Draft Chapter 33C

CENTRE HOUSING, REASSEMBLING

This draft chapter is issued for advance information pending the publication of the final chapter.

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GENERAL

1. Reconditioning of the component parts of the centre housing (*fig.* 1 *and* 2) is confined to operations whereby unserviceable parts are replaced by serviceable standard parts. Instructions for repair by fitting oversize or undersize parts, and the processes essential to such repairs, are contained in Chapter 28D.

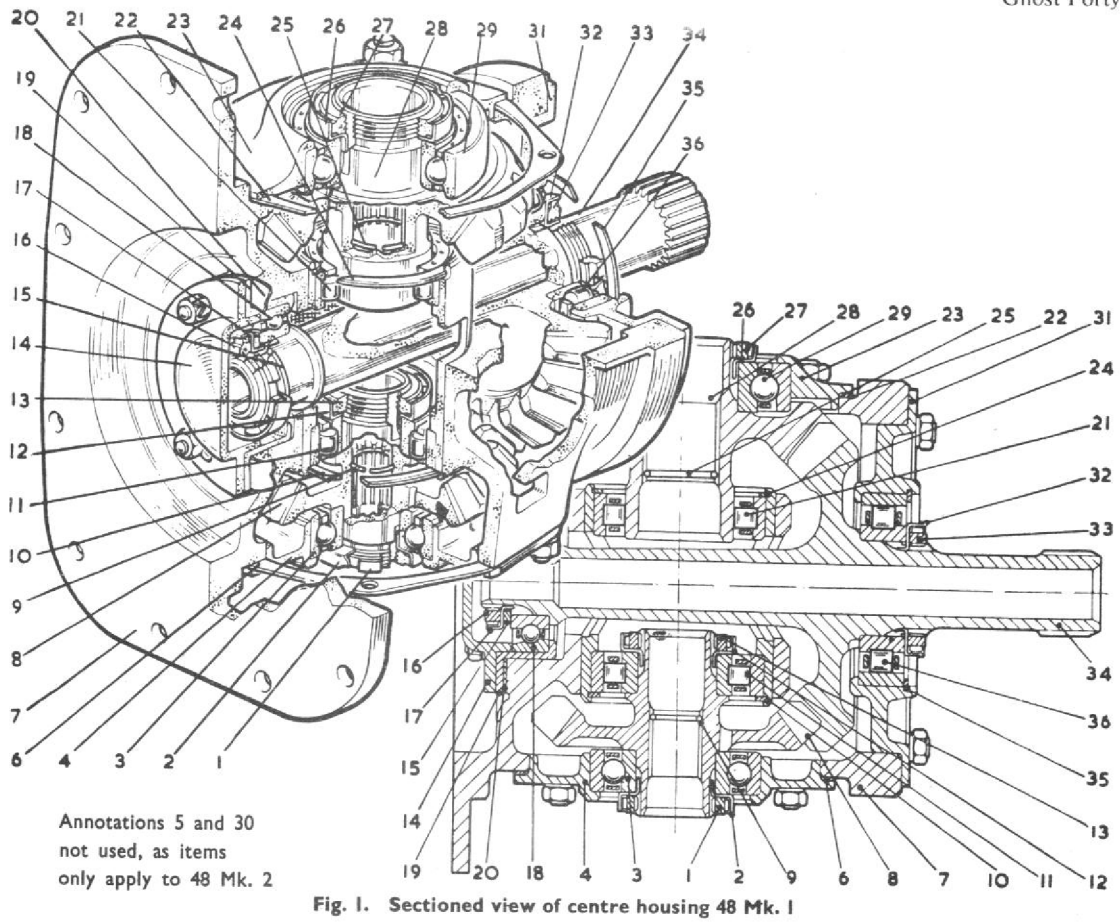
2. Consumable stores, required to replace items automatically discarded during dismantling, are listed at the end of the chapter. Tools are referred to in the text as they are used, and are also listed at the end of the chapter.

3. Throughout the text, the phrase "within the limits" implies that reference must be made to the Table of Fits and Clearances in Chapter 38 to ascertain the limits permissible. Similarly, instructions for parts to be pressed into position implies that a suitable hand or mechanical press will normally be required to effect the operation. It is important to keep sets of shims with their respective gear assemblies as their thicknesses have been determined during the previous build of the engine and, in addition to saving time, it is desirable for the gears to continue running under the same conditions.

4. Before making any renewals prior to rebuilding, the inspection sheet must be read carefully and all work carried out as directed. Minor rectifications, which may not be entered on the inspection report, include renewing damaged or loose studs, cleaning up steel components with fine emery or on a buff, stoning up gear teeth and splines, and polishing out scratches. Ball bearings, including new ones, must be washed in white spirit. After any work has been carried out, the component in question must be resubmitted for inspection.

