro Spring Shim.	58	Locknut.

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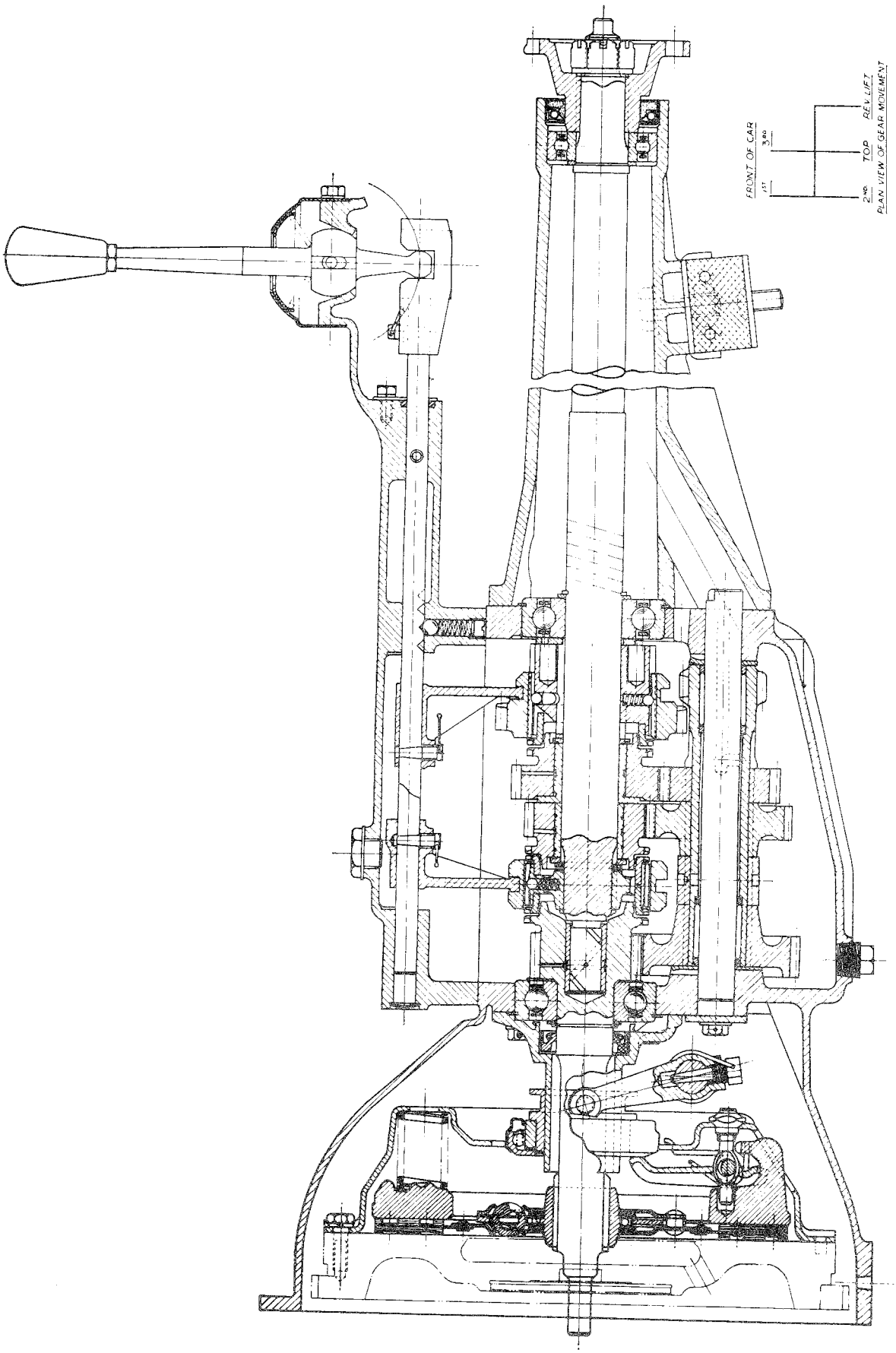
GEARBOX



Sectional view of Gearbox.

Fig. 3

GEARBOX

Description

Four forward speeds with gear synchronisation on 2nd, 3rd and Top and one Reverse ratio actuated by a compound gear which is disengaged when in Neutral or in any of the forward gears.

1. OPERATION

A remote control lever is carried in a turret formed in the rear end of the top cover, which is at a point approximately halfway down the rear extension housing. The selector forks are mounted on three selector shafts which are carried in the gearbox top cover and both cover and shafts extend rearwards to the control lever turret where gear selection is made by conventional "H" gate movement.

2. RATIOS

	Gearbox	Overall
Overdrive Top	0.82	3.03
Top	1.00	3.70
Third	1.325	4.90
Second	2.00	7.40
First	3.38	12.50
Reverse	4.28	15.80

3. BEARINGS

(a) **Constant Pinion Shaft**
Bearing (S.M.Co. Part No. 58391):
Fischer Ball Bearing No. MS12 S.G.
Hoffman Ball Bearing No. MS12 K.

(b) **Mainshaft Centre**
Bearing (S.M.Co. Part No. 58391):
As for Constant Pinion Shaft.

(c) **Mainshaft Rear**
Bearing (S.M.Co. Part No. SP75 G.):
Fischer Ball Bearing No. 6206.
Hoffman Ball Bearing No. 130.

(d) **Countershaft Cluster**
Front: 24 needle rollers retained by means of two retaining rings (press fit).
Rear: 24 needle rollers retained by means of two retaining rings (press fit).

4. MOUNTING

Unit assembly with engine which is two point mounted to the chassis at front, the gearbox being mounted on a silent block under the gearbox extension housing to the chassis cross member.

5. OIL CAPACITY

1½ pints (0.8 litres) from dry.
With Overdrive 3½ pints (2.0 litres).
For recommended grades of oil refer to Lubricant Recommendations in the "General Data" Section.

6. NUT AND BOLT DATA AND TIGHTENING TORQUES

For these particulars refer to "General Data" Section.

NOTE—For details regarding Special Tools, please refer to Section "Q" of this Manual.

7. TO REMOVE GEARBOX LEAVING ENGINE IN POSITION

(a) Disconnect battery lead.

(b) Remove both seats by withdrawing sixteen nuts, eight from beneath each seat cushion.

(c) Remove gear lever and grommet, after slackening the locknut and unscrew gear lever from its ball end.

(d) Withdraw floor centre section and carpet after the withdrawal of sixteen setscrews located round the edges of the pressing. Similarly remove the "U" plate (R.H. side) secured with two P.K. screws.

(e) Disconnect the propeller shaft at the front end by withdrawing the four bolts and nyloc nuts.

(f) Disconnect speedometer cable from gearbox by unscrewing the knurled collar from its adaptor.

(g) Remove clutch slave cylinder with its mounting bracket after withdrawing two nuts and bolts from the bell housing and one sump bolt securing the steady rod. The slave cylinder push rod can be removed from the clutch operating shaft after the withdrawal of the split pinned clevis pin from the operating fork to which is attached the clutch return spring.

(**h**) Disconnect the two wires from their terminals on the solenoid if an Overdrive is fitted.

(**i**) Remove gearbox mounting after the withdrawal of two nuts by jacking up the unit, using a block of wood between jack and sump to avoid damage.

(**j**) Remove starter motor bolts and slide starter motor forwards clear of the bell housing.

(**k**) Remove nuts and bolts from bell housing and withdraw gearbox (Fig. 4).

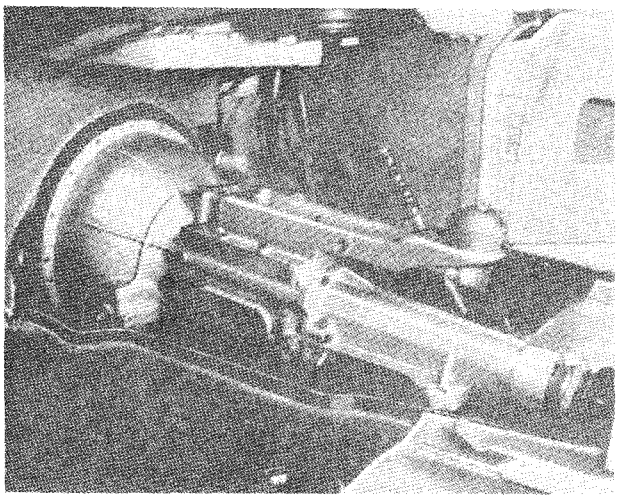


Fig. 4 Gearbox Unit ready for withdrawal.

TO REPLACE GEARBOX

Carry out the above procedure in reverse, but it is advisable before doing so to check the alignment of the clutch unit with a suitable mandrel (Fig. 5). If this is found to be incorrect slacken the clutch cover assembly bolts until the mandrel slides in freely, then re-tighten the bolts.

8. TO DISMANTLE

(**a**) Remove eight setscrews from the top cover assembly and withdraw complete with selector mechanism. To dismantle top cover assembly see page 18.

(**b**) Remove top cover paper joint.

(**c**) Break locking wire on clutch operating fork positioning setscrew and withdraw.

(**d**) Remove clutch operating shaft positioning bolt and grease nipple with fibre washer from R.H. of clutch shaft.

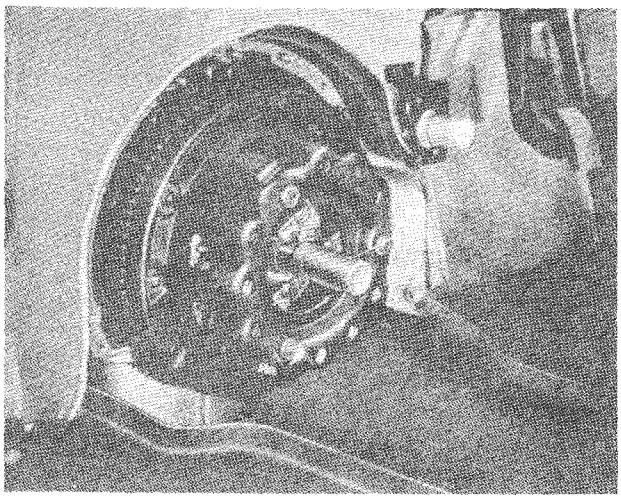


Fig. 5 Aligning Clutch Floating Plate with Mandrel. Churchill Tool No. 20S. 72.

Then withdraw operating shaft, coil spring, operating fork, clutch throwout bearing and sleeve.

(**e**) Detach the speedometer drive after removal of the special securing setscrew.

(**f**) Withdraw propeller shaft coupling, having first removed split pin, nut and plain washer.

