

GEARBOX



SERVICE INSTRUCTION LEAFLET

ISSUED BY
ROLLS-ROYCE LIMITED

RR/G 3

SB. 4/SF.

Subject :

PRE-WAR WRAITH GEARBOX.

Date
of
Issue

22nd April, 1949.

IMPORTANT

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Experience has shown that certain troubles may develop on the pre-war Wraith gearbox unless certain modifications are applied. The troubles which are possible are as follows:-

1. Jamming of gear lever in 2nd. gear, due to internal derangement in the box.
2. Gear lever coming out of engagement with the selectors. (This is caused by relative movement between engine and frame.)
3. Excessive wear of ball bearings at rear end of gearbox.

Retailers and all Repair Depots are advised to contact the London Service Depot for advice whenever a Wraith gearbox gives trouble or whenever the gearbox is being overhauled for any reason, as it is strongly recommended that the opportunity should be taken to embody a number of modifications which will prevent further trouble.

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ROLLS-ROYCE LIMITED, SERVICE STATION, HYTHE ROAD, WILLESDEN, LONDON, N.W.10



SERVICE INSTRUCTION LEAFLET

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ROLLS-ROYCE LIMITED

RR/G2.

SB.2/JM.

Subject : Shock Absorber Control Pump Drive.
Oil Leaks.
Ph.II, Ph.III, 20/25.h.p., and 25/30 h.p.

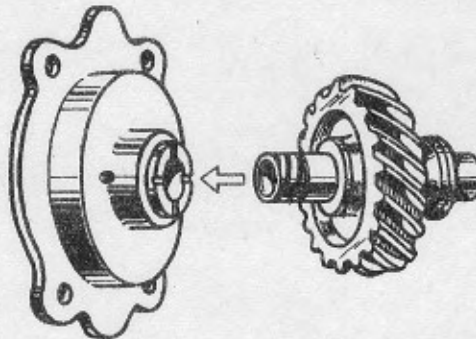
Date
of 4th December, 1946.
Issue

It is possible to produce a serious oil leak from the gear box if the skew gear which drives the governor pump is fitted the wrong way round. This is quite easily done since it will drive either way, and there is no apparent disability in functioning.

The correct method of assembly is shown in the drawing herewith, from which it will be seen that the Acme thread fits into the cover and acts as an oil return. If it is fitted the other way round, the Acme thread does not function, also the length of bearing is so short that the oil return hole is uncovered and permits a direct outlet for the oil.

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SERVICE INSTRUCTION LEAFLET

ISSUED BY

ROLLS-ROYCE LIMITED

RR/G1.

SB. 1/DP.

Subject :

CHANGE GEAR MECHANISM
WRAITH.

Date

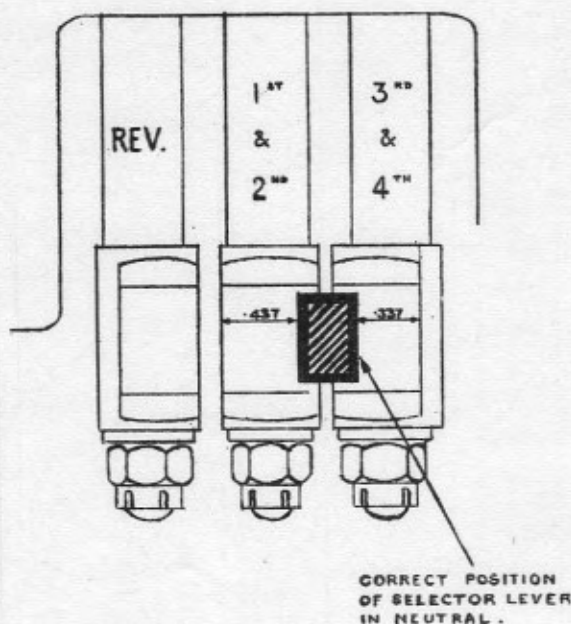
of 10th October, 1946.
Issue

The change speed lever and gate on Wraith Cars are mounted on the frame so as to isolate them from engine and gearbox movement, the actuating mechanism being flexibly coupled.

This results in relative movement between the selector lever and the selector shafts in the gearbox, and although this movement is within the capacity of the mechanism to absorb under normal conditions, instances have arisen where excessive engine movement has taken place, as for instance when the engine is running erratically, and this may cause the selector lever to move out of engagement with the appropriate selector shaft, thus temporarily making it impossible to change gear.

When this happens, it is a simple matter to unfasten the selector cover and to re-position the selector lever in the gearbox.

In such cases it will of course be necessary to take action to prevent this occurring again, and the following modification should be carried out.



(a) The selector lever should be set slightly to one side so as to give the lever a bias in the direction in which the engine moves under torque reaction, and the correct position for the selector lever in neutral with the engine stationary is shown in the sketch herewith.

(b) If the foregoing alteration has already been carried out and the trouble still persists, it will be necessary to limit the engine movement which is evidently excessive, possibly due to softening of the existing rubbers. New harder rubbers for fitting underneath the rear end of the gearbox may be had on application to Rolls-Royce Limited.

In view of the obvious embarrassment which may be caused the Owner when this trouble occurs, it is recommended that item (a) should be checked and if necessary corrected when a Wraith Car is received at a Service Station for other work.

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SERVICE INSTRUCTION LEAFLET

ISSUED BY

ROLLS-ROYCE LIMITED

RR/G4.

SE/VA.1/SF.

Subject : TO OVERHAUL A 20/25-HP & 25/30-HP ROLLS-ROYCE GEARBOX EXCLUDING THOSE FITTED TO 20/25-HP CHASSIS PRIOR TO CHASSIS NO. GLZ-51 IN 'Z' SERIES

Date of Issue 20th December, 1954.

GENERAL:

Four speeds and reverse with positive interlock selector mechanism. Synchronesh on third and fourth speed gears and from second to third speed gear. A servo motor of the dry, disc-clutch type and a plunger type pump with a centrifugal governor (carried in a casing and incorporated on 20/25-HP Chassis No. GYD-25 onwards) for the rear controllable shock dampers are mounted on the gearbox and driven from the 3rd motion shaft, together with the speedometer drive.

NOTE: Retailers in the British Isles are advised that gearboxes requiring major repairs should be returned to the London Service Station.

For the removal of the gearbox, refer to Service Instruction Leaflet No. RR/F2. "Clutches".

