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TRUCK, 4 TONNE, 4x4, BEDFORD MJ, ALL VARIANTS

REPAIR INSTRUCTIONS

REPRINTED AUG 1993 INCORPORATING AMDT Nos 1 to 3

*This publication contains information covering the
requirements of Sub-Category 5.2 at information
levels 3 and 4*

BY COMMAND OF THE DEFENCE COUNCIL

Alvin Whitmore.

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AMENDMENT RECORD

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12	Cooling system	AESP 2815-K-062-512
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PREFACE

Amendment identification

1 Except for manuscript entries, amendments are to be identified by marginal side lining. Manuscript amendments are identified by Amdt No in outside margin in line with the amendment.

Comments on this publication

2 Comments on this publication are to be forwarded in accordance with AESP 000-P-011-013 to Vehicles and weapons Branch REME, Chobham Lane, Chertsey, Surrey KT16 OEE.

ASSOCIATED PUBLICATIONS

AESP 2320-H-100-101	Purpose and planning information
AESP 2320-H-100-201	Operating instructions
AESP 2320-H-100-302	Technical description
AESP 2320-H-100-601	Maintenance Schedule
AESP 2320-H-100-711	Illustrated Parts Catalogue
AESP 2320-H-100-721	Commercial Parts List
AESP 2815-K-062-512	Engine Diesel 6 cyl Bedford 5.4 Litre Turbocharged
AESP 2610-A-409-301	Pneumatic Tyres and Tubes Associated, Road wheels
EMER Test & Measurement	A 028
EMER Power J 330	Lead Acid Battery Maintenance
EMER Workshop N 111	Preservation, Identification and Packaging of Assemblies
EMER Workshop N 345	Assembly Techniques, Split Shell Bearings using Plastigage Method
EMER Workshop C 010	Hydraulic Equipment Introduction to A, B and C Vehicle Hydraulic Systems
EMER Workshop C 011	BS Symbols used in Diagrams for Hydraulic and Pneumatic Systems
EMER Workshop C 171	Plessey Hydraulic Pumps, Beta and Gamma Range

WARNINGS/CAUTIONS

3 Before driving this vehicle or operating any fitted equipment, personnel are to read and understand the warnings, cautions and operating instructions detailed in Cat 201 of this AESP.

CHAPTER 2

CLUTCH

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- 17 Clutch pilot bearing

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TABLE 1 - SPECIAL TEST EQUIPMENT AND TOOLS

Ser	Tool No (where applicable)	NSN/Part No (where applicable)	Designation
(1)	(2)	(3)	(4)
1	99A		Churchill Clutch Fixture
2	99M		Churchill Clutch Fixture Adaptor
2	Z8527	7BD/5120-99-873-9362	Clutch Pilot Bearing Remover

CLUTCH

Disassembly

1 Remove friction disc and pressure plate as described in Chap 2, level 2, para 23.

2 Secure clutch cover assembly to Clutch Fixture 99A and Adaptor 99M and compress thrust springs before removing eye bolt nuts, and drive strap bolts and ferrules.

3 Before separating clutch cover from pressure plate, mark them for alignment on reassembly.



Fig 1 - Removing drive strap bolts

Inspection and Reconditioning

4 When renewing clutch disc friction facings, drill rivets sufficiently to allow them to be punched out. Do not shear rivets with a chisel as this may distort disc segments or elongate rivet holes.

5 Install rivets with the heads against the facing material. To avoid damage to the facing material do not overtighten the rivets.

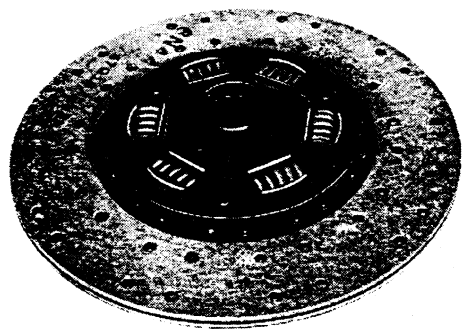


Fig 2 - Installing facing rivets

6 Scores on friction surface of pressure plate can be removed by grinding, providing plate thickness (dimension 'A') after machining is not less than 18.67 mm (0.735 in.). Thickness must be checked at several points around plate.

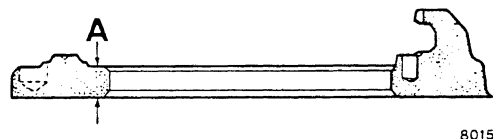
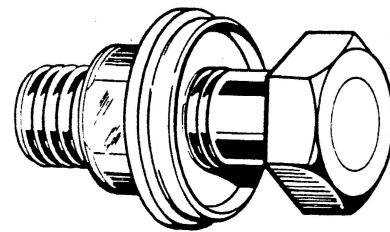


Fig 3 - Thickness of pressure plate

7 The heads of the drive strap ferrules are recessed to act as a lock for the bolt heads. Whenever the bolts are disturbed both these and the ferrules must be renewed. Bolts and ferrules are serviced as a kit.

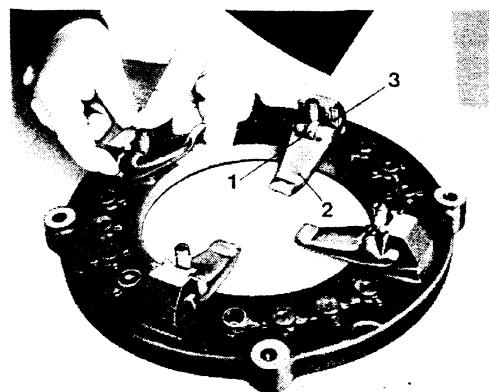


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Fig 4 - Drive strap ferrule and bolt

Reassembly

8 On reassembly apply a smear of XG 279 grease to bearing surfaces of release levers, eye bolts, pins and struts.

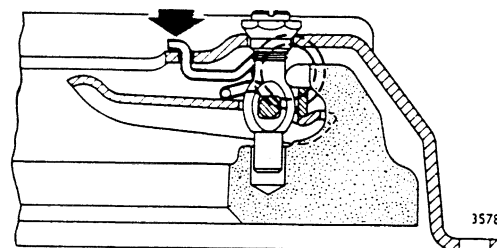


55313

- 1. Eye bolt
- 2. Release lever
- 3. Lever strut

Fig 5 - Installing release levers

9 Install anti-rattle springs with spring ends (arrowed) towards centre of cover.



3578

Fig 6 - Installing anti-rattle springs

10 When reassembling original cover and pressure plate, ensure that marks made during disassembly are in alignment.

11 Before finally tightening bolts securing clutch cover to jig, check that strap slots are aligned with pressure plate bolt holes then assemble ferrules in drive strap slots and loosely assemble strap attaching bolts.

12 Adjust release levers to 56.51/57.78 mm (2.225/2.275 in.) using gauge plate 0.33 in. thick by turning eye bolt nuts.



Fig 7 - Adjusting release lever heights

13 Before locking eye bolt nuts, operate release levers several times and recheck adjustment.

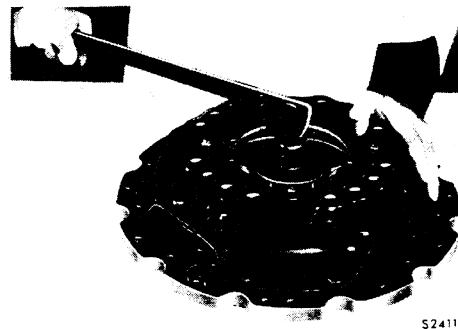


Fig 8 - Operating release levers

14 Before releasing clutch from jig, lock each eye bolt nut by staking nut into slot of bolt.

15 Tighten drive strap bolts to a torque of 24 Nm (18 lbf ft) and stake edge of ferrule on to bolt head.

16 Install clutch as described in Chap 2, level 2, para 24.

CLUTCH PILOT BEARING

17 To renew clutch pilot bearing in crankshaft flange, remove clutch assembly and withdraw bearing with Remover Z8527.

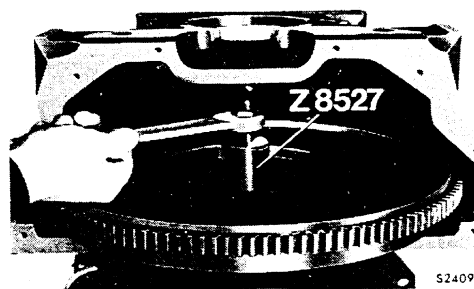


Fig 9 Removing clutch pilot bearing

18 On installation, drive bearing against shouldered face of crankshaft.

CHAPTER 3

GEARBOX

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- 14 Gearbox - Removal and installation
- 16 Gearbox - Disassembly and reassembly

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TABLE 1 - SPECIAL TEST EQUIPMENT AND TOOLS

Ser	Tool No (where applicable)	NSN/Part No (where applicable)	Designation
(1)	(2)	(3)	(4)
1	D1123		Wrench-pinion nut
2	Z8524	7BD/5120-99-825-5881	Bridge piece
3	Z8523	7BD/5120-99-833-4151	Drag
4	Z8283		Drift
5	D1141		Installer-bearing

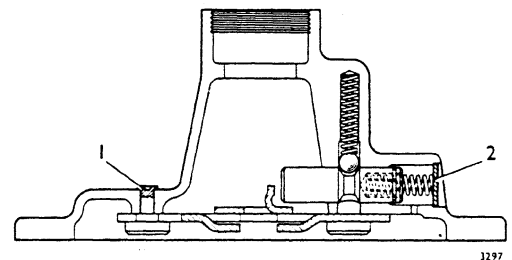
TOP COVER

Removal

- 1 Disconnect the coupling rod from the gearbox gearshift lever and withdraw the inner tube.
- 2 Remove the top cover and install a temporary cover.

Disassembly

- 3 Slide the gearshift lever rubber grommet up the lever.
- 4 Knock back the locking tab, remove the seating nut and withdraw the gearshift lever and upper seating.
- 5 Remove the spacer and lower seating.
- 6 Do not remove the rubber grommet from the lever unless renewal is necessary.
- 7 To remove interlock plate, chisel off ends of rivets (1). Reverse stop plunger and spring can be withdrawn after removing expansion plug (2).



1. Retaining rivets
2. Reverse stop plunger

Fig 1 - Interlock plate removal

Reassembly

- 8 Insert locking ball and spring in cover before installing reverse stop plunger. Use a short tapered rod to depress locking ball and spring while inserting plunger. Ensure circlip (arrowed) is located on plunger before installing a new expansion plug.

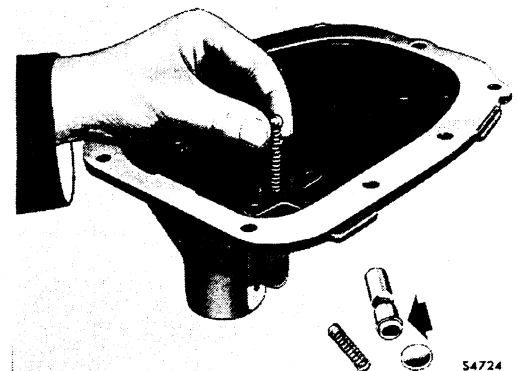


Fig 2 - Installing locking ball and spring

9 Special service replacement rivets and guides are used to secure interlock plate to top cover. After riveting plate to cover, ensure that plate slides freely on guides.

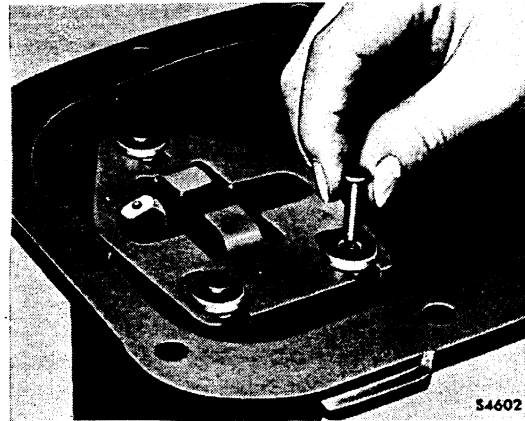


Fig 3 - Installing interlock plate

10 Before installing gearshift lever, ensure lower seating is located in cover turret.

11 After locating lever, spacer, upper seating and washer in turret, tighten retaining nut just sufficiently to eliminate lever slackness and secure nut with tab washer.

Installation

12 Use a new gasket and tighten evenly the special chamfered bolts.

13 Before reconnecting the coupling rod to the gearshift lever, smear the outer surface of the inner tube with grease.

GEARBOX

Removal

14 As described in Chap 3, level 2, para 22.

Installation

15 As described in Chap 3, level 2, para 27.

Disassembly

16 To facilitate disassembly and reassembly of gearbox, bolt two supports to casing lower attaching lugs.

17 After engaging top and reverse gears, remove coupling flange bolt.

18 Striking fork rods are located in gearbox casing by a retainer bolted to rear of casing.

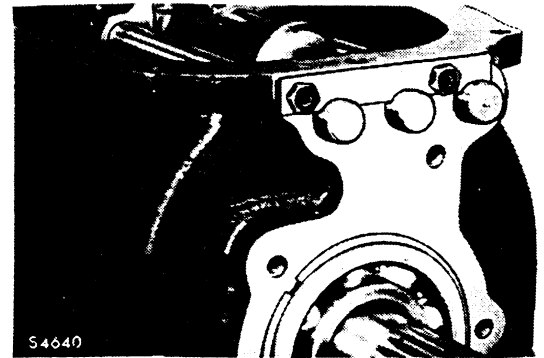


Fig 4 - Striking fork rod retainer

19 Fork rods must be driven out from front of casing. Take care not to lose locking balls as forks become detached.

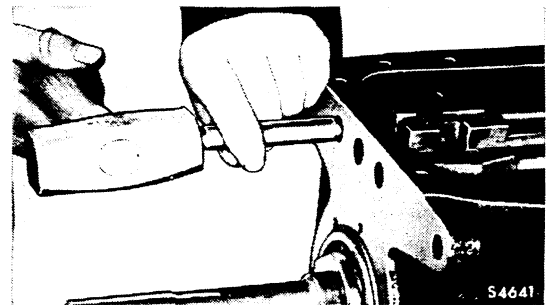


Fig 5 - Removing fork rods

20 To facilitate removal of pinion left-hand threaded nut, and layshaft bearing retainer bolts, engage second and third gears. Use Wrench D1123 to unscrew pinion nut.

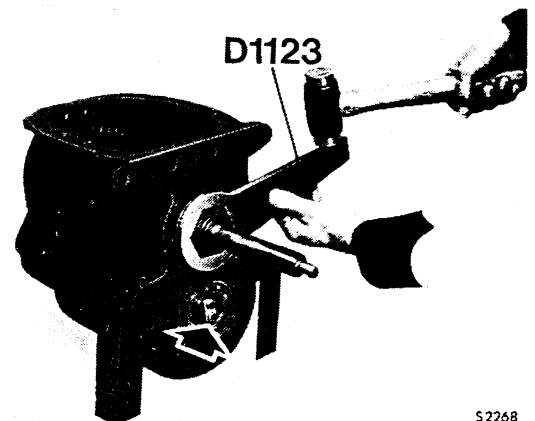


Fig 6 - Removing pinion nut

21 Remove the bolt, tabwasher and plain washer, and withdraw the universal joint flange from the mainshaft.

22 To remove main drive pinion bearing, remove locating ring from outer race and assemble Adaptor Z8524 to bearing. Use Remover Z8523 to withdraw bearing off shaft and out of casing. Ensure bridge piece (arrowed) is interposed between remover screw and casing to relieve main drive pinion of end thrust.

23 After removing bearing, withdraw oil thrower to prevent damaging it during removal of mainshaft.

24 Remove the rear cover.

25 After removing speedometer driving gear and oil thrower, mainshaft bearing can be removed in a similar manner to main drive pinion bearing, using Adaptor Z8524 and Remover Z8523 together with a distance piece (arrowed) and a plug supplied with the remover.

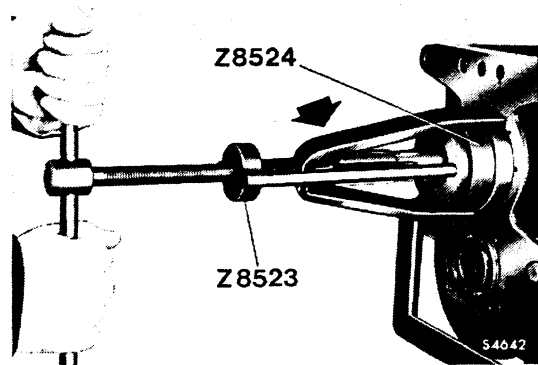


Fig 7 - Removing main drive pinion bearing

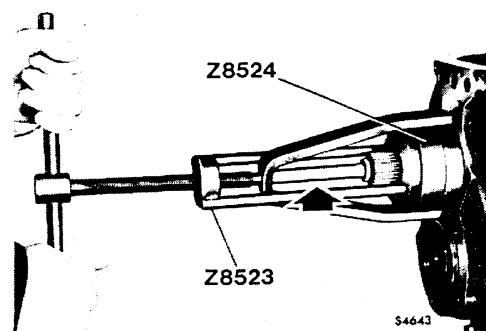


Fig 8 - Removing mainshaft bearing

26 To facilitate removal of mainshaft, slide first and reverse gear forward on mainshaft to engage second gear. Slide third and fourth clutch rearwards on clutch hub to engage third gear. Lay gearbox on its side, and with main drive pinion located as far forward as possible through casing bore, withdraw mainshaft assembly through top of casing.

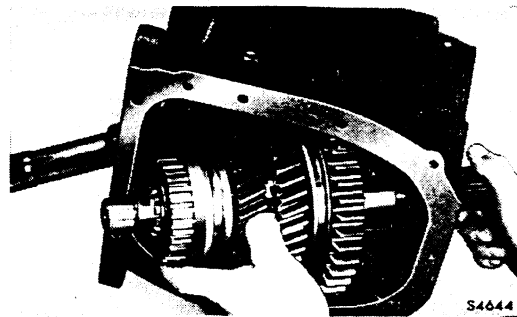


Fig 9 - Lifting out mainshaft assy

27 Use Adaptor Z8524 and Remover Z8523 to remove layshaft rear bearing.

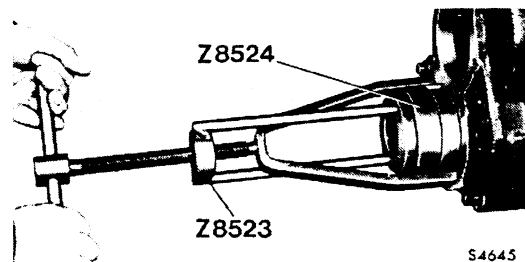


Fig 10 - Removing layshaft bearing

28 Reverse pinion shaft is retained in casing by a spring pin (arrowed). Pin must be driven in as far as possible so that it is contained within pinion shaft.

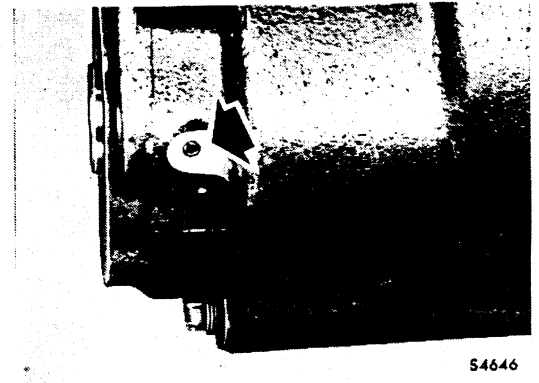


Fig 11 - Reverse pinion shaft retaining pin

29 When pressing reverse pinion shaft out of casing, support rear of casing on a sleeve.

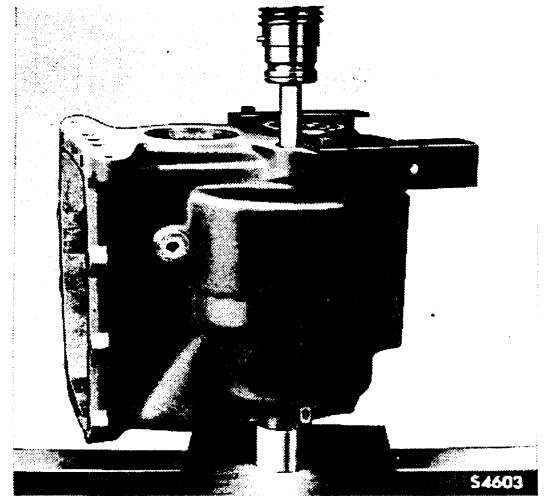


Fig 12 - Pressing out reverse pinion shaft

30 Layshaft gear can be pressed out of front bearing and assembly lifted out of casing. Front bearing can then be tapped out from inside casing.

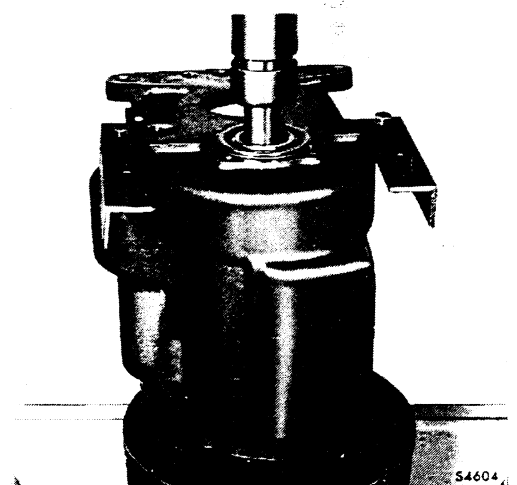


Fig 13 - Pressing out layshaft gear

31 Before disassembling mainshaft, mark with a spot of paint the radial position of third and fourth speed clutch relative to its hub. In addition mark position of first and reverse gears splines in relation to mating splines on mainshaft. This will ensure that components are reassembled in the same relationship as before.

32 First and reverse gear can be withdrawn off mainshaft after removing synchronizing cone retainer (arrowed).

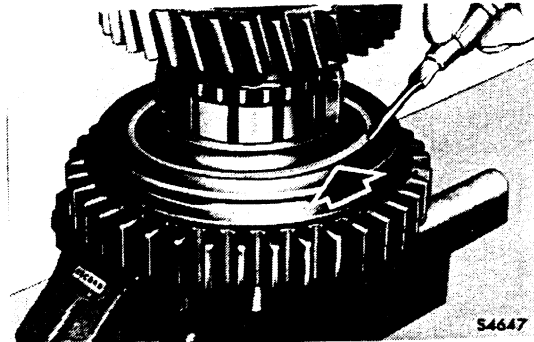


Fig 14 - Removing synchronizing cone retainer

33 Third and fourth speed clutch hub is retained on front end of mainshaft by a retaining ring.

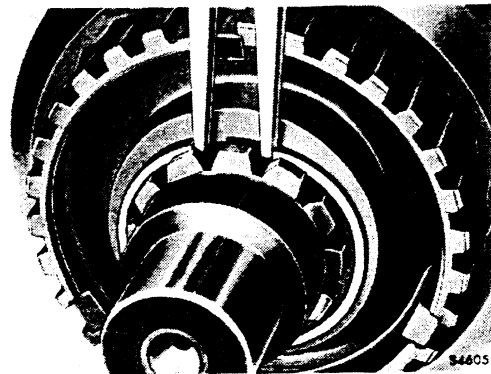


Fig 15 - Removing third and fourth speed clutch hub retaining ring

34 To press clutch hub and third speed gear sleeve off mainshaft, support second gear on press making sure that synchronizing springs are clear of press.

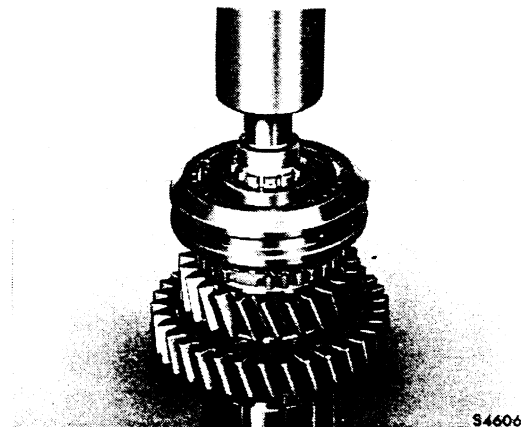


Fig 16 - Pressing clutch hub and third speed gear sleeve off mainshaft.

35 Discard damper ring and compression strip of first and reverse gear.

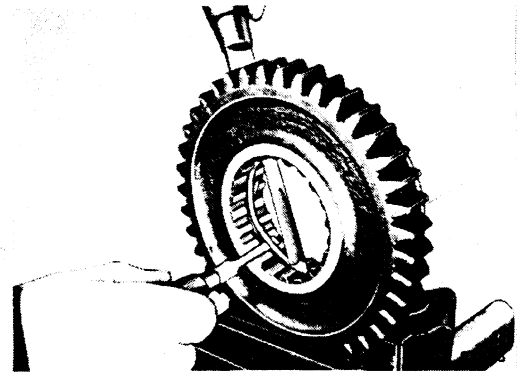


Fig 17 - First and reverse gear damper ring

36 Layshaft first speed gear is integral with layshaft. Remaining gears are pressed and keyed to layshaft. Support rear face of second gear on press when pressing layshaft out of gears. Discard keys after removing gears.

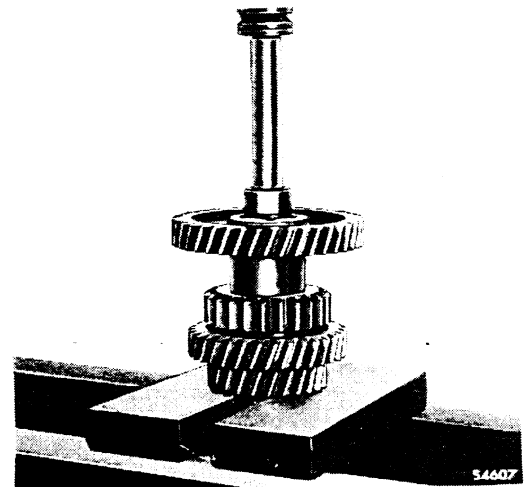


Fig 18 - Pressing gears off layshaft

Reassembly

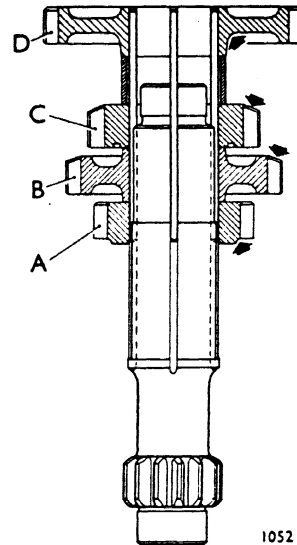
37 Before assembling gears to layshaft, locate new keys on shaft so that each key projects halfway above ends of keyways. Retain keys in this position with stiff grease.



Fig 19 - Assembling keys to layshaft

38 Layshaft gears must be assembled to layshaft as follows: 'A' - second gear, with boss to rear of shaft; 'B' - third gear and 'C' - reverse gear, with chamfers on end of teeth to front of layshaft; 'D' - driven gear, with boss to rear of shaft. Ensure that spacer, between driven gear and reverse gear, is concentric with boss of driven gear.

Before pressing gears on to shaft, keys must be flush with driven gear end face.



A Second gear C Reverse gear
B Third gear D Driven gear

Fig 20 - Assembling layshaft gears

39 When pressing gears on to shaft, use a sleeve to contact driven gear end face and ends of keys. Gears must be pressed on to shaft until second gear contacts layshaft shoulder. During this operation take care that keys do not jam in bottom ends of shaft keyways. Gears and spacer must be in firm contact with each other and keys must be tapped below end face of driven gear after gears are finally assembled.

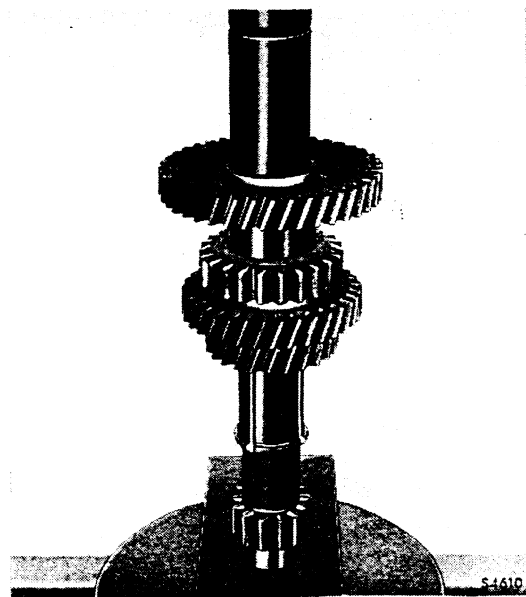


Fig 21 - Pressing gears on to layshaft

Note ...

Third and fourth speed clutch and hub, also first and reverse gear and mainshaft are matched assemblies, therefore components of each assembly must not be renewed individually.

40 Use long end of Remover Z8283 when pressing bush out of mainshaft second speed gear.

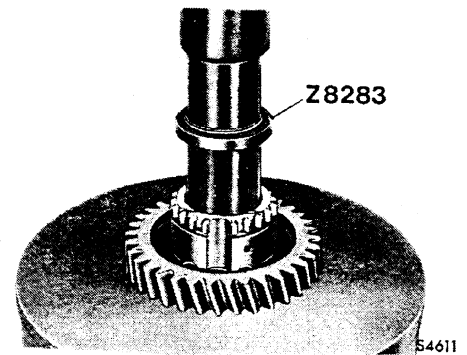


Fig 22 - second speed bush removal

41 New bush must be located so that oil holes are aligned with holes in gear bore.

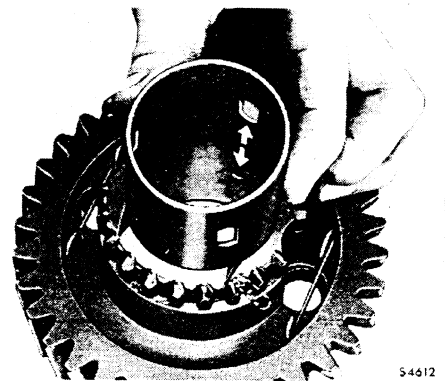


Fig 23 - Installing bush in second speed gear

42 Use short end of Installer Z8283 and press bush into gear until collar on drift contacts gear. Replacement bushes are pre-finished to size.