(**g**) Remove gearbox extension and paper joint after the withdrawal of six securing setscrews and spring washers Fig. 6. The oil seal and ball race will remain in position in the housing but can easily be tapped out with a suitable drift.

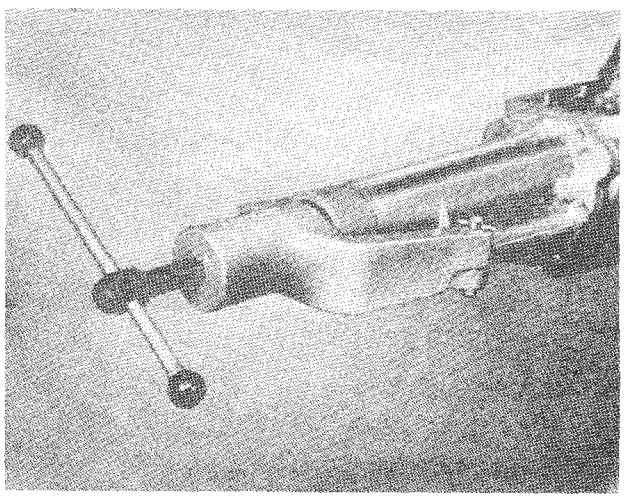


Fig. 6 Showing the removal of Gearbox Extension with Churchill Tool No. 20S. 63.

(**h**) Withdraw the countershaft locating setscrew as shown in Fig. 7.

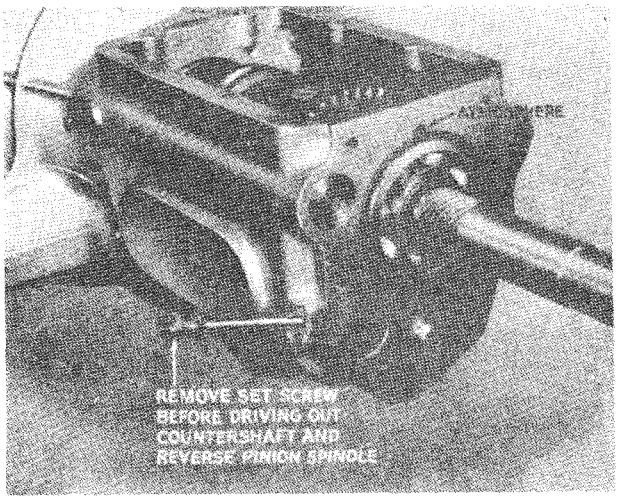


Fig. 7 **Countershaft and Reverse Locating Setscrew partially withdrawn.**

(**i**) After removal of the countershaft front end cover plate which is secured by two wired setscrews, plain washers and lead linger drive out the countershaft using a suitable tube as shown in Fig. 8, to retain the 48 needle rollers in position maintaining contact throughout between the tube and countershaft.

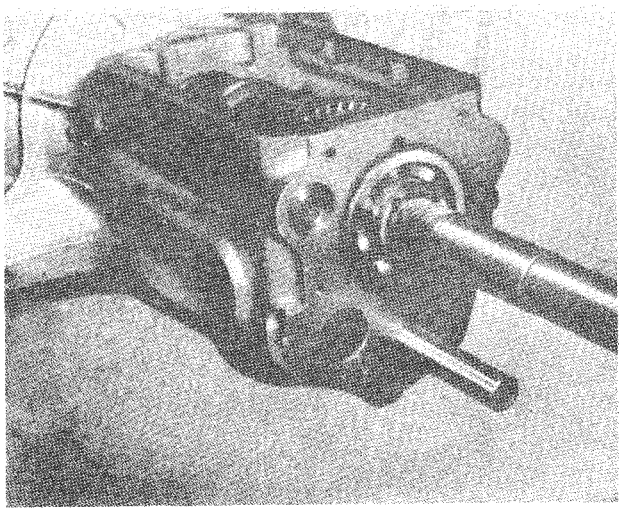


Fig. 8 **Showing Needle Roller Retainer Tube Tool No. 20SM68 being used to drive out Countershaft.**

(**j**) Remove the gearbox front end cover and paper joint after cutting the wire in the setscrew heads and withdrawing them complete with their plain washers and lead linger.

(**k**) Extract the constant pinion shaft assembly as shown in Fig. 9, and remove

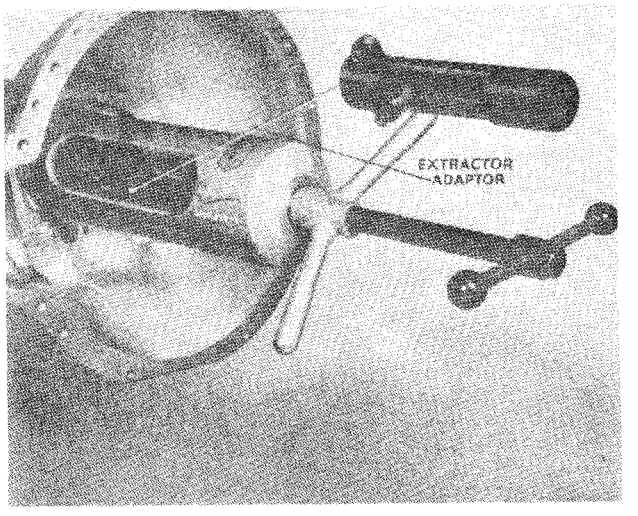


Fig. 9 **Extracting Constant Pinion Shaft Assembly with Churchill Tool No. 20SM66A.**

the mainshaft spigot bush located in the pinion itself. The further dismantling of this assembly necessitates the removal of the small circlip and thrust washer which fit against the inner ring of the ball race. After extraction of ball race in the fixture shown in Fig. 10, the oil thrower may be withdrawn, but owing to probable damage to this thrower during the dismantling operation a new one may be required when re-assembling the unit.

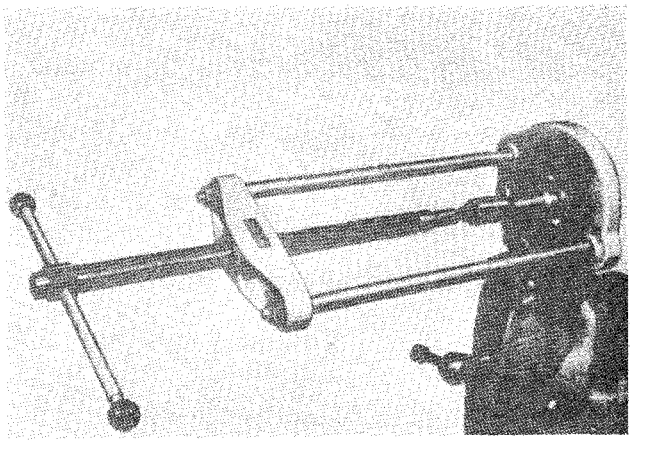


Fig. 10 **Extraction of Constant Pinion Ball Race with Churchill Press No. S4221 and Adapter from Set S.4615.**

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(l) Tap the mainshaft towards the rear with a soft metal drift, as shown in Fig. 11, sufficiently to clear the bearing

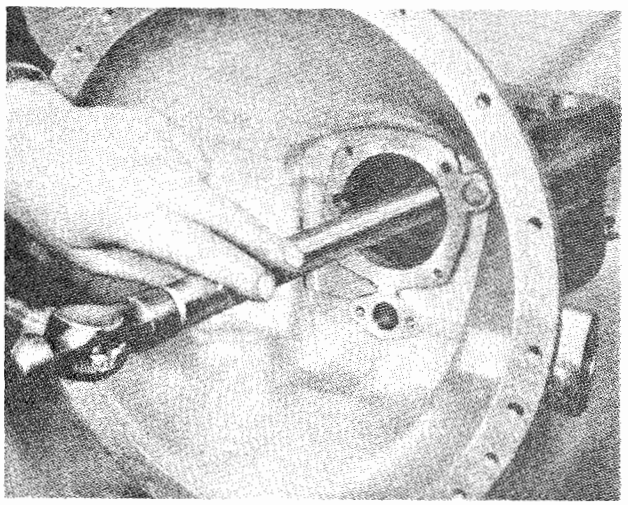

Fig. 11 Driving Mainshaft to rear with Tool No. 20SM1 to free Centre Main Bearing.

from the casing. Next tilt the shaft sufficiently to enable the third and top synchro unit to be withdrawn as shown in Fig. 12. Note the position

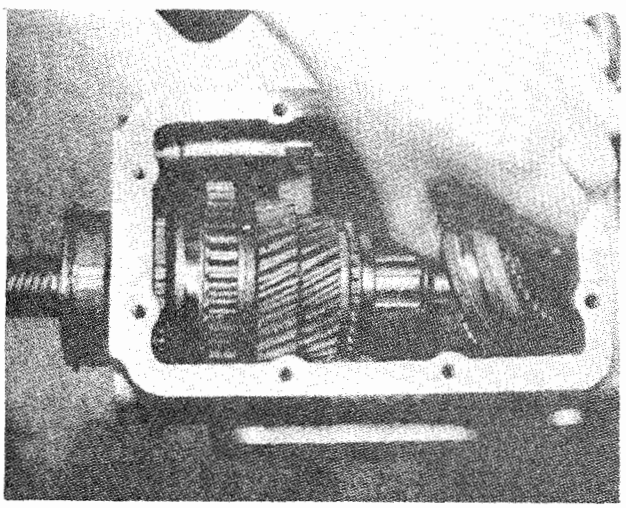

Fig. 12 Removing Top and Third Synchro Unit.

of the short boss on the synchro hub is towards the mainshaft circlip.

(m) Remove mainshaft circlip with the special extractor shown in Fig. 13. The extraction of this circlip is made somewhat difficult by the adjacent thrust washer which has three lugs,

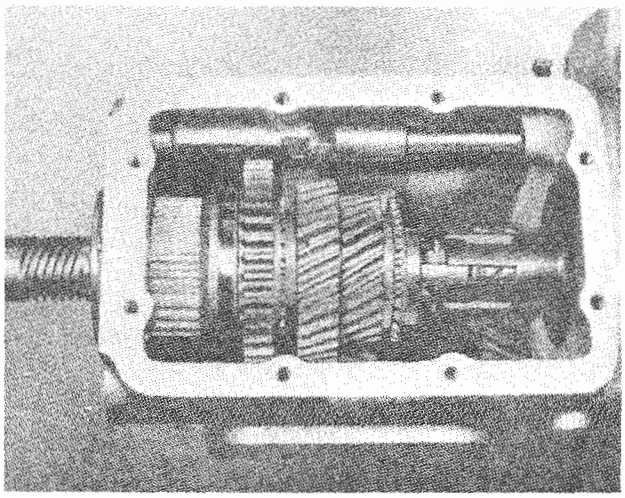

Fig. 13 Showing the removal of the Mainshaft Circlip with Churchill Tool No. 20SM69.

equally spaced, and engaging alternate splines on the mainshaft. Quite apart from the necessity to engage the three available splines with the full length prongs, in some cases it may be necessary to tap the circlip round on these prongs, to free it from its recess before it can be withdrawn. A new circlip should always be used when re-assembling.