1. SPECIAL TOOLS REQUIRED:

Tool No.	No. Off.	Title.	Application.	Remarks.
R-3181	1	Extractor.	Diaphragm.	If this tool is not available, a simplified and cheaper version can be made from details shown in Fig. 5.
-	1	Box spanner.	Nut-1st Motion shaft.	The width across the flats of the nut is 1.825"

Apart from the above, a $\frac{7}{8}$ " 15/16" and a 1" (B.S.F.) box spanner will be required for removing the retaining nuts of the 2nd and 3rd motion shafts. A 1" (Whitworth) box spanner will also be required for removing the nut from the servo motor countershaft.

2. PARTS REQUIRED:

Part No.	No. Off.	Title.	Designation.	Remarks.
RG-7081	1	Ball bearing.	1st Motion shaft.)It is recommended that when a gearbox is being overhauled, new bearings should be fitted. It should not however be necessary to change the two ball bearings supporting the servo drive shaft.
G-55822	1	Ball bearing.	3rd " " -centre.	
100/0296	1	Ball bearing.	3rd " " -rear end.	
100/0288	1	Ball bearing.	2nd " " -front "	
G-55822	1	Ball bearing.	2nd " " -centre.	
100/0276	1	Roller bearing.	2nd " " -rear end.	

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Part No.	No.Off.	Title	Designation.	Remarks.
E-27491	2	Aluminium washer.	Oil drain plugs.	
E-27491	3	Aluminium washer.	Inspection plugs.	On L.H. side of gearbox.
E-70781	1	Aluminium washer.	Plug-plunger housing.	
G-78565	1	Aluminium washer.	Oil filler plug.	
G-54710	2	Lockwasher.	1st Motion shaft.) An extra lock-washer is included in case of need.
G-54681	2	Lockwasher.	2nd Motion " -front end	
G-54681	2	Lockwasher.	3rd Motion " -rear end	
G-54678	2	Lockwasher.	2nd Motion " -rear end	
G-77672	1	Lockwasher.	Nut-servo suspension brkt.	
G-52135	1	Lockwasher.	Nut-servo pressure plate. (In case of need if servo is dismantled.	Required up to Chassis No. GEH-44
G-56555	1	Lockwasher.	Nut-servo pressure plate. (In case of need if servo is dismantled.	Required from Chassis No. GBJ- 1 onwards.
G-52731	2	Joint(Vellumoid)	C/shaft housing flange.	
G-54743	2	Joint(" ")	Rocking shaft bearings.	
G-54744	1	Joint(" ")	3rd & 4th speed selector guide.	
G-56149	1	Joint("Oakenstrong")	Selector lever cover.	Required up to Chassis No. GBK-21
G-57072	1	Joint("Oakenstrong")	Selector lever cover.	Required from Chassis No. GBK-22 onwards.
G-54817	1	Joint(Vellumoid)	Diaphragm.	
G-54818	1	Joint(Vellumoid)	Plunger housing-selector shafts	
G-54825	1	Joint(Vellumoid)	Rear cover-3rd motion shaft.	
G-54862	1	Joint(Vellumoid)	Cover-plunger housing.	
G-55642	1	Joint(Vellumoid)	Rear cover-2nd motion shaft.	
G-55643	1	Joint(Vellumoid)	Front end cover.	
G-56150	1	Joint("Oakenstrong")	Front top cover.	
G-56151	1	Joint("Oakenstrong")	Rear rop cover.	
G-56152	1	Joint("Oakenstrong")	Change gear & speedo drive bracket.	Required up to Chassis No. GBK-21
G-57036	1	Joint("Oakenstrong")	Change gear & speedo drive bracket.	Required from Chassis No. GBK-22 onwards.
F-60287	2	Joint(Vellumoid)	End plate & main casing of governor control for dampers.	Required from Chassis No. GYD-25 onwards when it is necessary to remove the main casing.
G-55824	2	Bush(bronze)	2nd speed driver gear-2nd motion shaft.	
G-55811	2	Bush(bronze)	3rd speed constant mesh gear.- 3rd motion shaft.	
E-89081	2	Corru. washer.	Exhaust pipe.	Required when assembling gearbox to chassis.
G-52881	1	Adjusting washer (54 Fig.2)	2nd Motion shaft.)The adjusting washers and the distance piece listed, are the thickest and longest of the range specified for the 2nd & 3rd motion shafts. Where it is found that an existing adjusting washer or distance piece is of insufficient thickness or length due to wear, a new one should be reduced to the required size. The faces must be kept parallel.
G-54844	1	Adjusting washer (48 Fig.2)	2nd Motion shaft.	
G-55081	1	Distance piece (50 & 52 Fig.2)	2nd Motion shaft.	
G-54843	1	Adjusting washer (23 Fig.2)	3rd Motion shaft.	
G-54686	1	Adjusting washer (26 Fig.2)	3rd Motion shaft.	
G-54846	1	Adjusting washer (29 Fig.2)	3rd Motion shaft.	

3. TO DISMANTLE THE GEARBOX (AFTER REMOVAL FROM CHASSIS):

NOTE: It is recommended that the 2nd and 3rd motion shafts and their associated parts should be put into separate containers during the dismantling operations.