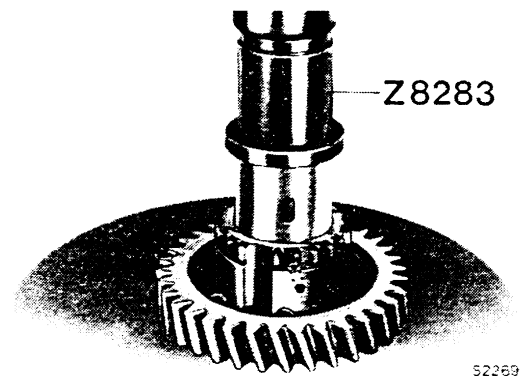


Fig 24 - Pressing bush into gear

43 After installing, bush must be staked into oil grooves in front end face of gear.

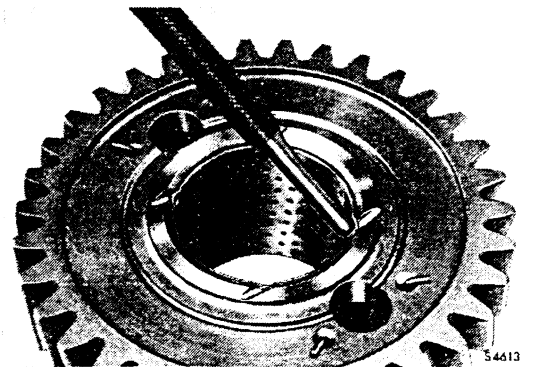
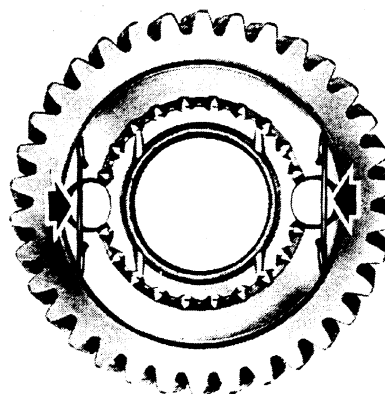


Fig 25 - Staking bush into gear

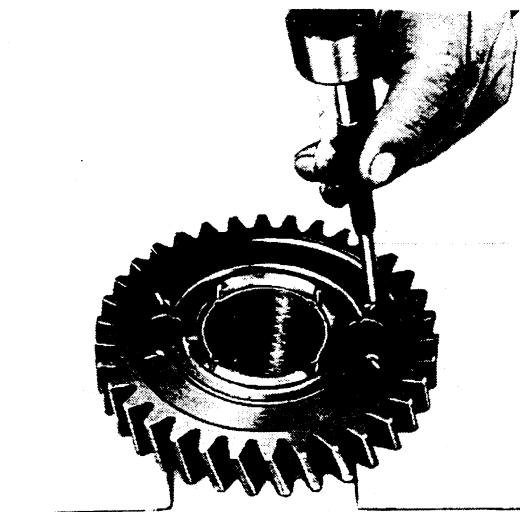
44 Synchronizing springs can be removed by straightening ends of springs. In order that lugs of first and reverse gear cone can engage holes in second gear, new synchronizing springs must be installed so that straight section of spring (arrowed) is offset outwards from centres of holes in gear.



S4617

Fig 26 - Replacing synchronizing springs

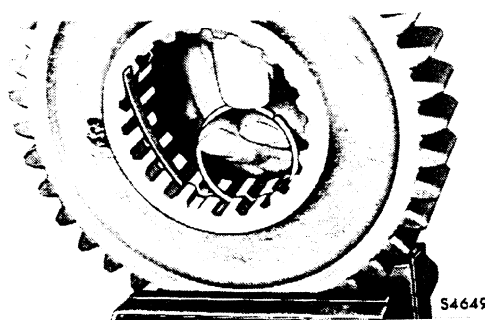
45 To secure springs in gear, support spring eyes on wood blocks and bend over ends of springs. Ensure each spring is secure in gear and with no end float.



S4618

Fig 27 - Securing springs in gear

46 When installing compression strip in bore of first and reverse gear, ensure strip is not twisted. Top speed hub retainer can be used to roll strip into groove.



S4649

Fig 28 - Installing compression strip in first and reverse gear

47 After installing compression strip, damper ring must be located in groove so that centre lugs (arrowed) on ring are aligned with high splines in gear.

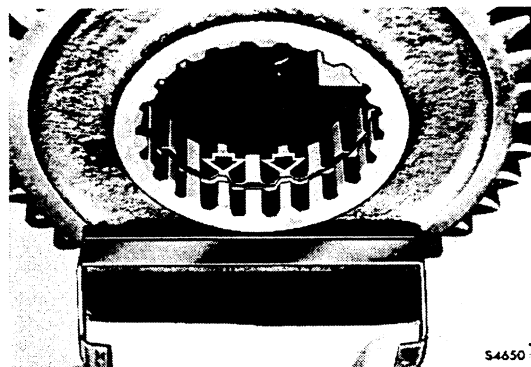


Fig 29 - Installing damper ring in first and reverse gear

48 When installing first and reverse gear on mainshaft, marked spline of gear and shaft must be re-aligned. Ensure lugs of damper ring engage splines of shaft, and tap gear on to shaft.

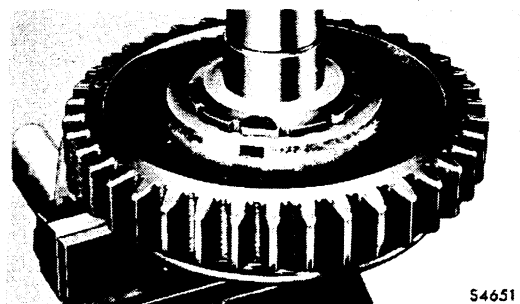


Fig 30 - Installing first and reverse gear on mainshaft

49 After installing gear on shaft, synchronizing cone must be assembled to gear and secured with retainer (arrowed).

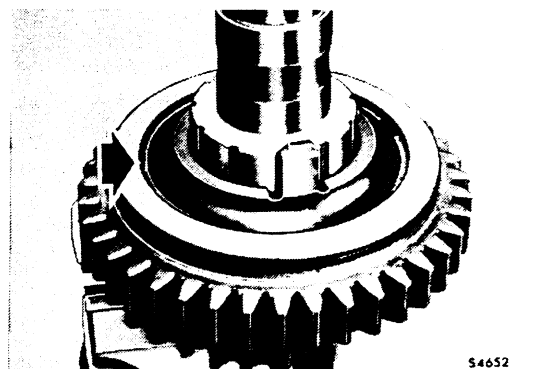


Fig 31 - Assembling synchronizer to gear

50 After assembling second gear on mainshaft, locate a new thrust washer, with chamfered end of bore first, against shoulder on mainshaft and check that gear end float is within 0.23/0.35 mm (0.009/0.014 in.).

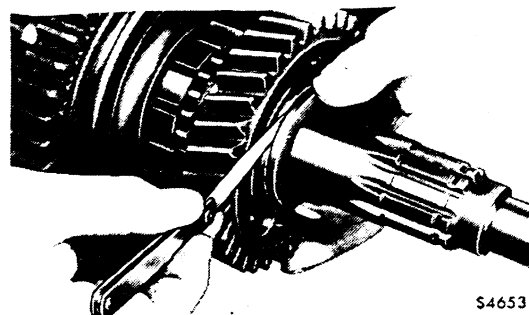


Fig 32 - Installing second gear thrust washer

51 When pressing third gear mainshaft sleeve on to shaft, avoid excessive pressure when sleeve contacts thrust washer as this may distort sleeve. After installing, ensure gear rotates freely on sleeve.

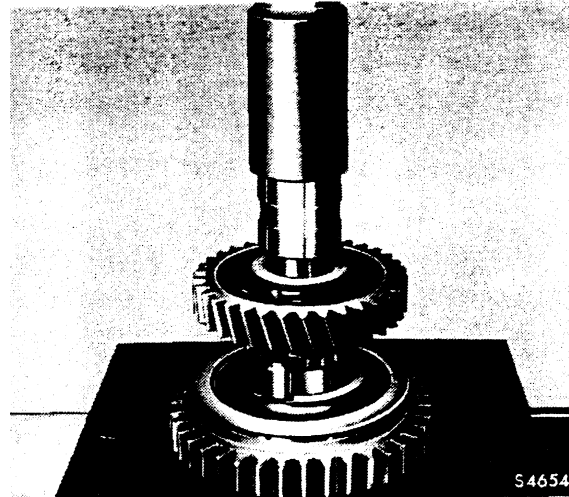


Fig 33 - Pressing third gear sleeve on to mainshaft

52 When assembling clutch key springs to third and fourth speed clutch hub, springs must be located on keys so that ends of both springs are on same keys. Spring ends must also be clear of curved surface of clutch hub.

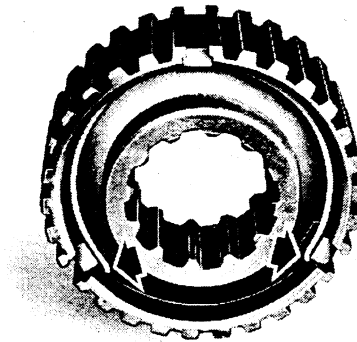


Fig 34 - Assembling clutch hub

53 Third and fourth speed clutch hub must be located on mainshaft so that longer boss of hub is towards spigoted end of shaft. Align slots (arrowed) in synchronizing ring with keys while pressing hub on to shaft. Avoid excessive pressure when hub contacts third gear sleeve as this may distort sleeve and result in insufficient clearance for gear.

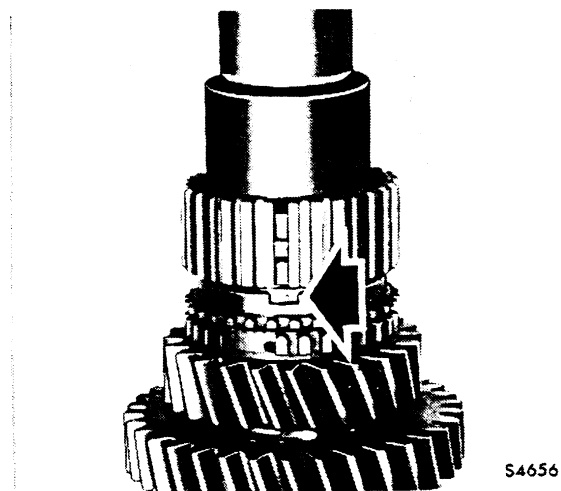


Fig 35 - Installing clutch hub to mainshaft

54 After installing third and fourth speed clutch hub, check that third gear end float is within 0.23/0.35 mm (0.009/0.014 in.) and that gear rotates freely. Clutch must be assembled to hub with its groove adjacent to the third speed gear.

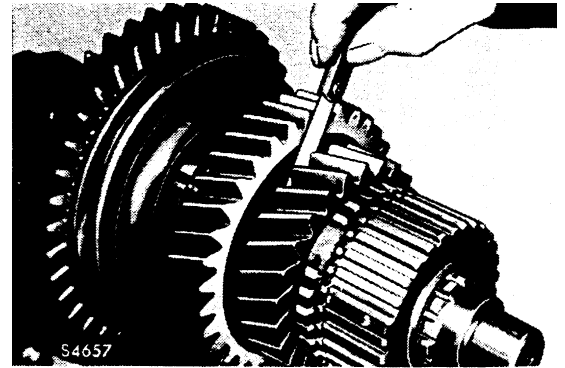


Fig 36 - Third gear end float

55 Third and fourth speed clutch hub retaining ring is serviced in four thicknesses. Select a new ring which will give minimum clearance between ring and clutch hub; clearance must not exceed specified maximum.

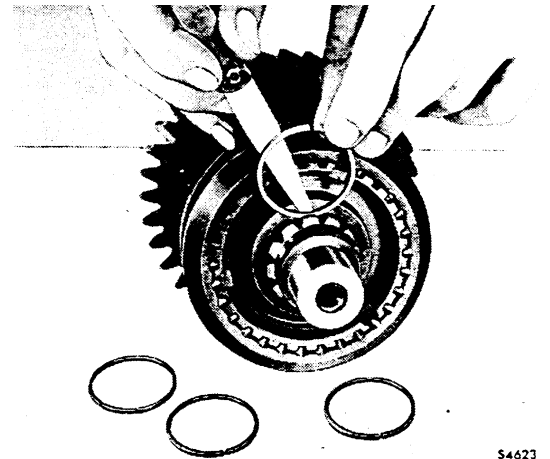


Fig 37 - Retaining ring selection

56 Layshaft front bearing must be pressed into casing until bearing locating ring contacts front face of casing.

57 Layshaft front bearing spacer must be assembled, bore chamfer first, to layshaft front spigot. Smear spacer with petroleum jelly to retain it on spigot while installing layshaft gear assembly.

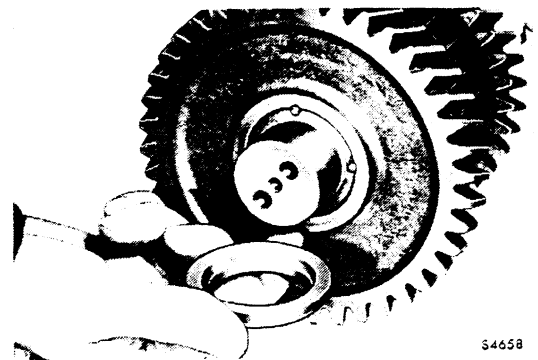


Fig 38 - Installing layshaft front bearing spacer

58 To install layshaft gear assembly, up-end casing so that layshaft front bearing rests on press. After aligning spigot on front end of layshaft with bearing, press in layshaft to fully engage spigot in bearing.

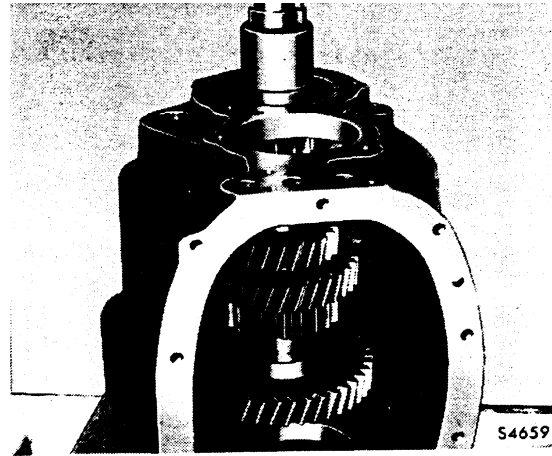


Fig 39 - Installing layshaft gear assembly

59 Layshaft rear bearing must be installed so that bearing locating ring contacts rear face of casing.

60 Before pressing in reverse pinion shaft ensure that retaining pin hole in rear end of shaft is aligned with hole in casing. Shaft must be secured by a pin driven in flush with casing.

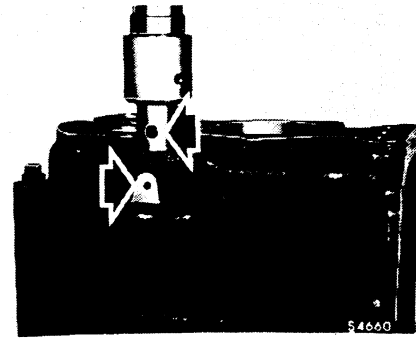


Fig 40 - Installing reverse pinion shaft

61 Front end of mainshaft is supported in main drive pinion counterbore by 18 bearing rollers.

62 Smear rollers with grease when assembling to pinion bore and locate keep ring (arrowed) midway along rollers to retain them in position prior to engaging mainshaft spigot.

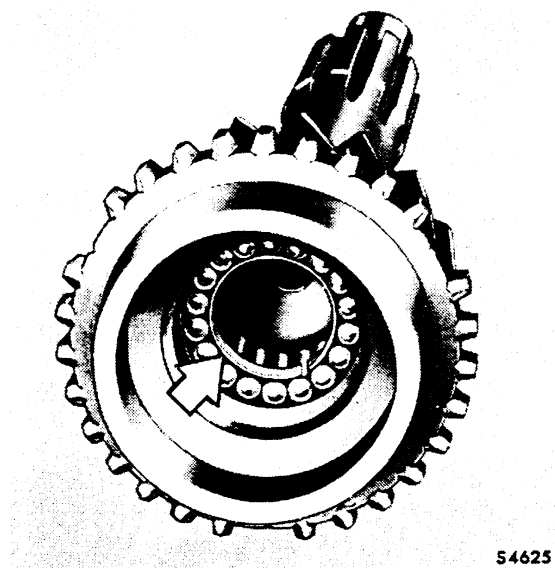


Fig 41 - Installing pinion roller bearings

63 To facilitate installation of mainshaft, lay gearbox casing on its side. Assemble a synchronizing ring to main drive pinion cone and insert pinion shaft as far as possible through casing bore. Slide first and reverse gear forward on mainshaft to engage second gear. Slide third and fourth clutch rearwards on clutch hub to engage third gear, and place mainshaft assembly in casing so that rear of shaft is as far as possible through casing bore.

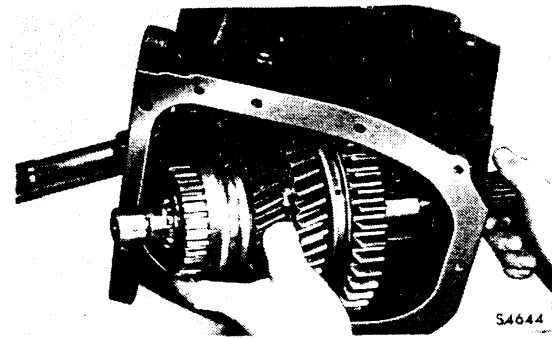


Fig 42 - Installing mainshaft

64 Mainshaft rear bearing must be located on shaft so that bearing retaining ring is to rear of shaft. Use Installer D1141 to drive bearing into contact with shaft splined hub.

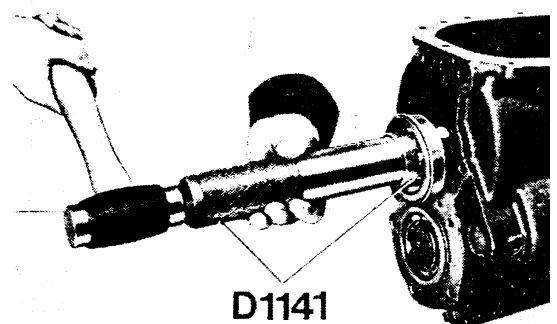


Fig 43 - Locating mainshaft rear bearing

65 When assembling main drive pinion to mainshaft spigot, ensure that synchronizing ring slots (arrowed) are aligned with clutch keys.

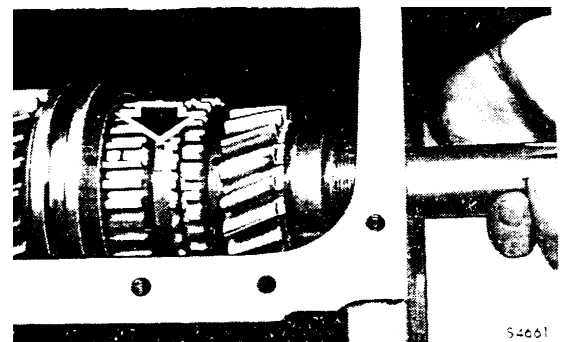


Fig 44 - Installing main drive pinion

66 To prevent third and fourth speed clutch contacting layshaft third gear when installing mainshaft rear bearing in casing, clutch must be located in the neutral position. Use Installer D1141 to drive bearing in until bearing retaining ring contacts rear face of casing.

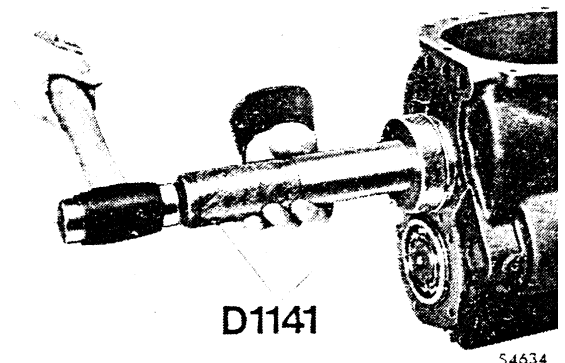


Fig 45 - Installing mainshaft rear bearing

67 Oil thrower is located on main drive pinion with concave side to pinion teeth, and concentric with pinion shoulder. Use stiff grease to retain oil thrower in position during subsequent installation of bearing.

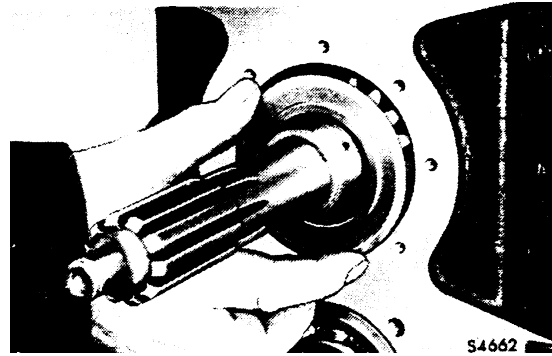


Fig 46 - Installing oil thrower

68 To ensure pinion bearing is located squarely on shaft and in casing bore, hold bearing on nut spigot and screw nut on to shaft until finger tight.

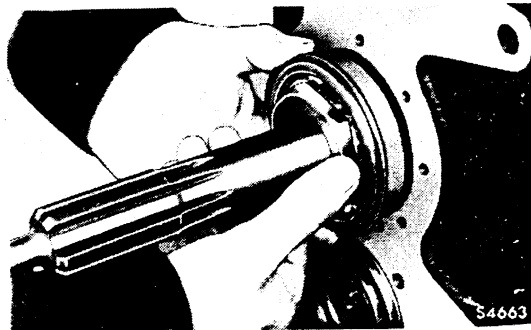


Fig 47 - Locating pinion bearing

69 After engaging both second and reverse gears, use Wrench D1123 to tighten nut approximately three turns, then carefully tap bearing into casing with Installer D1141. Repeat this procedure until bearing retaining ring contacts casing. During this operation, ensure fourth speed synchronizing ring is not forced into contact with gear cone otherwise synchronizing ring will be damaged. Ensure main drive pinion oil thrower remains in position.

70 After tightening pinion nut, secure it by staking into hole provided in main drive pinion.



Fig 48 - Staking pinion nut

71 When assembling retainer to front spigot of layshaft, ensure bolts are secured by locking plate.

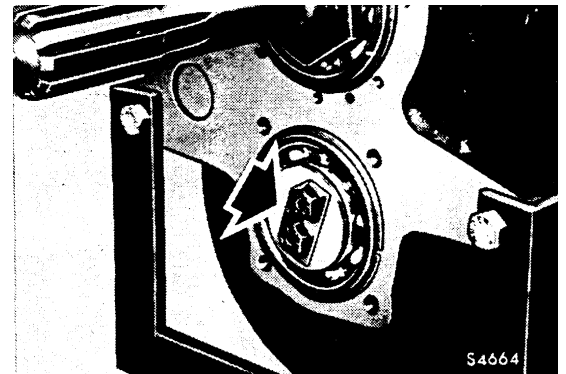


Fig 49 - Installing layshaft spigot bearing retainer

72 When assembling layshaft front cover apply Loctite 510 (sealant) to transmission face and smear bolts with jointing compound.

73 Install oil thrower to mainshaft so that paddles are away from bearing and install speedometer driving gear so that shoulder is towards oil thrower.

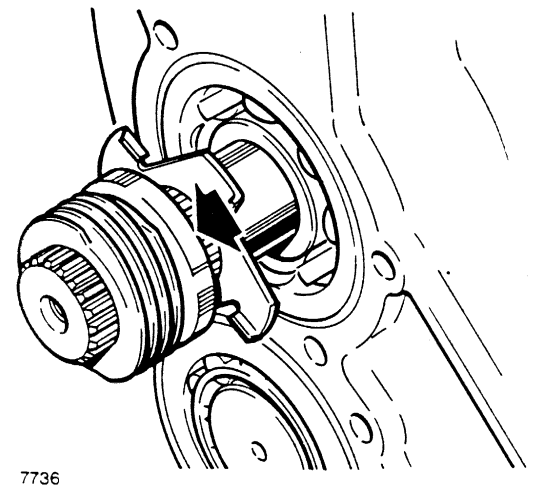


Fig 50 - Installing oil thrower and speedometer driving gear

74 When installing rear cover apply Loctite 510 (sealant) to transmission face and smear bolts with jointing compound. With both top and reverse gears engaged, tighten coupling flange bolt to specified torque.

75 When installing reverse striking lever, lower end of lever must be fully engaged in reverse idler gear groove in all positions when operated. Do not secure nut of lever eccentric bolt at this stage.

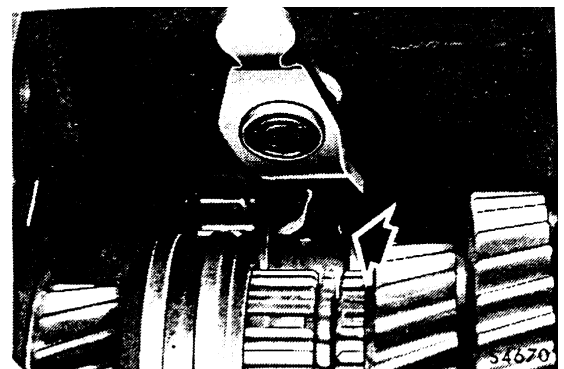


Fig 51 - Installing reverse striking lever

76 Striking fork rods are identified by location and number of locking slots. 'A' - reverse, has two locking slots at front of rod. 'B' - first and second, has three locking slots at rear of rod. 'C' - third and fourth, has three locking slots at front of rod.

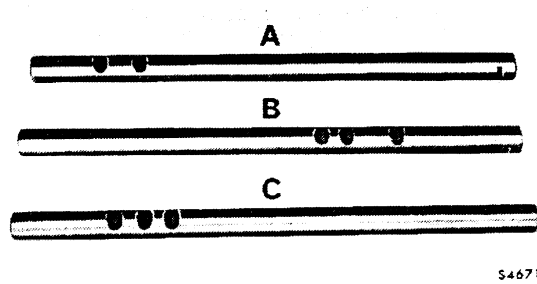


Fig 52 - Striking fork rod identification

77 To facilitate assembly of striking forks to rods, use pilot rods (arrowed) to retain locking ball and spring in forks and reverse lever head, installing rods will push pilots clear.

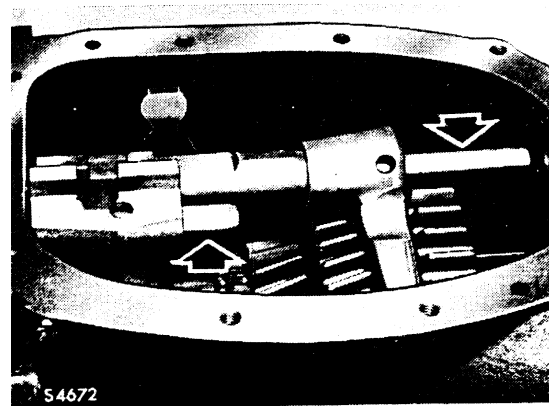


Fig 53 - Assembly of striking forks

78 Before driving striking fork rods into casing, engage top and second gear. Position retainer in rod locating grooves so that chamfered edge of retainer is to the bottom of casing and to rear of rods. Temporarily install guide bolts to align retainer holes with tapped holes in casing. Apply a small amount of Loctite 290 (adhesive) to ends of selector rods and drive rods into casing. Remove guide bolts, apply Hylomar PL 32/M jointing compound to threads and replace and tighten bolts.

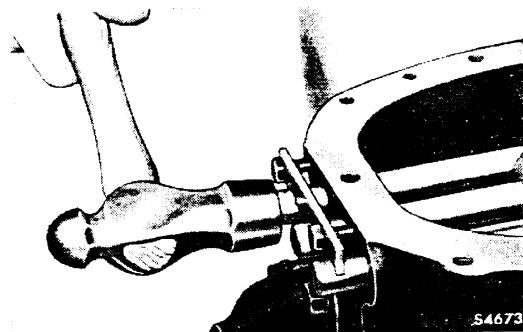


Fig 54 - Installing striking fork rods

79 Use new sealing washers on main drive pinion cover bolts, and ensure washers do not project beyond cover flange.

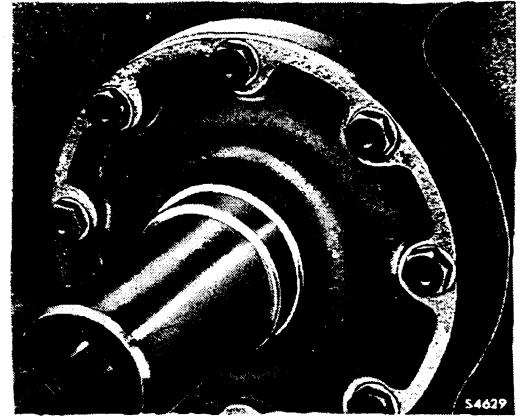


Fig 55 - Installing main drive pinion cover

80 To ensure reverse idler gear fully engages mainshaft first and reverse gear when in reverse, striking lever can be adjusted by means of an eccentric pivot bolt. High side of eccentric is indicated by punch marks (arrowed).