(n) Withdraw thrust washer, third mainshaft constant gear and bush, second mainshaft constant gear and bush, thrust washer with three lugs to fit splines and the second speed synchro unit which also incorporates the first mainshaft gear. The mainshaft can now be withdrawn.

(o) Remove the small seeger circlip and thrust washer which locates the ball race on the mainshaft and extract the race as shown in Fig. 14. The triangular washer can then be removed from behind the race.

(p) After removal of the lock nut and locating screw the reverse selector shaft and bronze selector fork can be withdrawn. A steel selector shaft insert located at the rear of the casing and a welch plug at the front can easily be removed.

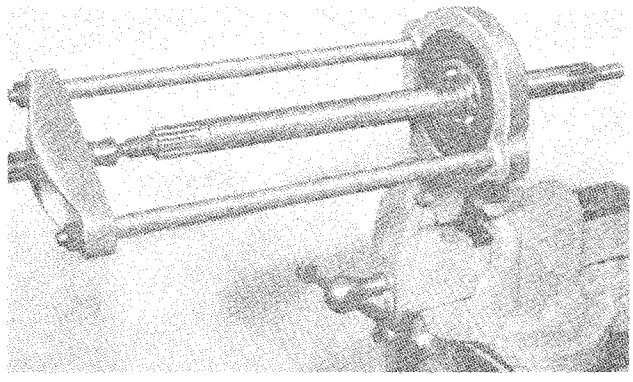

Fig. 14 **Removing Mainshaft Centre Bearing with Churchill Press No. S4221 and adapter from Set No. S4615.**

(q) Lift out the reverse pinion (compound gear) after tapping out its spindle through the rear of the casing, the retaining setscrew having been removed in a previous operation (h).

(r) The countershaft assembly can now be lifted out of the casing with the needle roller retaining tube still locating the 24 rollers at each end of the countershaft in their respective recesses. Lay aside the two phosphor bronze thrust washers for re-assembly.

(s) The countershaft gears and distance sleeve can now be removed from the splined portion of the countershaft, noting their position for re-assembly.

(t) If it is desired to examine the needle rollers they can be removed by withdrawing the retaining tube. Note the correct number of 48 for re-assembly (24 at each end) and the needle roller retaining rings can be tapped out with a suitable drift.

9. TO ASSEMBLE

(a) Thoroughly clean out the casing and examine for cracks, ball race housings for wear or other damage.

(b) Fit needle roller retaining rings if necessary, as shown in Fig. 15. Fit 24 needle rollers at each end of the countershaft ensuring first that the locating rings are in position. The chamfer on each retainer ring should be placed towards the bottom of the bore in the case of the inner ones, outwards for the outer ones. The rollers should

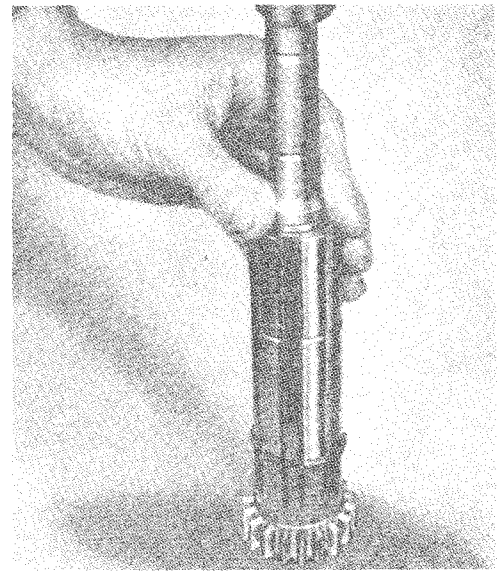

Fig. 15 **Fitting Needle Roller Retainer Rings with Churchill Tool No. 20SM68.**

be retained in grease and counted after installation to ensure that they have not become displaced before fitting the retainer tube.

(c) Assemble countershaft, noting correct position for the gears, observed in operation (s) when dismantling (see also Fig. 3).

(d) Install the countershaft assembly, positioning the thrust washers on the casing with grease. The correct end float for the countershaft gears should be between .006"—.010". If there is insufficient end float the distance piece should be reduced as necessary by rubbing it down on a sheet of emery cloth placed on a surface plate. Where too much end float exists new thrust washers and/or distance piece should be fitted.

(e) Fit reverse pinion (compound gear) with smaller gear towards front of box, having first ensured that there is no tooth damage or wear in bushes; leave the fitting of the locating setscrew until the countershaft has been assembled in its normal fitted position.

(f) Install the reverse selector shaft and bronze selector fork position with setscrew and tighten lock nut. The selector shaft steel insert and welch plug can now be fitted.

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(**g**) (**i**) Install the triangular washer on its splines on the mainshaft.

(**ii**) Press ball race on to mainshaft with Churchill fixture as shown in Fig. 16. Then fit the thrust washer

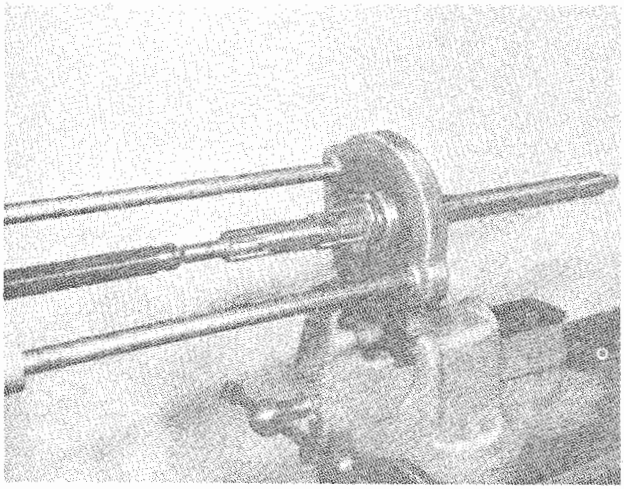

Fig. 16 Fitting Mainshaft Centre Bearing with Churchill Press No. S4221 and Adapter from Set No. S4615.

and small seeger circlip. A large circlip should be fitted into the annular groove in the outer ring of the bearing.

(**h**) Before the mainshaft is assembled into the gearbox the following points should be checked :

(**i**) The 2nd speed constant gear float on its bush (.004″—.006″).

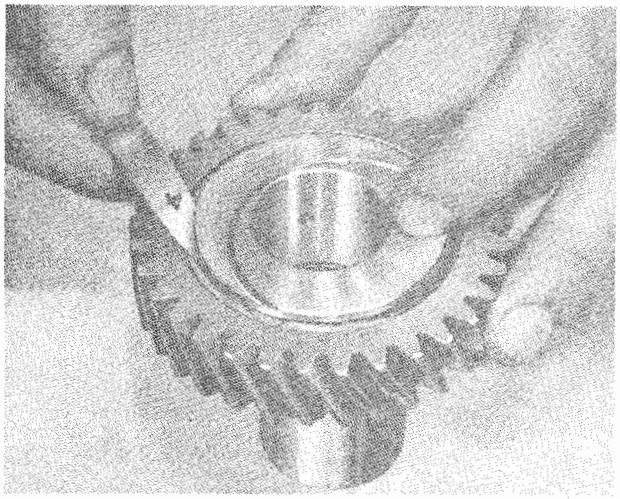

Fig. 17 Checking Second Mainshaft Constant Gear for End Float.

(**ii**) The 3rd speed constant gear float on its bush (.004″—.006″). (**i**) is checked as in Fig. 17, and (**ii**) as in Fig. 18.

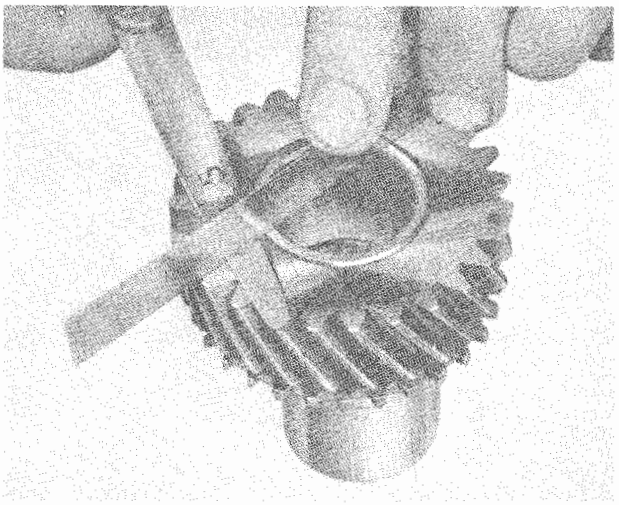

Fig. 18 Checking Third Gear Mainshaft Constant Gear for End Float.

(**iii**) Overall bush float on mainshaft (.007″—.012″).
To check gear bush end float, fit 2nd speed mainshaft gear thrust washer, ensuring that its three lugs engage in the mainshaft splines, 2nd and 3rd mainshaft gear bushes and 3rd mainshaft gear thrust washer fitted with oil scroll towards the bush. Install the original circlip and measure float with a feeler gauge as shown in Fig. 19.

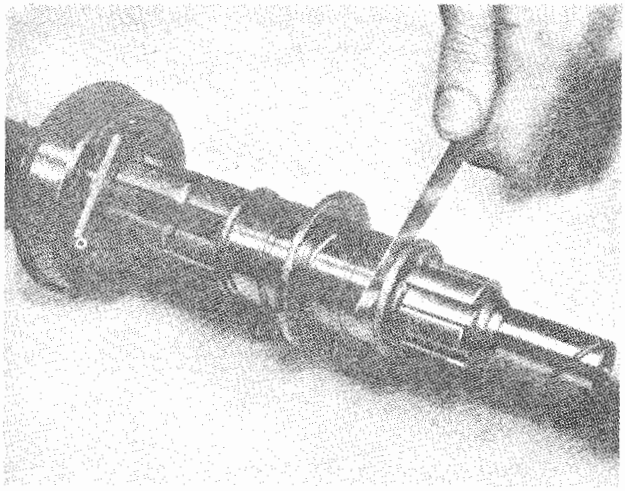

Fig. 19 Checking Mainshaft Gear Bush Overall Float.