- (i) Drain out the oil. Remove the front and rear top covers.
- (ii) Remove the selector lever cover from the top of the gearbox.
- (iii) If the change gear support bracket has not already been removed prior to the removal of the gearbox from the chassis, then unscrew the set-bolts and nuts securing it to the gearbox and remove the bracket complete with the governor casing (if the latter is fitted). Before removal, push the change gear lever towards the gearbox and manoeuvre the unit out of position and withdraw the square speedometer drive shaft. (1 Fig.1).
- (iv) Remove the external oil pipe from the top of the clutch casing.
- (v) Remove ten nuts securing the clutch casing. Only remove the nuts from the bolts of which the heads are visible inside the clutch casing. Do not remove at this stage, the two nuts situated about halfway up the casing on either side. Remove the clutch casing by lightly tapping it with a hide mallet.
- (vi) Remove the clamping bolt securing the lever (on L.H. side of gearbox) to the servo countershaft which passes through the gearbox; remove the lever, its key and adjacent washer.
- (vii) Next, remove the large nut and washers from the end of the servo countershaft and the clamping bolt and coil spring from the suspension link.
- (viii) Disconnect the oil pipe from the brake damper cylinder and remove the damper unit.
- (ix) Remove the eight bolts securing the servo friction plate to its driving disc.
- (x) Remove the 5/16"(B.S.F.) nut securing the servo bridge (plate) to its bracket near rear end of gearbox; withdraw the servo mechanism and remove the bracket secured by two nuts.
- (xi) Withdraw the servo drive shaft (2 Fig.1) simultaneously collecting the distance pieces (3 & 6), the adjusting washers (4 & 7), and the worm gear (5). It should not be necessary to remove the ball bearings of the drive shaft.
- (xii) Remove the external oil pipe from the L.H. side of the gearbox.
- (xiii) Pass a drift through the aperture at the top of the front end of the gearbox and tap out the two steel bearings supporting the rocking shaft and operating stirrup. These bearings have oval flanges which abut against the outside of the gearbox on either side. Withdraw the rocking shaft complete with the operating stirrup.
- (xiv) The next operation is to lock the 1st, 2nd and 3rd motion shafts so that the retaining nuts of these shafts can be removed.
Proceed as follows:-
 - a) Place a circular lever (about 14" long x 7/16" dia.) through the aperture at the top of the front end of the gearbox, enter the lever in the stirrup groove of the 3rd and 4th speed actuating sleeve (11 Fig.2) and push the sleeve towards the rear of the gearbox to engage the 3rd speed gear.

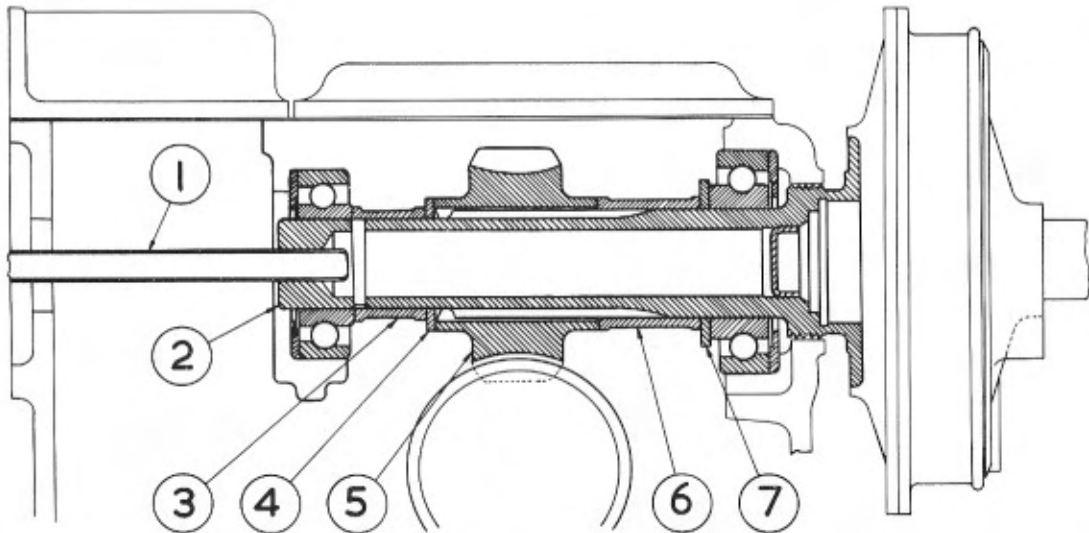


FIG. 1. SECTION - SERVO MOTOR & SPEEDOMETER DRIVE.

- | | |
|-----------------------------|----------------------|
| 1. Speedometer drive shaft. | 5. Worm gear. |
| 2. Servo drive shaft. | 6. Distance piece. |
| 3. Distance piece. | 7. Adjusting washer. |
| 4. Adjusting washer. | |

- .b) Pass the lever through the selector lever cover aperture (top of gearbox), and enter it in the jaw of the reverse gear selector shaft (i.e. shaft nearest to centre of gearbox) and push the shaft rearwards to engage the reverse gear.
 - (xv) Remove the retaining nut, 34 Fig.2 (R.H.thread) from the rear end of the 3rd motion shaft, collect the clamping washer (32) and withdraw the coupling flange (31) from the shaft.
 - (xvi) Remove the gearbox support bracket from the rear of the box and the cover for the 3rd motion shaft complete with oil drain pipe (if the latter is fitted). Remove the adjusting washer (29) and TIE it to the coupling flange.
- NOTE:** Do not remove at this stage the 2nd motion and reverse shaft cover from the rear of the box.
- (xvii) Remove the cover (secured by 11 nuts) from the front end of the gearbox, collect the thin metal oil baffle adjacent to the ball bearing of the 1st motion shaft and the aluminium distance piece adjacent to the ball bearing at the front end of the 2nd motion shaft. Remove the nut, 58 (R.H.thread) from the front end of the 2nd motion shaft and collect the clamping washer (56)
 - (xviii) Remove the nut, 64 (L.H.thread) from the 1st motion shaft and collect the clamping washer (66).
 - (xix) Remove the spring loaded cover (secured by 2 nuts) from the bronze plunger housing at rear of gearbox and the three springs(75 Fig.3). Remove the plunger housing (73) as follows:-
 - a) Remove the nuts and pull the housing away from the gearbox, if obstinate to remove, then slide any one of the three selector shafts backwards and forwards simultaneously shaking the housing to and fro to release it from the internal ball operated locking mechanism.