RENEWALS

5. With the exception of damaged studs, no additional work, other than that required for normal assembly, is necessary to renew any standard part; the defective parts rejected by inspection being discarded and new, serviceable, or



Annotations 5 and 30 not used, as items only apply to 48 Mk. 2

Fig. 1. Sectioned view of centre housing 48 Mk. 1

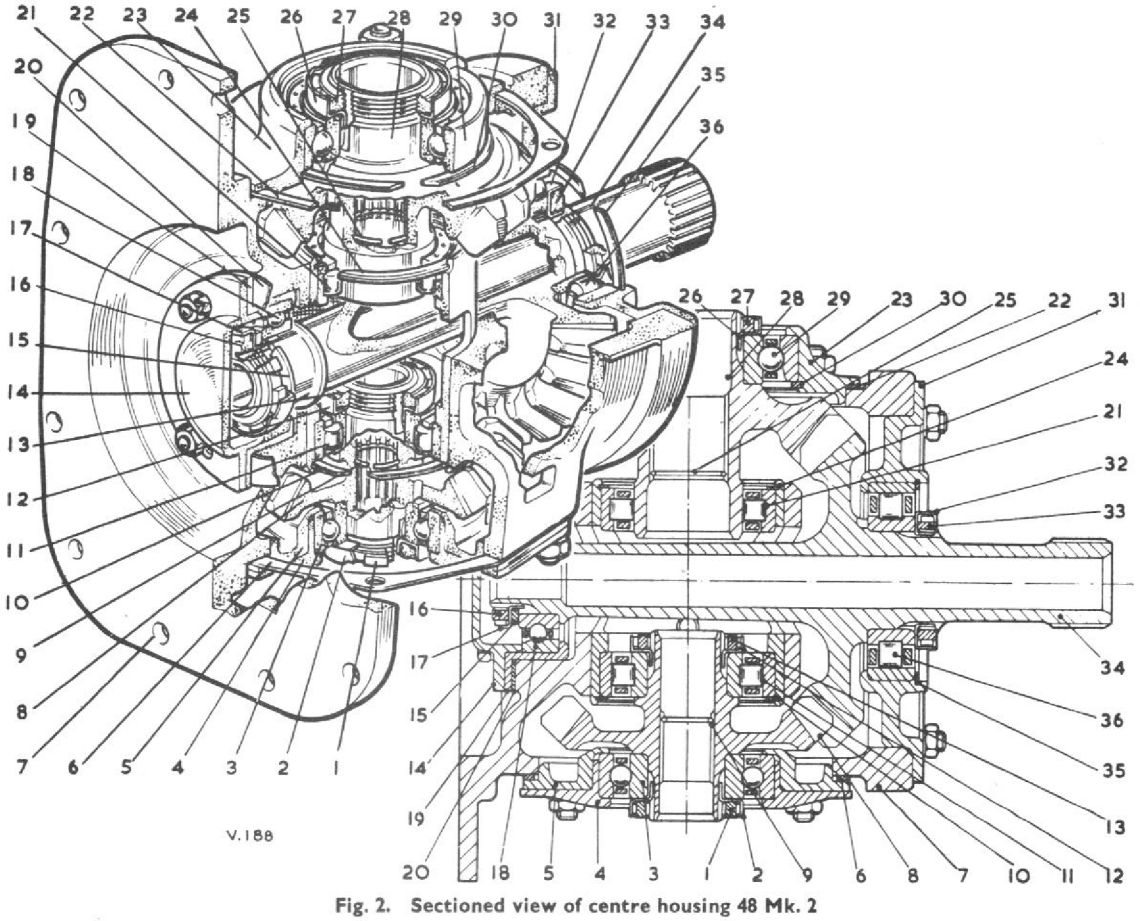


Fig. 2. Sectioned view of centre housing 48 Mk. 2

KEY TO FIG. 1 AND 2

1 RING NUT
2 CUP-LOCKING WASHER
3 BALL BEARING
4 STEEL RETAINING HOUSING
5 ALLOY RETAINING HOUSING
6 LAMINUM ADJUSTING WASHER
7 CENTRE HOUSING AND BUSH ASSEMBLY
8 LOWER VERTICAL GEAR
9 CIRCLIP
10 RETAINING RING
11 ROLLER BEARING
12 CUP-LOCKING WASHER
13 RING NUT
14 RETAINING COVER
15 SPACER RING
16 RING NUT
17 CUP-LOCKING WASHER
18 FRONT BEARING
19 FRONT BEARING HOUSING
20 LAMINUM ADJUSTING WASHER
21 ROLLER BEARING
22 LAMINUM ADJUSTING WASHER
23 RETAINING HOUSING
24 RETAINING RING
25 CIRCLIP
26 CUP-LOCKING WASHER
27 RING NUT
28 UPPER VERTICAL GEAR
29 ANGULAR CONTACT BEARING
30 RETAINING RING
31 REAR BEARING HOUSING
32 CUP-LOCKING WASHER
33 RING NUT
34 HORIZONTAL DRIVING GEAR
35 RETAINING RING
36 REAR BEARING