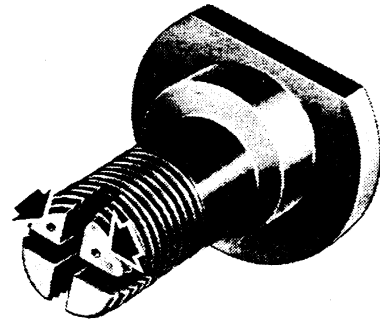


Fig 56 - Reverse idler gear pivot bolt

81 To adjust reverse striking lever, select reverse gear and rotate eccentric pivot bolt until clearance between reverse gear and layshaft third speed gear is 1.3/1.5 mm (0.05/0.06 in.).

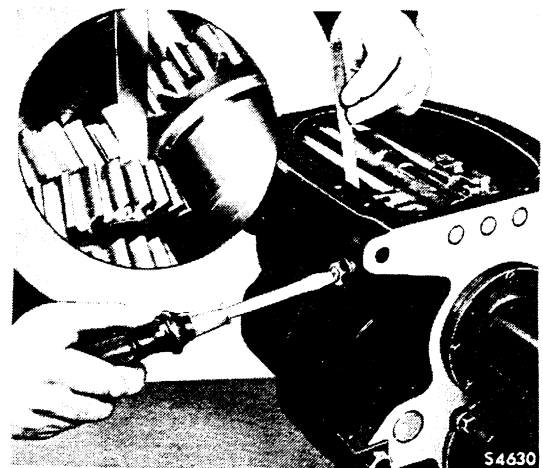


Fig 57 - Adjusting reverse striking lever

82 After setting reverse striking lever, do not disturb pivot bolt when tightening nut. Secure nut by staking it into each end of pivot bolt slots.

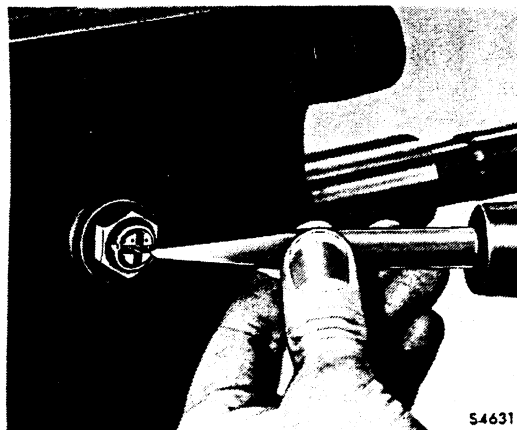


Fig 58 - Staking pivot bolt nut

83 Ensure chip collector is installed in bottom of casing before assembling cover to power take-off aperture.

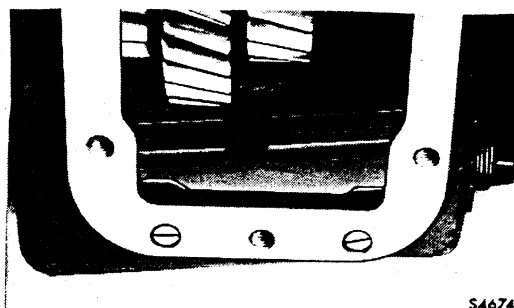


Fig 59 - Installing chip collector

84 Before installing gearbox, lubricate front cover sleeve and main drive pinion splines sparingly with grease.

CHAPTER 4

TRANSFER BOX

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- 13 Transfer box assembly

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SPEEDOMETER GEARS

Removal

- 1 Drain the oil from the transfer box.
- 2 Disconnect and support the front end of the rear propeller shaft.
- 3 Disconnect the speedometer cable and remove the driven gear and housing from the transfer box rear cover.
- 4 Remove the bolt, tabwasher and plain washer and withdraw the flange from the mainshaft.
- 5 Remove the transfer box rear cover.
- 6 Withdraw the speedometer driving gear.

Installation

- 7 Install the driving gear with its spigot towards the mainshaft bearing.
- 8 Tighten the propeller shaft flange attaching bolt to 87Nm (64 lbf ft), and secure it with the lock tab.
- 9 Lubricate the speedometer driven gear and shaft with gear oil.
- 10 Locate the driven gear housing as shown in Fig 1.

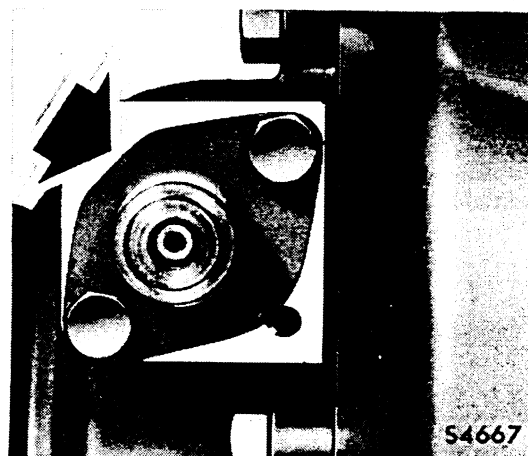


Fig 1 - Speedometer housing
location

- 11 Tighten the propeller shaft bolts to 108 Nm (80 lbf ft).
- 12 Refit the transfer box with oil meeting specification MIL-L-2105 (SAE 90 oil for temperatures above 0°C or SAE 80 for temperatures below 0°C).

TRANSFER BOX ASSEMBLY

Removal

- 13 Drain the oil.
- 14 Disconnect and support the propeller shafts.
- 15 Disconnect the control rod from the power take-off striking fork rod.

- 16 Disconnect the control rod from the striking levers on the transfer box controls support bracket.
- 17 Disconnect the speedometer cable.
- 18 Slacken the bolts securing the transfer box to the chassis frame and mounting bracket.
- 19 Support the transfer box weight approximately 75 kg (165 lb), and remove the bolts securing it to the mounting bracket and chassis frame.
- 20 Lower the transfer box and withdraw it clear of the vehicle.

Installation

- 21 Installation of transfer box is the reverse procedure of removal.
- 22 Tighten universal joint flange bolts to 75 Nm (55 lbf ft) for 7/16 in. dia bolts and 108 Nm (80 lbf ft) for 1/2 in. dia.
- 23 Refill transfer box to correct level with oil meeting specification MIL-L-2105 SAE 90 for temperatures above 0°C or SAE 80 for temperatures below 0°C.

Disassembly

- 24 Disconnect the short control rod from the transfer box striking fork outer lever.
- 25 Disconnect the striking fork rod connecting link from the striking rod link. Remove the link and locknut from the rod.
- 26 Remove the transfer box controls support bracket.
- 27 Remove the mainshaft and the power take-off flanges.
- 28 Knock back the staking, remove the nut securing the layshaft flange and withdraw the flange.
- 29 Unscrew the retainer and withdraw the striking fork locking ball spring and ball from the layshaft and power take-off front covers.

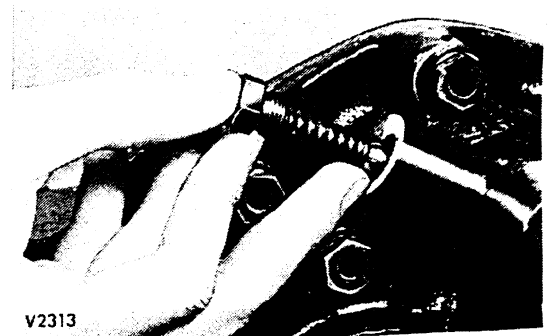


Fig 2 - Striking fork locking ball

30 Remove the eye bolt and locknut from the power take-off striking fork rod and remove the bolts securing the power take-off front cover, withdraw cover.

31 Remove the layshaft front cover. Withdraw the front wheel drive clutch and striking fork.

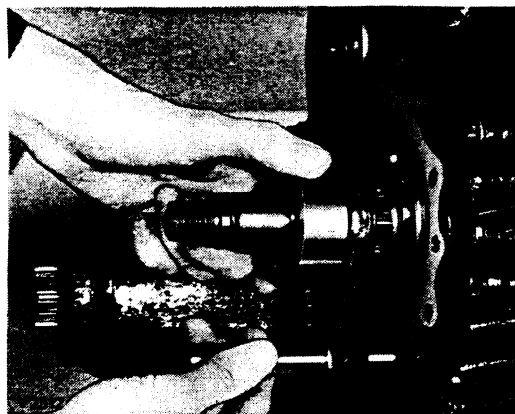


Fig 3 - Front wheel drive clutch removal

32 Remove the circlip and retaining ring locating the layshaft front bearing on the shaft.

33 Remove the locating ring from the layshaft front bearing outer race, and withdraw the bearing using Remover Z8523 and Adaptor Z8524.

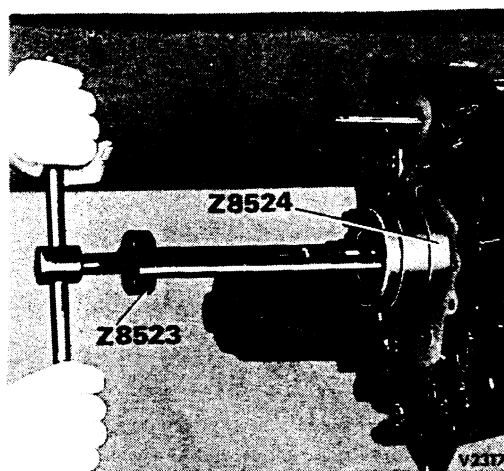


Fig 4 - Layshaft front bearing removal

34 Using Remover Z8523, Adaptor Z8524 and a distance piece installed between the Remover and power take-off shaft withdraw the power take-off front bearing.

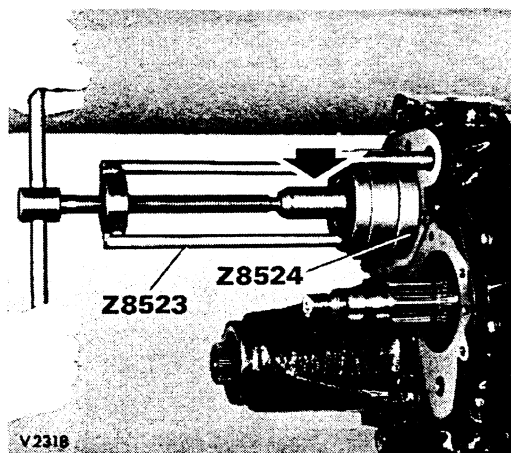


Fig 5 - Power take-off front bearing removal

35 Remove the bolts securing the transfer box front cover, and withdraw the cover squarely off the two dowels. A flat (arrowed) is machined on the input pinion dogs to clear the layshaft driven gear teeth.

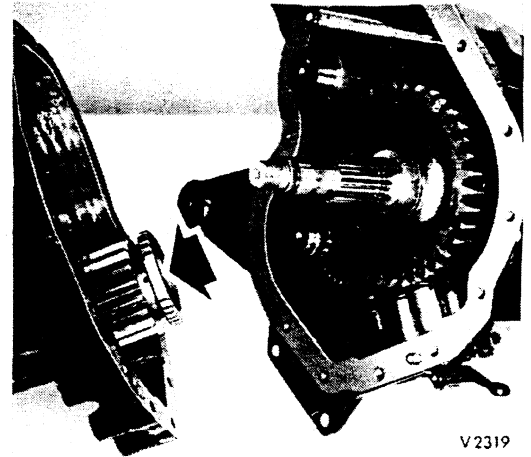


Fig 6 - Front cover removal

36 Carefully withdraw the layshaft driven gear and spacer. Remove the rollers and the roller spacer.

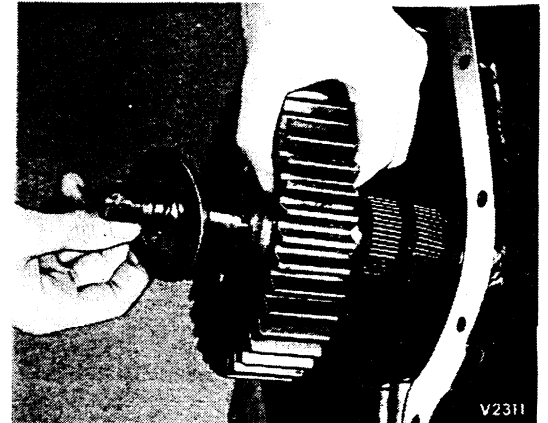


Fig 7 - Layshaft driven gear removal

37 withdraw power take-off gear and spacer together with the striking fork and rod.

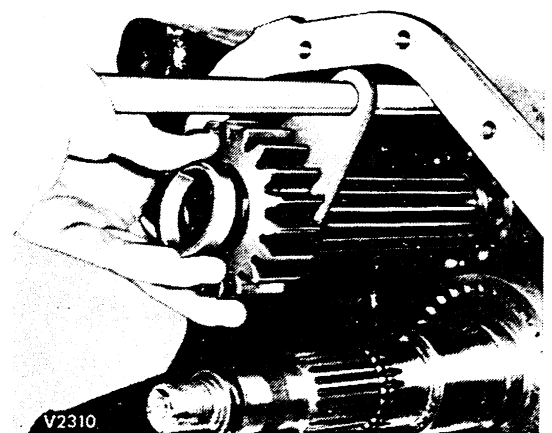


Fig 8 - Power take-off gear removal

38 Remove the speedometer driven gear and housing from the transfer box rear cover.

39 Remove the transfer box and power take-off rear covers. Withdraw the speedometer gear from the mainshaft.

40 Remove the cotter from the transfer box outer lever, and withdraw the lever, circlip and washer from the shaft.

41 Unscrew the retainers and extract the locking plunger springs from the striking fork lever housing. Remove the housing, taking care not to lose the two locking plungers. Withdraw the oil seal from the housing.

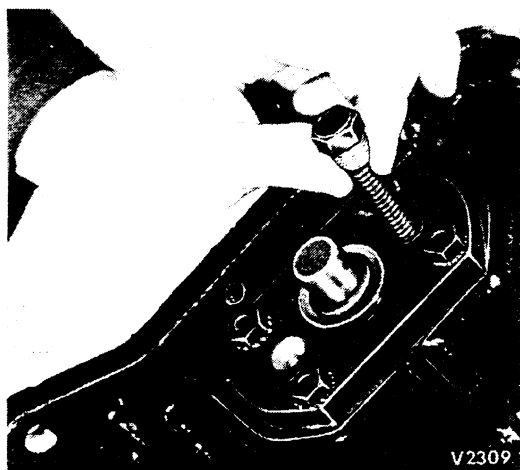


Fig 9 - withdrawing locking plunger and springs

42 Lift the striking fork lever and shaft to enable the striking forks to be disengaged from the clutch sleeves, and withdraw the assembly through the open end of the casing.

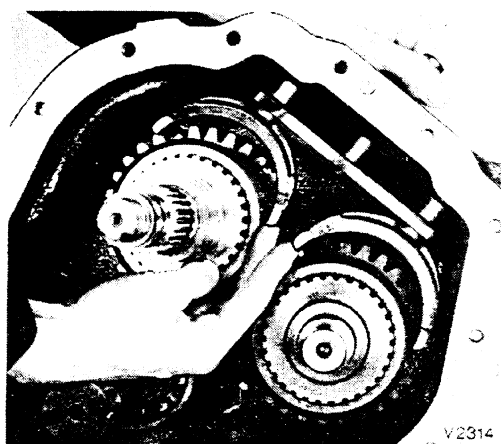


Fig 10 - Striking fork withdrawal

43 Support the front end of the layshaft, and drive the rear bearing out of the casing by tapping the rear end of the layshaft.

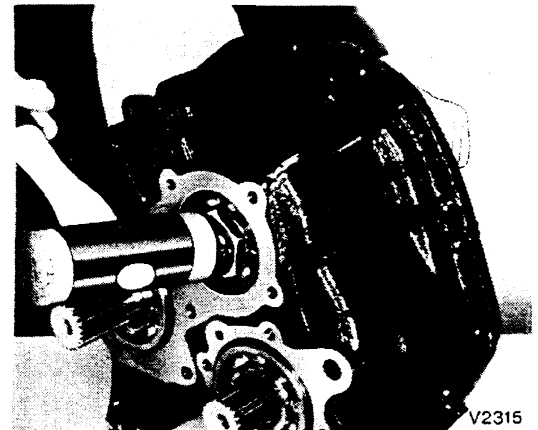


Fig 11 - Layshaft removal

44 Remove the locating ring from the mainshaft rear bearing outer race. Support the mainshaft and using a soft mallet against the rear end of the shaft, drive the bearing out of the casing.

45 Remove the locating ring from the power take-off rear bearing outer race. Support the shaft, and using a soft mallet against the rear end of the shaft, drive the bearing out of the casing.

46 Disassemble the mainshaft assembly as follows:

46.1 Slide the sleeve off the clutch hub.

46.2 Support the mainshaft gear on the bed of a press and press the rear end of the mainshaft through the bearing spacer and gear.

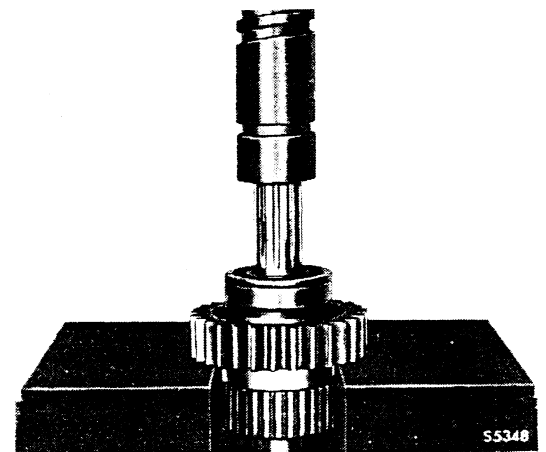


Fig 12 - Mainshaft disassembly

47 Disassemble the layshaft assembly as follows:

47.1 Slide the sleeve off the layshaft clutch hub.

47.2 Grip the splined end of the layshaft in a soft jawed vice and remove the bearing left hand threaded retaining nut.

47.3 Support the layshaft direct drive gear on the bed of a press and, using a suitable drift, press the shaft through the rear bearing, spacer and gear.

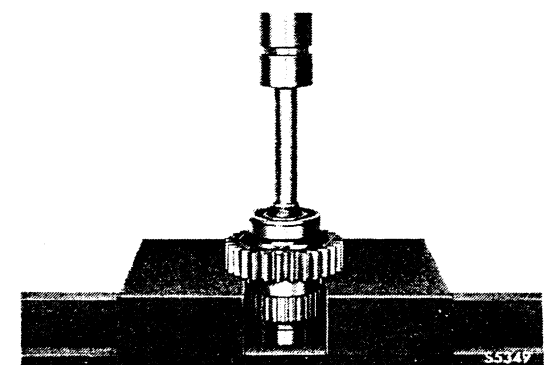


Fig 13 - Layshaft disassembly

48 Disassemble the input pinion and cover as follows:

48.1 Remove the roller bearing from the pinion counterbore.

48.2 Remove the input pinion flange and tap the shaft rearwards out of the pinion and transfer box front covers.

48.3 Remove the pinion cover from the transfer box front cover.

48.4 Remove the roller bearing from the transfer box cover.

48.5 From inside the pinion cover, remove the outer bearing retaining ring, and with the cover supported and a drift contacting the bearing inner race, press the bearing out of the cover.

49 Support the power take-off bearing spacer on the bed of a press, and press the shaft through the bearing and spacer.

Inspection and reconditioning

50 Remove all burrs from the gear teeth and splines with a fine grade carborundum stone and afterwards wash the components thoroughly to remove all traces of carborundum. Gears must be renewed only in pairs, not individually.

51 To renew the striking fork rod oil seal in the power take-off or layshaft front cover, prise out the retainer from the boss of the cover and withdraw the seal. Smear the new seal with Rocol anti-scuffing paste and fit a new retainer.

52 When renewing a main oil seal, smear the seal lip with Rocol anti-scuffing paste and ensure that the lip faces inwards before pressing in the seal. The seal casing must be flush with the cover.

53 The layshaft universal joint flange and bush is serviced only as an assembly. When renewing the flange mud sling, it should be pressed on to the shoulder of the flange.

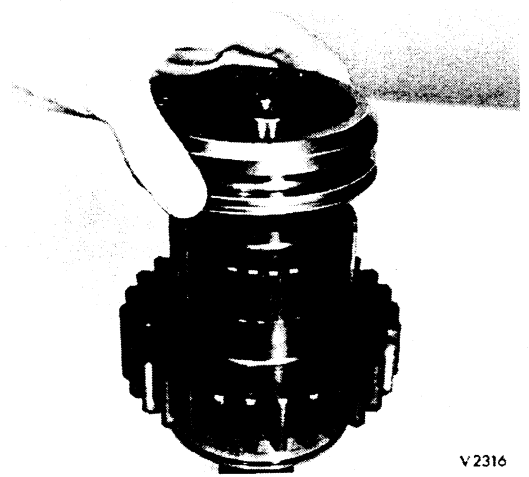
Reassembly

54 Reassemble the main shaft assembly as follows:

54.1 Rest the rear face of the mainshaft gear on the bed of a press. Locate the mainshaft squarely in the gear bore, rotating the gear if necessary to bring the internal teeth into alignment with the corresponding dog teeth of the mainshaft. Press the shaft down until it is right home against the clutch hub.

54.2 Locate the spacer, bore chamfer first, against the gear and, with the front face of the clutch hub supported on a press, assemble the mainshaft bearing with the locating ring groove away from the gear, and press the bearing on to the shaft until it contacts the spacer.

54.3 Assemble the sleeve to the clutch hub, ensuring that it slides freely on the hub splines.



V 2316

Fig 14 - Clutch hub assembly

55 Reassemble the layshaft assembly as follows:

55.1 Rest the rear face of the layshaft direct drive gear on the bed of a press. Locate the layshaft squarely in the gear bore, rotating the gear if necessary to bring the internal teeth into alignment with the corresponding dog teeth of the layshaft. Press the shaft down until it is right home against the clutch hub.

55.2 Locate the spacer, bore chamfer first, against the gear and, with the front face of the clutch hub supported on a press, assemble the layshaft bearing with the locating ring groove away from the gear, and press the bearing on to the shaft until it contacts the spacer.

55.3 Grip the splined end of the layshaft in a soft jawed vice and refit the bearing left hand threaded retaining nut. Secure the nut by staking it into the groove in the shaft.

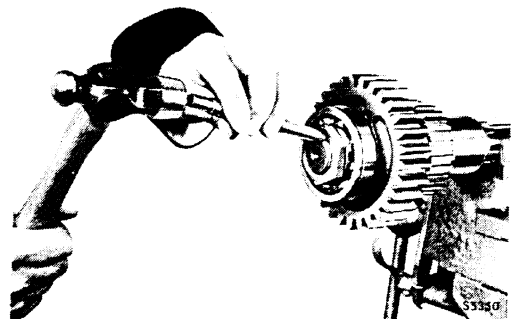


Fig 15 - Staking layshaft nut

55.4 Assemble the sleeve to the clutch hub, ensuring that it slides freely on the hub splines.

56 Assemble the spacing washer to the rear end of the power take-off shaft, and press the bearing, with the locating ring groove away from the spacer washer, right home on the shaft.

57 Install the layshaft assembly as follows:

57.1 Rest the rear face of the transfer box on the bench with the mounting bosses away from the operator.

57.2 Locate the layshaft in the casing so that the bearing is entered squarely in the casing bore nearest the operator.

57.3 Tap the front end of the layshaft to drive in the bearing, until the groove in the outer race can just be seen at the rear of the casing. A locating ring is not used on this bearing.

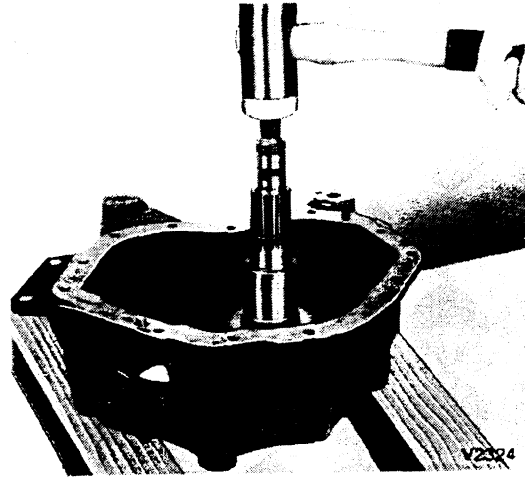


Fig 16 - Layshaft installation

58 Install the mainshaft assembly as follows:

58.1 Position the rear end of the mainshaft through the bearing bore. Hold the mainshaft assembly so that the bearing remains square to the bore, and drive the bearing into the casing by tapping the front of the mainshaft. If necessary, rotate the shaft to engage the teeth on the mainshaft gear with the teeth on the layshaft gear.

58.2 Assemble the locating ring to the bearing outer race and tap the rear end of the shaft until the ring contacts the casing.

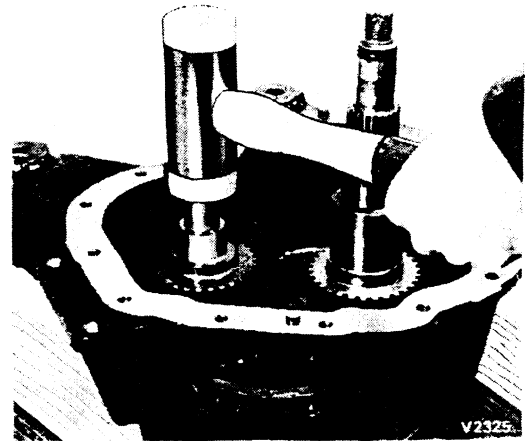


Fig 17 - Mainshaft installation

59 Assemble the power take-off shaft as follows:

59.1 Locate the rear end of the shaft in the bearing bore so that the bearing is square to the bore, and drive the bearing into the casing.

59.2 Assemble the locating ring to the bearing outer race and tap the rear end of the shaft until the ring contacts the casing.

59.3 Assemble the striking fork to the gear and position the gear (flanged side first) over the shaft, at the same time entering the striking fork rod in the bore of the casing.

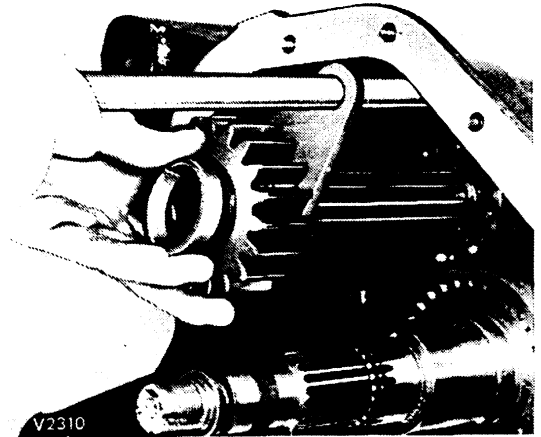


Fig 18 - Power take-off gear and striking fork installation

60 Assemble the selector mechanism as follows:

60.1 From the open end of the casing, position the shaft of the striking fork lever with the flat on the end of the shaft away from the layshaft, and insert the assembly through the aperture in the top of the casing. Hold the shaft and assemble the forks to the bushes of the striking lever; power the assembly and engage the forks in the grooves in the mainshaft and layshaft clutch sleeves.

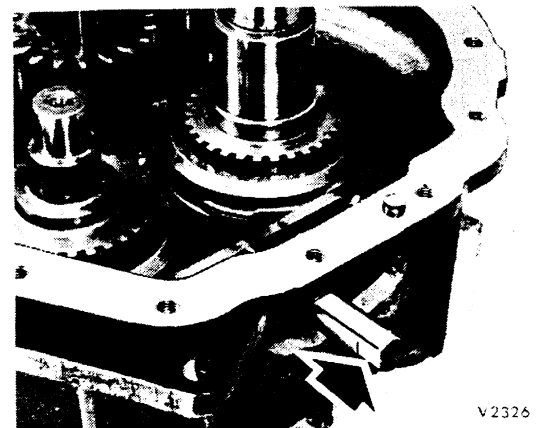


Fig 19 - Striking fork lever

60.2 Using a new gasket reassemble the striking fork lever housing. Smear the attaching bolt threads with jointing compound and tighten evenly. Do not overtighten.

60.3 Place a new oil seal in the housing recess, and refit the washer and circlip. Position the clutch sleeves in neutral, and install the locking plungers, springs, and retainers. Assemble the outer lever to the shaft and fit the cotter with the threaded portion towards the casing flange.

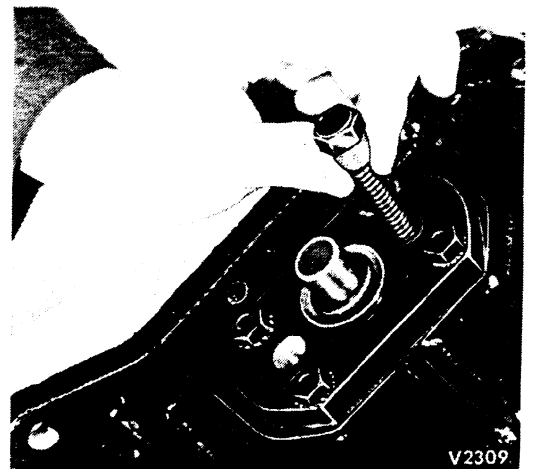


Fig 20 - Installing locking plunger and springs

61 Assemble the layshaft driven gear to the shaft as follows:

61.1 Smear grease on the layshaft journal and assemble 116 rollers to the journal, with the spacer between the two rows of rollers.