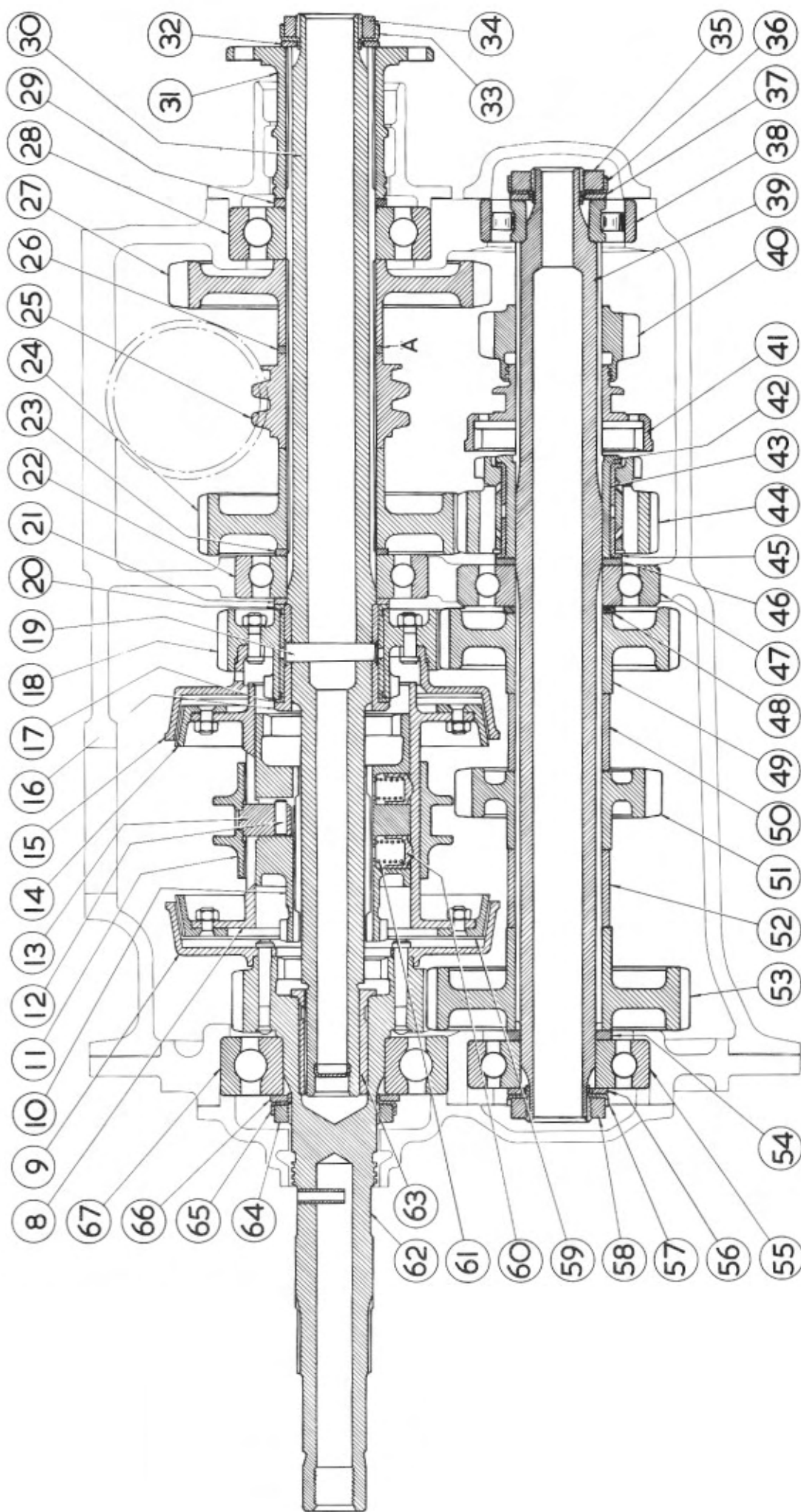


FIG. 2. SECTION - 1ST, 2ND AND 3RD MOTION SHAFTS.

Notation List for Fig.2.

- | | |
|---|--|
| 8. Outer member-synchromesh, 3rd & 4th | 38. Roller bearing-2nd motion shaft. |
| 9. Outer cone-front. (speed. | 39. 2nd Motion shaft. |
| 10. Sliding piece-3rd & 4th speed. | 40. 1st speed driver gear. |
| 11. Actuating sleeve-3rd & 4th speed. | 41. 2nd speed sliding gear. |
| 12. Pin-operating cam. | 42. Sleeve(fixed)-2nd motion shaft. |
| 13. Operating cam-synchromesh. | 43. Bush-2nd speed driver gear. |
| 14. Inner cone-rear. | 44. 2nd speed driver Gear. |
| 15. Outer cone-rear. | 45. Bush-2nd speed driver gear. |
| 16. Sleeve(fixed)-3rd motion shaft. | 46. Thrust washer. |
| 17. Bush-3rd speed constant mesh gear. | 47. Ball bearing-2nd motion shaft. |
| 18. Constant mesh gear-3rd speed. | 48. Adjusting washer. |
| 19. Taper pin-sleeve-3rd motion shaft. | 49. Constant mesh gear. |
| 20. Bush-3rd speed constant mesh gear. | 50. Distance piece. |
| 21. Thrust washer. | 51. Reverse driving gear. |
| 22. Ball bearing-3rd motion shaft. | 52. Distance piece. |
| 23. Adjusting washer-2nd speed driven gear. | 53. Constant mesh gear. |
| 24. 2nd Speed driven gear. | 54. Adjusting washer. |
| 25. Worm gear-servo drive. | 55. Ball bearing-2nd motion shaft. |
| 26. Adjusting washer. | 56. Clamping washer. |
| 27. 1st Speed driven gear. | 57. Lockwasher. |
| 28. Ball bearing-3rd motion shaft. | 58. Retaining nut-2nd motion shaft. |
| 29. Adjusting washer. | 59. Inner cone-front. |
| 30. 3rd Motion shaft. | 60. Plunger. |
| 31. Coupling flange-3rd motion shaft. | 61. Plunger spring. |
| 32. Clamping washer. | 62. 1st Motion shaft. |
| 33. Lockwasher. | 63. Floating bush-1st & 3rd motion shafts. |
| 34. Retaining nut-3rd motion shaft. | 64. Retaining nut-1st motion shaft. |
| 35. Retaining nut-2nd motion shaft. | 65. Lockwasher. |
| 36. Lockwasher. | 66. Clamping washer. |
| 37. Clamping washer. | 67. Ball bearing-1st motion shaft. |

- (b) Collect the plunger mechanism pin (72) from the end of the centre selector shaft, also collect the two .375" dia. and the three .500" dia. steel balls (71 & 74).
- (xx) Remove the two 5/16" (B.S.F.) nuts from the countersunk head screws holding the large circular diaphragm to the front end of the gearbox. Secure the extractor R-3181 (or one made from the detail drawing Fig.5) to the diaphragm in line with the 2nd motion shaft; withdraw the diaphragm complete with the 1st motion shaft, at the same time collecting the adjusting washer (54) and the constant mesh gear (53), TIE the adjusting washer to the gear.
- (xxi) Remove the first distance piece (52) from the 2nd motion shaft; withdraw the 3rd and 4th speed synchromesh assembly from the 3rd motion shaft, together with the reverse driving gear (51) from the 2nd motion shaft; remove the second distance piece (50).
- (xxii) Remove the constant mesh gear (49) and the adjusting washer (48) from the 2nd motion shaft and TIE the washer to the gear.
- (xxiii) Next, remove the 3rd motion shaft (30) as below:-
- NOTE: A mild steel drift, 12" long x $\frac{7}{8}$ " dia. will be required; one end of which should have a 60° chamfer to abut against the corresponding internal chamfer at the rear end of the 3rd motion shaft. Do NOT use a drift that will pass down the bore of the shaft, as this would damage the taper pin (19) near the centre of it.
- a) Pull the reverse motion shaft forward clear of its rear bearing.