(iv) Axial release loading of 2nd speed synchro unit 25—27 lbs.

(v) Axial release loading of 3rd and top speed synchro unit 19—21 lbs.

(iv) and (v) can be checked as shown in Fig. 20. If it is found to be in-

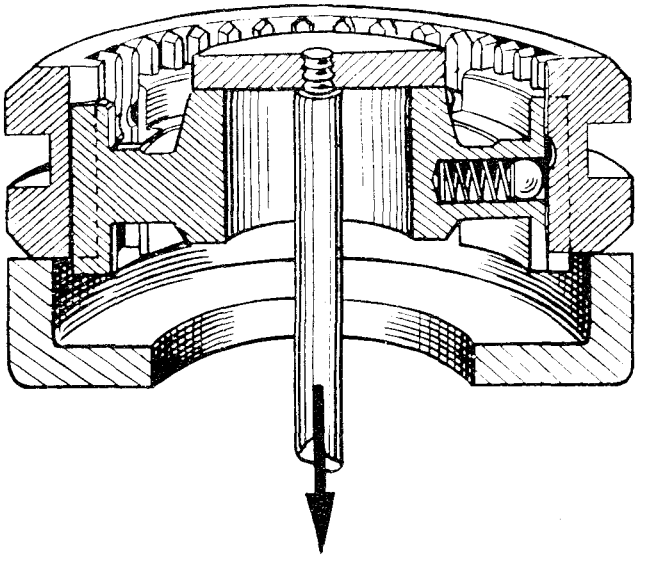

Fig. 20 **Fixture which can be readily manufactured to test Synchro Axial loading.**

correct, steel shims can be added or removed from below the axial release loading springs to increase or decrease respectively the axial release load as required.

(i) After completion of checks the mainshaft circlip, thrust washers and constant gear bushes can be removed. The mainshaft can then be installed into the gearbox casing, and assembled as follows :

(i) Second speed synchro unit incorporating the first mainshaft gear.

(ii) Thrust washer with three lugs to fit splines.

(iii) Second mainshaft constant gear and bush.

(iv) Third mainshaft constant gear, bush and thrust washer fitted with oil scroll towards gear.

(v) New mainshaft circlip as shown in Fig. 21.

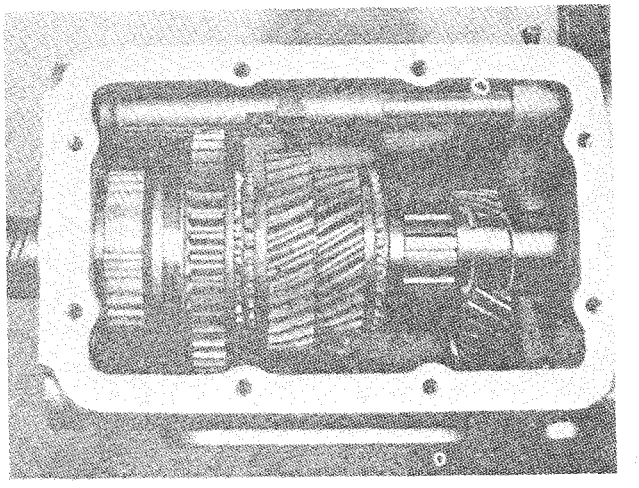

Fig. 21 **Fitting Mainshaft Circlip with Churchill Tool No. 20SM. 46.**

EI

(vi) Third and top speed synchro unit with the short boss of the synchro hub towards the mainshaft circlip or rear of gearbox as shown in Fig. 3. The mainshaft and ball race can then be driven into the gearbox casing, positioning the gap of the circlip on the outer ring of the bearing in line with the atmosphere hole in the casing as shown in Fig. 7.

(j) Assemble oil thrower on to constant pinion shaft and press ball race on the shaft as shown in Fig. 22, ensuring that this goes right home and that in

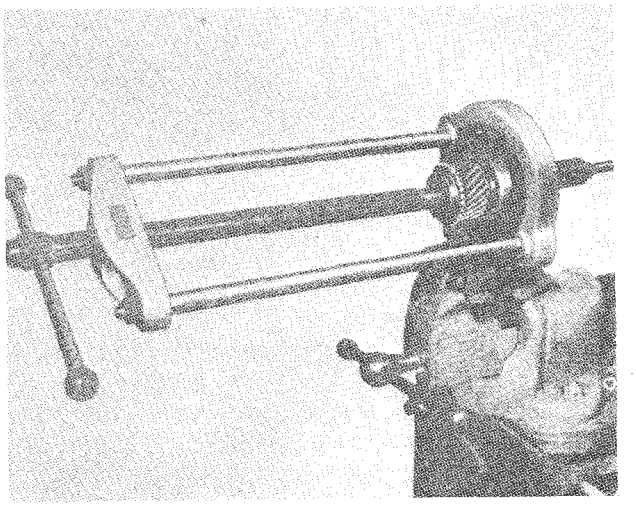

Fig. 22 **Fitting Bearing on to Constant Pinion Shaft with Churchill Press No. S4221 and Adapter from Set No. S4615.**

this position with the correct thrust washer fitted, the small seeger circlip fits properly into its recess. When passing this circlip along the ground portion of the constant pinion shaft, take care not to score the shaft as such damage may cause subsequent leakage of oil. Fit larger circlip into the annular groove in the outer ring of the ball race.

(**k**) Fit Oilite spigot bush into constant pinion, placing the internally bevelled portion of it towards the mainshaft.

(**l**) Drive the constant pinion shaft and bearing into the gearbox casing, positioning the gap in the circlip on the outer ring of the bearing in line with the oil hole in the casing.

Utilising a feeler gauge, measure the distance between the dog teeth of all the mainshaft synchro gears, and the dog teeth of their respective baulk rings. (Fig. 23).

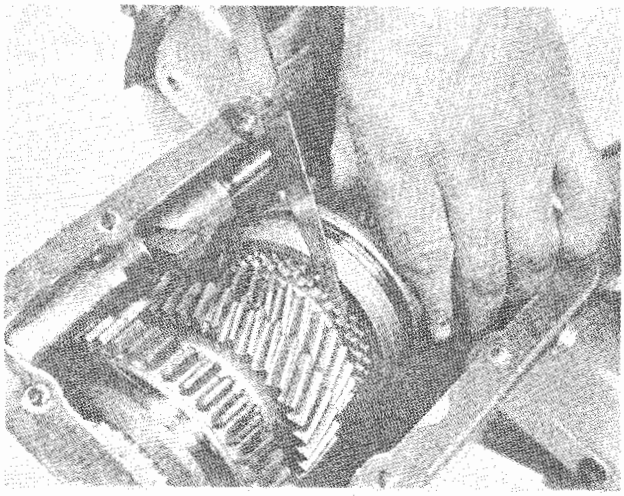

Fig. 23 Measuring the gap between Baulk Ring teeth and Cone.

Move the outer synchro sleeve towards the gear being measured thus forcing the baulking ring on to its cone. In this position the dimension should be between .035″ and .040″ for new components and .005″ to .010″ less for components which have been run-in.

(**m**) Utilise a pilot to align thrust washers and countershaft gear assembly as

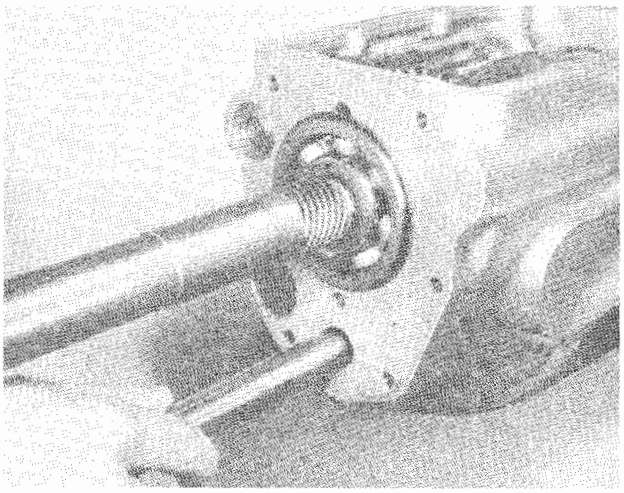

Fig. 24 Inserting Churchill Tool No 20S. 77 preparatory to driving out needle roller retaining tube.

shown in Fig. 24, driving out needle roller retaining tube, subsequently ejecting the pilot tool with the actual countershaft. It is important when carrying out this operation that the pilot tool should maintain contact with the retaining tube or countershaft, as appropriate, throughout the operation, alternatively there is danger that the needle rollers may leave their recess.

(**n**) Install locating setscrew through countershaft, and reverse spindle, first checking the alignment of the holes in the reverse gear spindle and countershaft.

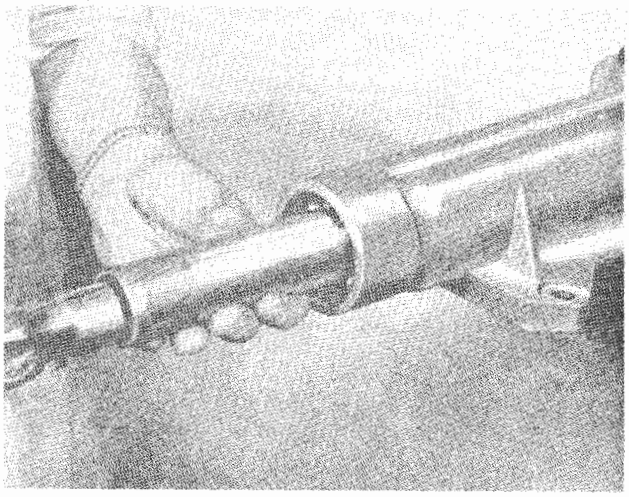

Fig. 25 Fitting Extension Ball Bearing and Thrust Washer with Churchill Tool No. 20S. 87.

(o) Fit countershaft front end cover plate and paper joint securing with two setscrews and washers using lead linger and wiring as necessary.

(p) Assemble gearbox extension and paper joint, securing with six setscrews and washers, using lead linger and wiring as necessary.

(q) Install thrust washer and ball race into gearbox extension with suitable tool as shown in Fig. 25.

(r) Locate gearbox extension oil seal as shown in Fig. 26.