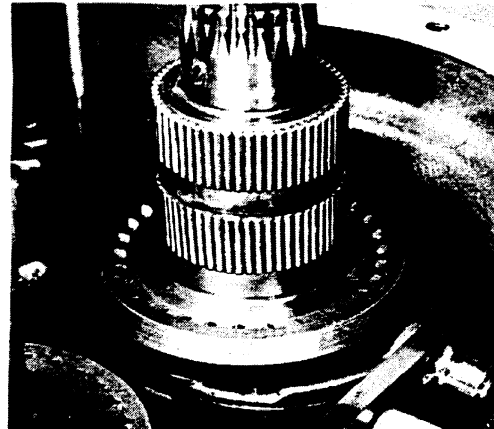


Fig 21 - Roller installation

61.2 Check that the oil feed holes in the layshaft driven gear are free from obstruction, and that the circlip (arrowed) is secure in the gear groove. with the oil feed holes towards the box, assemble the gear over the rollers, taking care not to displace any of the rollers.

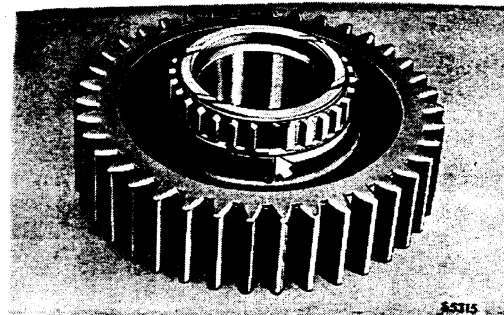


Fig 22 - Layshaft driven gear

61.3 Fit a new spacer, bore chamfer first, to the layshaft shoulder and check that the end float of the layshaft driven gear is 0.23/0.35 mm (0.009/0.014 in.).

62 Using jointing compound, assemble a new gasket to the attaching face on the transfer box casing. Assemble the cover squarely on to the dowels and fit the bolts after smearing them with jointing compound. Tighten the bolts evenly.

63 Using a tubular drift, install the layshaft front bearing in the transfer box front cover. The bearing locating ring must be in contact with the face of the cover. Position the washer on the front of the layshaft against the bearing inner race and install the circlip.

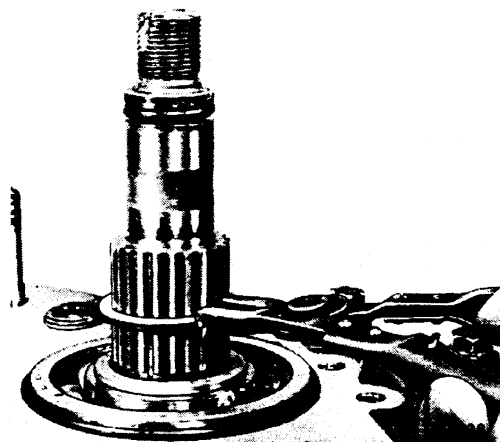


Fig 23 - Layshaft front bearing installation

64 Assemble the front wheel drive clutch to the layshaft, with the selector fork groove in the clutch to the rear.

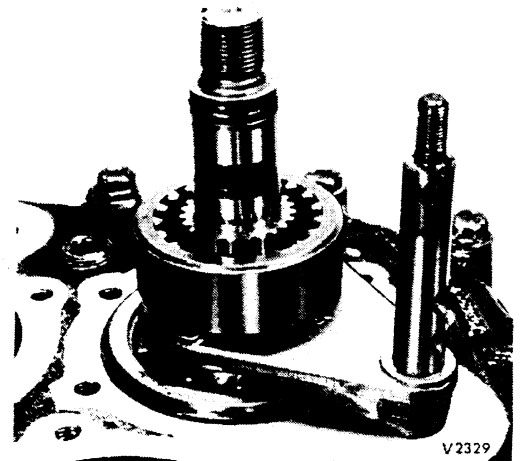


Fig 24 - Front wheel drive clutch installation

65 Engage the striking fork rod with the groove in the clutch, at the same time entering the rear end of the rod in the bore in the front cover.

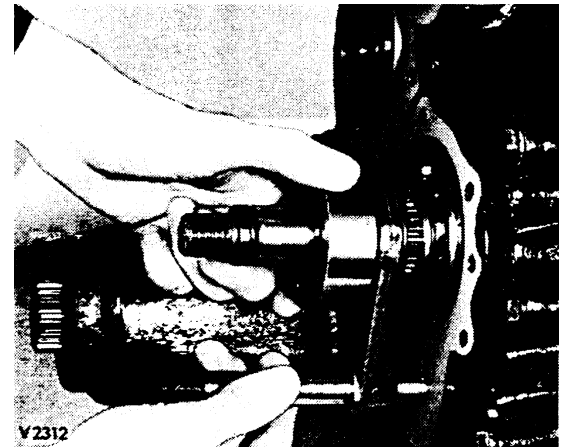


Fig 25 - Striking fork rod installation

66 Smear the layshaft cover oil seal with Rocol anti-scuffing paste and assemble the cover to the transfer box, using a new gasket. Install the striking fork and locking ball, spring and retainer.

67 Before installing the layshaft universal joint flange, place a new O-ring seal in the groove of the layshaft and smear the seal with gear oil.

68 Assemble the washer over the end of the layshaft, tighten the nut and secure by staking it into the slot in the shaft.

69 Assemble the locknut and striking rod link to the threaded end of the 2/4 wheel drive clutch striking fork rod but do not tighten the locknut at this stage.

70 Using a hammer and drift through the rear end of the input pinion cover, tap the outer bearing squarely in to the cover bore until it locates against the shoulder. Install the bearing retaining ring in the groove.

71 Assemble the input pinion and cover as follows:

71.1 Lubricate the mainshaft spigot bearing and place it in the counterbore of the input shaft pinion.

71.2 Align the flat on the input pinion dogs to clear the layshaft driven gear, put the pinion into mesh with the layshaft, and carefully feed the pinion on to the mainshaft spigot. Enter the roller bearing squarely in the cover and gently tap the bearing into the cover. The bearing locating ring must be in contact with the cover.

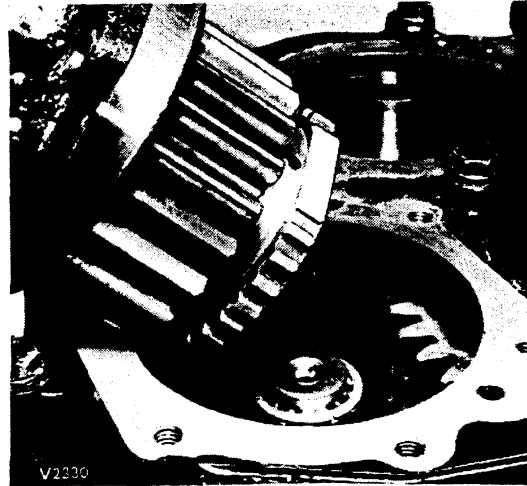


Fig 26 - Input pinion installation

71.3 Attach a new pinion cover gasket to the transfer box front cover. Place the pinion cover over the input pinion shaft and assemble the coupling flange to the shaft. Refit the washer, tabwasher and attaching bolt.

71.4 Tighten the flange attaching bolt sufficiently to enable the pinion cover bolts to be installed.

71.5 Install the cover bolts, after smearing the threads with jointing compound, but do not tighten them. Tighten the coupling flange bolt to 104 Nm (77 lbf ft) and secure with the lock tab.

71.6 Tighten the cover bolts evenly and check that the mud sling does not foul the cover.

72 Refit the speedometer driving gear with the spigot towards the mainshaft bearing and assemble the transfer box rear cover, using a new gasket. Smear the bolt threads with jointing compound and tighten evenly.

73 Assemble the flange to the mainshaft, tighten the bolt to 104 Nm (77 lbf ft) and secure with the lock tab.

74 Lubricate the speedometer driven gear and shaft with gear oil. Insert the gear into the gear housing, and fit the gear and housing to the transfer box rear cover. Locate the housing as shown under 'Speedometer Gears'.

75 Refit the power take off rear cover, using a new gasket. Smear the attaching bolt threads with jointing compound and tighten evenly. Assemble the flange to the shaft, tighten the bolt to 104 Nm (77 lbf ft) and secure with the lock tab.

76 Assemble the split collar against the splines on the front end of the power take off shaft and replace the front bearing, using a tubular drift. The bearing must be in contact with the collar.

77 Using a new gasket, fit the power take off front cover and striking fork rod. Smear the bolt threads with jointing compound and tighten evenly. Refit the eye bolt and locknut to the striking fork rod and tighten the nut. Check the operation of the rod, which must slide freely.

78 With the power take-off gear disengaged, install the striking fork rod locking ball, spring and retainer.

79 Assemble the transfer box controls support bracket and reconnect the short control rod to the transfer box outer lever and to the outer lever on the bracket.

80 Install the transfer box as described in Chap 4, level 2, para 9.

CHAPTER 5

REAR AXLE

CONTENTS

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9	Differential assembly
22	Pinion bearing
27	Differential and pinion
46	Oil deflector

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TABLE 1 - SPECIAL TEST EQUIPMENT AND TOOLS

Ser	Tool No (where applicable)	NSN/Part No (where applicable)	Designation
(1)	(2)	(3)	(4)
1	Z8457	7BD/5120-99-828-6750	} Pinion bearing removers
2	Z8458	7BD/5120-99-828-6751	
3	Z8428		
4	1500	6MT2/5120-99-401-3589	Two legged drag
5	Z8455	7BD/5120-99-804-5825	Ram
6	Z8456	7BD/5120-99-804-5827	Remover
			Collets

REAR AXLE ASSEMBLY

Removal

- 1 Scotch the front wheels and raise and support the rear of the vehicle.
- 2 Remove the road wheels. The wheel nuts on the left-hand side have left-hand threads.
- 3 Disconnect and support the rear end of the propeller shaft.
- 4 Disconnect the brake hose, and the axle breather tube.
- 5 Disconnect the parking brake cable.
- 6 Remove the rear spring retaining bolts and disconnect the shock absorbers from the axle.
- 7 Lower the axle to disengage the springs and remove the axle.

Installation

- 8 Rear axle installation is a reversal of removal with particular attention being paid to the following points:
 - 8.1 Install spring hanger and shackle bolts and tighten to a torque of 257 Nm (190 lbf ft).
 - 8.2 Install propeller shaft and tighten nuts to a torque of 108 Nm (80 lbf ft).
 - 8.3 Check oil level in axle centre and in each hub.
 - 8.4 Recheck the spring retaining bolt tightness with the vehicle fully laden.
 - 8.5 Bleed and adjust the brakes.

DIFFERENTIAL ASSEMBLY

Removal

- 9 Drain the axle by removing the cover.
- 10 With hubs positioned with oil filler plugs at bottom, remove plugs and drain oil from hubs.
- 11 Remove the axle shaft flange nuts and sling plate, and withdraw the shaft. A drift may be used to break the flange joint with the hub.
- 12 Slacken the locknut and unscrew the gear thrust screw.
- 13 Remove the lockplates from the differential side bearing caps.

14 Mark the bearing caps to ensure they are not interchanged during reassembly.

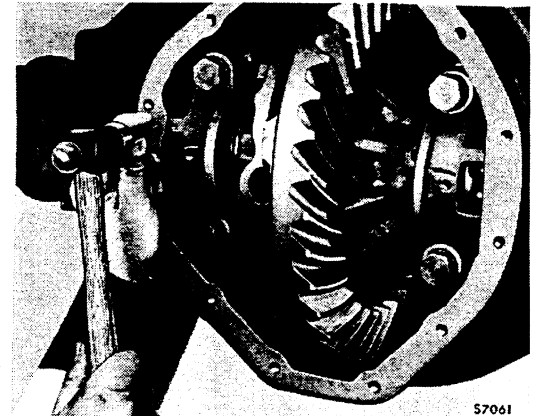


Fig 1 - Marking bearing caps

15 Remove the bearing caps together with the adjusting nuts and bearing outer races.

16 withdraw differential and hypoid gear keeping side bearing outer races with their respective bearings. Do not remove side bearings from differential unless renewal is necessary.

Disassembly

17 Remove differential assembly from axle housing as previously described.

18 Disassemble the hypoid gear and differential as follows:

18.1 Remove the bolts securing the hypoid gear and cover to the differential case, and lift away the cover. Remove the differential spider, pinions and thrust washers. Ensure that all pinions and side gears are kept to their respective thrust washers for correct reassembly.

18.2 The side bearing inner race and rollers should only be removed if they are to be renewed.

18.3 Remove the hypoid gear using a soft metal hammer to tap the gear from the differential case register.

19 To remove a bearing, split cage and remove cage and rollers. Install a plug (arrowed) in differential case spigot, and assemble Remover Z8455 and Collets Z8456 to bearing inner race. Locking ring must be unscrewed from body of remover as far as possible to ensure collets fully engage bearing race collar. Use a No 1500 Hydraulic Ram to withdraw race.

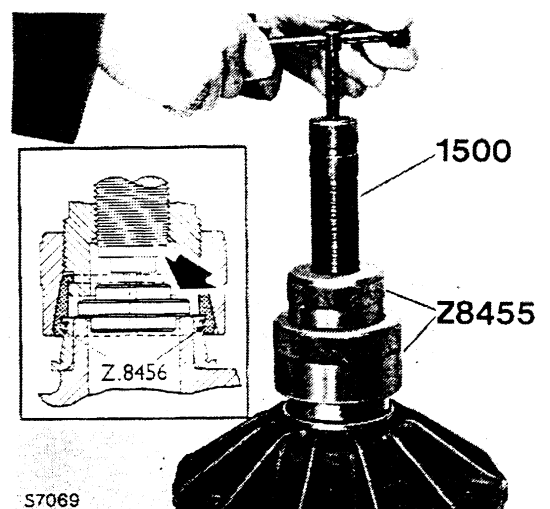


Fig 2 - Removing side bearing inner race

Reassembly

20 Press the new bearing inner race and rollers on to the differential case spigot, making sure that it is right home against the spigot shoulder.

21 Reassemble the differential as follows:

21.1 Prior to assembly, lubricate all parts with oil.

21.2 Place a side gear and thrust washer into the differential case cover.

21.3 Assemble the four differential pinions and thrust washers to the spider. Install the spider in the cover ensuring that the pinions mesh with the side gear.

21.4 Place the second side gear in mesh with the pinions and assemble the thrust washer to the gear.

21.5 Differential case and cover must be assembled with pairing numbers in line.

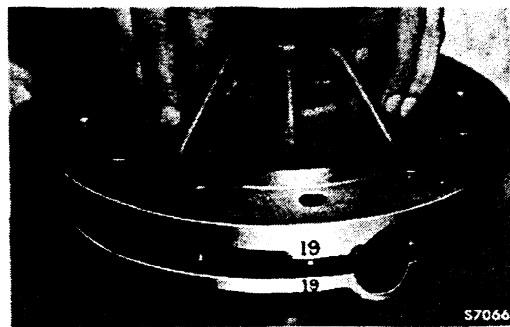


Fig 3 - Assembling differential

21.6 Place the hypoid gear on the differential case register and using new lockwashers, tighten the bolts evenly to 156 Nm (115 lbf ft). Three guide studs, each 51 mm (2.0 in.) long and slotted at one end for a screw-driver, can be made from spare attaching bolts and screwed into the gear to facilitate assembly.

21.7 The hypoid gear may be an interference fit on the register. If this is so, warm the gear, avoiding local heating, then place in position on the case register.

PINION BEARING

Removal

22 Remove pinion as described in Chap 5, level 2, para 22.

23 To inspect front bearing, press outer race and front inner race and rollers off pinion shaft, leaving rear inner race and rollers in position. Ensure that races and rollers are kept to their respective ends of the bearing.

24 Front bearing rear inner race and rollers, and pinion rear bearing, need not be disturbed unless renewal is necessary.

25 To remove rear half of pinion front bearing, support assembly on Removal Plate Z8457 (5-tooth pinion), Z8458 (6-tooth pinion) or Z8459 (7-tooth pinion).

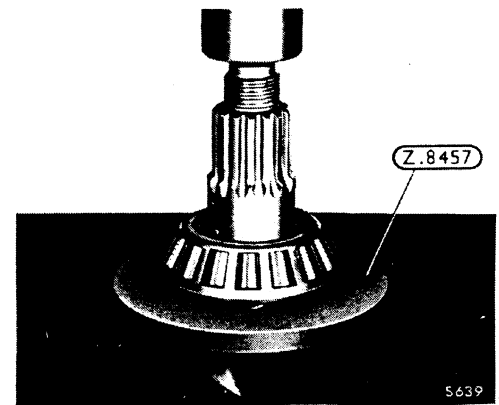


Fig 4 - Removing pinion front bearing

26 Use Remover Z8428 with a No 1500 Ram to remove pinion rear bearing inner race. Note that race is secured to pinion shaft by a circlip.

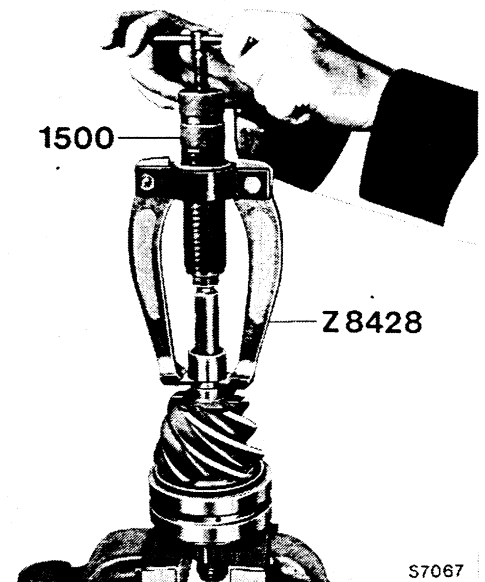


Fig 5 - Removing pinion rear bearing inner race

DIFFERENTIAL AND PINION

Installation

27 Before installing pinion rear bearing outer race, smear periphery with Loctite 270 (studlock).

28 To ensure clearance with the hypoid gear, install pinion bearing race retaining bolt from front of boss.

29 Before installing hypoid pinion and bearings, assemble the differential and hypoid gear to the axle housing as follows:

29.1 Ensure the side bearing outer races and caps are refitted in their original positions and check that the adjusting nuts correctly engage the threads of the carrier and bearing caps. Tighten the cap bolts sufficiently to hold the caps firmly but allow the bearing adjusting nuts to be turned.

29.2 Tighten the adjusting nuts with a lever until the bearing outer faces are firmly in contact with the rollers. Back off one of the adjusting nuts, then retighten and note when the bearing outer races come into contact with the rollers, the point at which firm contact occurs will be felt quite distinctly. From this point, tighten the nut further by not less than one slot, or not more than two, to pre-load the bearings. Note that the ultimate fitment of the adjusting nut lockplates must be kept in mind and the slots of the nuts lined up accordingly. Do not finally tighten the bearing cap bolts or install the lockplates at this stage.

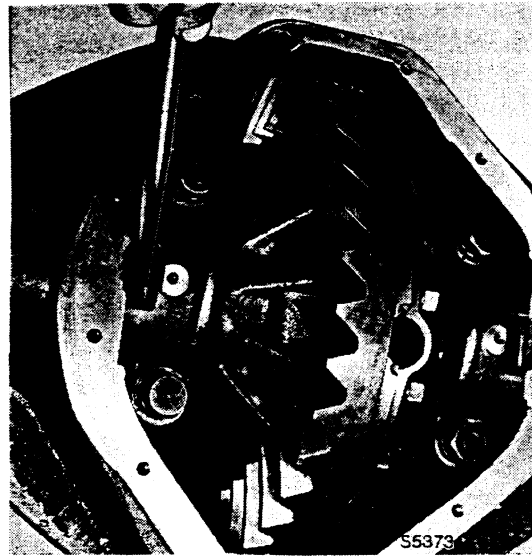


Fig 6 - Pre-loading differential side bearing

30 After adjusting bearing pre-load, check the run-out on the rear face of the hypoid gear. If run-out exceeds 0.13 mm (0.005 in.), gear must be removed and a check made for burrs or foreign matter on the mating faces, or a check made for run-out of the differential case flange.

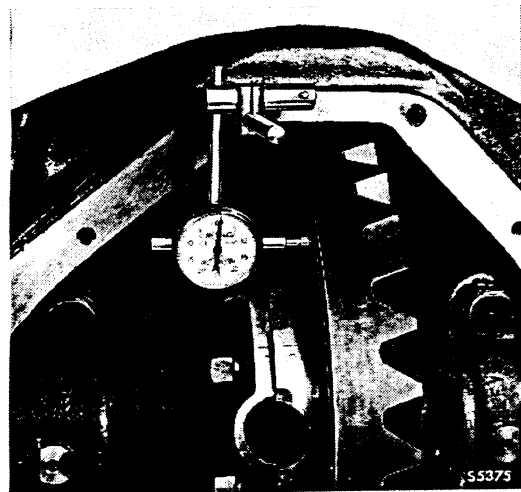


Fig 7 - Hypoid gear run-out

31 When assembling front bearing to hypoid pinion, ensure that spacer supplied with bearing is used. Spacer (arrowed) is graded for thickness and must not be interchanged indiscriminately.

32 Ensure that the end of the pinion rear bearing inner race with the larger internal radius is towards pinion teeth.

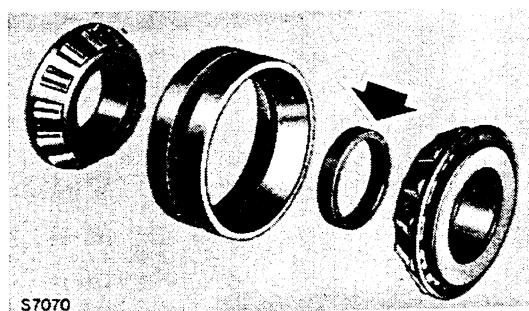


Fig 8 - Front bearing spacer

33 Smear the pinion bearing shims (arrowed) with grease to retain them in position. It is essential to install shims of the same total thickness as originally installed. The spacer located in the pinion housing cover can be selected by subtracting the amount of bearing protrusion (A) above the axle housing plus 0.12 mm (0.005 in.) from the depth of the machined shoulder, (B) in the pinion housing cover.

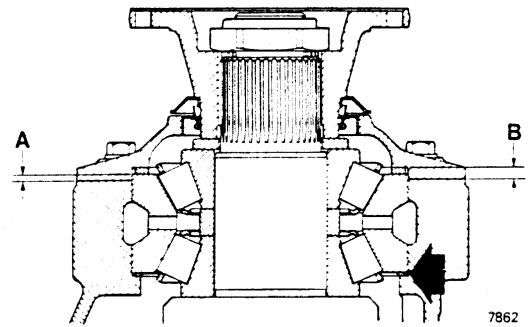


Fig 9 - Pinion assembly

34 Tighten flange nut to 745 Nm (550 lbf ft) at the same time rotating front bearing to ensure it does not bind in one position.

35 Tighten cover bolts evenly, at the same time checking that pinion does not bind against hypoid gear. If necessary, move gear away from pinion by backing off left-hand adjusting nut and tightening right-hand nut by the same amount. This is essential to maintain correct pre-load. Again keep in mind the ultimate fitting of the lockplates.

36 Backlash must be checked at heel of tooth. If backlash is outside specified limit 0.18-0.28 mm (0.007-0.011 in.), move gear in appropriate direction as described above. Check backlash at several points around hypoid gear, to ensure there are no tight spots.

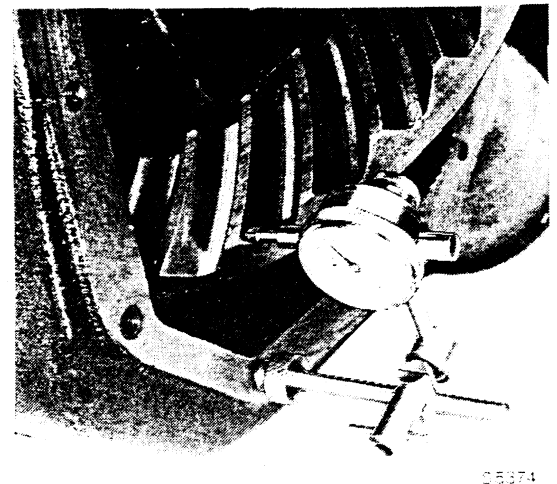


Fig 10 - Checking backlash

37 Having obtained correct backlash, tighten bearing cap bolts to 196 Nm (145 lbf ft) check that bearing cap abutment pads are in contact with axle housing and carry out a tooth marking check. Use a wrench on one of the hypoid gear attaching bolts to rotate gear backwards and forwards.

38 Correct meshing should produce marking 'A' on drive (convex) side of hypoid gear teeth. Marking 'B' indicates that pinion is too far in, and pinion shim thickness is insufficient. If marking is as at 'C', shim thickness must be decreased.

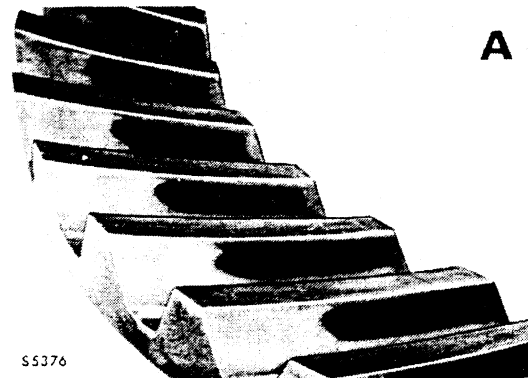


Fig 11 - Tooth markings

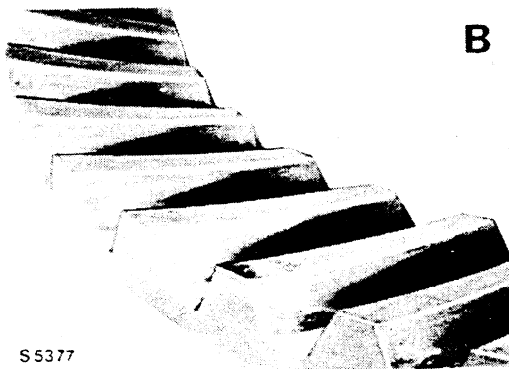


Fig 12 - Tooth markings

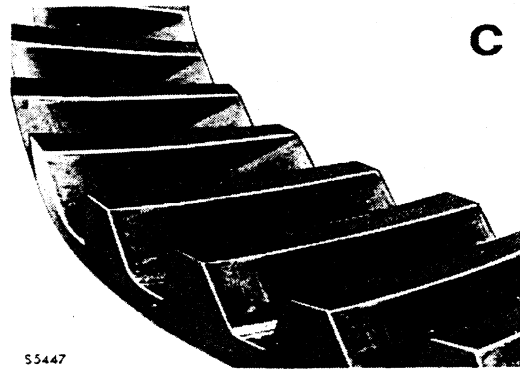


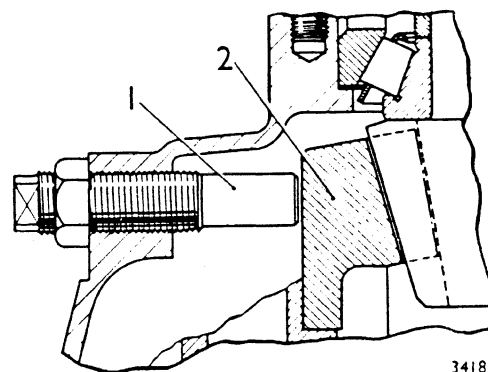
Fig 13 - Tooth markings

39 whenever a change is made to the setting shims, the spacer located in the pinion housing must be re-calculated as stated previously.

40 After refitting the pinion assembly it is essential to re-adjust the hypoid gear and pinion backlash, as previously explained, before re-checking the tooth marking. Readjustment of side bearing pre-load may be omitted provided care is taken to rotate both adjusting nuts an equal number of slots.

41 Having obtained correct meshing of the hypoid gear and pinion, remove the three lower pinion housing cover bolts and re-install after smearing threads with pipe sealer.

42 Install hypoid gear thrust screw (1) and adjust by screwing it lightly into contact with the gear (2) and backing off an eighth of a turn before tightening locknut.



1. Thrust screw 2. Gear
Fig 14 - Adjusting thrust screw

43 When installing axle housing cover, assemble reinforcement to the two lower bolts.

44 On installation of axle shafts, smear mating faces of shaft and hub with jointing compound.

45 Fill axle and hubs with clean axle oil as described in Chap 5, level 2, para 2.

OIL DEFLECTOR

Renewal

46 When renewing an oil deflector, position it squarely on axle tube.

CHAPTER 6

FRONT AXLE

CONTENTS

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10	Differential assembly
24	Pinion bearing
25	Drive shafts and tracta joints
53	Steering arms
64	Steering pivot bearings

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2	Hub drive shaft end float
3	Drive shaft alignment
4	Bush end float
5	Steering arms
6	Steering third arm

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5
6
8
8

TABLE 1 - SPECIAL TEST EQUIPMENT AND TOOLS

Ser	Tool No (where applicable)	NSN/Part No (where applicable)	Designation
(1)	(2)	(3)	(4)
1	814		Remover
2	1500	6MT2/5120-99-401-3589	Ram
3	Z8455	7BD/5120-99-804-5826	Remover
4	Z8456	7BD/5120-99-804-5827	Collets

FRONT AXLE ASSEMBLY

Removal

- 1 Scotch the rear wheels and raise and support the front of the vehicle. Remove the road wheel. The wheel nuts on the left hand side have left hand threads.
- 2 Disconnect the hoses at the front brake cylinders.
- 3 Disconnect the connecting rod from the steering third arm, using Remover 814.
- 4 Disconnect the shock absorbers from the axle.
- 5 Disconnect the propeller shaft from the pinion shaft flange and support the shaft.
- 6 Disconnect the breather pipe from the axle housing.
- 7 Jack up the axle, and remove the spring retaining bolts.
- 8 Withdraw the axle from the front of the vehicle. Note that the assembly weighs approximately 417 kg (920 lb).