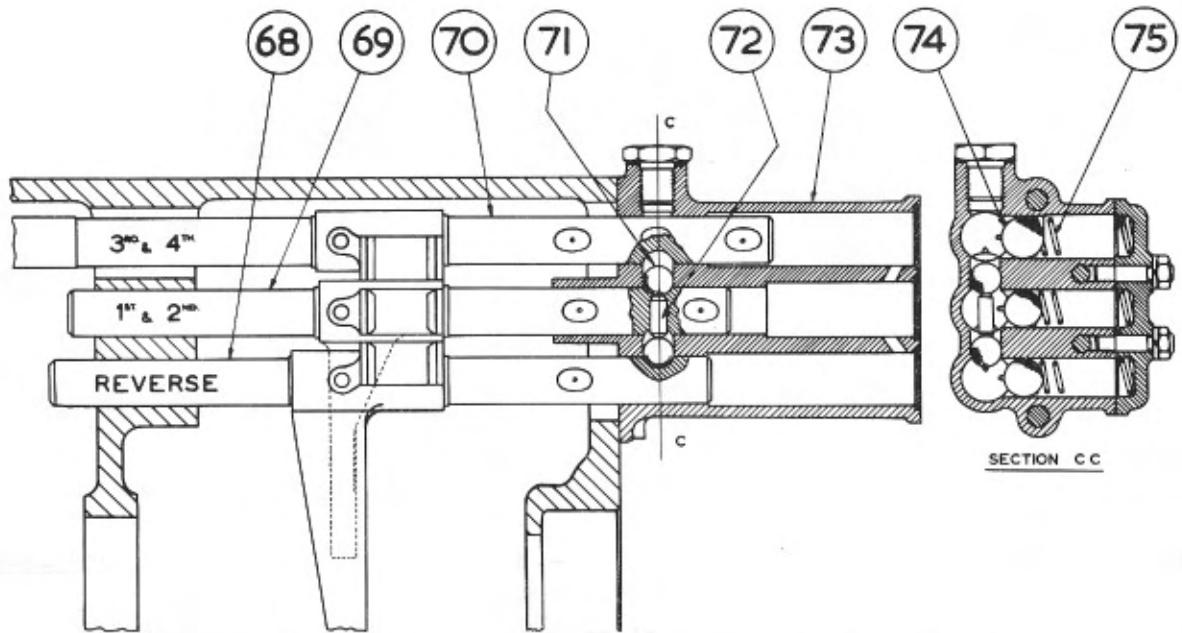


FIG. 3. SECTION - SELECTOR SHAFTS & INTERLOCK MECHANISM.

- | | |
|---|---------------------------------------|
| 68. Selector shaft, reverse | 72. Pin-interlock mechanism. |
| 69. Selector shaft, 1st & 2nd speed. | 73. Plunger housing-selector shafts. |
| 70. Selector shaft, 3rd & 4th speed. | 74. Ball, .500" dia.-plunger housing. |
| 71. Ball, .375" dia.-interlock mechanism. | 75. Plunger spring. |

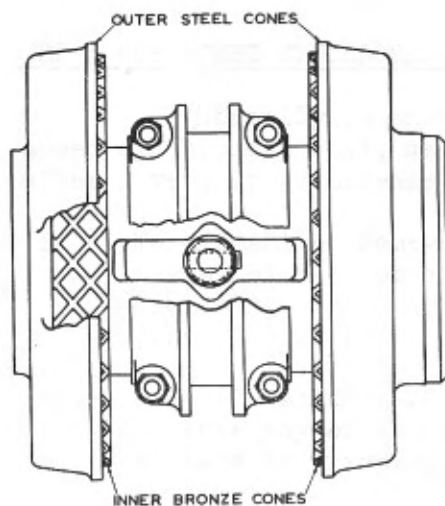


FIG. 4. PLAN VIEW-3RD & 4TH SPEED SYNCHROMESH UNIT.

- b) With the drift and a mallet, progressively tap the 3rd motion shaft towards the front end of the gearbox, removing the gears and adjusting washers up to the centre ball bearing (22). TIE the adjusting washer (26) to the servo drive worm gear (25) and the adjusting washer (23) to the 2nd speed driven gear (24).
- (xxiv) Remove the 2nd and reverse motion shaft cover from the rear of gearbox (do not remove the small retaining cover secured by four 2-BA nuts).
- (xxv) Manoeuvre the reverse motion shaft rearwards sufficiently to disengage the selector fork and draw the shaft forwards out of the gearbox.
- (xxvi) Slide the 2nd speed gear and the 1st speed driver gear assembly, (41 and 40) to the rear of the gearbox, and with a mallet, tap the 2nd motion shaft (39) towards the front of the gearbox until the rollers of the rear end bearing (38) are clear of the outer race and manoeuvre the shaft out of the gearbox. Remove the selector shafts.
- (xxvii) If new ball bearings are being fitted, then remove the 1st motion shaft and its bearing and the front bearing of the 2nd motion shaft from the circular diaphragm, taking care not to distort the latter. Also remove the outer race of the 2nd motion shaft roller bearing from the gearbox.

- (xxviii) Unscrew the retaining nut, 35 (L.H. thread) from the rear end of the 2nd motion shaft and remove the remaining parts from it. TIE the thrust washer (46) to the 2nd speed driver gear (44).
- (xxix) Withdraw the drilled distance piece (adjacent to the front end bush of the reverse motion shaft) from the diaphragm so that the oil passages in the latter can be cleaned to remove sludge.
- (xxx) Thoroughly clean the gearbox and all dismantled parts leaving the washers tied to their respective gears.