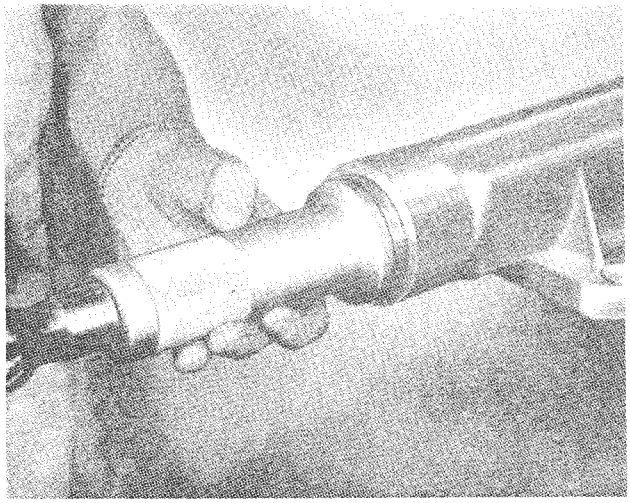

Fig. 26 Fitting Extension Housing Oil Seal with Churchill Tool No. 20S. 87.

(s) Fit plain washer, slotted nut as shown in Fig. 27, tightening to 85—100 lbs. ft., and install split pin.

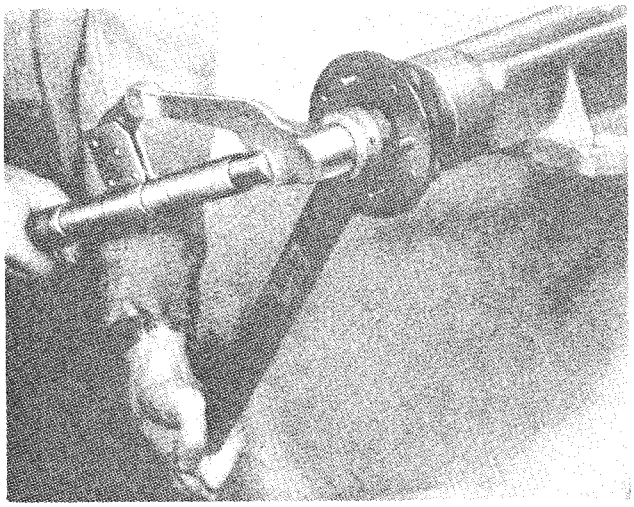

Fig. 27 Tightening Driving Flange Securing Nut with torque spanner and Churchill Tool No. 20SM. 90.

(t) Install speedometer driving gear and accommodating bush, securing with special setscrew.

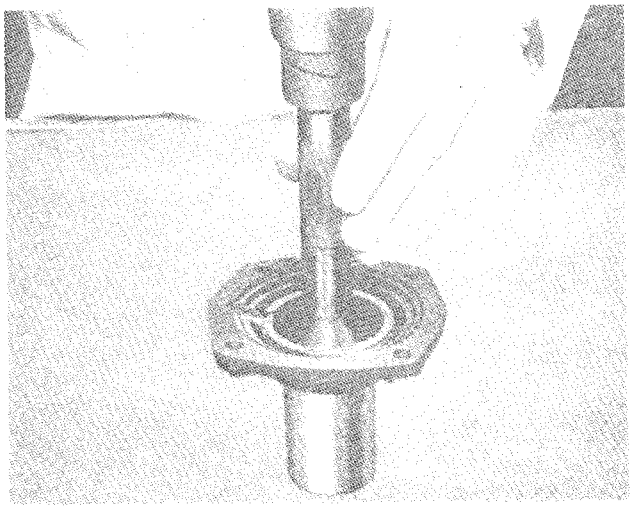

Fig. 28 Fitting Front Cover Oil Seal with Tool No. 20SM. 73.

(u) Fit front cover, having installed oil seal as shown in Fig. 28, utilising fitting tool to protect oil seal (see Fig. 29).

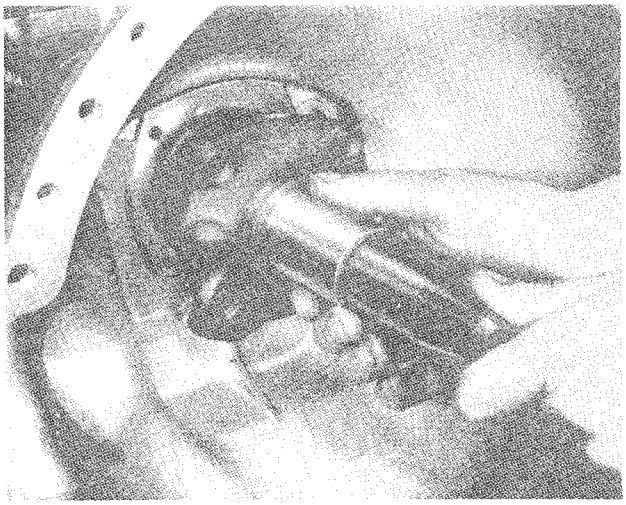

Fig. 29 Assembling Front Cover, utilising Churchill Tool No. 20SM. 47 to protect Seal Face.

Fit four setscrews and plain washers with lead linger after positioning the slot in the face of the front cover horizontally at 9 o'clock and wire setscrew heads.

(v) Assemble clutch throw-out bearing and sleeve and install with clutch operating shaft coil spring and clutch operating fork, positioning both with special securing setscrews, wire locking the latter. Install grease nipple with fibre washer into R.H. end of clutch operating shaft.

(w) Fit top cover assembly with selector mechanism, paper joint, securing with eight setscrews.

10. TO DISMANTLE TOP COVER ASSEMBLY

(a) Remove oil level dipstick.

(b) Ensure that the selector mechanism is in the neutral position.

(c) Remove change speed lever positioning bolt, nyloc nut and setscrew. This enables the change speed lever complete with knob, cap, spring retainer, spring and ball end to be removed as an assembly. Further dismantling requires the removal of the knob and/or the removal of the screwed change speed lever ball end.

(d) Remove 1st and 2nd speed selector shaft wire locked stop screw and $\frac{3}{8}$" dia. positioning ball, spring and retaining screw, then 1st and 2nd speed bronze selector fork wire locked positioning setscrew, and slide selector shaft rearwards clear of the casting to enable the selector fork to be removed.

(e) Remove reverse selector fork and shaft, carrying out procedure as in (d) except that the shaft is positioned by a plunger spring, distance piece and retaining screw instead of the ball, spring and retaining screw.

(f) Remove 3rd and top speed selector shaft and fork, carrying out the procedure as in (d).

N.B. It is important that no attempt is made to move more than one selector shaft at a time otherwise damage will be caused to the selector shaft bores by the interlock mechanism consisting of two $\frac{3}{8}$" dia. ball bearings located in the top cover casting either side of the 3rd and top speed selector shaft, and the .185" dia. interlock roller made of key steel which makes contact with these balls being installed, in a hole drilled transversely through the 3rd and top speed selector shaft. (See Fig. 1.)
The interlock roller and steel balls can easily be shaken or pushed out of position if it is desired to examine them.

(g) Further dismantling of the selector shafts only requires the removal of the selector shaft end pieces on the 1st and 2nd and reverse rods, they are located by a wired setscrew; on the 3rd and top they are silver soldered together.

(h) Remove the two setscrews and spring washers from the oil sealing ring cover plate, enabling the plate and three rubber sealing rings at the end of the selector shaft bores to be removed.

(i) The three 16G pressing selector shafts welch plugs located at the front of top cover and the two 14G pressing welch plugs either side of top cover can easily be removed with a suitable drift.

(j) The threaded plug located on the top cover can also be removed.

TO ASSEMBLE, carry out the reverse procedure to that of dismantling, but for ease of assembly install the $\frac{3}{8}$" dia. interlock mechanism balls after the 3rd and top speed selector shaft has been fitted but before the reverse and 1st and 2nd selector shafts.

Important.
Whilst fitting the selector shafts make sure that the selector shaft or shafts already fitted are in the neutral position.

INSTALLATION OF OVERDRIVE

1. DISMANTLING

Remove the detachable floor pressing from around the gearbox. Remove the four bolts connecting the propeller shaft to the gearbox flange. Disconnect the speedometer drive from the gearbox. Remove the bottom nuts of rear mounting and jack up engine sufficiently to allow removal of rear mounting. Remove the starter motor. Remove the clevis pin from the lever on the clutch operating shaft.

Remove the bolts from around the bell housing and detach the gearbox from the engine.

The gearbox should now be dismantled and the various gears and ball races examined for possible damage. Any parts which are damaged or suspect in any way should be replaced.

The mainshaft originally fitted will be replaced by the special one supplied. To ensure the future life of the Overdrive Unit it is advisable to fit a new mainshaft bearing.

2. ASSEMBLY OF GEARBOX

Proceed to re-assemble in the following manner after ensuring that the gearbox has been drilled as shown in Fig. 31.

(**a**) Fit 1st and reverse idler pinion and shaft with the smaller gear pointing forward and the hole in the shaft in line with the securing bolt.

(**b**) Fit the reverse selector fork and shaft with the tapered hole forward. Secure in position by fitting the tapered bolt and locknut.

(**c**) With heavy grease, assemble the needle rollers into the 1st countershaft gear (24 each end) and slide in a needle retaining tube to retain the rollers during assembly.

(**d**) With heavy grease, position the front thrust washer with the lip of the washer engaged with a recess in the gear case.

(**e**) Slide the small, or 2nd speed gear, on to the 1st countershaft gear, following this by the 3rd speed gear with the boss pointing forward. Next slide on the distance piece and finally the constant speed gear with the boss towards the distance piece.

(**f**) Position the completed countershaft gear assembly in the bottom of the gear case and slide into position the rear thrust washer.

(**g**) For checking purposes the countershaft should be fitted. The countershaft gears (when new) have an end float of .006″—.010″.

(**h**) After checking, the countershaft should be removed by pushing the needle retaining tube into the countershaft gears and forcing the layshaft out, after which the gears will drop to the bottom of the gearbox casing.

(**i**) Fit the triangular washer, ball race, distance washer and circlip to the new mainshaft. Gripping the mainshaft in the protected jaws of a vice, assemble the gears on this shaft up to the main locating circlip, ensuring that the recess for this is free for its eventual entry by checking with half the circlip previously used (a new one will be required when re-assembling). When a new 2nd or 3rd mainshaft gear is to be fitted, ensure that .004″—.006″ end float of the gears is permitted by the length of their bushes, when in their fitted position.

Having ensured that the synchro units are perfectly free on their splines, check the overall float of the constant mesh assemblies by removing the 2nd and 3rd speed constant gears, but leaving their respective bushes in position with the hardened steel thrust washers and the half circlip.