Installation

- 9 Installation of axle to vehicle is a reversal of removal with particular attention being paid to the following:
 - 9.1 Tighten the spring hanger and shackle bolts and nuts to 169 Nm (125 lbf ft).
 - 9.2 Install propeller shaft and tighten nuts to a torque of 108 Nm (80 lbf ft).
 - 9.3 Fill the tracta joint housings and axle housing with oil.
 - 9.4 Ensure there is adequate clearance between the road wheels and springs on full lock. Adjust lock stops if necessary.
 - 9.5 Bleed and adjust the brakes.
 - 9.6 Adjust the front wheel toe-in.

DIFFERENTIAL ASSEMBLY

Removal

- 10 Scotch the rear wheels and raise and support the front of the vehicle. Remove the road wheel. The wheel nuts on the left hand side have left hand threads.
- 11 Drain the axle by removing the cover.
- 12 Remove the hubs and brake drums as described in Chap 6, level 2, para 17.
- 13 Disconnect the brake shoe return springs and remove the brake flange plates and drive shaft housings.

- 14 withdraw the hub drive shafts and tracta joints.
- 15 Disconnect the connecting rod from the steering third arm, and the tie rod from the steering arms, using Remover 814.
- 16 Mark the flanges of the axle tube ends and axle housing, to ensure correct assembly.
- 17 Knock back the lock tabs on the nuts securing the axle tube ends. Support the tube ends and remove the nuts and bolts, then withdraw the tube ends complete with axle shafts.
- 18 Slacken the locknut and unscrew the gear thrust screw.
- 19 Remove the lockplates from the differential side bearing caps.
- 20 Mark the caps and ensure that the bearing adjusting nuts are kept to their respective sides for correct reassembly.
- 21 Remove the bearing caps together with the adjusting nuts and bearing outer races, then withdraw differential assembly.
- 22 Disassembly and reassembly of the differential is the same as that described in Chap 5, level 3, para 17.

Installation

- 23 Installation of the differential assembly is similar to that described in Chap 5, level 3, para 27 apart from the following points:
 - 23.1 when installing the axle tube end, use a new gasket, and ensure that the mark across the tube end and housing flanges is in alignment. Use new tab washers under the tube end attaching nuts.
 - 23.2 To ensure that the axle shaft bush is seating correctly in the tube end, drive the bush and shaft assembly home using a block of wood as a drift inserted in the fork of the shaft.
 - 23.3 Assemble the tracta spigot joint to the axle shaft fork, followed by the slotted joint and hub drive shaft.
 - 23.4 Fit a new gasket between the hub drive shaft housing and tracta joint housing after smearing the gasket and the threads of the attaching bolts and studs with jointing compound. Tighten the bolts and nuts to 57 Nm (42 lbf ft) after assembling the brake flange plate.
 - 23.5 Install the hub and adjust the hub bearings as described in Chap 6, level 2, para 11.
 - 23.6 when installing the steering tie rod ensure that the left-hand threaded end is connected to the left-hand steering arm. Tighten the tie rod and connecting rod ball joint nuts to 190 Nm (140 lbf ft).
 - 23.7 Refill the axle housing and tracta joint housings with oil.
 - 23.8 Bleed and adjust the brakes.
 - 23.9 Adjust the front wheel toe-in.

PINION BEARING

24 Removal and installation of pinion bearing is similar to that described in Chap 5, level 3, para 31.

DRIVE SHAFTS AND TRACTA JOINTS

Removal

25 Before removing the hub drive shaft and tracta joint, check for end float as follows:

25.1 Scotch the rear wheels and raise and support the front of the vehicle. Remove the road wheel. The wheel nuts on the left-hand side have left-hand threads.

25.2 Remove the bolt securing the oil seal retainer to the hub drive shaft, and withdraw the retainer and seal assembly.

25.3 Rotate the road wheel until the line marked on the end of the hub drive shaft is at 90° to the steering pivot axis.

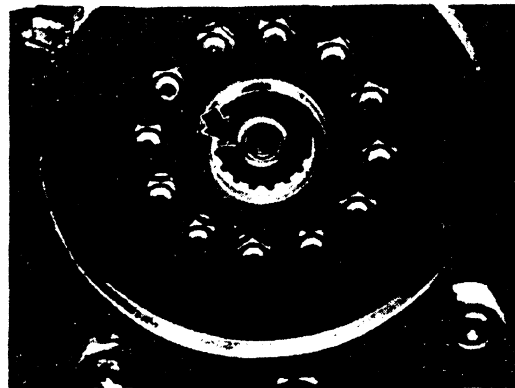


Fig 1 - Hub drive shaft alignment

25.4 Turn the road wheel to full lock, tap the hub drive shaft inwards as far as possible, and measure the distance between the end of the shaft and the oil seal retainer abutment, dimension 'A'. The dimensions must be between 3.0 and 7.1 mm (0.12 and 0.28 in.). If the dimension exceeds the top limit it is probable that wear has taken place in the tracta joint or thrust face of the axle shaft bush. If the dimension is less than the bottom limit the inference is that the axle shaft bush is not fully home in the axle tube end.

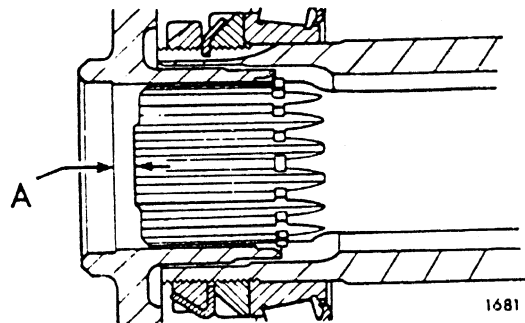


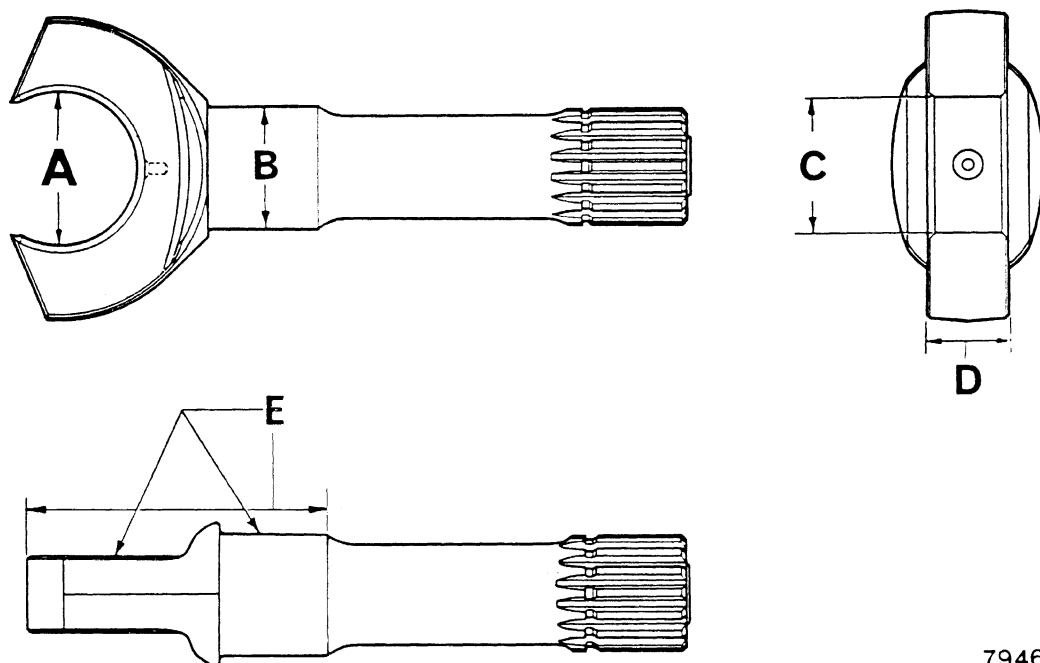
Fig 2 - Hub drive shaft end float

26 Remove the front hub and brake drums as described in Chap 6, level 2, para 17.

27 Disconnect the tie rod and connecting rod ball joints using Remover 814.

28 Clean the axle around the tracta joint housing oil seal.

- 29 Remove the bolts attaching the oil seal assembly to the housing, and withdraw the seal cover plate, seal spring and seal.
- 30 Disconnect the hose from the front brake cylinder.
- 31 Disconnect the brake shoe return springs and remove the nuts and bolts securing the brake back plate and hub drive shaft housing to the tracta joint housing.
- 32 Lift away the brake back plate, and withdraw the hub drive shaft housing from the tracta joint housing.
- 33 withdraw the hub drive shaft and tracta joint.
- 34 Mark the flanges of the axle tube end and the axle housing to ensure correct reassembly.
- 35 knock back the lock tabs on the nuts securing the axle tube end, remove the nuts and bolts, and withdraw the tube end complete with the axle shaft.
- 36 Drive the axle shaft and bush out of the axle tube end, using a soft hammer on the inner end of the shaft.
- 37 Should misalignment of the axle shaft or hub drive shaft be suspected, check the shafts alignment against the dimensions given below.



7946

- A - 60.04/60.12 mm (2.364/2.367 in.)
- B - (Axle shaft 46.012/46.042 mm (1.8115/1.8127 in.)
Hub drive shaft 47.60/47.62 mm (1.874/1.875 in.)
- C - 52.12/52.37 mm (2.052/2.062 in.)
- D - 29.94/29.97 mm (1.179/1.180 in.)
- E - These faces to be parallel within 0.05 mm (0.002 in.) for this length

Fig 3 - Drive shaft alignment

38 To renew the axle shaft bush, proceed as follows:

38.1 Carefully split the collar and remove from the shaft.

38.2 Remove the old bush and place the new bush in position with the flanged end towards the tracta joint fork.

38.3 Heat a new collar to dark blue colour and place it quickly in position on the shaft. To ensure that the end float of the bush is within the specified limits, insert a 0.38 mm (0.015 in.) feeler strip between the end of the bush and the shoulder of the shaft to prevent the collar being pushed on too far.

39 To renew the hub drive shaft bush, press the old bush out of the hub drive shaft housing from the outer end, and press the new bush home against the shoulder from the inner end of the housing.

40 Slight scoring of the tracta joint spigot and slotted joints may be removed by using a fine grade carborundum stone dipped in thin oil.

41 The joints are graded and serviced as selected assemblies. For identification, each component is etched with the type number 120 and the grading number 1, 2, 3 or 4. Whilst spigots and slotted joints having different grading numbers must not be assembled together, complete joint assemblies are interchangeable and can be assembled to any pair of shafts.

42 After assembly, the end float of the bush should be within 0.25/0.50 mm (0.010/0.020 in.).

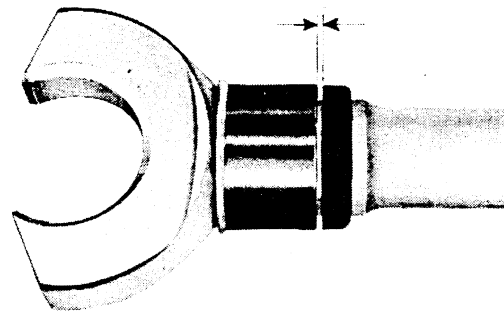


Fig 4 - Bush end float

Installation

43 When installing the axle tube end, use a new gasket, and ensure that the mark across the tube end and housing flanges is in alignment. Use new tab-washers under the axle tube end attaching nuts.

44 Feed the axle shaft splines into the differential side gear until the bush enters the bore of the axle tube end. Drive the bush and shaft assembly home using a block of wood as a drift inserted in the tracta joint fork.

45 Assemble the tracta spigot joint to the axle shaft fork, followed by the slotted joint and hub drive shaft.

46 Coat the mating faces of the hub drive shaft housing, tracta joint housing and hub with Loctite 575 (sealant) prior to assembly. Smear threads of attaching bolts with jointing compound and tighten the bolts and nuts to 57 Nm (42 lbf ft).

- 47 Adjust the hub bearings as described in Chap 6, level 2, para 11.
- 48 Check the tracta joint end float.
- 49 Tighten the tie rod ball joint nut to 190 Nm (140 lbf ft).
- 50 Fill the tracta joint housing with oil.
- 51 Bleed the brakes.
- 52 Adjust the front wheel toe-in.

STEERING ARMS

CAUTION ...

Do not remove the steering third arm and steering arm on the same side of the vehicle simultaneously otherwise difficulty will be experienced in supporting the tracta joint housing and hub, and aligning the pivot bearings on reassembly.

Removal

- 53 Scotch the rear wheels and raise and support the front of the vehicle. Remove the road wheel. The wheel nuts on the left-hand side have left-hand threads.
- 54 When removing the steering third arm, support the tracta joint housing and hub and drum assembly by placing a jack under the lower pivot. When removing the steering arm, support the assembly by placing a jack under the hub drive sleeve flange.
- 55 Clean the axle around the tracta joint housing oil seal. Slacken the seal attaching bolts.
- 56 Detach the tie rod or connecting rod ball joints using Remover 814.
- 57 Remove the nuts and withdraw the arm by screwing 3/8 in. - 24 UNF bolts evenly into the tapped holes provided in the flange. Take care of the shim assembled between the flange and the tracta joint housing.

Inspection

58 Check the arm for distortion against the dimensions given below. No attempt should be made to reset a distorted arm.

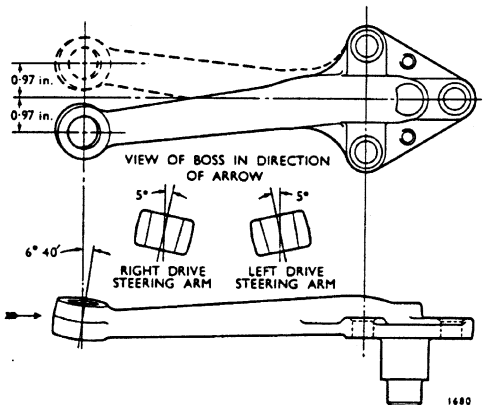


Fig 5 - Steering arm - right and left hand

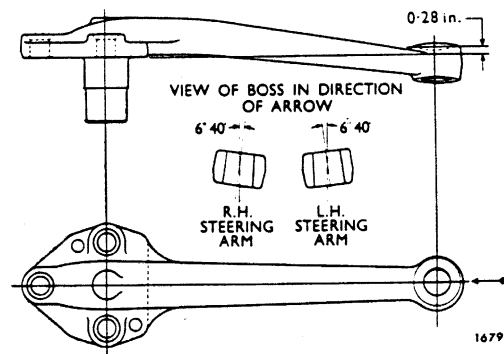


Fig 6 - Steering third arm - right-drive. Left drive is shown chain dotted

Installation

Note the following:

- 59 Before refitting the steering arm ensure that the faces of the arm flange and tracta joint housing are clean and free from burrs.
- 60 Check that the tracta joint housing pivots freely without slackness in the bearings. If necessary, adjust as described in para 11.
- 61 Tighten the steering arm and ball joint nuts to 318 Nm (235 lbf ft) and 190 Nm (140 lbf ft) respectively.
- 62 Refill the tracta joint housing.
- 63 Adjust the front wheel toe-in.

STEERING PIVOT BEARINGS

Bearing adjustment

- 64 Raise and support the front of the vehicle.
- 65 Remove the road wheel. The wheel nuts on the left-hand side have left-hand threads.
- 66 Disconnect the connecting rod ball joint using Remover 814.
- 67 Clean the axle around the tracta joint housing oil seal. Slacken the seal attaching bolts.
- 68 Support the tracta joint housing and hub.

- 69 Remove the securing nuts from the steering third arm or upper pivot flange.
- 70 Screw 3/8 in. – 24 UNF bolts evenly into the tapped holes in the steering third arm or pivot flange and withdraw the pivot and shim.
- 71 Unscrew the bolts from the flange and remove any burrs from the faces of the flange and tracta joint housing.
- 72 Replace the pivot installing a shim 0.13 mm (0.005 in.) thinner than the original.
- 73 Tighten the securing nuts to 244 Nm (180 lbf ft).
- 74 Check for slackness in the bearings and for free swivelling of the tracta joint housing by applying a force of 13 lbf to the steering arm utilizing a spring balance.
- 75 If necessary, repeat the previous operations, varying the shim thickness until the correct adjustment is obtained.
- 76 Tighten the tracta joint housing oil seal bolts and top up with oil.
- 77 Reconnect the connecting rod and tighten the ball joint to 190 Nm (140 lbf ft).

Removal

- 78 Remove the front hub and brake drum.
- 79 Disconnect the tie rod and connecting rod ball joints using Remover 814.
- 80 Clean the axle around the tracta joint housing oil seal.
- 81 Remove the bolts attaching the oil seal assembly to the housing, and withdraw the seal cover plate, seal spring and seal.
- 82 Disconnect the hose from the front brake cylinder.
- 83 Disconnect the brake shoe return springs and remove the nuts and bolts securing the brake back plate and hub drive shaft housing to the tracta joint housing.
- 84 Lift away the brake back plate, and withdraw the hub drive shaft housing from the tracta joint housing.
- 85 Withdraw the hub drive shaft and tracta joint.
- 86 Remove the nuts securing the steering arm and pivot to the bottom of the tracta joint housing, screw 3/8 in. – 24 UNF bolts evenly into the tapped holes provided in the pivot flange, and withdraw the pivot.

87 Remove the nuts securing the steering third arm and pivot on steering pivot flange. Withdraw the pivot and lift away the tracta joint housing. Take care of the shim assembled between the pivot flange and the tracta joint housing.

88 Lift the inner race and rollers out of the upper bearing, and drive the upper and lower bearing outer races out of the axle tube end.

Installation

89 If the original pivot bearings are refitted, use the original shim when installing the upper pivot.

90 If new bearings are being fitted temporarily, replace the upper pivot without a shim, and lightly tighten the nuts to eliminate clearance in the bearings. Measure the clearance between the pivot and housing faces. Select a shim 0.30/0.45 mm (0.012/0.018 in.) thinner than the measurement obtained to pre-load the bearings.

91 Tighten the nuts securing the steering arm and pivot, and steering pivot flange to 244 Nm (180 lb ft). Check that the tracta joint housing has free rotation without slackness. If necessary, re-adjust as previously described.

92 Coat the mating faces of the hub drive shaft housing, tracta joint housing and hub with Loctite 575 (sealant) prior to assembly. Smear threads of attaching bolts with jointing compound and tighten the bolts and nuts to 57 Nm (42 lbf ft).

93 Adjust the hub bearings as described in Chap 6, level 2, para 11.

94 Fill the tracta joint housing with oil.

95 Bleed the brakes.

CHAPTER 7

STEERING

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1 Steering gear

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6	Installation of worm shaft seal and coupling flange	4
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STEERING GEAR

- 1 Remove steering gear as described in Chap 7, level 2, para 39.
- 2 Secure gear in vice with coupling flange uppermost.
- 3 Remove nut and washer from the end of worm shaft and withdraw coupling flange and steering gear shield.

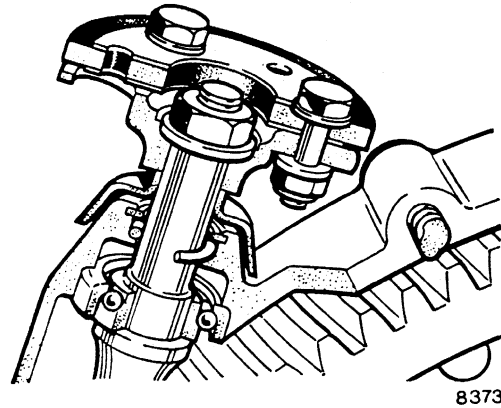
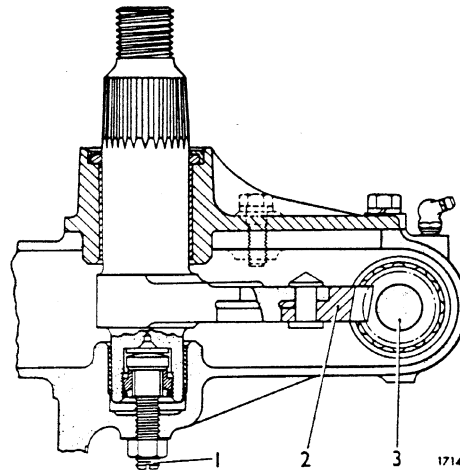


Fig 1 - Steering gear coupling flange and shield

- 4 Reposition the steering gear in the vice so that the cover bolts are uppermost and the gear lash adjusting screw (1) is accessible. Remove the lash adjusting screw locknut (4) and turn the screw clockwise several times to ensure clearance between the teeth of sector (2) and worm (3).

- 5 Remove cover retaining bolts and detach cover. Drain oil from steering gear and remove drop arm shaft and sector. Rotating lash adjusting screw clockwise will assist in releasing shaft from case.

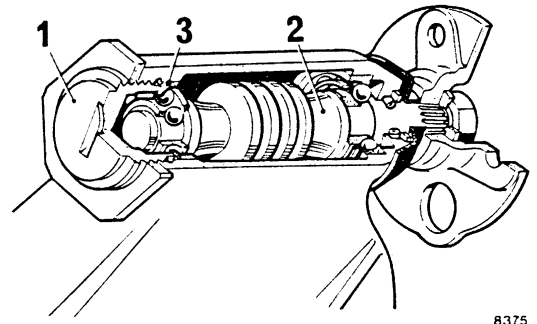


1. Gear lash adjusting screw
2. Sector
3. Worm shaft
4. Locknut

Fig 2 - Steering gear showing the gear lash adjustment details

6 Remove worm bearing adjuster (1) from casing and withdraw wormshaft (2) together with lower bearing (3).

7 worm shaft upper bearing outer face can be driven out after removing oil seal retainer and seal from upper end of casing.



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1. Worm bearing adjuster
2. Wormshaft
3. Lower bearing

Fig 3 - Steering worm shaft assy

Inspection and reconditioning:

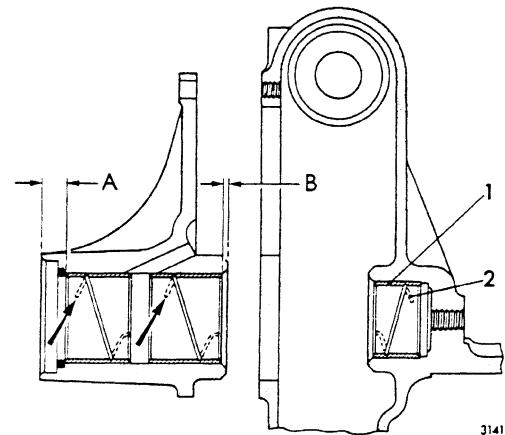
8 Renew the drop arm shaft bushes as follows:

8.1 with the cover supported, press out the bush. To remove the bush from the case, screw a 1 in. standard pipe tap into the bush and push out the tap and bush using a 7/16 - 20 UNF x 1.50 in. bolt screwed into the lash adjusting screw hole.

8.2 Drop arm shaft bush must be installed in case cover so that closed ends of oil grooves are towards the outer side of cover.

8.3 Dimension 'A' (from end of bush to end face of cover) should be 10.6 mm (0.42 in.).

8.4 Bush (1) must be pressed into gear case, with closed end of oil groove (2) first, until it contacts shoulder in case.



3141

1. Bush
2. Closed end of oil groove

Fig 4 - Drop arm shaft bush
Installation

8.5 Bolt the case and cover together and machine bushes to:

Outer bush bore	38.12-38.17 mm	(1.50-1.503 in.)
Inner bush bore	31.77-31.82 mm	(1.251-1.253 in.)

9 worm shaft bearings must be pressed on worm shaft so that open end of each bearing is towards worm.



Fig 5 - worm shaft and bearing assembly

Reassembly

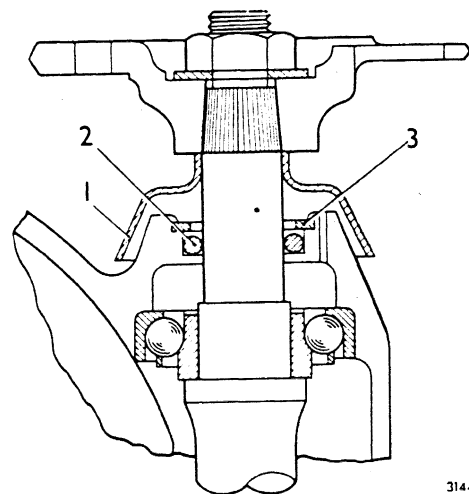
10 Before installing worm bearing adjuster, smear threads of adjuster with jointing compound. Adjust worm bearings so that there is no perceptible end float or binding of shaft.

11 worm shaft O-ring (2) should be smeared with oil before assembly.

12 To secure retainer (3), stake end face of gear case in four places.

13 Before assembling coupling flange, place shield (1) over worm shaft but do not press shield on to shaft, as final position of shield will be determined by coupling flange.

14 Coupling flange nut should be tightened to 64 Nm (47 lbf ft) after installing drop arm shaft and sector.



1. Shield 2. O-ring
3. Retainer

Fig 6 - Installation of worm shaft seal and coupling flange

15 Before assembling drop arm shaft to steering gear case, smear threads of gear lash adjusting screw 1 with jointing compound.

16 Before finally assembling side cover fill steering gear with oil to specifications GM4734-M, GM4735-M, or API GL5 or MIL-L-2105B or MIL-L-2105C.

17 Gear lash adjusting screw must be adjusted to ensure adequate clearance between sector teeth and worm before tightening cover bolts.

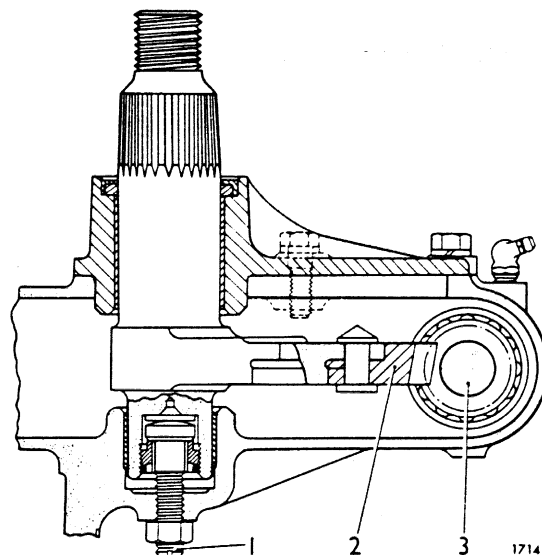


Fig 7 - Steering gear assembly

18 Gear lash adjusting screw must be finally adjusted until steering gear operates smoothly with no perceptible backlash or binding between sector teeth and worm with sector in midway position, i.e. when notch on end of drop arm shaft is at right angles to worm shaft axis. Tighten adjusting screw locknut to 38 Nm (28 lbf ft) torque.

19 Install steering gear as described in Chap 7, level 2, para 42.

CHAPTER 10

AIR PRESSURE AND BRAKING SYSTEM

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BRAKE PEDAL AND SUPPORT - LEFT DRIVE VEHICLESRemoval and reconditioning

1 On left drive vehicles, steering gear assembly must be removed from vehicle to withdraw brake pedal. Refer to Chap 7, level 3. Footbrake valve and clutch push-rods may be left in position after removing push rod yoke clevis pin.

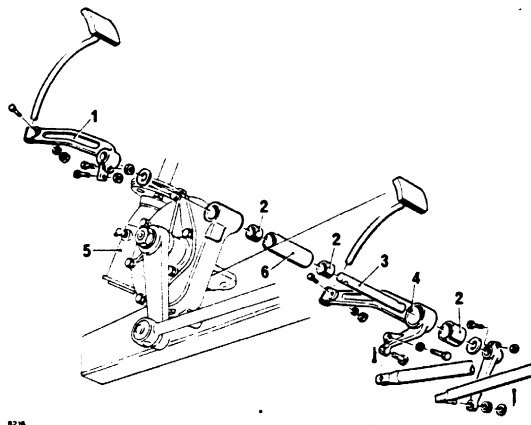
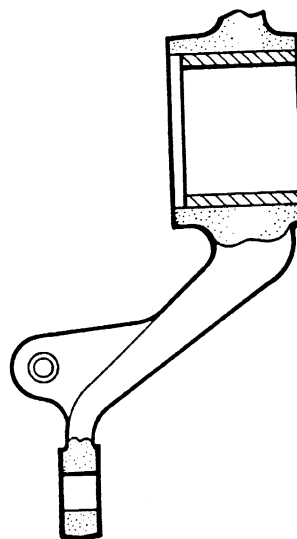


Fig 1 - Left drive brake pedal assy

2 Brake pedal bush should be pressed in until flush with the pedal outer face.



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Fig 2 - Brake pedal section

3 Press the bushes into the pedal shaft bore so that dimension 'A' (Fig 3) is 1.5 mm (0.06 in.). Press shaft into steering gear until flush with clutch pedal side of gear.

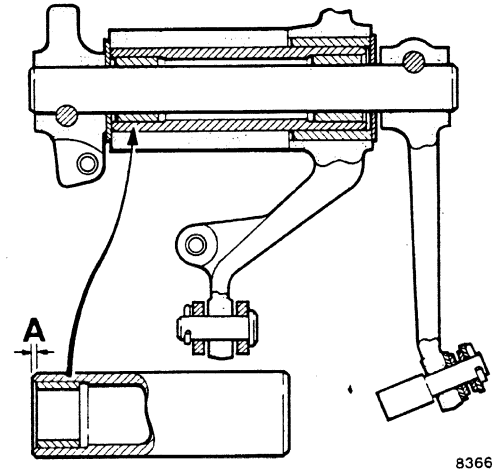


Fig 3 - Brake and clutch pedal assembly section

4 The replacement brake pedal bushes are of the prefinished type that do not require reaming on assembly.

Installation and pedal setting

5 For installation and pedal setting refer to para 7, Chap 10, level 3.

BRAKE DRUMS

Machining

6 Excessive scoring or ovality of the drum braking surface may be rectified by machining, providing the internal diameter 'A' and run-out after machining do not exceed the following dimensions:

6.1 Maximum diameter after surface refacing:

411.15 mm (16.187 in.)