4. 3RD & 4TH SPEED SYNCHROMESH UNIT (ON 3RD MOTION SHAFT):

Normally it should NOT be necessary to dismantle the 3rd and 4th speed synchromesh unit, as it is not subject to appreciable wear even after a very large mileage has been covered.

- (i) To dismantle, remove the four 2-BA nuts and bolts securing the two halves of the actuating sleeve (11 Fig.2) and remove the two operating cams (13) from the sliding piece (10) and collect the two pins (12) if free.
- (ii) Push the sliding piece out of the outer member (8), taking care not to lose any of the six or eight plungers and springs. This may be avoided by wrapping a piece of cloth around the outer member prior to removal of the sliding piece.
- (iii) If the splines of the sliding piece are found to be worn, the piece should be renewed; wear is more likely to occur on the splines of the 3rd motion shaft. The width of the splines of the sliding piece (new) are $.350" + .0005"$; the corresponding width of the splines on the front end of the 3rd motion shaft (new) are $.349" - .001"$
- (iv) If the circular portion at the upper end of the two operating cams (13) where they locate in the actuating sleeve, are worn, new cams should be fitted.
- (v) When re-assembling the unit, four new 2-BA bolts (G-55649) and four nuts (K-4307) will be required. After tightening the nuts, centre punch each nut in four places to lock.

5. TO RE-ASSEMBLE THE GEARBOX:

When re-assembling, discard all old tab locking washers, aluminium washers, Vellumoid and red fibre (or "Oakenstrong") joints. If the 1st speed gears are noisy due to wear of the teeth beneath the hardened surface, opportunity should be taken to fit a new driver and driven gear (40 & 27 Fig.2), otherwise the small particles of metal which disintegrate from worn gears will be carried around in the oil and may cause damage to the teeth of other gears and the bearings.

If the 2nd motion shaft is worn on the centre journal due to revolving of the inner race of the ball bearing (47), a new shaft should be fitted. This also applies if the centre and rear journals of the 3rd motion shaft are worn.

The diameter (new) of the centre journal of the 2nd motion shaft (adjacent to the non-flanged end of the sleeve 42) is $1.37795" + .00025"$ (35 m/m). The diameter (new) of the centre and rear ball bearing journals of the 3rd motion shaft is $1.3779" +$ or $-.0001"$ (35 m/m).

A) 2nd Motion Shaft:

NOTE: When re-assembling the parts to the 2nd motion shaft, the gears must be placed the correct way round and the various washers positioned as shown in Fig.2.

- (i) Hold the rear end of the shaft horizontally in a vice. Fit two new bronze bushes (43 & 45) to the 2nd speed driver gear and check the gear for freedom of rotation on the shaft. The bushes should be a floating fit on the shaft and in the gear.

Next, place the thrust washer (46) in position; press hard against it and ascertain that the gear can be revolved freely with the minimum of end float, i.e. NOT more than .002". If the gear is not free due to lack of end float, lightly rub down the flanged faces of the bushes until the correct fit is obtained after which they should be oiled.

- (ii) If the adjusting washer (48) is worn, measure the thickness on the unworn portion and fit a new washer of the same thickness. This washer controls the amount of "nip" (which should not exceed .003") on the inner race of the ball bearing (55) when the nut (58), is fully tightened.
- (iii) With the gear (44) and the thrust washer (46) in position, fit the remaining ball bearings, gears, distance pieces and washers to the front end of the shaft, including the clamping washer 56 (omit the lockwasher 57 at this stage.)

NOTE: The distance pieces (50 & 52) are identical but may differ in length, therefore the distance piece marked 1 should be positioned between the gears (49 & 51) and the one marked 2 positioned between the gears (51 & 53).

- (iv) Tighten up the retaining nut (58) and again check the gear (44) for freedom; if not free, this will be due to excess of "nip" on the inner race of the ball bearing (55) causing the thrust washer (46) to exert a slight load on the bronze bushes. Fit a thinner washer (48) of the required thickness.

Conversely, if after tightening up the nut, the distance pieces (50 & 52) can be rotated, this will be due to lack of "nip", and it will be necessary to fit a longer distance piece. To determine length, proceed as follows:-

- a) Select a feeler gauge which can just be pushed between a distance piece and a gear.
- b) If for example, the gap is .007", fit a distance piece .010" longer which will give the required "nip" of .003".
- (v) Remove all parts from the 2nd motion shaft up to the gear (49) and reverse position of shaft in vice.
- (vi) Screw the 2nd speed sliding gear (41) into the 1st speed driver gear (40) as far as it will go and then screw back until the etchings on the gears are in line; the internal splines of both gears will then be in line with one another. Place this sub-assembly on to the shaft.
- (vii) Tap the roller bearing (38) fully home on the shaft. Fit the clamping washer (37), the lockwasher (36) and tighten up the retaining nut and check that a .002" or .003" thick feeler gauge cannot be inserted between the clamping washer and the inner race of the roller bearing. If a feeler can be inserted, the clamping washer should be counterbored to a depth of the feeler thickness plus .004" at a diameter of 1.000" in order to give the required "nip" on the roller race. Fit the counterbored side of the washer against the roller race, tighten up the retaining nut and lock.

NOTE: It is important to observe that when finally tightening up the retaining nuts of the 1st, 2nd and 3rd motion shafts, prior to locking, that the lockwasher does NOT ROTATE, otherwise this would cause the inner tabs of the washer to shear, in which case, another washer must be fitted.

B) 3rd Motion Shaft:

NOTE: When re-assembling the parts to the 3rd motion shaft, the gears must be placed the correct way round (this does not apply to the worm gear 25) and the various washers positioned as shown in Fig.2.