repaired parts being substituted. To renew damaged studs, a $\frac{1}{4}$ in. B.S.F. stud box T70809 and $\frac{5}{16}$ in. B.S.F. stud box T71006 are required. Damaged studs may be removed, and serviceable replacements fitted, in accordance with standard practice. As the light alloy bush is shrunk into the magnesium alloy casting, no attempt must be made to separate these two parts.

Note . . .
If it is found necessary to change any of the gears, it is essential that a complete new set is fitted.

UPPER VERTICAL BEARING HOUSING

6. Untie the adjusting washer from the housing flange and place it on one side. Care must be taken that the components of the two vertical drives are not mixed.

(1) Place the bearing housing, flange uppermost, on press block T74940.

(2) Position the upper angular contact bearing over the mandrel of the press block, with the face of the bearing marked "thrust" positioned into the housing as shown in fig. 3.

(3) Using adapter T74941, press the bearing into the housing.

(4) Remove the housing from the press block.

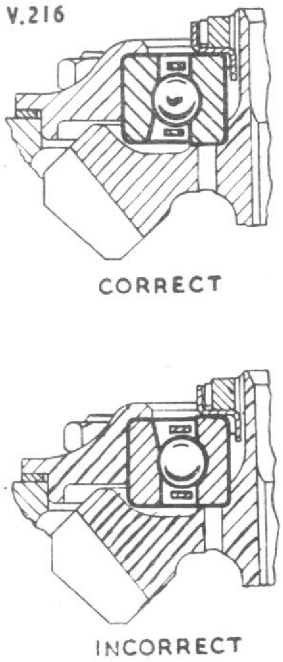


Fig. 3. Assembling the upper angular contact bearing to its housing

(5) *48 Mk. 2 only.* Fit a new retaining ring (Part No. 60577).

(6) Place the upper vertical drive gear, gear downwards, on press block T74942.

(7) Assemble the bearing and housing to the drive gear. Using guide mandrel T74746 and adapter T74745, press on the bearing and housing until it abuts the shoulder behind the gear (*fig.* 4).

(8) Remove the assembly from the vice block.

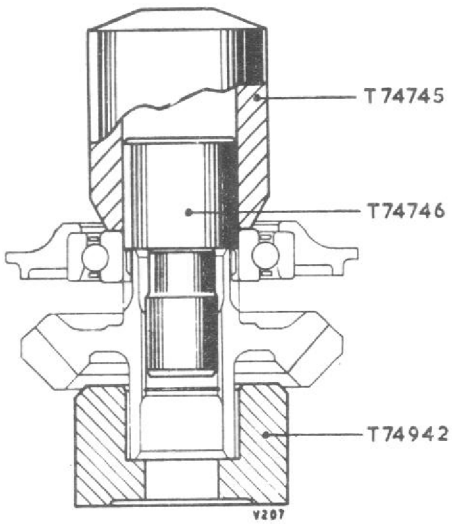


Fig. 4. Pressing the bearing and housing on to the upper vertical drive

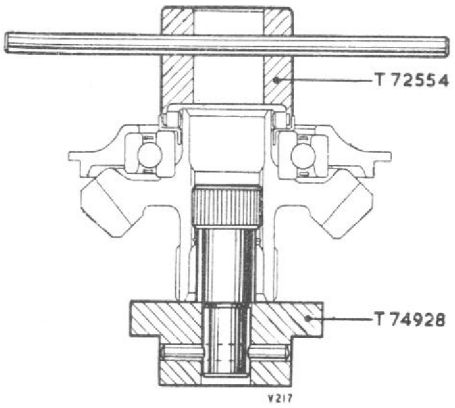


Fig. 5. Tightening the nut on the upper vertical gear shaft

(9) Place the gear assembly over the splined mandrel of vice block T74928, assemble a new cup-locking washer (Part No. N2865) and the ring nut to the shaft, using serrated spanner T72554 tighten the nut (*fig.* 5).

(10) Lock the nut by lightly tapping the cup-washer into the serrations of the nut at two opposite positions.