6.2 Maximum run-out of braking surface:

0.25 mm (0.010 in.)

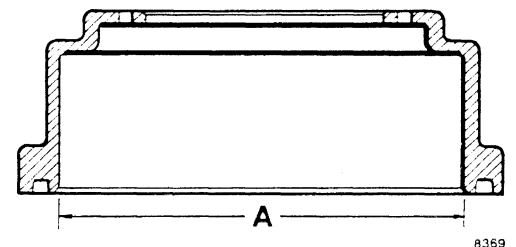


Fig 4 - Maximum diameter after refacing

PARKING BRAKE DRUM

7 Slight ovality or scoring of the parking brake drum braking surface may be rectified by machining provided the internal diameter 'B' and run-out after machining do not exceed the following dimensions:

7.1 Maximum diameter after surface refacing:

306.37 mm (12.062 in.)

7.2 Maximum run-out of braking surface:

0.15 mm (0.006 in.)

7.3 To ensure a true surface the machining operation must be carried out with the drum mounted on the pinion shaft flange.

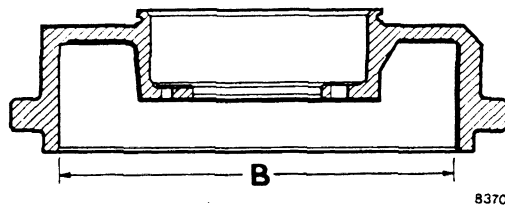


Fig 5 - Maximum diameter after refacing

CHAPTER 13

ELECTRICAL

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- 22 CAV CA45F Starter (WARNING)

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TABLE 1 - SPECIAL TEST EQUIPMENT AND TOOLS

Ser	Tool No (where applicable)	NSN/Part No (where applicable)	Designation
(1)	(2)	(3)	(4)
1	CAV 5693-266		Drive end shield bush extractor
2	CAV 5693-222		Armature end float checking gauge
3	CAV 5693-240		Commutator end shield bush installer
4	CAV 5693-267		Drive end shield bush plug gauge
5	CAV 5693-275		Commutator end shield bush plug gauge
6	CAV 6244-6		Drive end shield seal protector

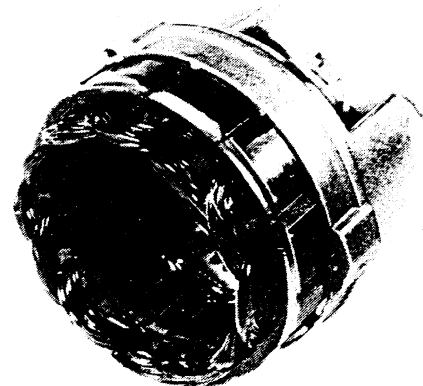
CAV AC5R/24 ALTERNATOR

CAUTIONS ...

- (1) Negative polarity must be observed. Reversed battery connections, however brief, may result in the destruction of the rectifying diodes and possible damage to the charging system wiring harness.
- (2) Before disconnecting any wire in the charging system, ensure that a battery terminal is disconnected.
- (3) The alternator must never be run with the output wire disconnected.
- (4) Do not boost-charge a battery when it is connected to the vehicle's electrical system. If the engine is started during boost-charging, the semi-conductor devices in the regulator may be damaged.
- (5) If using electric welding to repair a vehicle, it is essential that the battery cut-out switch is turned to the 'off' position and the alternator output wires are first disconnected.

Disassembly

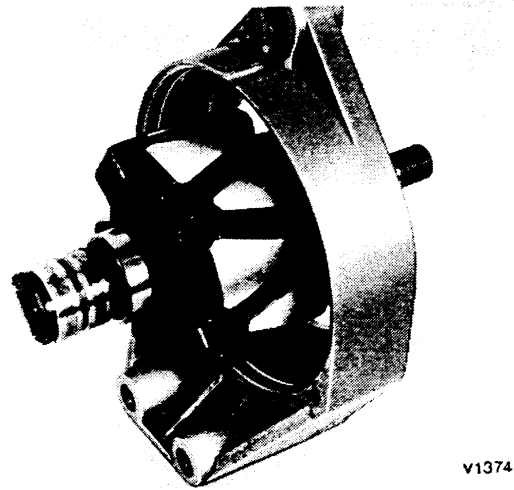
- 1 Remove alternator as detailed in AESP 2320-H-100-522, Chap 13, para 1.
 - 1.1 Remove pulley and fan.
- 2 Remove moulded cover from slip ring end bracket. Disconnect the three wires from bush holder, remove retaining screws and withdraw brush holder assembly and gasket.
- 3 Remove the three regulator securing bolts, disconnect remaining connections and withdraw regulator. The green and yellow regulator wires will pass through terminal mounting block after removing the plastic terminal covers.
- 4 Remove through bolts securing drive end and slip ring end brackets to stator. Mark end brackets relative to stator for correct location on reassembly.
- 5 Withdraw drive end bracket and rotor from stator and slip ring end bracket. If necessary use a hide-faced mallet to tap drive end bracket away from stator.



58546

Fig 1 - Withdrawing drive end bracket

6 Drive end bracket and rotor need not be separated unless drive end bearing requires examination or rotor needs renewing. In this case remove key, and with drive end bracket supported, press rotor out of bracket.



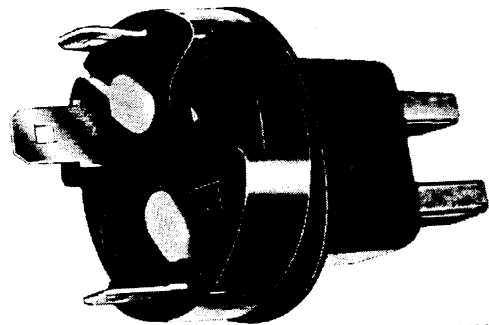
V1374

Fig 2 - Drive end bracket and rotor

7 Remove O-ring from slip ring end bracket with a sharp pointed probe. Take care not to damage O-ring groove.

Inspection and reconditioning

8 Servicing of brushes is confined to checking that brush protrusion is no less than 7 mm (0.28 in.) and brushes move freely in holder. If brush movement is sluggish, lightly polish sides of brush with a smooth file.



S8578

Fig 3 - Servicing brushes

Slip rings

9 The surfaces of the slip rings should be smooth, clean and dry. If they require cleaning, use a cloth moistened with white spirit and polish with a very fine emery cloth. Burned or scored ring may be skimmed in a lathe, removing the least amount of material necessary, and polished to produce a smooth surface. Minimum diameter and maximum eccentricity should be 28.85 mm (1.136 in.), and 0.05 mm (0.002 in.), respectively.

Rotor

10 Rotor windings may be checked by connecting an ohmmeter across slip rings. If reading is lower than 9.6 ohms, this indicates a short circuit between coils; a high reading indicates surfaces of slip rings need cleaning; an infinity reading indicates an open circuit in field windings.

11 Insulation between slip rings and rotor poles is checked by connecting test circuit as shown using a 50 volt AC mains supply and a 2.4 watt test lamp. The mains supply should be sourced from a mains isolating transformer with a screened primary winding. If lamp lights, coil is grounding and a replacement rotor is required.

CAUTION ...

No attempt should be made to machine rotor poles or straighten a distorted shaft.

Stator

12 Stator windings may be checked as follows:

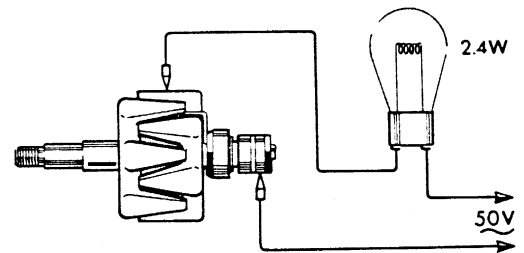
12.1 Unsolder the three stator wires from the heat sink tags.

12.2 Do not disturb tag attachment to heat sink nor flex stator wires unduly.

12.3 Remove stator from slip ring end bracket. If necessary employ a hide-faced mallet to effect separation. Stator and slip ring end bracket should be marked to assist during assembly.

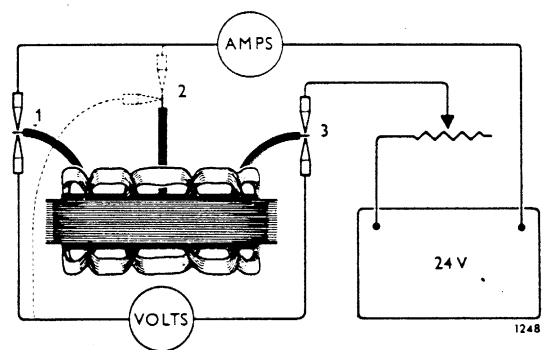
12.4 Connect a test circuit as shown, using a 24 volt, 20 amp DC supply; position probes in the following sequence 1-2, 2-3 and 1-2. Check that voltage drops in each case to 8.3 - 8.5 volts. If voltage reading is outside these limits, renew stator.

13 Insulation between stator coils and core is checked by connecting test circuit as shown using a 50 volt AC mains supply and a 2.4 watt test lamp. The mains supply should be sourced from a mains isolating transformer with a screened primary winding. Connect test probes between any one of the three wire ends and stator core. If lamp lights, stator coils are grounding and a replacement stator is required. Before resoldering stator wires, check diodes for serviceability.



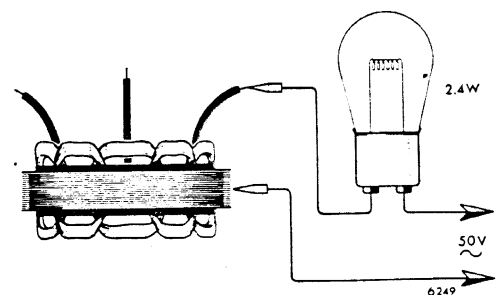
5830

Fig 4 - Checking insulation between slip rings and rotor poles



1248

Fig 5 - Checking stator windings



6249

Fig 6 - Checking insulation between stator coils and core

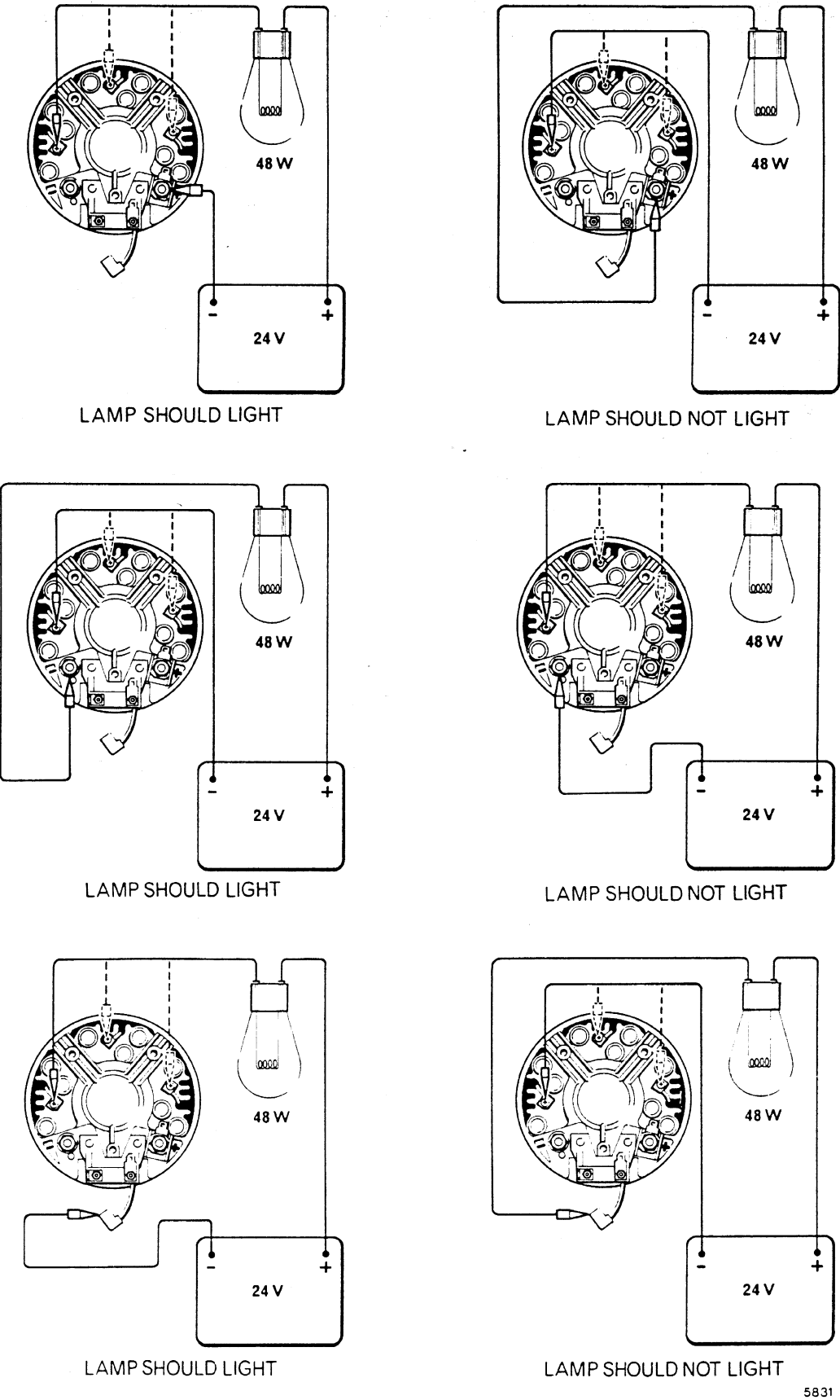


Fig 7 - Checking diodes

Heat sinks and diodes

14 Diodes may be checked as follows:

14.1 Connect a test circuit as shown in Fig 7, using a 24 volt supply and a 48 watt test lamp. Test probe should contact each heat sink in turn, following sequence indicated. If test gives opposite result, this indicates a faulty diode. This procedure is adequate for service purposes.

14.2 Should a battery ohmmeter be used to check the diodes, a serviceable diode will indicate infinity in one direction and a much lower reading in the other.

CAUTION ...

Hand-driven generator-type ohmmeter must never be used for checking diodes.

15 Diodes are not individually replaceable, but are supplied for service purposes already pressed into appropriate heat sink. When renewing a heat sink, proceed as follows:

15.1 withdraw 'A' terminal wire complete with spade terminal and grommet through hole in end bracket after disconnecting from terminal block.

15.2 Remove positive and negative terminal nuts, washers, terminal block and blades (capacitors and positive terminal blade, insulated ground return only), noting disposition of same for reassembly. Remove heat sink retaining screws and washers from slip ring end bracket and withdraw complete heat sink assembly.

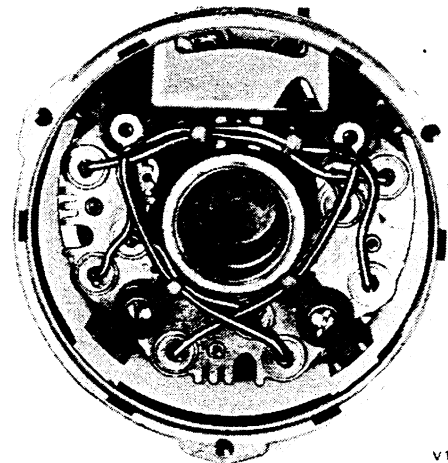


Fig 8 - Removing heat sinks

15.3 Replacement heatsinks are supplied with wires attached which must be cut to correct length. When it is necessary to solder a wire to a diode post use a pair of long-nose pliers to act as a thermal shunt and solder joint as quickly as possible. Great care must be taken to avoid overheating diodes or bending diode posts. After soldering connections, check diode for correct operation.

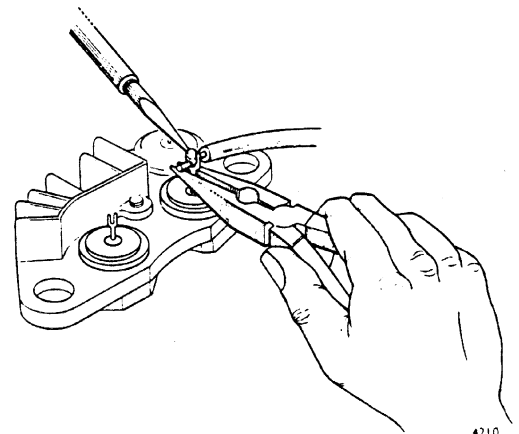


Fig 9 - Soldering wire to diode post

15.4 When assembling heat sinks, ensure nylon insulation washers are interposed between adjacent heat sinks and between heat sinks and end bracket. Check tightness of tag attachment to terminal bolt heads.

Bearings

16 Bearings are of the fully shielded type which are pre-packed with lubricant and sealed for life.

17 Access to bearing in drive end bracket is obtained by removing clamp plate and pressing bearing out of bracket. Care must be taken during removal and installation of bearing to ensure that end bracket is supported on bearing housing, so that no undue strain is placed upon support webs.

18 To renew slip ring end bracket bearing, proceed as follows:

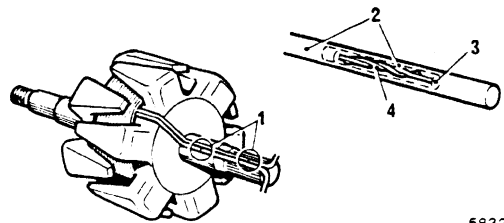
18.1 Unsolder ends of field wires from slip ring, taking care not to break wires. Withdraw slip ring assembly from rotor. Removal of slip ring assembly will render it unserviceable and a new one must be installed.

18.2 Remove bearing circlip and withdraw bearing and bearing spacer.

18.3 Before installing a new bearing, check that field wires are serviceable and of sufficient length.

18.4 Should a wire break when re-soldering it to a slip ring terminal, it will be necessary to remove slip ring assembly, rendering it unserviceable. If new wires are required they should be installed as follows:

18.4.1 If both wires require renewal, joints should be staggered as shown at (1). Trim back sleeving and lightly twist length of 23 SWG copper wire to existing wire (4) and solder. Remove any excess wire. Apply coating of shellac and slide short length of 2 mm sleeving (3) over joint to fit inside existing sleeve. Apply further coating of shellac and slide a new length of 3 mm sleeving (2) to abut original sleeve. Apply final coat of shellac to sleeve exterior.



5832

1. Staggered joints
2. 3 mm sleeving
3. 2 mm sleeving
4. Existing wire

Fig 10 - Renewing field wires

18.4.2 Install bearing spacer with groove adjacent to field wires. Press new bearing on to shaft and install circlip. Plug with ICI Silcoset 151 any gap where wires enter spacer, and between spacer and rotor poles. Pass field wires through bore of new slip ring. Locate slip ring on shaft so that terminal posts are positioned at 90° relative to shaft slot. Press slip ring assembly on to rotor shaft using length of 16 mm (5/8 in.) diameter bar. An incline should be made on bar to provide passage for field wires. Slip ring assembly must be installed with its centre sleeve flush with end of rotor shaft. Re-solder field wires to terminal posts.

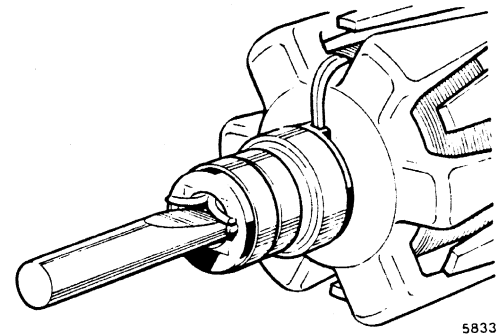


Fig 11 - Pressing slip ring assembly on to rotor

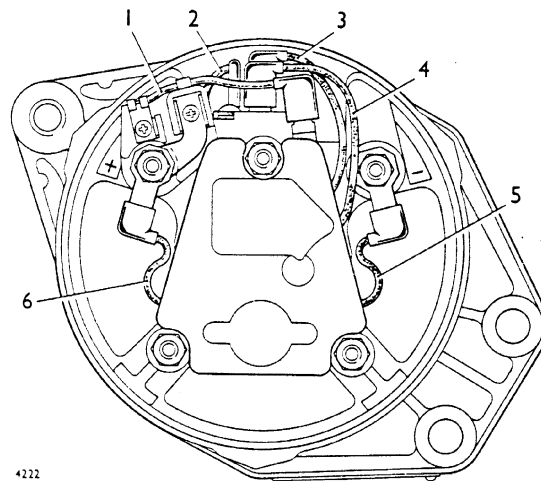
18.4.3 After assembly, lightly skim slip rings to ensure they are concentric with slip ring end bearing. Do not reduce ring diameter below 28.85 mm (1.136 in.). Polish to produce a smooth surface.

Reassembly

19 When assembling stator to slip ring end bracket, ensure that wide space in finning of each heat sink coincides with a stator wire and that locating marks made during disassembly are in alignment.

20 Alternator ground is via machine body. Assemble alternator through bolts clean and dry to ensure ground continuity between end brackets (except insulated ground return).

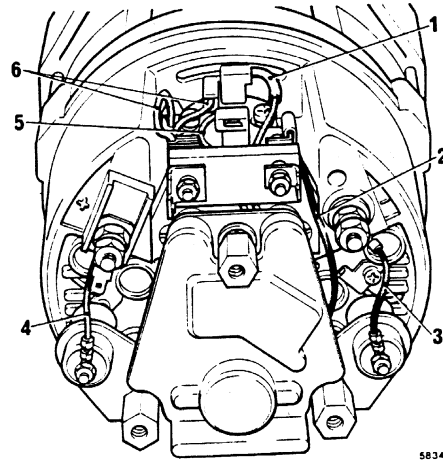
21 Tighten through bolts to a torque of 7.4 Nm (65 lbf in.) and pulley nut to a torque of 61 Nm (45 lbf ft). When the alternator is completely assembled, check that rotor can be turned freely by hand. It should turn noiselessly.



1. Warning lamp (yellow)
2. Auxiliary diodes (yellow)
3. Auxiliary diode feed (yellow with red sleeve)

4. Field (green)
5. Ground (black)
6. B + sensing (red)

Fig 12 - Wiring connections (chassis ground return)



- | | |
|---|---------------------------------|
| 1. Auxiliary diode feed
(yellow with red sleeve) | 4. Capacitor (red) |
| 2. Negative (black) | 5. Field (green) |
| 3. Capacitor (black) | 6. Auxiliary diodes
(yellow) |

Fig 13 - wiring connections (insulated ground return)

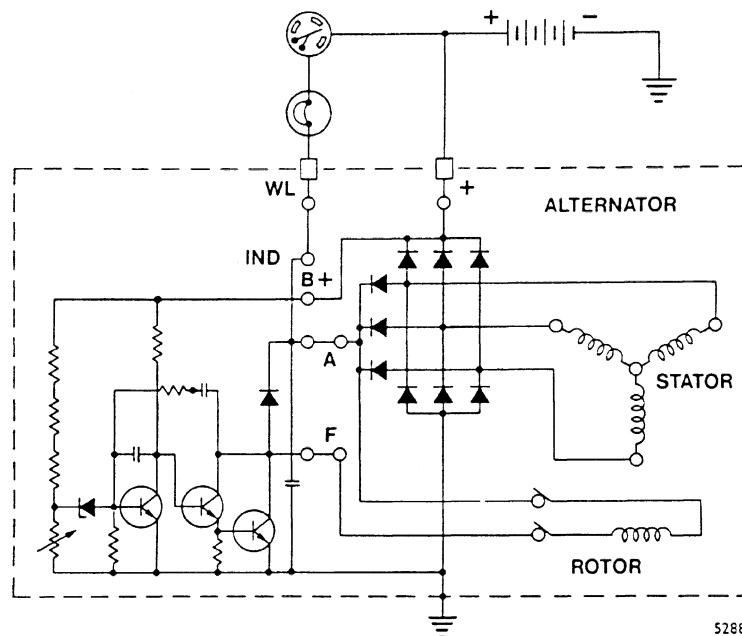
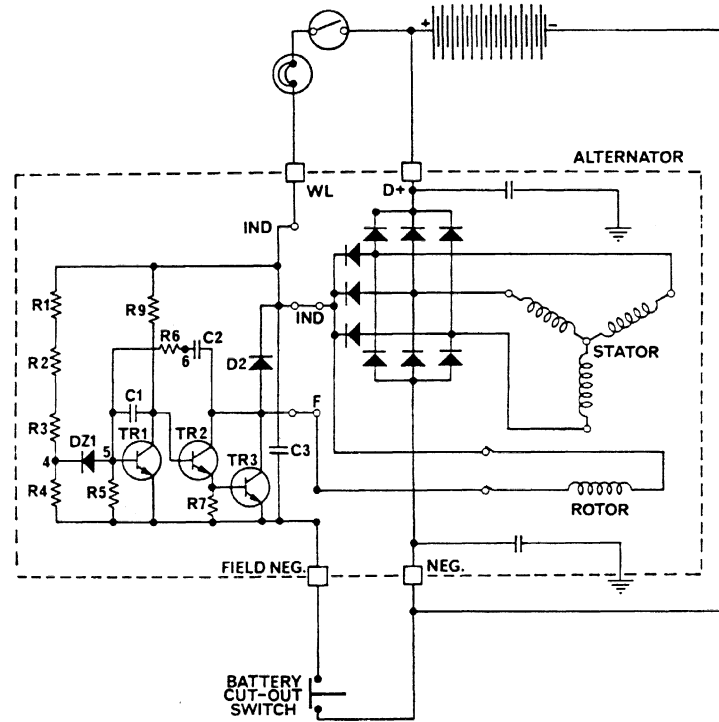


Fig 14 - Circuit diagram (chassis ground return)



5846

Fig 15 - Circuit diagram (insulated ground return)

CAV CA45F STARTERWARNING ...

UNDER NO CIRCUMSTANCES SHOULD ANY ATTEMPT BE MADE TO PULL THE PINION OUTWARDS WHILE THE MAIN TERMINALS ARE CONNECTED TO THE POWER SUPPLY. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SERIOUS INJURIES BEING SUSTAINED.

GENERAL

CAUTION ...

Before disconnecting any wire in the electrical system ensure a battery terminal is disconnected.

Disassembly

22 Remove terminal box cover and gasket, secured by four screws which are held in cover by rubber O-rings.

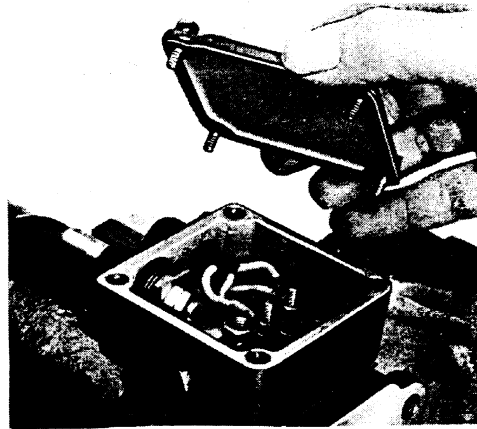


Fig 16 - Removing terminal box cover

23 Unlock and remove nuts and plain washer securing main terminal connecting bar to post. Remove nuts and lock washers from solenoid terminals and lift off wires.

24 Remove three screws and lock washers securing terminal box to starter. Withdraw terminal box and gasket complete with main terminal connection bar and switch wiring plugs.



Fig 17 - Removing terminal box

25 withdraw terminal block after removing nut together with lock and plain washer from the main terminal post and four screws securing block to starter.

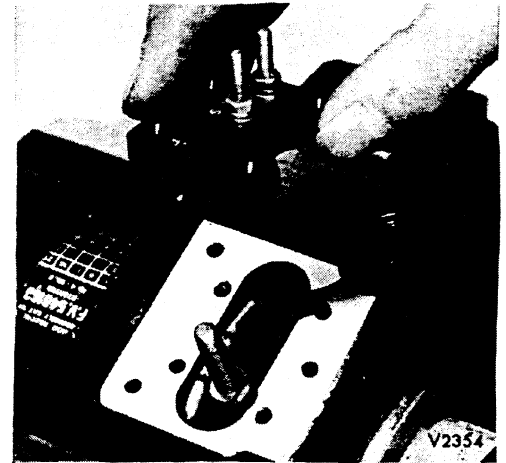


Fig 18 - Removing terminal block

26 Prise the two core plugs from drive end shield after piercing them with a pointed tool. Remove pinion bearing lubrication wick spring.

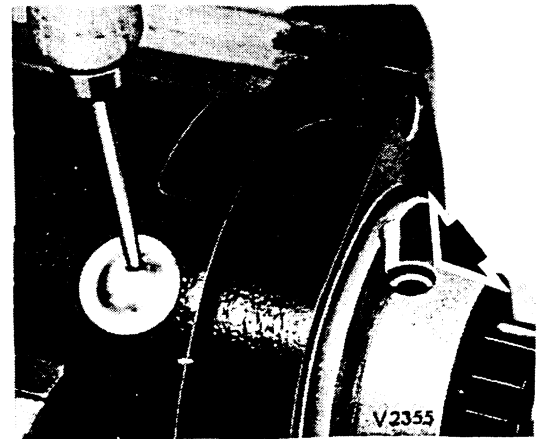


Fig 19 - Prising out core plugs from drive end shield

27 Remove the two screws, together with lock and plain washers, securing the field terminal to the fixed contacts.

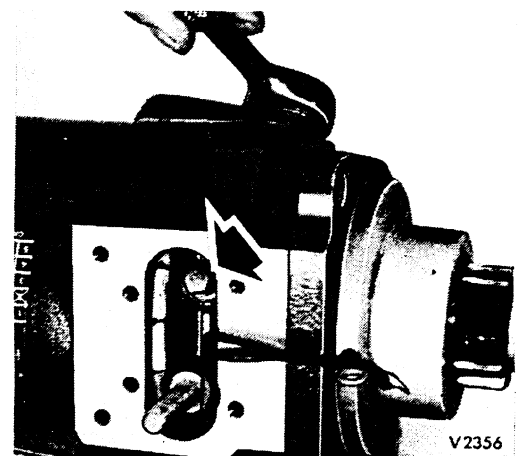


Fig 20 - Removing field terminal screws

28 Remove commutator end shield cover after removing nuts, washer and insulation from main negative and thermal switch terminals. Remove and discard sealing ring.