- (i) Hold the front end of the shaft horizontally in a vice. Fit two new bronze bushes (17 & 20) to the 3rd speed constant mesh gear (18) as described in sub-para.(i) for the 2nd motion shaft.
- (ii) If the adjusting washer (23) is worn, measure the thickness on the unworn portion and fit a new washer of the same thickness.
- (iii) With the gear (18) and the thrust washer (21) in position, fit the remaining ball bearings, gears, washers and the driving flange (31) to the shaft including the clamping washer (32); omitting the lockwasher (33) at this stage.
- (iv) Tighten up the retaining nut (34) and again check the constant mesh gear (18) for freedom, if not free, this will be due to excess of "nip" on the rear face of the driving flange (31) causing the thrust washer (21) to exert a slight load on the bushes. Remove the adjusting washer (26) and fit a washer of a thickness that will allow the end face of the driving flange to stand out .003" beyond the ends of the splines of the shaft to give the required nip when the retaining nut is fully tightened up. Conversely, if after tightening up the retaining nut, the 1st speed driven gear (27) has end float, however small, proceed as follows:-
 - a) Select a feeler gauge which can just be inserted between the washer (26) and the gear (27) i.e. at point 'A' Fig.2.
 - b) If for example, the gap is .002", fit a .005" thicker washer to give the required "nip" of .003"
- (v) Remove all parts from the shaft up to the washer (23); greasing the latter to keep it in position against the ball bearing.

C) Re-assembling the Motion Shafts etc. to the Gearbox:

- (i) Fit a new outer roller race (38) to the rear end of the gearbox.
- (ii) Place the centre selector shaft (69 Fig.3) in the gearbox. With the constant mesh gear (49 Fig.2) in position on the 2nd motion shaft, enter the shaft into the gearbox, simultaneously engaging the fork of the selector shaft with the corresponding groove in the 2nd speed sliding gear (41), taking care to enter the roller bearing (38) SQUARELY into its outer race.
- (iii) Enter the reverse motion shaft into position, place the reverse selector shaft (68) in the gearbox and manipulate the fork of it into the groove in the reverse motion shaft and then slide the selector shaft into its bore in the gearbox.
- (iv) Fit the 2nd and reverse motion shaft cover to the rear end of the gearbox and slide the reverse motion shaft into its rear bearing.
- (v) Place the remaining selector shaft (70) in position.

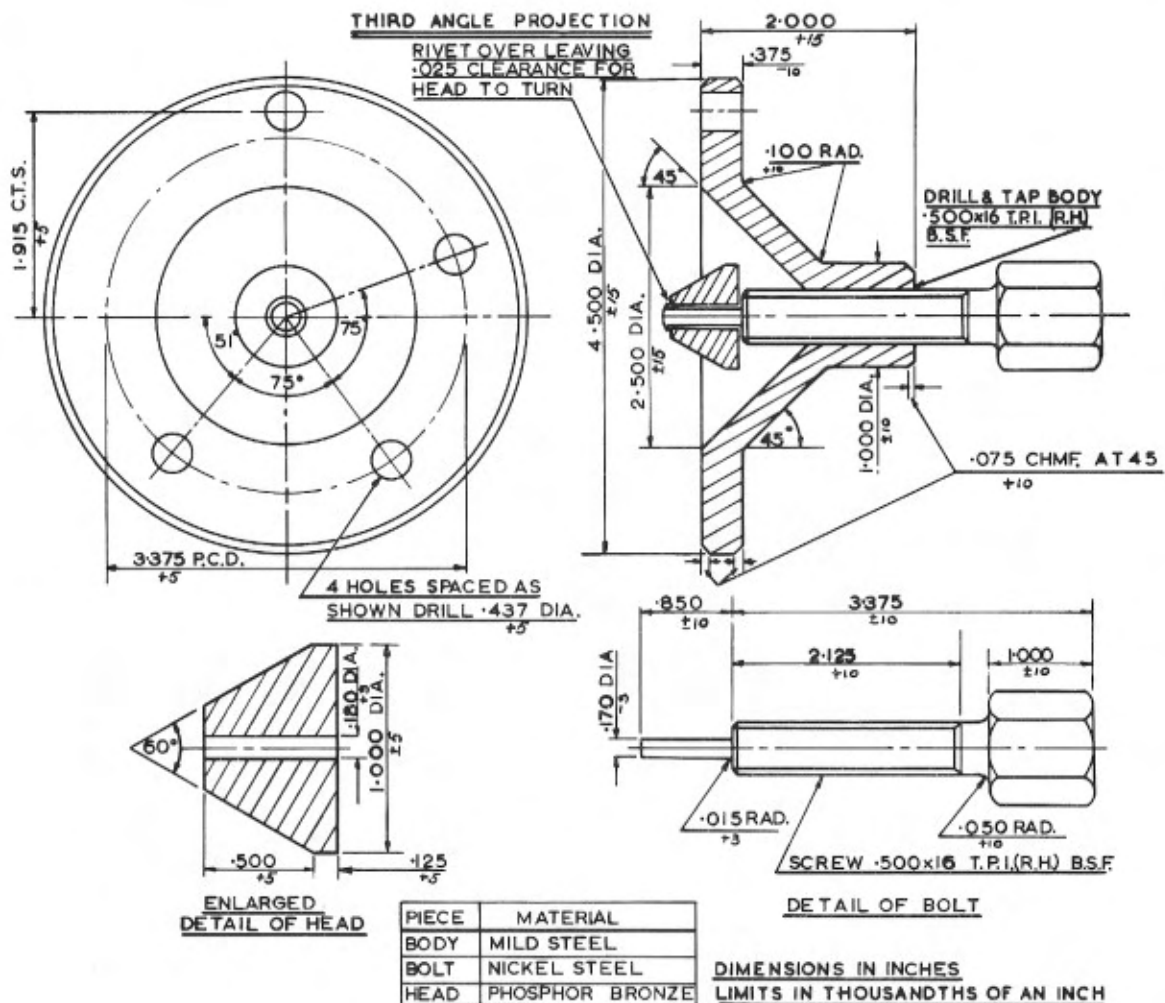


FIG. 5. EXTRACTOR - DIAPHRAGM.

- (vi) Next, fit the 3rd motion shaft as follows:-
- Place the 1st speed driven gear (27) and the 2nd speed driven gear (24) into the gearbox the correct way round. Pull the reverse motion shaft forwards as far as it will go.
 - With the adjusting washer (23) still in position, enter the shaft at the front end of the gearbox and engage the gear (24), the worm gear (25), the washer (26), this washer must be placed at the REAR END of the worm gear, (as shown in Fig.2) and the gear (27).
 - Continue to push the shaft rearwards simultaneously engaging the constant mesh gear (18) with the constant mesh gear (49) on the 2nd motion shaft; line up the centre ball bearing (22) with its housing in the gearbox and tap the shaft into position until the ball bearing is centrally located in the housing.
 - Fit the rear ball bearing (28) followed by the washer (29); greasing the latter to keep it in position.
- (vii) Next, place No.1 distance piece (50) on the 2nd motion shaft.
- (viii) Slide the reverse driving gear(51) on to the end of the 2nd motion shaft, hold this gear with the left hand and the 3rd and 4th speed synchromesh assembly with the right hand and manoeuvre the synchromesh assembly on to the 3rd motion shaft, the gear (51) will then be about midway between the two bronze cones. The synchromesh assembly should be positioned so that the external teeth of the sliding piece (10) face towards the front of the gearbox.