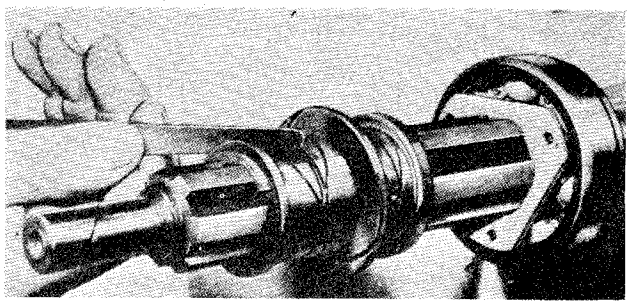

Fig. 30 Checking overall float of mainshaft bushes with feeler gauge.

The end float can then be checked with a set of feeler gauges as shown in Fig. 30. The correct float should be between .007″ and .012″.

(j) Remove the mainshaft details remaining on the shaft and begin the final assembly.

Feed the shaft into the casing and assemble the 2nd gear synchro unit, the hardened steel thrust washer which must be located on the splines, the 2nd constant gear with its bush, the 3rd constant gear with bush, the front hardened steel thrust washer and finally fit the main locating circlip with a special sleeved tool.

(k) Withdraw the gearbox mainshaft, with the gears so far assembled, sufficiently towards the rear to enable the assembly to be tipped upwards, thus permitting the 3rd and top synchro unit to be fitted.

(l) Tap the mainshaft assembly into position and fit the constant pinion assembly.

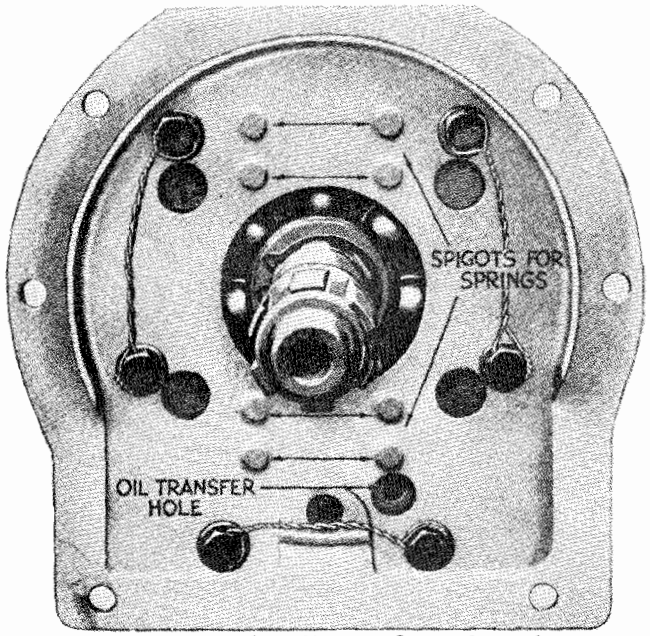

Fig. 31 Showing the oil transfer hole and method of wiring bolts. The Gearbox casing has to be drilled on early models whereas all present production are already drilled.

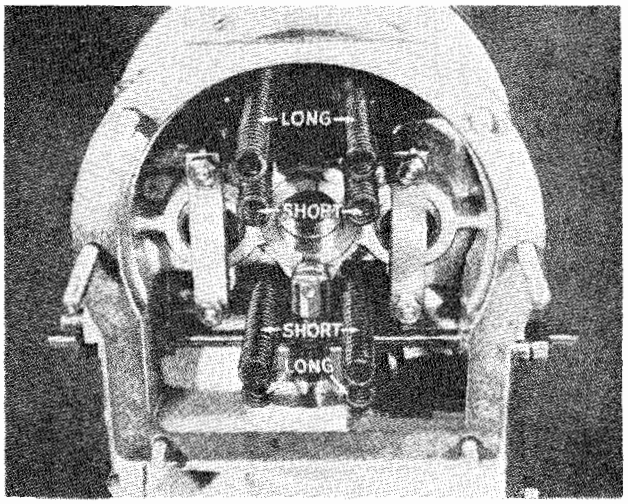

Fig. 32 Showing correct location of four springs.

3. FITTING THE OVERDRIVE UNIT

(a) Locate the paper washer on the gearbox casing with grease, fit the overdrive adapter plate and wire the six securing bolts, as shown in Fig. 31. The correct positioning of the wiring is important to ensure proper working clearance for the assembled overdrive unit. Ensure that the oil transfer hole is free (see Fig. 31).

(b) Ensure that the eight springs in the overdrive unit are correctly located, as shown in Fig. 32, that is, the long springs on the outside and the short springs nearer the centre.

(c) After placing a paper joint on the adapter plate, fit the gearbox assembly

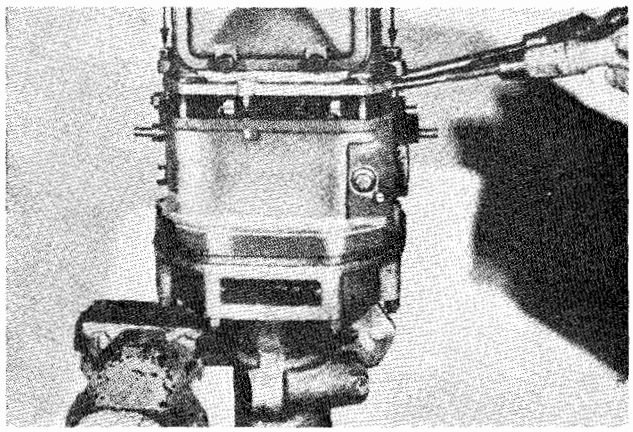

Fig. 33 Method of fitting Gearbox to Overdrive Unit.

to the overdrive unit, holding the latter vertically in the vice as shown in Fig. 33. After engaging top gear, turn the constant pinion until the splines in the overdrive unit mesh with those of the mainshaft. The eight springs are now located on their spigots and a nut and washer fitted to each long stud.

These two nuts are now evenly tightened until the pump roller is nearing the pump driving cam. The driving cam should have been assembled on the gearbox mainshaft splines so that the least amount of eccentricity is nearest to the pump roller. It is necessary to depress the pump plunger with a screwdriver to allow the pump roller to pass over the cam. The nuts are now finally tightened.

CAUTION. Do not use undue force in tightening the nuts on the long studs. There are two sets of splines in the overdrive unit and unless these are in line, it is impossible to tighten the overdrive unit home on to the adapter plate face.

The overdrive valve setting should now be checked.

4. VALVE CHECKING

On the R.H. of the overdrive unit and pinned to the valve operating shaft, is a valve setting lever with a $\frac{3}{16}$" diameter hole. In the casting adjacent to this lever is another $\frac{3}{16}$" diameter hole. Actuate the solenoid with a 12 volt battery and while the plunger is drawn into the solenoid and if the valve adjustment is correct, it should be possible to insert a $\frac{3}{16}$" diameter pin through the valve setting lever and into the casting (see Fig. 34).

If this is not possible then the valve must be re-adjusted in the following manner.

5. VALVE ADJUSTMENT (Fig. 35)

Remove the cover plate by unscrewing three cheese headed bolts. Slacken off the clamping bolt on the solenoid lever.

Rotate the valve setting lever until its $\frac{3}{16}$" diameter hole coincides with the $\frac{3}{16}$" diameter hole in the casting. Insert a $\frac{3}{16}$" diameter pin through the hole in the

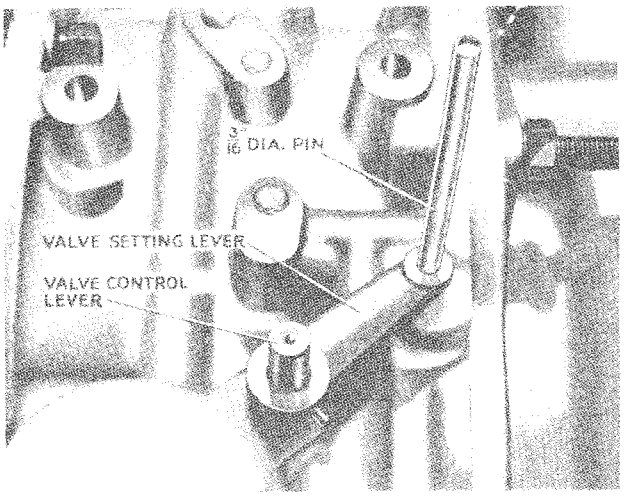

Fig. 34 Method of setting Valve Operating Levers.

setting lever and into the casting thus locking the valve operating shaft.

Actuate the solenoid with a 12 volt battery and while the plunger is drawn into the solenoid, tighten the clamping bolt on the solenoid lever and at the same time ensure that opposite end of the solenoid lever is against the head of the actuating bolt. Repeat the first check and if satisfactory, refit the cover plate.

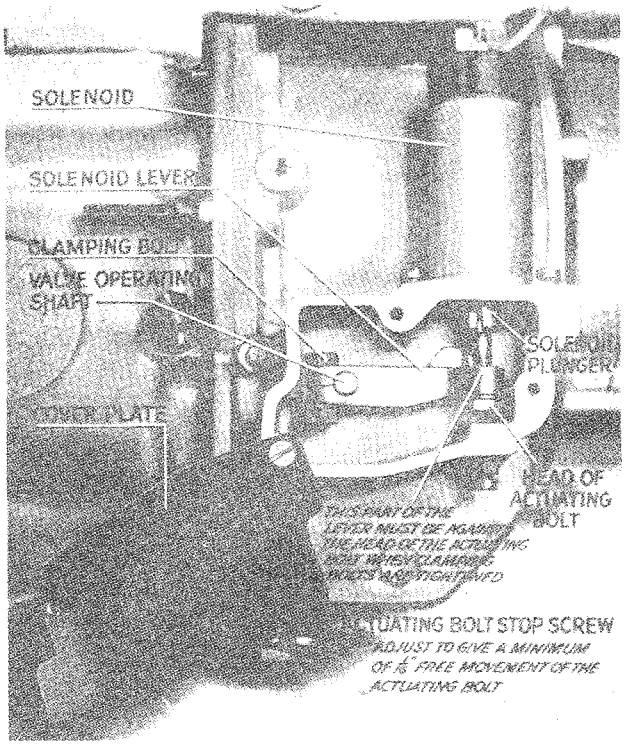

Fig. 35 Setting Solenoid Lever.

6. FITTING THE ISOLATOR SWITCH

On the lid of the gearbox, and situated near the dipstick, is a plug with a 16 mm. dia. thread. This plug should be removed and replaced by an isolator switch type SS10/1, which is supplied (see Fig. 36). See page 24 for multi-gear overdrive.