29 Disconnect brush leads and field coil connections from brush holders. Lift brush springs and withdraw brushes. Each brush should be marked in relation to its holder, unless the brushes are to be renewed.

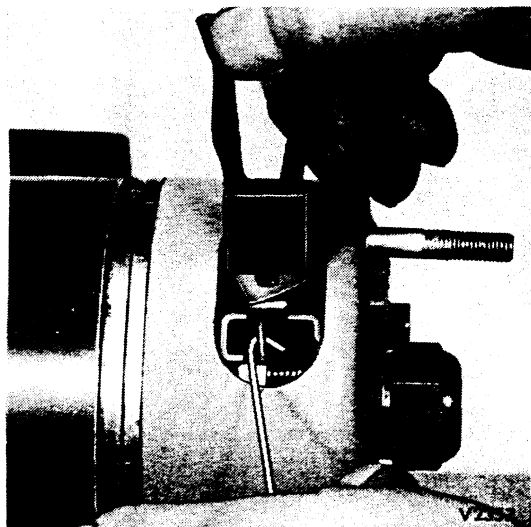


Fig 21 - withdrawing brushes from holders

30 Remove hexagon end cap, thrust pad and steel ball from commutator end shield. Remove recoil spring located in end of armature shaft.

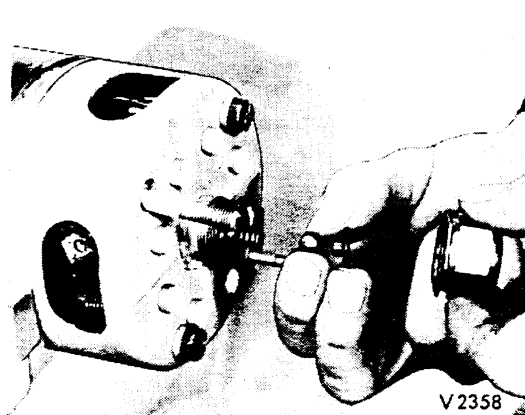


Fig 22 - Removing hexagon end cap

31 Remove circlip, thrust washer and shims from armature shaft, noting number fitted.

32 After removing two through bolts and lock washers, withdraw commutator end shield. Remove shims from armature shaft, noting number fitted.

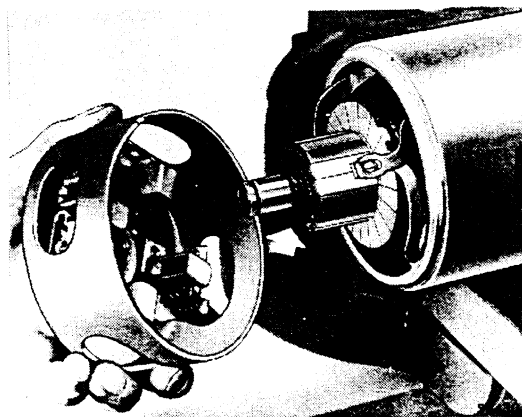


Fig 23 - Removing commutator end shield

33 Tap drive end shield away from yoke with a soft mallet, then withdraw it complete with armature from yoke. Support armature to avoid damaging windings and commutator.

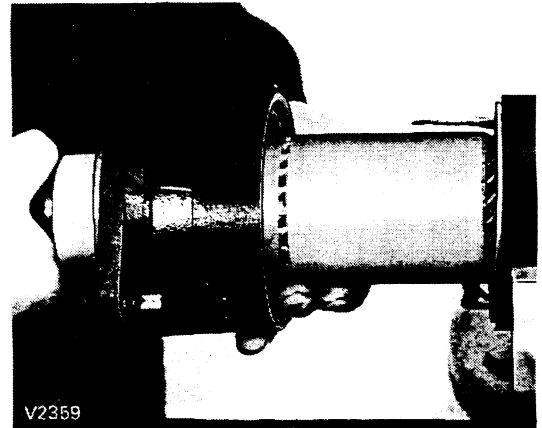


Fig 24 - Removing drive end shield from yoke

34 Mount armature in an armature clamp and unscrew pinion stop nut in direction of starter rotation. Remove thrust washer, shim, spring and helix shroud.

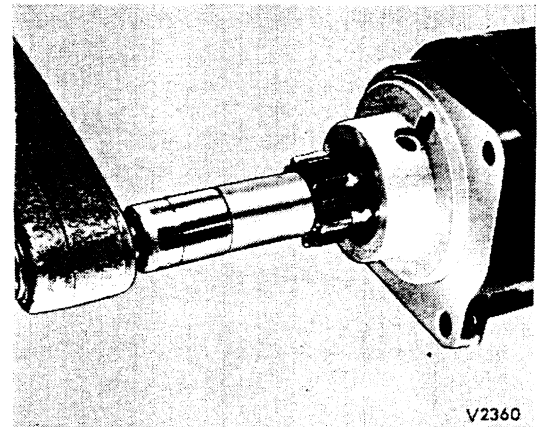


Fig 25 - Unscrewing pinion stop nut

35 Release ball lock by pushing end shield towards armature. With end shield held in this position, rotate pinion anti-clockwise until the helix disengages. Slide pinion together with drive end shield off armature shaft. Retrieve any of the six locking and four overspeed balls which may fall through to inside of the pinion sleeve.

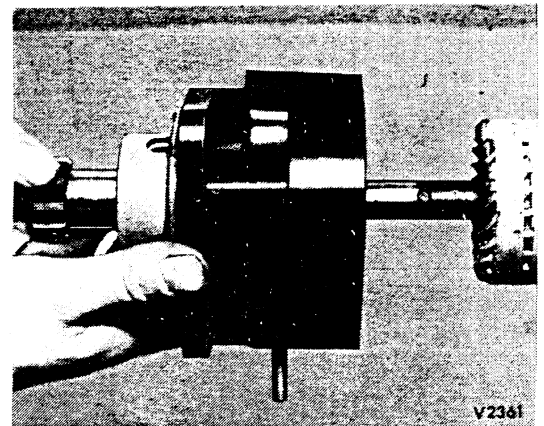


Fig 26 - Withdrawing drive end shield from armature

36 Remove and discard circlip from end of pinion sleeve and withdraw trip collar, lock collar and spring.

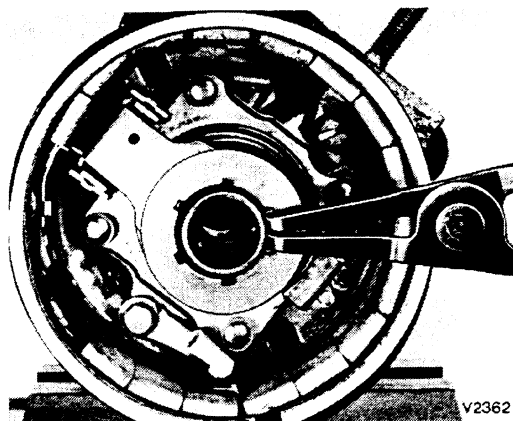


Fig 27 - Removing circlip from pinion sleeve

37 withdraw pinion from drive end shield. Carefully remove any burrs on pinion with a stone before withdrawing the pinion.

38 Detach the resistor flexible lead from moving contact plate and drive out rivet securing resistor to drive end shield. Remove resistor, bush and spacer.

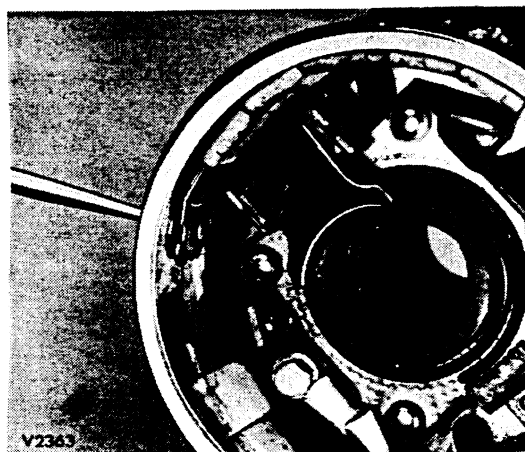


Fig 28 - Removing resistor

39 Remove main terminal post screw and lock washer and withdraw post.

40 withdraw solenoid assembly after removing two screws (arrowed) and lock washers.



Fig 29 - Solenoid securing screws

Inspection and Reconditioning

Armature

41 Check armature windings visually and with a 'growler'.

42 Commutator can be cleaned with very fine grade glass paper. Do not use emery or carborundum paper. If necessary, commutator can be skimmed using a diamond tipped tool, providing diameter is not reduced below 39.2 mm (1.56 in.). The radius at the junction of the risers and commutator must not exceed 1.0 mm (0.04 in.). Do not skim the risers.

43 Examine armature shaft for damage or wear, particularly the pinion helices. Burrs caused by the steel locking and overspeed ball can be carefully removed using a carborundum stone.

Field Coils

44 Test the windings for grounding to the yoke and poles with a 100 volt 'megger'. There is no easy way of checking for internal shorts in the coils as their resistance is low. New coils should be substituted if the existing ones are suspect.

45 To renew the coils or re-insulate, proceed as follows:

45.1 Check that pole shoes and yoke are numbered to ensure correct relationship on reassembly.

45.2 Remove field coils and pole shoes from yoke, using a pole screw-driver.

45.3 To re-insulate the coils, use 12.7 mm (0.50 in.) wide linen tape.

45.4 Where necessary, fit new tags to coil leads.

45.5 Assemble shoes to coils so that, when installed in yoke, the field leads will be in line with their appropriate terminals and the numbers on end of pole shoes line up with corresponding numbers on ends of yoke.

45.6 Locate coil and pole shoe assembly in yoke so that numbers on shoes and yoke correspond. Smear screws with jointing compound, insert and tighten to 38 Nm (28 lbf ft) with a pole shoe screwdriver. Ensure shoes are aligned and no space exists between them and the yoke.

Brushgear

46 Check for sticking of brushes in their holders and for excessive brush wear. Do not renew brushes individually, fit a complete set.

47 To free sticking brushes, clean off all deposits from brush and holder. If necessary ease brushes by polishing sides of each brush with a fine cut file.

48 Bed-in new brushes as follows:

48.1 Mount the armature in an armature clamp and wrap a strip of fine grade glass paper (not emery cloth or carborundum paper) around the commutator.

48.2 Assemble the commutator end shield to the armature. Fit the brushes to the holders and retain with the brush springs.

48.3 Rotate the end shield in the direction opposite to normal rotation of the armature until the brushes are bedded over a minimum of 80% of their contact area.

48.4 Remove the glass paper and all traces of dust and abrasive.

49 Check the tension of the brush springs with a spring balance. Correct spring tension is between 27-34 N (6-7.5 lbf).

Drive end shield and pinion

50 Prise out and discard the bearing bush oil seal. Check bush using CAV Plug Gauge 5693-267.

51 If necessary renew bush as follows:

51.1 Ensure that the oiler sealing plug and spring have been removed, then extract bush with CAV Tool No 5693-266 and discard the rectangular shaped felt wick.

51.2 Install a new felt wick into oil reservoir groove in drive end shield, so that the ends meet 180° from oiler hole, then cut off surplus.

51.3 The new bush must be fine bored to correct size after it has been pressed in. To prevent swarf getting into felt wick the cut-out in the bush must be sealed in the following manner before the bush is installed.

51.3.1 Place bush on a suitable mandrel held horizontally in a vice. Place a piece of thin leatheroid over the bush aperture and tap all round the edge of the hole with a small hammer. The leatheroid will be cut exactly to size and will fit snugly in the aperture.

51.4 Press bush, chamfered end first, fully into end shield bore, ensuring that cut-out in bush aligns with oiler hole in end shield.

51.5 Fine bore the bush to 28.63/28.65 mm (1.127/1.134 in.) diameter so that it is concentric with the oil seal recess.

51.6 Remove leatheroid pad from cut-out in bush and press in a oil seal with lip facing outwards.

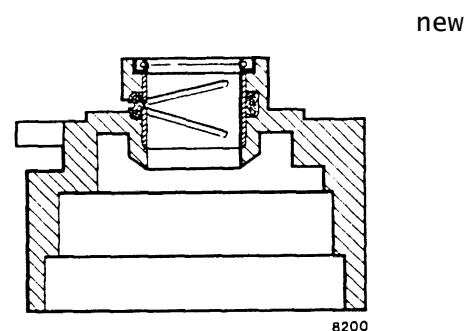


Fig 30 - Installing new oil seal to drive end shield

Note ...

If a new end shield assembly is being installed, the leatheroid pad must be removed from the bearing bush before starter is assembled.

52 Examine bearing surfaces of pinion sleeve and also pinion teeth for excessive wear or damage. Grease internal surfaces of pinion sleeve before assembly with XG 279.

53 Where necessary the complete pinion sleeve must be renewed. This is serviced with oil seal installed.

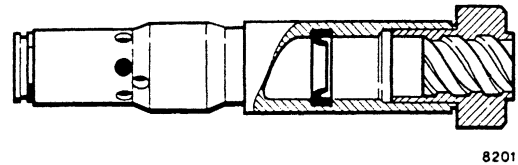


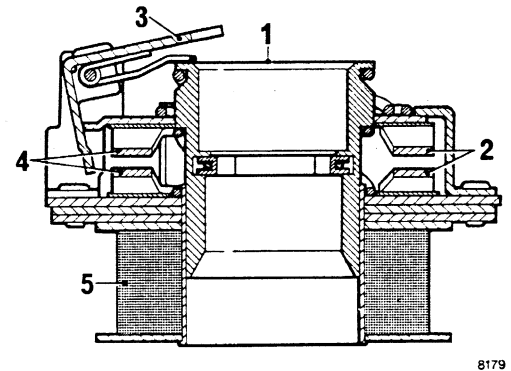
Fig 31 - Pinion sleeve

Solenoid switch unit

54 After checking the unit for wear or damage, check coils for short or open circuits by measuring current consumption as follows:

54.1 With an ammeter in supply circuit, apply 24 volts to black and green leads, current consumption should be approximately 19 amps.

55 To check solenoid switch for correct operation, position switch coil (5) on a flat surface. Apply downward pressure to the top of plunger (1) and check that first stage contacts (2) close. Whilst still maintaining pressure, depress trigger (3) and the second stage contacts (4) should now close.



1. Top of plunger
2. First stage contacts
3. Trigger
4. Second stage contacts
5. Coil

Fig 32 - Checking solenoid switch for correct operation

56 If necessary clean both first and second stage contacts with very fine carborundum paper then wipe them over with white spirit. Should they be excessively burnt or pitted, the solenoid and switch assembly must be renewed.

57 Check the first stage contact gap, it should be 2.1 mm (0.083 in.), with a bottom limit of 1.93 mm (0.076 in.), and a maximum of 2.5 mm (0.098 in.).

Commutator and shield bearing

58 Check that the bearing bush is tight in the commutator end shield housing. Check bearing for wear using CAV Plug Gauge 5693-275.

59 If necessary renew bearing as follows:

59.1 Remove bearing and install new bearing using CAV Tool No 5693-240.

59.2 When installing new bearing lubricate bore of commutator end shield housing with a light oil. The bearing is pre-finished and should not be machined.

Reassembly

60 When installing pinion, use CAV Split Collar 6244-6 to protect seal in end of drive end shield.

61 Assemble garter spring and segments to solenoid switch plunger with a smear of grease as follows:

61.1 Locate the four segments in garter spring so that the spring engages grooves in the segments and holds them together end to end in a circle.

61.2 Push garter spring and segments assembly into bore of solenoid plunger from coil end of switch until it engages the recess. Engaging one segment in recess first and edging the others into position will simplify installation.

62 Lightly smear solenoid trigger with grease.

63 Insert solenoid switch into drive end shield so that the extensions (arrowed) on switch locate in recesses in the shield.

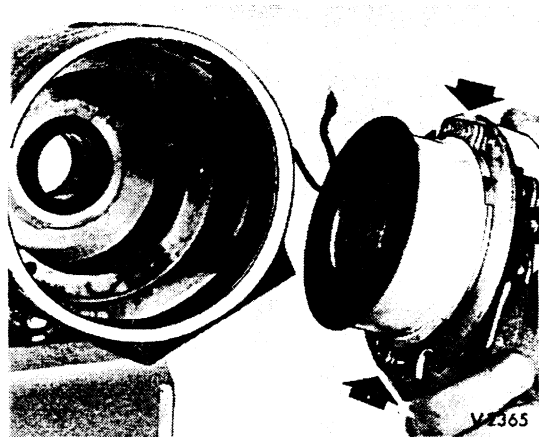


Fig 33 - Installing solenoid assembly

64 Before tightening main terminal post securing screw, position terminal block on end shield to ensure correct post location.

65 Secure resistor to drive end shield with insulation spacer and rivet (arrowed). Connect flexible lead to solenoid.

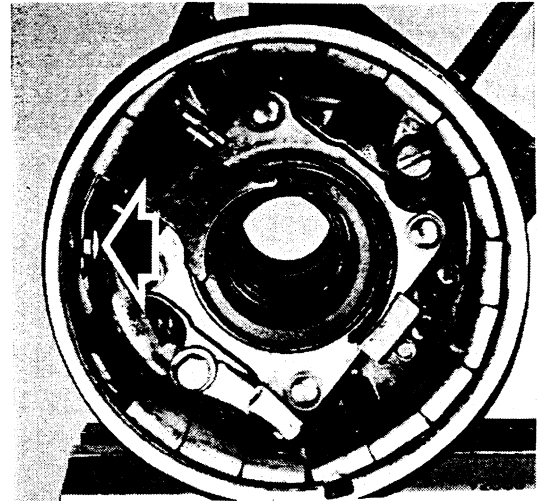


Fig 34 - Installing resistor to drive end shield

66 Insert locking and overspeed release balls into pinion sleeve holes from inside bore, using a spot of grease XG 279 to hold them in position.

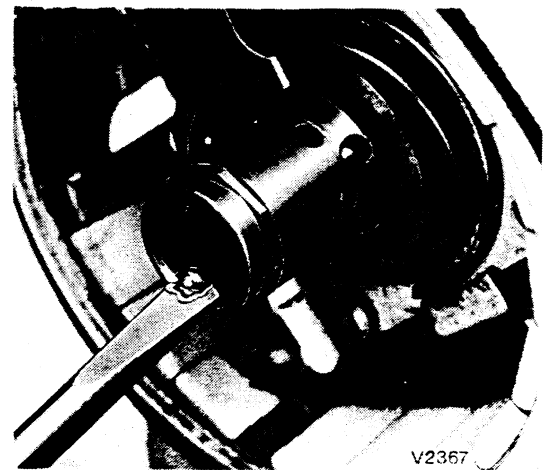


Fig 35 - Inserting locking and overspeed release balls

67 Assemble lock collar (inside chamfer toward solenoid), spring and trip collar to pinion sleeve and secure with a new circlip.

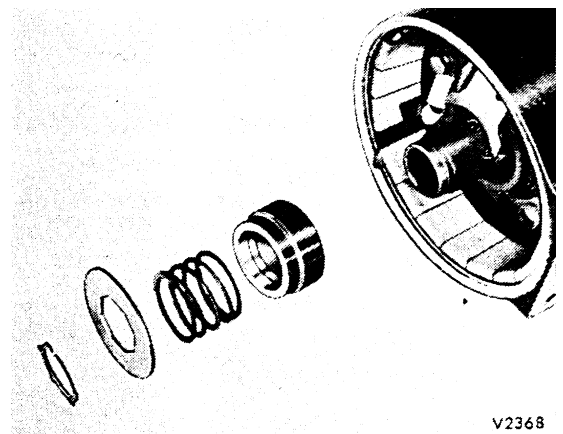


Fig 36 Installing locking and trip mechanism to pinion sleeve

68 Mount armature in an armature clamp and smear helix and bearing surfaces with grease. Pull pinion out as far as possible from drive end shield, slide pinion and end shield on to the armature shaft, engage pinion with shaft helix and then release pinion. Screw pinion on to shaft and check that the pinion locking mechanism engages.

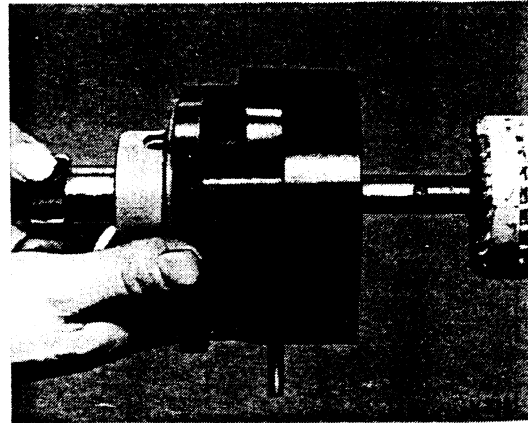


Fig 37 - Sliding pinion and drive end shield on to armature

69 Support weight of drive end shield and rotate pinion first in one direction and then in the other to ensure that pinion is free on shaft and locking mechanism functions correctly. The locking mechanism can be released by pulling the lock collar back against its spring.

70 Assemble helix shroud, pinion return spring, shim and thrust washers to armature shaft. Smear shaft thread with Loctite 290 (Penetrating Adhesive). Tighten pinion stop nut to 61 Nm (45 lbf ft).

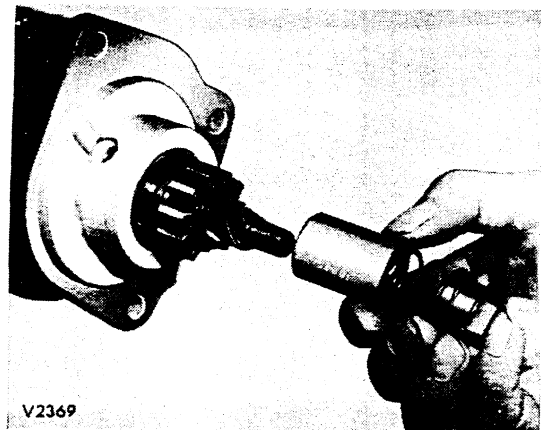


Fig 38 - Installing pinion return assembly

71 Assemble armature and drive end shield to yoke, ensuring dowel (arrowed) in yoke engages end shield slot. Seal joint with jointing compound.

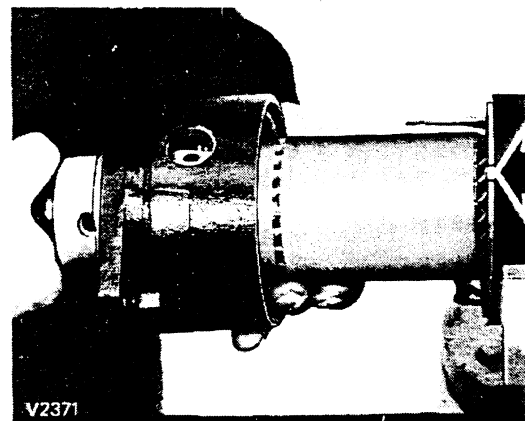


Fig 39 - Installing armature and end shield to yoke

72 Check that all the shims have been removed from armature shaft, assemble commutator end shield to yoke ensuring that slot and dowel engage and secure with through bolts.

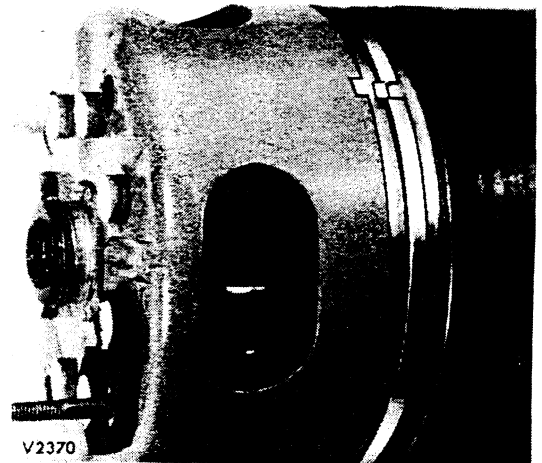
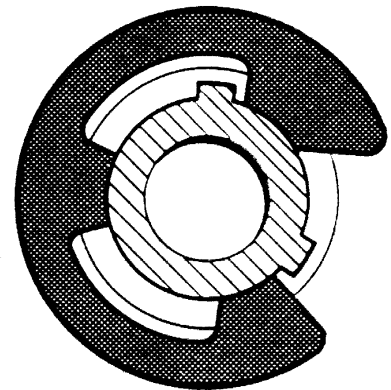


Fig 40 - Installing commutator end shield

73 Assemble thrust washer and circlip, but no shims, to armature shaft. The circlip must be located in relation to shaft key as shown in Fig 41.

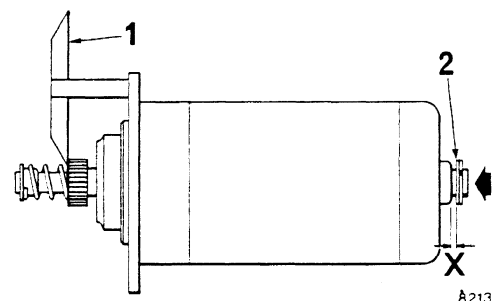


8202

Fig 41 - Commutator end circlip location on shaft

74 Adjust armature end float using CAV Gauge 5693-222 as follows:

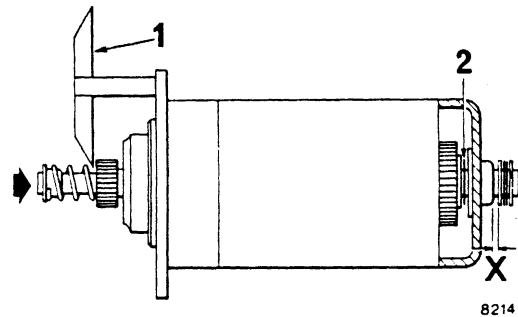
74.1 with gauge (1) held firmly against drive end shield lightly push against commutator end of armature until pinion contacts gauge. Measure gap 'X' between thrust washer (2) and commutator end shield. Shims equivalent to the gap measurement should then be fitted between the thrust washer and circlip. Shims should be well greased before use and are available in two thicknesses 0.20 and 0.10 mm (0.008 and 0.004 in.)



1. Checking gauge
2. Thrust washer

Fig 42 - Measuring pinion location

74.2 To check armature shaft end float, firmly push shaft toward commutator end shield and again measure gap 'X'.



1. Checking gauge
2. Armature end float shims

Fig 43 - Measuring armature end float

74.3 Correct shaft end float is 2.0/2.5 mm (0.08/0.10 in.). If gap is in excess of this, remove commutator end shield and install shims (2), equivalent to the excess, to the armature shaft.

74.4 Reinstall commutator end shield, thrust washer, shims and circlip, then re-check end float. Seal joint between yoke and end shield with jointing compound.

74.5 Smear the armature shaft recoil spring and ball with grease and insert them into the bore of shaft. Insert the thrust pad into end cap using grease to retain it in position. With starter held vertically screw cap on to commutator end shield. Lock in position by punching two thin corners of hexagon into slots in bearing collar.

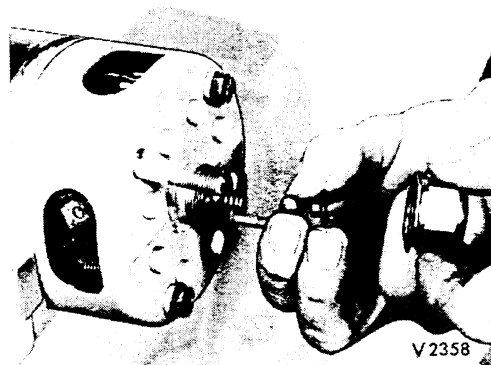


Fig 44 - Installing armature recoil mechanism

74.6 Check that any variation in the relationship of pinion position to the checking gauge is within the limits of plus 0.08 mm (0.003 in.) or minus 0.05 mm (0.002 in.).

75 Fill reservoir in drive end shield with oil OM-13. Insert spring and secure with a new core plug.

76 Connect field winding leads to the solenoid switch lugs, ensure that leads are located on outside of lugs. Install a new core plug in the drive end shield.

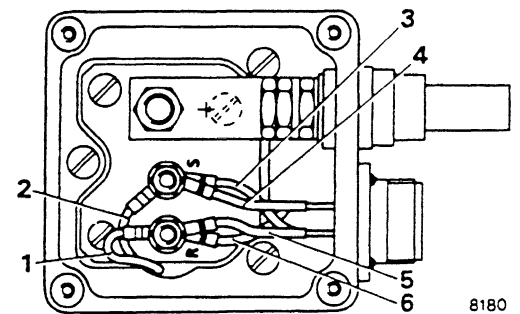
77 Install brushes to their respective holders. Connect brush and field winding leads to brush gear.

78 Assemble terminal block and box with a new gasket to drive end shield. Secure main terminal post to block.



Fig 45 - Installing brushes to holders

79 Connect solenoid green wire and switch wires 'B' and 'D' to 'R' terminal post. Connect solenoid black wire and switch wires 'A' and 'C' to 'S' terminal post.