(11) Fit a new circlip (Part No. N4221) into the bore of the lower end of the upper vertical drive gear.

(12) Tie the adjusting washer to the housing.

LOWER VERTICAL BEARING HOUSING

7. Untie the adjusting washer from the housing flange and place it on one side.

(1) Place the bearing housing, flange uppermost, on press block T74747.

(2) Position the lower vertical ball bearing over the mandrel of the press block, and using adapter T74748 press the bearing into the housing.

(3) Remove the housing from the press block.

(4) *48 Mk. 2 only.* Assemble the light alloy retaining housing to the steel retaining housing, align the stud holes and tie the housings together.

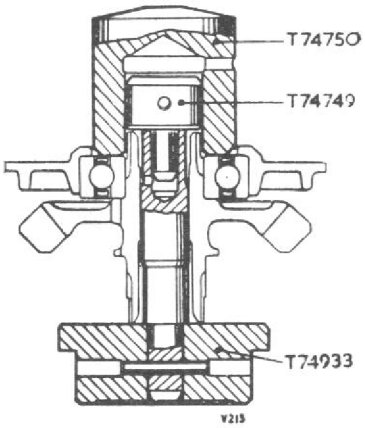


Fig. 6. Pressing the bearing and housing on to the lower vertical drive

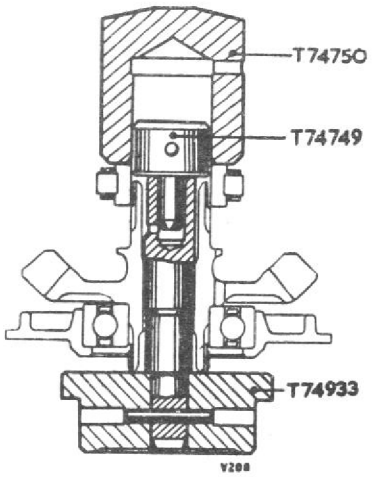


Fig. 7. Pressing the inner race on to the lower vertical drive

(5) Place the lower vertical drive gear, gear downwards, on press block T74933 and pass the mandrel through the bore of the drive gear into the press block.

(6) Position the bearing and housing on the shaft of the gear.

(7) Using guide plug T74749 and adapter T74750 (*fig.* 6) press on the bearing and housing until it abuts the shoulder behind the gear.

(8) Remove the mandrel.

(9) Invert the assembly on the press block and replace the mandrel.

(10) Position the inner race of the roller bearing on the gear shaft and, using the guide plug and adapter, press the bearing on to the shaft until it abuts the shoulder behind the gear (*fig.* 7).

Note . . .

The roller race must be fitted with the serial number uppermost, towards nut.

(11) Mount the press block with the assembly in a vice.

(12) Assemble a new cup-locking washer (Part No. N2866) and the ring nut to the gear shaft, using serrated spanner T74934, tighten the nut (*fig.* 8).

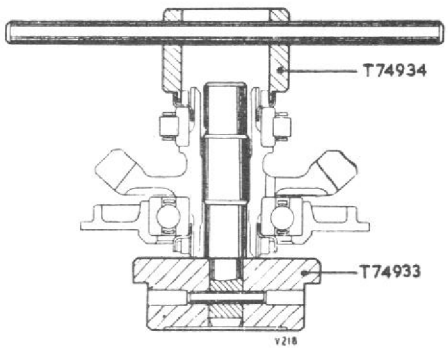


Fig. 8. Tightening the nut on the lower vertical shaft

(13) Lock the nut by lightly tapping the cup-washer into the serrations of the nut at two opposite positions.

(14) Invert the assembly on the press block, assemble a new cup-locking washer (Part No. N2866) and a ring nut, tighten and lock as described in Op. 12 and 13.

(15) Fit a new circlip (Part No. N4206) into the bore of the lower end of the lower vertical drive gear.

(16) Tie the adjusting washer to the housing.

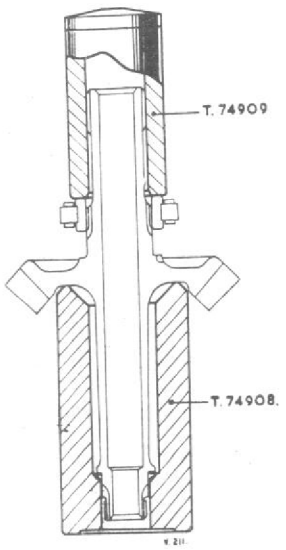


Fig. 9. Pressing the roller bearing on to the horizontal drive shaft

HORIZONTAL DRIVE SHAFT

8. Before the horizontal shaft is assembled in the centre housing, the front bearing must be assembled to its housing, and the inner race of the rear bearing assembled to the horizontal shaft. Ensure that the inner and outer races of the bearing are perfectly clean prior to assembly.