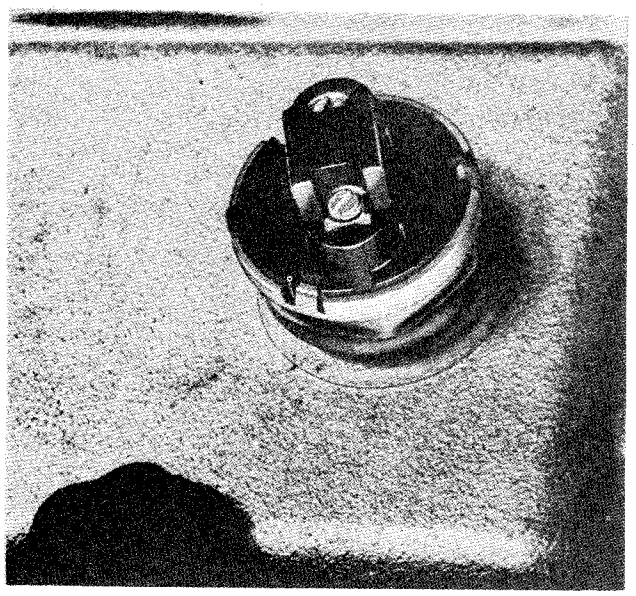

Fig. 36 Showing the position of the Isolator Switch on the Gearbox Cover.

7. THE OPERATING SWITCH

L.H. Drive Cars. Two holes are pierced in the facia panel on the L.H. side of the speedometer and covered with fabric. The fabric should be pierced through the extreme L.H. hole and the operating switch fitted. The remaining hole is used for a heater switch when fitted.

R.H. Drive Cars. Two holes are pierced in the facia panel on the R.H. side of the speedometer and covered with fabric. The fabric should be pierced through the extreme R.H. hole and the operating switch fitted (see Fig. 37).
The remaining hole is used for a heater switch when fitted.

The Relay. Reference to Fig. 38 shows the fitted position of the relay.

Wiring. The feed wire to the terminal marked " W1 " on the relay is taken from

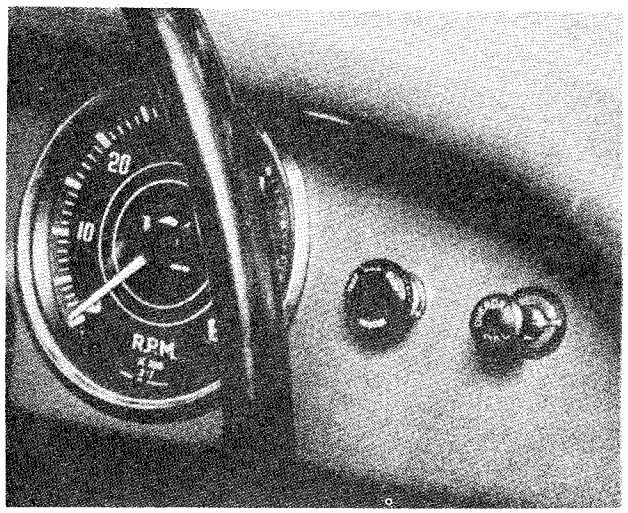

Fig. 37 Showing the position of the Overdrive Control.

the " live " side of the starter switch on the facia panel (see Fig. 39).

NOTE—The terminal on the starter switch is " live " only when the ignition is switched " ON."
A wire is connected from " W2 " on the relay to a terminal of the operating switch on the facia panel. The remaining terminal

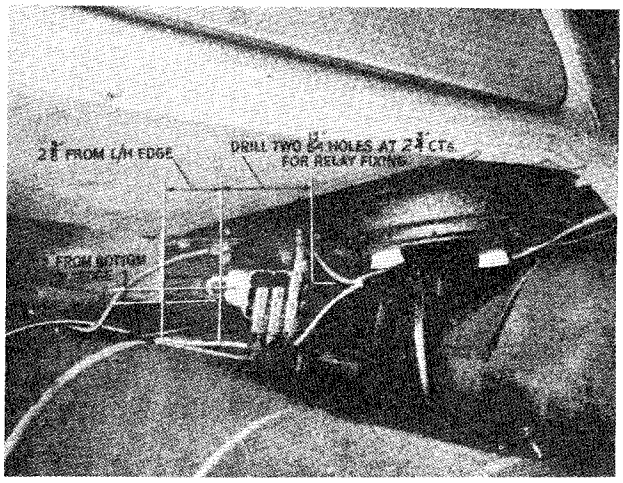

Fig. 38 Instructions for fitting the Relay Switch.

of the operating switch is connected through a snap connecter to a terminal on the isolating switch situated on the gearbox lid. The remaining terminal of the isolating switch is earthed to one of the bolts securing

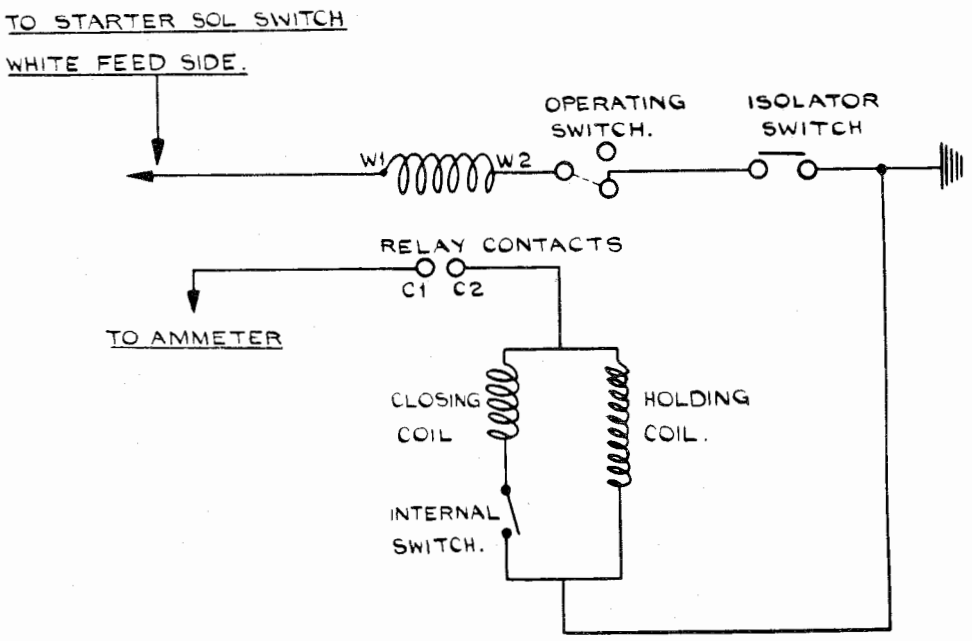

Fig. 39 **Overdrive Control Circuit.**

the gearbox lid. A second feed wire is connected from the negative side of the ammeter to " C1 " on the relay.

To complete the wiring, a wire is connected from " C2 " on the relay through a snap connecter to the solenoid.

Built into the solenoid are two coils, a closing coil and a holding coil. These two coils are connected in parallel with an internal switch connected in series with the closing coil.

When the solenoid is energised, both coils are in circuit until the plunger reaches a pin which operates the internal switch. This switch switches out the closing coil and allows the holding coil to remain in circuit.

The closing current of 15 amperes is of a very short duration. The holding current should be less than one ampere. Fig. 39 shows the theoretical wiring diagram.

SUPPLEMENTARY INSTRUCTIONS FOR INCORPORATING OVERDRIVE ON "SECOND" AND "THIRD" GEARS

1. The incorporation of Overdrive on "Second" and "Third" gears has necessitated the following engineering alterations :—

(a) Increasing the diameter of the clutch operation pistons in the overdrive unit from $1\frac{1}{8}$" to $1\frac{3}{8}$".

(b) Re-designing the gearbox top cover assembly to permit the selection of overdrive in other gears.

2. OVERDRIVE UNIT

To enable the unit to transmit the maximum available torque in the lower gears, it is necessary to use larger clutch operating pistons than those fitted previously.

From Chassis No. TS.5980 onwards, all Triumph Sports Cars, which have been equipped with overdrive, have been fitted with the re-designed unit, Part No. 301991 : Serial No. 22/1374/— incorporating the larger pistons.

NOTE. A small number of cars with chassis numbers prior to TS.5980 have been fitted with the re-designed overdrive unit.

To establish whether or not a re-designed unit has been fitted, remove the gearbox floor covering and a brass plate can be seen bearing a serial number. The old unit number is 22/1275/—, and the re-designed unit number is 22/1374/—.

Unit Exchange
The Spares Department of The Standard Motor Company Ltd., in conjunction with Messrs. Laycocks, operate an exchange system whereby the old unit can be exchanged for the later type at a cost fixed by the Spares Division of The Standard Motor Company Ltd.

3. GEARBOX TOP COVER ASSEMBLY Fig. 41

To permit the selection of overdrive in "Second" and "Third" as well as "Top" a new top cover assembly has been designed and the Part No. is 502411.

The new cover assembly has been fitted to Chassis No. TS.6280 and all subsequent Sports Cars.

NOTE. A limited number of cars prior to Chassis No. TS.6280 were fitted with the new cover assembly and can be recognised by the two isolator switch bosses, Fig. 41.

Modification of Top Cover Assembly. To modify the old top cover assembly, thus permitting the selection of overdrive in 2nd, 3rd and top gears necessitates the fitting of certain new parts. The new parts required are detailed under "Top Cover Conversion Pack" on page 27.

Top Cover Assembly—Fig. 40—Dismantling. Proceed as follows :—

(a) Remove the dipstick and ensure that the selector mechanism is in the "Neutral" position.

(b) Disconnect the wires from the isolator switch, where fitted, and remove the top cover assembly from the gearbox.

(c) Remove the change speed lever by :—
(i) Unscrewing and removing the $\frac{1}{4}$" UNF setscrew (1) which secures the retaining cap to the top cover casting.

(ii) Unscrewing the nyloc nut (2) from the pivot bolt.