- (ix) Push the reverse motion shaft into its rear bearing.
- (x) Place No.2 distance piece (52) on to the 2nd motion shaft.
- (xi) Fit the ball bearing (67) to the diaphragm and tap the 1st motion shaft into this bearing.
- (xii) Replace the drilled distance piece in the diaphragm.
- (xiii) With the floating bush (63) in position in the 1st motion shaft, hold the constant mesh gear (53) against the diaphragm with the left hand and enter the diaphragm into position on the gearbox simultaneously guiding the gear on to the 2nd motion shaft.
- (xiv) In order to correctly align the three close fitting bolt holes in the diaphragm and the front face of the gearbox, proceed as follows:-
 - a) Fit the two 5/16" (B.S.F.) countersunk head screws to the diaphragm and gearbox and tighten the nuts finger tight at this stage.
 - b) Temporarily fit the clutch casing to the gearbox (tap into position with a soft mallet) which will allow the three close fitting bolts of the casing to align the corresponding bolt holes in the diaphragm and gearbox. Tighten up the nuts of the two countersunk head screws to secure the diaphragm in position.
 - c) Remove the clutch casing.
- (xv) Next, assemble to the 2nd motion shaft, the washer (54), the ball bearing (55), the clamping washer (56), the lockwasher (57) and lightly tighten up the retaining nut.
- (xvi) Assemble to the 1st motion shaft, the clamping washer (66), the lockwasher (65) and also lightly tighten up the retaining nut.
- (xvii) Re-assemble the interlock mechanism of the selector shafts as follows:-
 - a) Push the centre selector shaft rearwards; grease and place the pin (72 Fig.3) in the rear end of it.
 - b) Apply a soft type of grease to the horizontal passage in the bronze plunger housing (73) in which the two .375" dia. steel balls are housed and place the latter in position.
 - c) It will be observed that spherical recesses are machined in the top and side/s of the three selector shafts for ball location. Push the plunger housing on to the centre shaft until the inner spherical recess on the top of the shaft can be seen upon looking down the centre vertical hole in the housing.
 - d) Whilst holding the casing, push the reverse selector shaft rearwards until the recess in the side of it lines up with the corresponding recess in the left-hand side of the centre shaft.
 - e) Next, whilst still holding the plunger casing, move the outer shaft into position in the casing and push the latter up to the gearbox and secure.
 - f) With the jaws of the three selector shafts in line (i.e. in neutral position), move the reverse selector shaft into reverse gear and check that the remaining two shafts are locked. Repeat likewise for the 1st and 2nd, and the 3rd and 4th gear selector shafts.

- g) Assemble the three .500" dia. steel balls and springs to the housing and fit the top cover.
- (xviii) Fit the 3rd motion shaft rear cover and the gearbox support bracket.
- (xix) Assemble the washer (29), the coupling flange (31), the clamping washer (32) and the lockwasher (33) to the rear end of the 3rd motion shaft.
- (xx) Next, lock the 1st, 2nd and 3rd motion shafts as described in Sub-para. xiv of Para. 3, and fully tighten up the retaining nuts of the 1st, 2nd and 3rd motion shafts and bend back the tabs of the lockwashers to lock.
- (xxi) Place the aluminium distance piece against the ball bearing at the front end of the 2nd motion shaft and the oil baffle (.047" thick) against the ball bearing of the 1st motion shaft and fit the front end cover to the gearbox.
- (xxii) Assemble the clutch casing to the gearbox.
- (xxiii) Move the outer selector shaft (70) into its neutral position, fit the rocking shaft and operating stirrup assembly and its two bearings to the gearbox. Temporarily replace the front top cover to prevent ingress of foreign matter.
- (xxiv) Assemble the servo motor drive shaft to the gearbox; (the worm gear, 5 Fig.1, may be fitted either way round) correctly positioning the distance pieces (3 & 6) and the adjusting washers (4 & 7) as shown in Fig.1. Temporarily replace the rear top cover.
- NOTE: When replacing the servo motor, particular care should be taken to see that the driving disc (attached to the servo drive shaft) is not pulled away from the gearbox, as this may result in the distance piece (3) and the washer (4) dropping into the gearbox. If the servo motor requires attention, opportunity should be taken before it is replaced on the gearbox.
- (xxv) Refit the servo motor and its mechanism to the gearbox by reversing the procedure for removal. Do not omit to refit the key to the end of the servo countershaft.
- (xxvi) Remove the front and rear top covers. Inspect that the distance piece (3) and the washer (4) are still in position on the servo drive shaft. Turn the gearbox upside down to dislodge any foreign matter that may have fallen in. Replace the two top covers and secure.
- (xxvii) Place the speedometer drive shaft (1 Fig.1) in position and fit the change gear support bracket complete with the governor casing (if the latter is fitted) providing the support bracket was not removed during the removal of the gearbox from the chassis.
- NOTE: Opportunity should be taken to remove and renew if necessary, the ball thrust bearing of the clutch operating mechanism.
- (xxviii) The gearbox should be replenished with oil after it has been re-assembled to the car. Use a recommended S.A.E. 30 oil; see "Lubricants Chart for Rolls-Royce & Bentley cars" Ref:-No.RR/D2c.
- (xxix) The correct tension for the coil spring of the Ferobestos lined suspension link ("swinging arm") of the servo mechanism is finally adjusted during road test. Proceed as follows:-

- a) With the front brakes functioning correctly and correctly adjusted externally, tighten the nut (1-BA-R.R.) of the clamping bolt choc-a-bloc to compress the coil spring, then release the nut back one complete turn. This adjustment will prevent the front brakes from thumping when the brake pedal is applied.
- b) If the front brakes are not correctly adjusted, the above adjustment will not overcome thumping. If the nut is not screwed back one turn, it will probably cause the front brakes to shudder and also prevent the brake pedal from returning to its 'off' position.