(1) Place the rear bearing housing on press block T78985 and position the outer race of the roller bearing over the mandrel of the press block.

(2) Use adapter T78986 to press the roller race into the housing.

(3) Remove the housing from the press block.

(4) Secure the race in the housing with a new retaining ring (Part No. N4211) using Seeger pliers.

(5) Place the horizontal drive gear on press block T74908.

(6) Position the roller bearing (inner race) over the shaft.

(7) Using adapter T74909, press the bearing on to the shaft until it abuts the shoulder behind the gear (*fig.* 9).

(8) Transfer the shaft to vice block T74910 and secure the shaft by screwing on the special nut.

(9) Assemble a new cup-locking washer (Part No. N2873) and the ring nut to the rear end of the shaft; tighten the nut to the torque loading given in Chapter 22; lock the nut by lightly tapping the cup-washer into the serrations of the ring nut at two opposite positions.

(10) Assemble the housing and horizontal shaft together by sliding the rear bearing housing roller race (outer race) over the roller race (inner race) on the shaft.

PREPARATION OF THE CENTRE HOUSING

9. (1) Place the front bearing housing on press block T74918, flange uppermost; position the front ball bearing over the mandrel of the press block and, using adapter T74919, press the bearing into the housing. Refer to Chap. 22 for correct method of assembly.

(2) Remove the housing from the press block.

(3) Assemble the front laminum adjusting washer and front housing assembly to the centre housing.

(4) Position sleeve T78423 with the small diameter uppermost over the mandrel of press block T78422.

(5) Place the centre housing on the press block, with the top uppermost, which is denoted by the dowel hole in the front flange.

(6) Position the upper roller bearing over the mandrel of the press block.

(7) Using adapter T74915, press the bearing into the bush (*fig.* 11) and secure in position with the retaining ring using Seeger pliers.

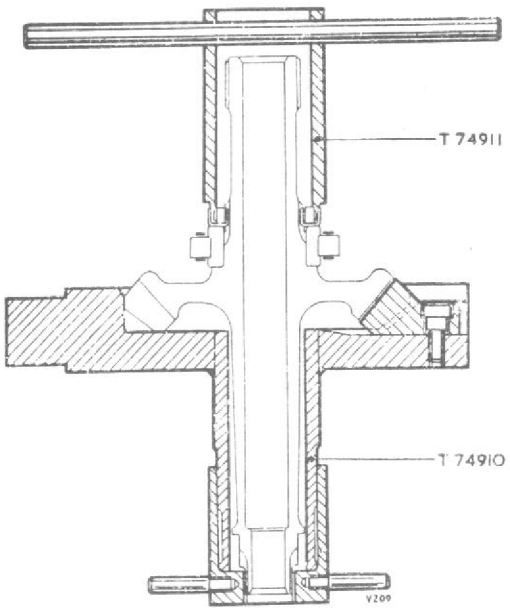


Fig. 10. Tightening the nut on the rear of the horizontal shaft. *(NOTE : This nut is now torque loaded to the figure specified in Chapter 22).*

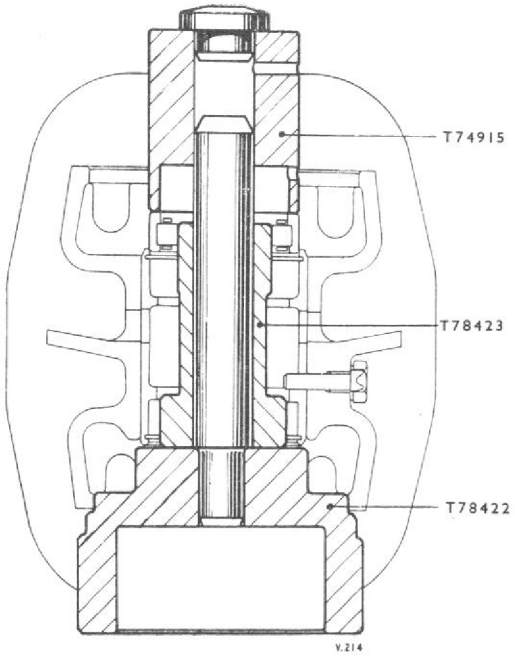


Fig. 11. Pressing the upper roller bearing into the bush

(8) Remove the housing from the press block, reverse the sleeve; invert the housing and replace on the press block.

(9) Position the lower roller bearing (outer race) over the mandrel. Using adapter T74915, press the bearing into the bush (*fig.* 12).