SUPPLEMENTARY INSTRUCTIONS FOR INCORPORATING OVERDRIVE ON "SECOND" AND "THIRD" GEARS

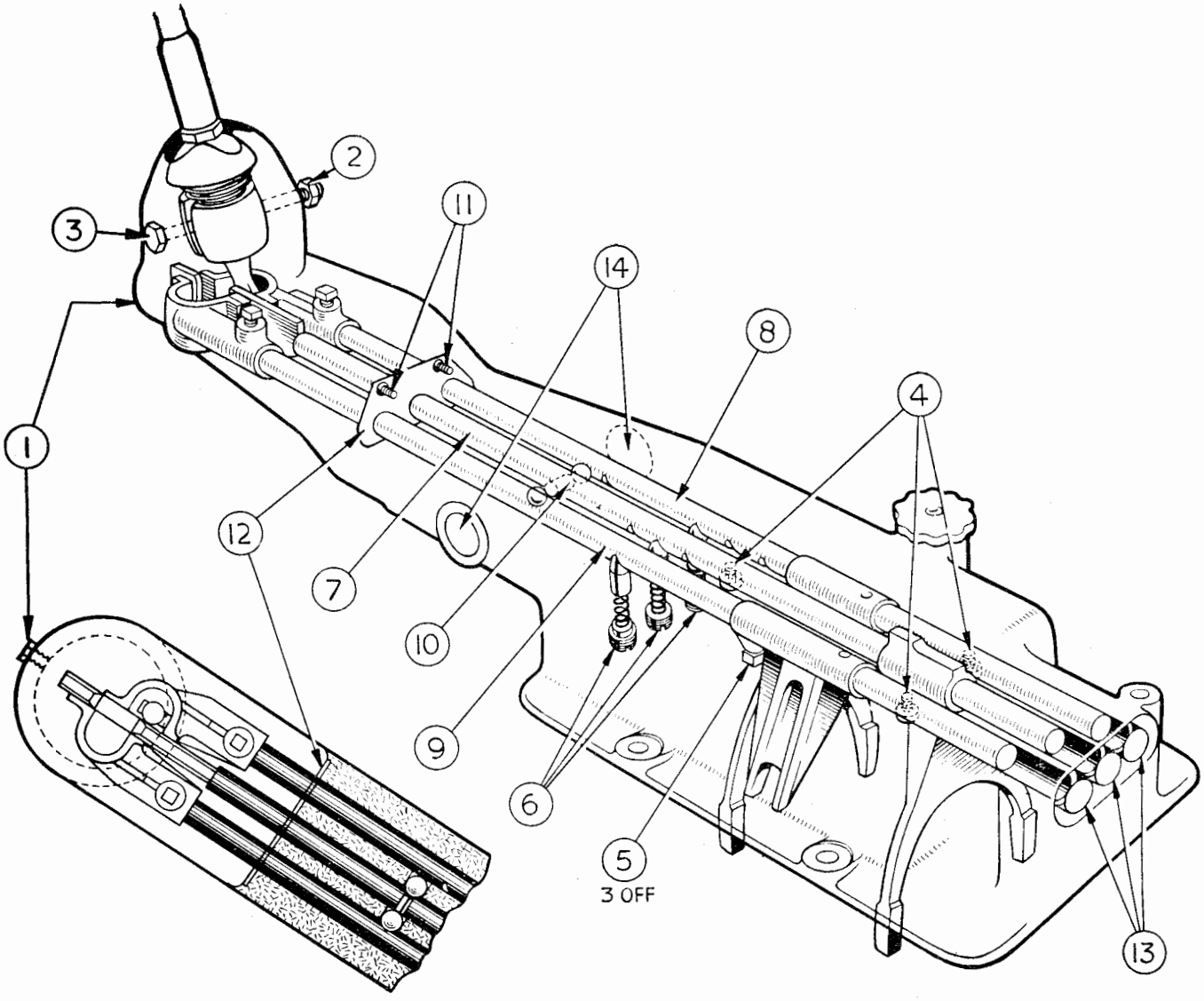

Fig. 40 **Ghost view of Top Cover Assembly.**

(**iii**) Withdrawing the pivot bolt (3) to enable the change speed lever assembly to be withdrawn.

Caution. When withdrawing the change speed lever assembly, ensure that the anti-rattle spring and retainer, which is located on the spherical part of the lever, is retained for re-assembling.

(**d**) Remove the three wire locked stop screws (4).

(**e**) Unscrew and remove the three wire locked screwed taper pins (5) securing the forks to the selector shafts.

(**f**) Remove 1st and 2nd speed selector shaft retaining screw (6), spring and $\frac{3}{8}$" locking ball and slide this selector shaft rearwards clear of the casting to enable the removal of the selector fork.

(**g**) Remove " Reverse " selector fork and shaft (9) carrying out the procedure as in (**f**) above, excepting that the shaft is positioned by a plunger, spring, distance piece and retaining screw instead of the ball, spring, and retaining screw.

(**h**) Remove 3rd and " Top " speed selector shaft (7) and fork, carrying out the procedure used in (**f**) above.

SUPPLEMENTARY INSTRUCTIONS FOR INCORPORATING OVERDRIVE ON "SECOND" AND "THIRD" GEARS

NOTE. It is important that no attempt is made to move more than one selector shaft at a time otherwise damage will be caused to the bores of the top cover and difficulty will be experienced in removing the shafts.

(**i**) Finally shake out the interlock balls from the casing.

(**j**) Remove the existing isolator switch.

(**k**) Remove the two $\frac{1}{4}$" UNF setscrews (11) from the oil sealing ring cover plate (12), enabling the plate and three rubber sealing rings to be removed.

(**l**) It being very difficult to remove the welch plugs (13 and 14) without damaging them, it is desirable to replace the old plugs with new ones when re-assembling the new top cover.

Top Cover Assembly—Fig. 40—To Assemble. Assemble the new selector forks into the new top cover by reversing the dismantling procedure, observing the following :—

(**a**) Ensure before fitting the centre selector shaft that the interlock pin is positioned in the end of the shaft. (See 10).

(**b**) After fitting and moving the centre shaft to the " Neutral " position, feed the two interlock balls into position from either side. (See 10).

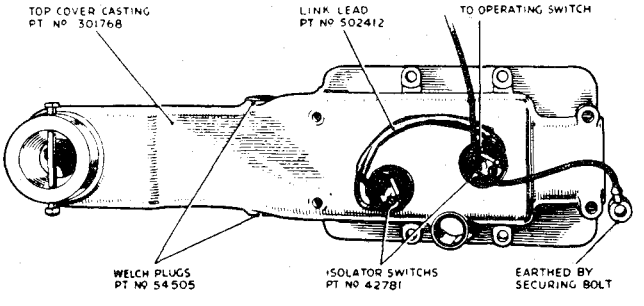

Fig. 41 **Top Cover showing Isolation Switches.**

Isolator Switches. The isolator switches, Fig. 41 (Part No. 42781), are not included in the top cover assembly (Part No. 502411) and will therefore be required.

Switch Adjustment. Fig. 42. It is important when moving the gear lever to an engaged position, that the switch contacts close at a precise point during the lever's movement.

The correct time for contact closure is when :—

(**a**) Synchronisation is complete.

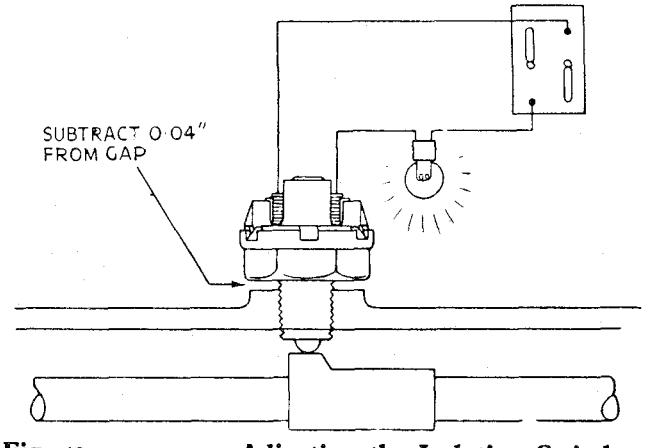

Fig. 42 **Adjusting the Isolation Switches.**

(**b**) The synchro sleeve begins to cover the dog teeth of the driving gear.

NOTE. Failure to obtain these conditions will result in noisy and difficult gear changing.

To obtain correct switch adjustment proceed as follows :—

(**a**) Move the gear lever until " Second " gear is fully engaged.

(**b**) Wire a bulb in series with the switch contacts and connect to a battery. (Fig. 42).

(**c**) Screw the switch into the rear switch boss (Fig. 42), until the contacts close. (Indicated by the bulb lighting.)

SUPPLEMENTARY INSTRUCTIONS FOR INCORPORATING OVERDRIVE ON "SECOND" AND "THIRD" GEARS

(**d**) Measure with feeler gauges the gap between the switch and boss, that is, the amount the switch would have to be screwed down to be fully home.

(**e**) From this dimension subtract .040″ and make up the remainder with paper packing washers, Part No. 502146.

Example. If the gap measured .090″ the subtraction of the .040″ would leave .050″. By selection (the washers vary in thickness) obtain a pack which measures .050″.

(**f**) Disconnect the switch and remove it from the top cover.

(**g**) After installing the washer-pack over the screwed portion of the switch, screw the switch securely into the top cover.
Repeat the procedure with the "Third" and "Top" isolator switch.

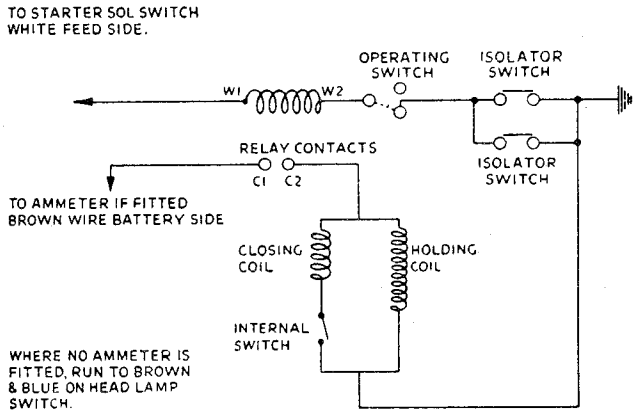

Fig. 43 **Wiring Diagram.**

Wiring. The switches are wired in parallel (Fig. 43) and the necessary link lead from switch to switch is obtainable under Part No. 502412.

One of the link wires is connected to earth (Fig. 41). The remaining link wire is connected through a snap connector to one side of the operating switch.

Top Cover Conversion Pack—Part No. 503219. The following is a list of the parts included in the pack to convert the old type cover assembly, part No. 502078 to 502411.

1	Top Cover Casting	301768
1	1st and 2nd Selector Fork	110753
1	Top and 3rd Selector Fork	110754
2	Welch Plugs	54505
1	Isolator Switch	42781
6	Packing Washers	502146
1	Link Lead	502412
3	Welch Plugs	104449

Overdrive Kit—Part No. 501803 for R.H.
Part No. 502104 for L.H.

These kits may be used either:

(**a**) Where a car is to be fitted with overdrive on all gears and is already fitted with a top cover (Part No. 502411).

(**b**) To convert cars fitted with the old type overdrive unit (Serial No. 22/1275/—, in which case either:—

(**i**) A complete new top cover assembly, Part No. 502411, may also be required, or

(**ii**) A top cover conversion Pack, No. 503219.

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