(10) Secure the bearing in position with the retaining ring using Seeger pliers.

GEAR MESHING

10. A trial assembly of the centre housing must be carried out to check and, if necessary, adjust the meshing and backlash of the bevel gears. The shims used during the previous engine build should have been retained with the appropriate gear assemblies during the various stages of reconditioning, and, unless new components have been fitted, the original meshing of the gears should be readily obtained.

11. During the trial assembly, the meshing and backlash of the gears must be checked simultaneously and adjusted if necessary. All backlash checks must be made in three angular positions. An excellent guide to the correct meshing is the quietness of the dry gears when rotated by hand. When correctly adjusted, the back angle faces (or large end of the teeth) of the two gears should be aligned. This condition can be judged by eye and the adjustment is made by moving the gears, one inwards and the other outwards, by adjusting the shims beneath the vertical drive housing flanges and the laminated shim behind the front bearing. As both vertical drive assemblies are driven from the same horizontal shaft bevel gear, it will be necessary to make adjustments to both drives simultaneously.

12. Adjustment is made to the horizontal shaft and vertical gears by adding shims to, or peeling shims from, the laminated shim pack.

Note . . .
When building a centre housing with a new set of gears, the initial assembly should be made with adjusting washers of nominal thickness.

(1) Adjusting washer (Upper Drive) Nominal thickness ·096 in.

(2) Adjusting washer (Lower Drive) Nominal thickness ·063 in.

(3) Adjusting washer (Horizontal Drive) Nominal thickness ·063 in.

13. Whilst the correct gear meshing is being obtained, the backlash must also be checked and adjusted. To minimize wear, it is advisable to keep the backlash reading as near as possible to the bottom limit, making allowance for the other requirements which have to be satisfied. The gears must also be held apart so that the condition under which they normally run under load is simulated, and in assemblies with double bearings the shafts should be tapped with a mallet to ensure that the bearings seat in the running position. To increase the backlash, both gears should be moved away from each other, and to decrease it they should be moved towards each other. The method of adjustment is described in para. 12. Experience will dictate the amount that each gear should be moved to obtain simultaneous backlash and meshing adjustment.

14. After the backlash and meshing have been adjusted, the latter as well as possible by eye, marking blue must be used on the gear teeth to check that the gear meshing is accurate. The

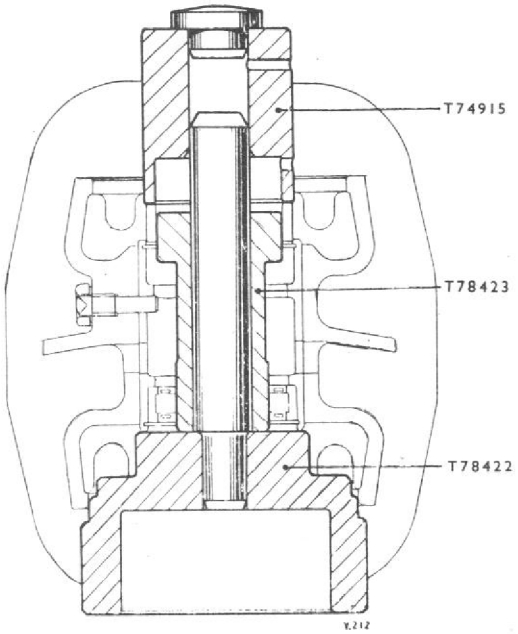


Fig. 12. Pressing the lower outer roller race into the bush

marking blue must be painted on all the teeth of the driving gear with a small brush, and the gears rotated with a rocking motion until all the driven gear teeth have been marked. Examine the marking on the driven gears and, if the marking is correct, each tooth should be marked over approximately 60 per cent of its total length starting from the "toe" or small end. The first 45 to 50 per cent of the tooth should be heavily marked, and the rest lightly marked as shown in fig. 13.

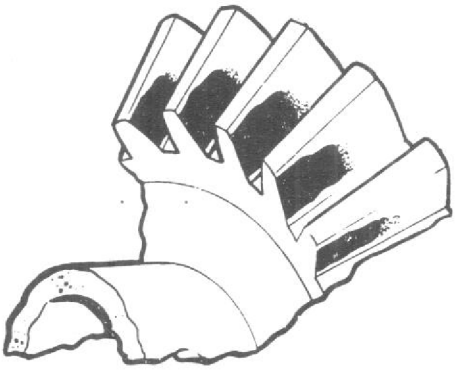


Fig. 13. Example of marking blue on correctly meshed gear

TRIAL ASSEMBLY OF CENTRE HOUSING

15. The initial assembly must be made dry.

(1) Fit retaining ring T74907 to the front bearing housing and secure with four $\frac{1}{4}$ in. B.S.F. nuts.

(2) Assemble the horizontal shaft to the centre housing, inserting the shaft into the housing from the rear.

(3) Place the centre housing on press block T74921, the retaining ring on the front bearing sitting on the spigot of the press block. Position adapter T74922 in the bore of the shaft and press the shaft into the centre housing (*fig.* 14).

(4) Secure the rear bearing housing with six new tab-washers (Part No. AGS518E) and $\frac{1}{4}$ in. B.S.F. nuts; do not lock the nuts.

(5) Place the centre housing on vice block T74912 front flange uppermost (*fig.* 15).

(6) Assemble a new spacer ring (Part No. 606275), a new cup-locking washer (Part No. N2857) and ring nut, tighten this nut to the torque loading specified in Chapter 22. Do not lock the nut.

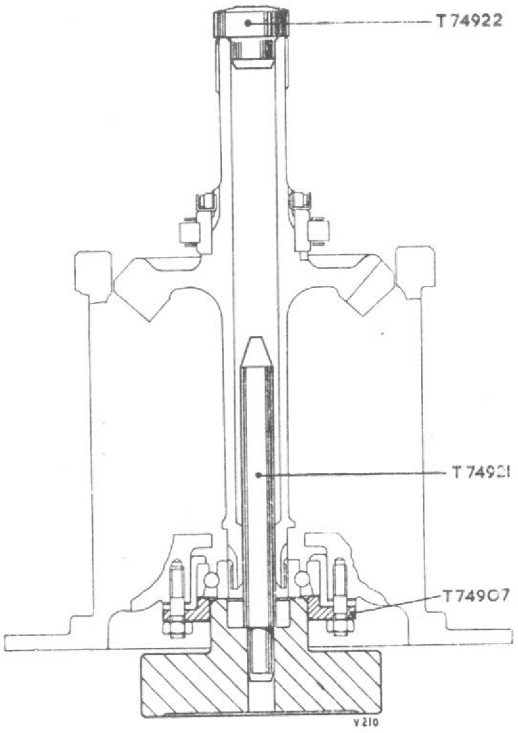


Fig. 14. Pressing the horizontal shaft into the centre housing

(7) Tap the gear of each vertical drive assembly with a hide mallet to ensure that the bearing behind the gear is seating on its shoulder. The bevel gear will then be in its correct running position for the subsequent checks.

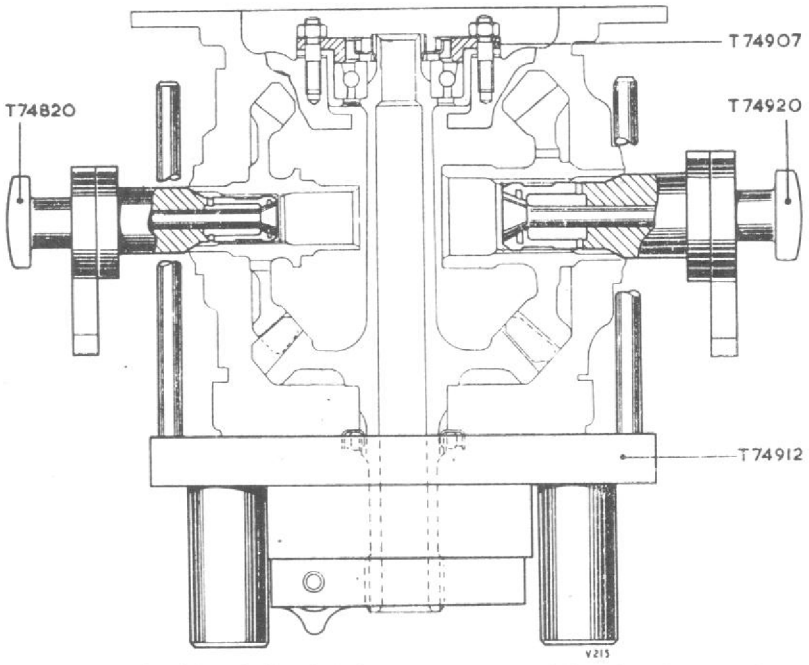


Fig. 15. Checking the backlash between the vertical drive bevel gear and the bevel gear on the horizontal shaft

(8) Assemble the upper vertical drive gear assembly to the centre housing with its laminum adjusting shim washer; temporarily secure with four $\frac{5}{16}$ in. B.S.F. nuts.

(9) Assemble the lower vertical drive gear assembly to the centre housing with its laminum adjusting shim washer; temporarily secure with four $\frac{1}{4}$ in. B.S.F. nuts.

Checking the meshing and backlash of the gears

16. (1) Insert the backlash checking tool T74920 into the upper vertical drive gear shaft bore.

(2) Clamp a dial test indicator on to the vice block, locate the stylus on the scribed line on the end of the checking tool. Check in accordance with the instructions contained in para. 12 that the backlash is within the limits.

Note . . .

The horizontal shaft is locked by the special screw at the bottom of the vice block.

(3) Remove the backlash checking tool and insert it in the shaft in two further positions, spaced at 120 deg. from the first. Repeat the backlash check at each position.

(4) Check the bottom vertical drive gear as described in Op. 1 and 2, using backlash checking tool T74820.

(5) Examine the meshing of the gears and, if necessary, adjust the meshing and backlash as described in para. 10, 11 and 12.

Note . . .

To adjust the laminum adjusting shim washer on the horizontal drive shaft, the shaft should be dismantled as described in Chapter 23.

(6) Check the meshing of the gears with marking blue as described in para. 13. If necessary, further adjustment must be made until the requirements are fulfilled.

FINAL ASSEMBLY OF CENTRE HOUSING

17. (1) Lock the ring nut at the front bearing end of the horizontal shaft, which is already assembled in the housing, by lightly tapping the cup-washer into the serrations of the nut at two opposite positions.

(2) Lock up the six tab-washers and $\frac{1}{4}$ in. B.S.F. nuts on the rear housing.

(3) Remove the retaining ring T74907 on the front bearing housing.

(4) Fit the front bearing retaining cover and secure with four new tab-washers (Part No. AGS518E) and $\frac{1}{4}$ in. B.S.F. nuts; lock the nuts.

(5) Liberally oil the gears and bearings with clean approved engine oil.

(6) Secure the upper vertical drive gear with four new tab-washers (Part No. AGS518G) and and $\frac{5}{16}$ in. B.S.F. nuts; lock the nuts.

(7) Secure the lower vertical drive gear with four new tab-washers (Part No. AGS518E) and $\frac{1}{4}$ in. B.S.F. nuts; lock the nuts.

LIST OF CONSUMABLE PARTS

18. The following consumable parts will be required during assembly of the centre housing.

Part No.	Description	Quantity
N2873	Cup-washer, horizontal drive shaft	1
N2865	Cup-washer, vertical drive gear upper	1
N2866	Cup-washer, vertical drive gear lower	2
AGS518E	Tab-washer, rear bearing housing	6
N2857	Cup-washer, horizontal drive shaft	1
AGS518G	Tab-washer, vertical drive gear upper	4
AGS518E	Tab-washer, vertical drive gear lower	4
AGS518E	Tab-washer, front bearing housing	4
N4221	Circlip, upper vertical gear	1
N4206	Circlip, lower vertical gear	1
606275	Spacer ring, front bearing housing	1
N4211	Retaining ring, rear housing	1
Mk. 104 only		
60557	Retaining ring, upper vertical drive housing	1

LIST OF TOOLS

19. The following tools are required for assembly of the centre housing.

Tool No.	Description
T70809	Stud box, $\frac{1}{4}$ in. B.S.F.
T71006	Stud box, $\frac{5}{16}$ in. B.S.F.
Standard	Edgwick Arbor press
T74940	Press block, upper vertical drive housing
T74941	Adapter, upper vertical drive housing
T74942	Press block, upper vertical drive
T74746	Guide mandrel, upper vertical drive
T74745	Adapter, upper vertical drive
T74928	Vice block, upper vertical drive
T72554	Serrated spanner, upper vertical drive
T74747	Press block, lower vertical drive housing
T74748	Adapter, lower vertical drive housing
T74933	Press vice block, lower vertical drive
T74934	Serrated spanner, lower vertical drive
T74749	Guide plug, lower vertical drive
T74750	Adapter, lower vertical drive
T78985	Press block, rear bearing housing
T78986	Adapter, rear bearing housing
T74908	Press block, horizontal drive shaft
T74909	Adapter, horizontal drive shaft
T74910	Vice block, horizontal drive shaft
*T74911	Serrated spanner, horizontal drive shaft
T74918	Press block, front bearing housing
T74919	Adapter, front bearing housing
T78422	Press block, centre housing
T78423	Sleeve, centre housing
T74915	Adapter, centre housing
T74907	Retaining ring, front bearing housing
T74921	Press block, centre housing
T74922	Adapter, horizontal drive shaft
T72556	Serrated spanner, horizontal drive shaft
T74912	Vice block, centre housing
T74920	Backlash checking tool, upper vertical drive
T74820	Backlash checking tool, lower vertical drive

**Use torque spanner, see fig. 10*