- | | |
|-------------|-------------|
| 1. Green | 4. 'A' wire |
| 2. Black | 5. 'D' wire |
| 3. 'C' wire | 6. 'B' wire |

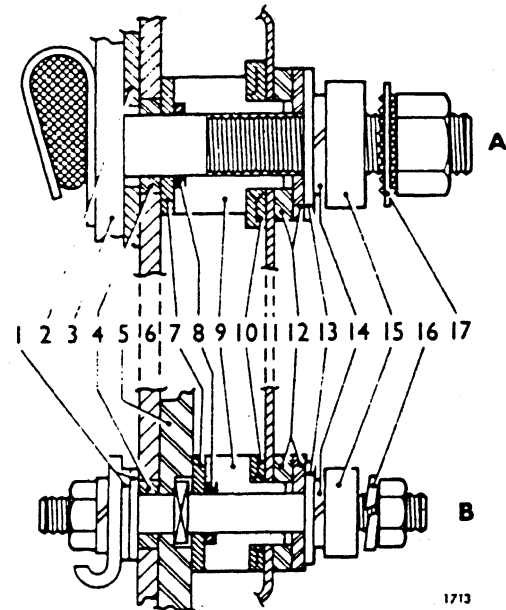
Fig 46 - Connections in terminal base

80 Secure main terminal connecting bar to terminal post. Install cover with a new gasket to terminal box.

81 Install a new commutator end cover sealing ring into groove in yoke.

82 Assemble insulating washer and bushes to main negative terminal 'A' and thermal switch terminal 'B' as shown in Fig 47.

83 Install commutator end cover (11), place two insulating washers (12) on each terminal and secure with flat washers (13), lock washer (14) and screwed collars (15).



1. Insulating washers
2. Brush holder
3. Terminal post
4. Insulating bushes
5. Insulator
6. Commutator end shield
7. Insulating washers
8. Sealing rings
9. Bushes
10. Shakeproof washers
11. Commutator end cover
12. Insulating washers
13. Flat washers
14. Lock washers
15. Screwed collars
16. Spring washer
17. Shakeproof washer

Fig 47 - Commutator end cover
terminal installation

Solenoid engagement mechanism tests

WARNING ...

WHEN TESTING SOLENOID ENGAGEMENT MECHANISM UNDER NO CIRCUMSTANCES SHOULD BOTH MAIN TERMINALS BE CONNECTED TO THE SUPPLY, OTHERWISE THE PINION WILL ROTATE AT HIGH SPEED WHEN PULLED FORWARD, CAUSING SERIOUS INJURY TO THE OPERATOR.

84 Pull the pinion forward by hand approximately 1.6 mm (0.06 in.) and release. The pinion should return to its original position.

85 Energise the solenoid by means of a 24 volt supply connected between solenoid terminals 'R' and 'S'. When the solenoid has been energised, the pinion should move forward for a distance of 6.3 mm (0.24 in.) minimum.

86 With the solenoid still energised, pull the pinion forward by hand. The locking mechanism should now come into operation, locking the pinion in the forward position.

87 Disconnect the supply to the solenoid. The pinion must return to its disengaged position in one sharp movement.

88 Check the recoil spring action by applying a compression spring balance to the driving end of the armature shaft. The force required before backward movement of the shaft occurs should be 133/168 N (30/38 lbf).

STARTER PERFORMANCE TESTS

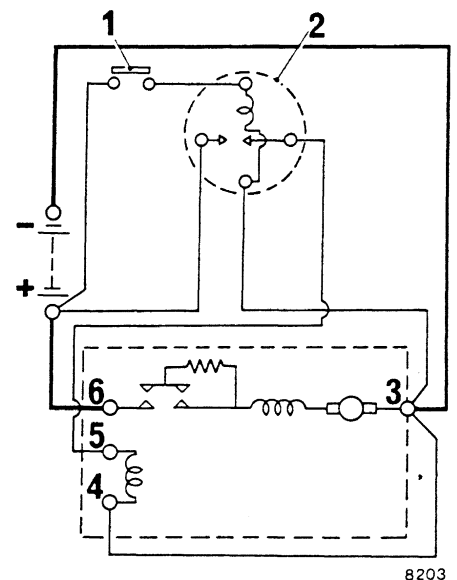
CAUTION ...

If the starter is allowed to run without engagement with a flywheel, the pinion will not be restrained from rotation in the initial stages, and thus will not complete the forward movement necessary to trip the second stage contacts. Under these conditions, the resistor will remain in circuit and may be damaged by overheating. Moreover, prolonged running on first stage contacts may cause grooving of the solenoid trip mechanism. For these reasons, the starter should always be run in conjunction with a flywheel, but if this is not possible, the running period must not exceed five seconds.

89 For these tests the brushes must bed for at least 80% of their contact area.

90 Mount the starter on the starter test bench, with a 3.18 mm (0.125 in.) in clearance between the face of the pinion and the face of the test bench flywheel.

91 Connect starter terminals as shown in test circuit Fig 48 to fully charged 24 volt battery with a capacity not less than that shown in the Test Data Table 2.



1. Switch
2. ST relay
3. Starter ground terminal
4. Solenoid 'R' terminal
5. Solenoid 'S' terminal
6. Starter main terminal

Fig 48 - Test circuit

92 Complete ten engagements into a partly locked flywheel to ensure that the engaging mechanism is operating satisfactorily. Non-engagement may be caused by a tight drive end bearing or by the pinion binding on the armature shaft.

93 Disconnect the separate supply to the solenoid, and connect the machine for normal operation. Then check the lock torque (LT) the running torque (RT) and the light running (LR) of the starter against that given in Table 2.

TABLE 2 - TEST DATA

Ser	Type of Test	Minimum battery capacity	Torque figures	Current ampere	Terminal voltage	Speed rev/min
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	LT	78 Ah	51 Nm (38.0 lbf ft)	910 max	9.2	-
2	RT	78 Ah	23 Nm (17.0 lbf ft)	555 max	15.2	1550 min
3	LT	78 Ah	NIL	60 100	24.0	7000

Note ...

It is important that the battery is adequately charged, in good condition and of the minimum capacity specified. A partly charged battery or one in poor condition will not provide current sufficient to reach the specified torque figures.

Chapter 16

CAB AND FITTINGS

CONTENTS

Para

1 Cab assembly

Fig

1 Cab nominal dimensions

Page

2

CAB ASSEMBLY

Removal

CAUTIONS ...

- (1) Turn battery cut-out switch to the 'OFF' position.
- (2) Do not attempt to lift cap using a rope or wire sling without a beam, otherwise the cab structure may be damaged.

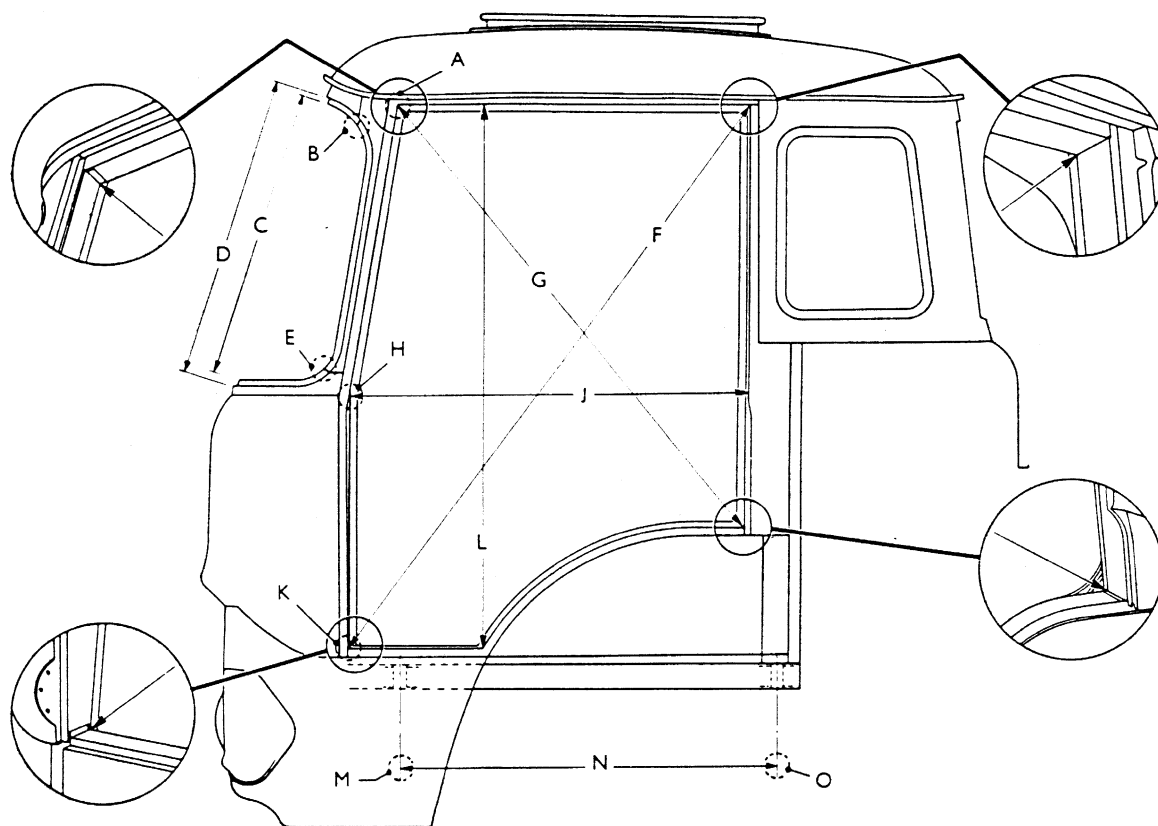
94 Drain cooling system.

95 Disconnect all electrical connections, pipes and cables from cab to chassis.

96 Disconnect steering shaft flange from flexible coupling and remove the brake and clutch pedal stems.

97 Remove cab mounting bolts.

98 Raise cab by means of a flat beam inserted through the door apertures (not window apertures) with the lifting slings attached to ends of beam. so that they are clear of cab. Ensure that all wiring and controls are clear before commencing to lift.



1736

A - 1465 mm (57.70 in.)	Across cab at pinchweld flanges
B - 1470 mm (57.90 in.)	Across cab at weld in pinchweld flanges
C - 648 mm (25.50 in.)	Centre of front end panel aperture
D - 670 mm (26.40 in.)	Centre of front end panel on edge of rebate
E - 1679 mm (66.10 in.)	Across cab at weld in pinchweld flanges
F - 1478 mm (58.20 in.)	From top of lock pillar to bottom of hinge pillar
G - 1204 mm (47.40 in.)	From top of hinge pillar to bottom of lock pillar
H - 1618 mm (63.70 in.)	Across cab at pinchweld flanges
J - 879 mm (34.60 in.)	From hinge pillar at upper hinge to cab lock pillar
K - 1742 mm (68.60 in.)	Across cab at pinchweld flanges
L - 1201 mm (47.30 in.)	From roof side rail to sill upper panel
M - 991 mm (39.00 in.)	Between centres of front and rear mounting points
N - 810 mm (31.90 in.)	Between centres of front and rear mounting points
O - 991 mm (39.00 in.)	Between centres of rear cab mounting points

Fig 1 - Cab nominal dimensions 7b/1067

7b/1067 (207)

CHAPTER 17

WINCH

CONTENTS

Para

- 1 winch assembly

Table

- 1 Special test equipment and tools

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| 1 | Removing oil seal housing from drum | 3 |
| 2 | Removing circlip and bronze locating washer | 3 |
| 3 | Removing drum | 4 |
| 4 | Removing mainshaft | 4 |
| 5 | Removing clutch housing cover | 4 |
| 6 | Removing sliding clutch | 5 |
| 7 | Removing clutch housing | 5 |
| 8 | Removing universal joint flange | 5 |
| 9 | Removing oil seal and bearing housing assembly | 6 |
| 10 | Removing wormshaft outer taper roller bearing outer race | 6 |
| 11 | Removing wormwheel and hub assembly | 6 |
| 12 | Installing shim to bore of wormcase | 7 |
| 13 | Installing spacer to wormshaft | 8 |
| 14 | Checking wormshaft end float | 9 |
| 15 | Installing thrust washer to clutch housing | 10 |
| 16 | Correct contact area on wormwheel teeth | 11 |

TABLE 1 - SPECIAL TEST EQUIPMENT AND TOOLS

Ser	Tool No (where applicable)	NSN/Part No (where applicable)	Designation
(1)	(2)	(3)	(4)
1	SP152400		Hydraulic puller
2	SP152800		Hydraulic puller

WINCH ASSEMBLY

Removal

- 1 Remove vehicle body and drain oil from wormcase.
- 2 Remove cable from drum as follows:
 - 2.1 Disengage the winch clutch by moving lever forward.
 - 2.2 Release winch brake by turning the control lever (white) to the 'OFF' position (anti-clockwise).
 - 2.3 Pay out cable, knock back the lock tab and remove pin securing cable eye to winch drum. Withdraw cable from winch.
- 3 Remove the clutch operating lever.
- 4 Release air pressure from air system condensing reservoir.
- 5 Disconnect the linkage to winch brake cylinder and remove circlips from the brake shaft and brake band link pin. Remove securing bolts from the brake bracket and the brake clevis pin from the brake shaft jaw. Lift brake bracket complete with shaft, distance piece and lever, away from the chassis frame.
- 6 Remove the brake band from drum. Withdraw brake shaft from its bracket, after removing the brake lever and pinch bolt.
- 7 Disconnect the pipes from the tensioner control valve located on the torque bracket making note of pipe location for ease of replacement.
- 8 Disconnect wiring socket from load limiter switch.
- 9 Remove the two nuts and one eye bolt securing the torque arm to the winch casing and remove dowels.
- 10 Loosen the nut securing torque bracket to the crossmember and swing torque bracket towards chassis frame.
- 11 Disconnect propeller shaft from winch flange and support to one side.
- 12 Remove caps from winch mounting brackets and lift winch assembly clear of brackets.
- 13 Move assembly forward until winch is clear of torque brackets.

14 Turn winch assembly anti-clockwise until sufficient clearance is obtained to lift it past the chassis crossmembers.

Disassembly

15 Remove both clevis pins from clutch lever, withdraw clutch engagement rod and spring assembly, remove three bolts and withdraw torque reaction bracket and limiter assembly complete with clutch actuator.

16 Use two of the four securing bolts as draw bolts (arrowed) to withdraw oil seal housing from drum.

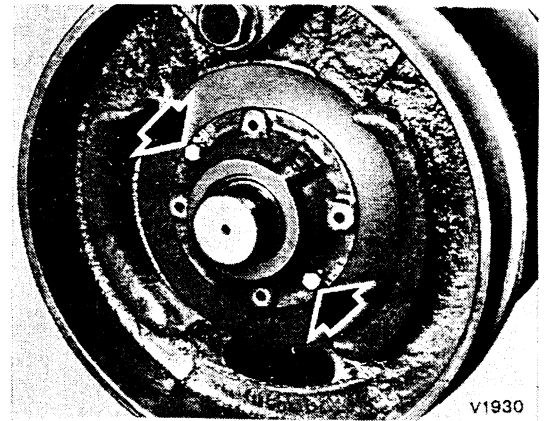


Fig 1 - Removing oil seal housing from drum

17 Position winch assembly on wormcase side so that drum is uppermost. Remove circlip bronze locating washer and key from mainshaft.

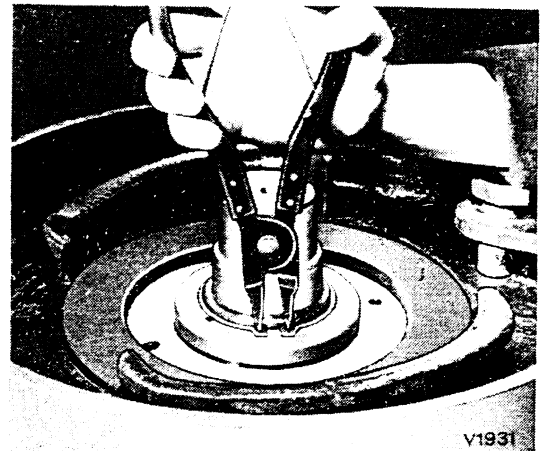


Fig 2 - Removing circlip and bronze locating washer

18 with the aid of a chain hoist and a pair of lifting brackets secured to existing bolt holes, withdraw drum from wormcase and mainshaft

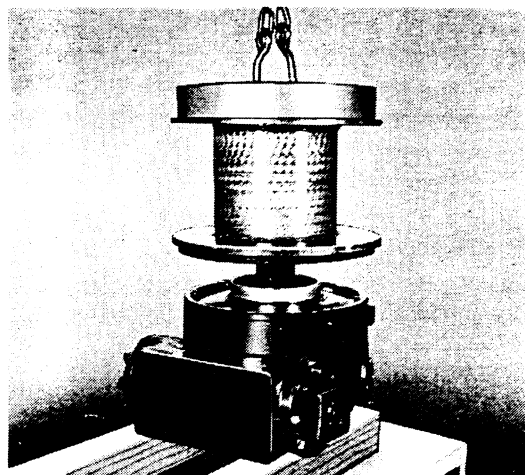


Fig 3 - Removing drum

19 Remove circlip from wormwheel end of mainshaft, remove six bolts and withdraw end plate and O-ring housing. Withdraw mainshaft

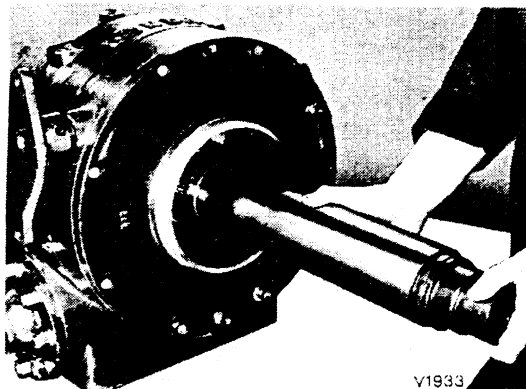


Fig 4 - Removing mainshaft

20 Remove the eight clutch housing securing bolts and use two of these bolts as draw bolts to withdraw cover from clutch housing.

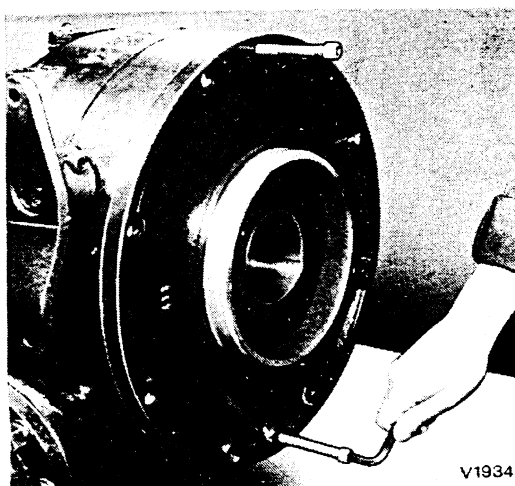


Fig 5 - Removing clutch housing cover

21 Rotate clutch shaft and remove sliding clutch from wormwheel hub. Remove slippers from fork.



Fig 6 - Removing sliding clutch

22 Lightly tap clutch housing to release it from dowels and withdraw clutch housing from worm-case complete with clutch shaft and fork. Withdraw thrust washer from clutch housing. If required, remove grub screw and withdraw clutch shaft and fork.

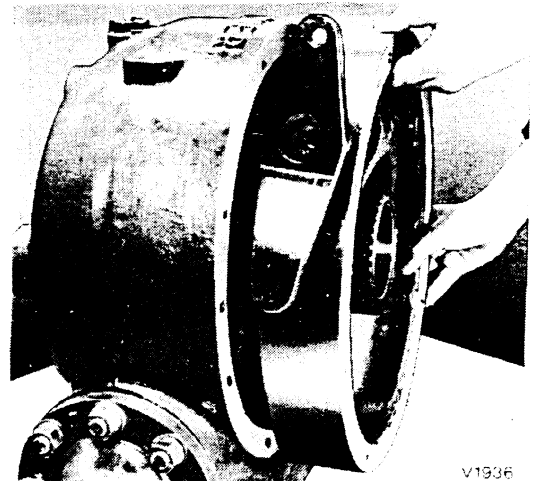


Fig 7 - Removing clutch housing

23 Remove universal joint flange securing nut and withdraw flange from wormshaft using a two legged puller. In the example shown opposite, hydraulic puller No SP152400 is used together with a 100 mm (4 in.) extension (arrowed).

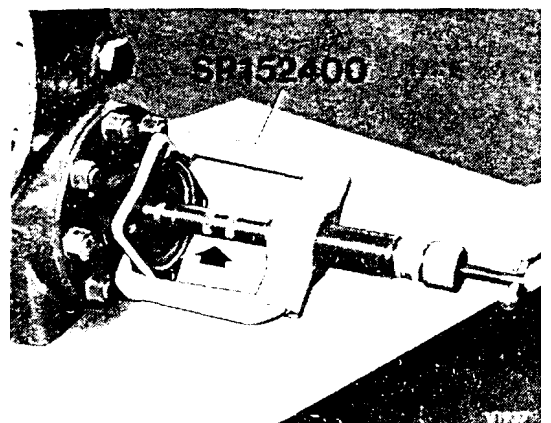


Fig 8 - Removing universal joint flange

24 Remove eight nuts and spring washers and withdraw oil seal and bearing housing retaining plate. With the aid of two draw bolts and a steel bar resting against end of wormshaft, withdraw oil seal and bearing housing assembly followed by shim and bearing spacer.

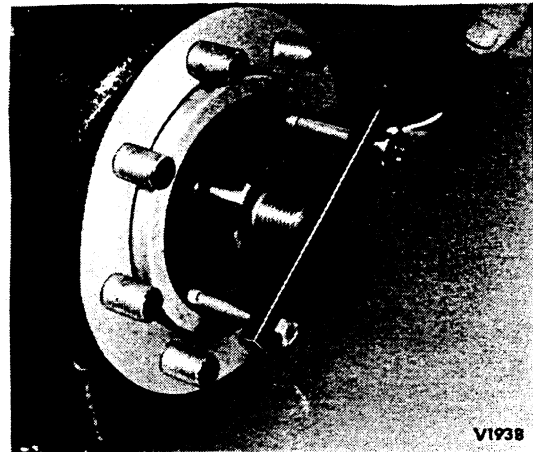


Fig 9 - Removing oil seal and bearing housing assy

25 Remove eight nuts, spring washers and flat washers and withdraw wormshaft end cover, O-ring and shims. Keep shims in safe place for reassembly. Temporarily install oil seal and bearing housing retaining plate to wormcase and force wormshaft towards taper roller bearings so as to push outer bearing outer race from case. In the example shown opposite, hydraulic puller No SP152800 is used together with a 150 mm (6 in.) spacer (arrowed) with legs of puller positioned behind retaining plate and centre of puller acting on end of wormshaft. This will enable wormshaft to drop out of mesh with wormwheel.

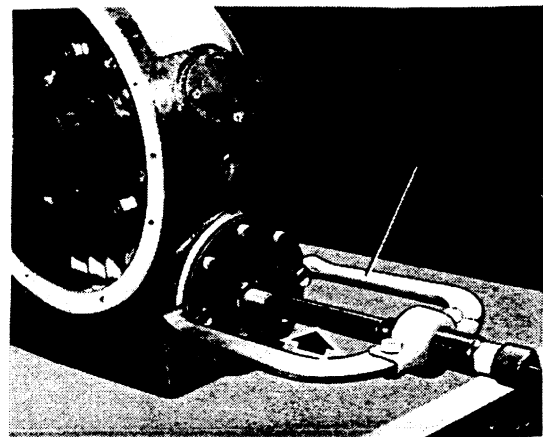


Fig 10 - Removing wormshaft outer taper roller bearing outer race

26 withdraw wormwheel and hub assembly from case and remove thrust washer.

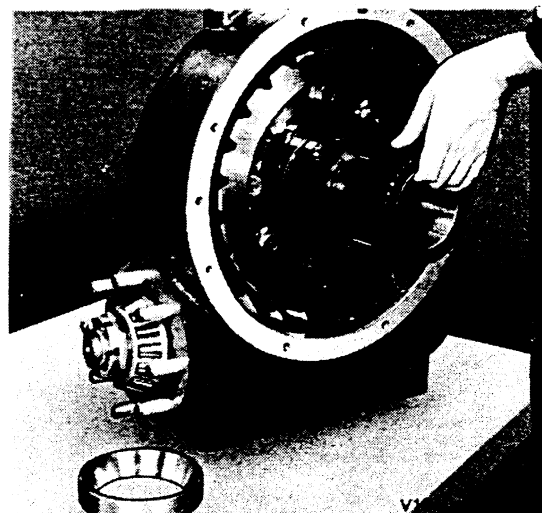


Fig 11 - Removing wormwheel and hub assembly

27 Support wormshaft and tap out remaining taper roller bearing outer race from wormcase and withdraw wormshaft. If bearings are in need of renewal, remove split pin and slotted nut and press bearings from shaft. Press off remaining wormshaft bearing from other end of shaft.

28 If wormwheel or hub are in need of renewal, remove bolts and press hub out of wheel. Keep shims in safe place for reassembly.

Inspection and Reconditioning

29 Examine mainshaft and wormwheel hub bushes for scores and wear and renew if necessary.

30 Inspect wormwheel hub thrust washers for scores and wear and renew if necessary.

31 Examine all oil seals and O-rings and renew as required.

Reassembly

32 Reassembly is the reverse procedure of disassembly provided the following points are noted.

33 Ensure inner bearing outer race is installed over end of wormshaft before pressing taper roller bearings on to shaft. Tighten nut to 142 Nm (105 lbf ft) and continue tightening nut until hole in shaft is aligned with the next nearest slot in nut and secure with split pin.

34 Assemble wormwheel to hub using shims removed during disassembly between wheel and hub flange. Tighten bolts to 142 Nm (105 lbf ft).

35 Before installing wormwheel and hub assembly, install thrust washer to wormcase using grease to retain washer in position. Apply a coating of marking blue to worm teeth on wheel and install wormwheel and hub assembly ensuring wormshaft is positioned as far out of mesh with wheel as possible.

36 Gently tap outer taper roller bearing outer race into wormcase and install end cover with shims (removed during disassembly) situated between cover and case. Tighten nuts to 61 Nm (45 lbf ft).

37 Install shim to bore of wormcase prior to installation of oil seal and bearing housing.

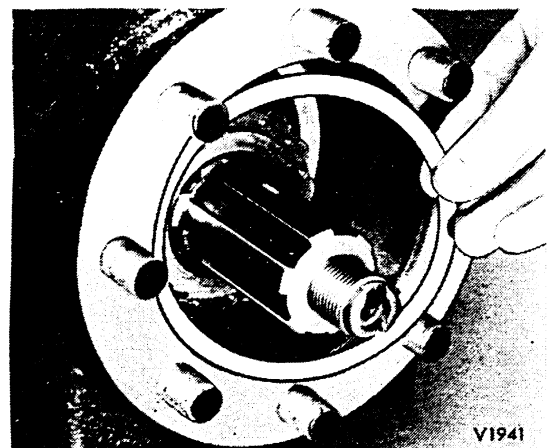


Fig 12 - Installing shim to bore of wormcase

38 Similarly, install spacer to wormshaft with chamfer towards bearing, fill cavity between oil seals with recommended grease. Install oil seal and bearing housing to wormcase, install retaining plate and tighten nuts to 61 Nm (45 lbf ft).

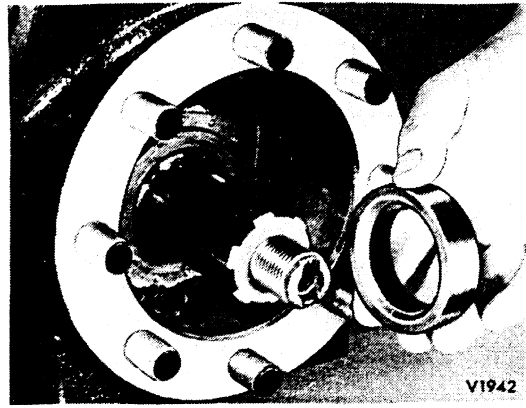


Fig 13 - Installing spacer to wormshaft

39 The procedure for checking end float of wormshaft is as follows:

39.1 Tap driving end of wormshaft to spread taper roller bearing outer races. Install dial gauge so that plunger of gauge contact driving end of wormshaft and adjust gauge to register zero. Remove plug from centre of end cover and replace it with a bolt approximately 38 mm (1.5 in.) long.

39.2 Screw in bolt until all end float of wormshaft is taken up and note reading on gauge. Correct end float is 0.05/0.13 mm (0.002/0.005 in.). End float can be adjusted by altering thickness of shims between end cover and wormcase. Removing shims will reduce end float, adding shims will increase it.

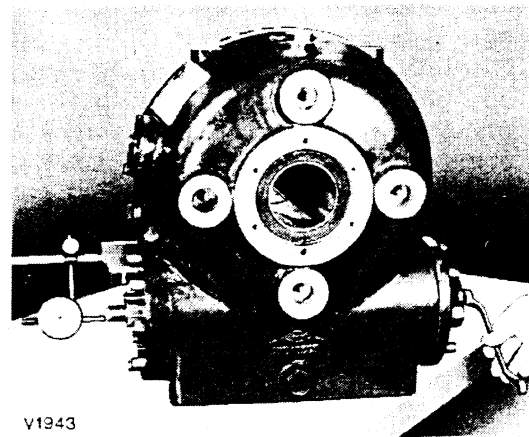


Fig 14 - Checking wormshaft end float

40 Assemble universal joint flange to wormshaft followed by washer and nut. Tighten nut to 142 Nm (105 lbf ft) and stake to shaft.

41 Before installing clutch housing, install thrust washer to housing using grease to retain washer in position. Smear gasket with jointing compound. After installing cover, tighten clutch housing bolts to 41 Nm (30 lbf ft).

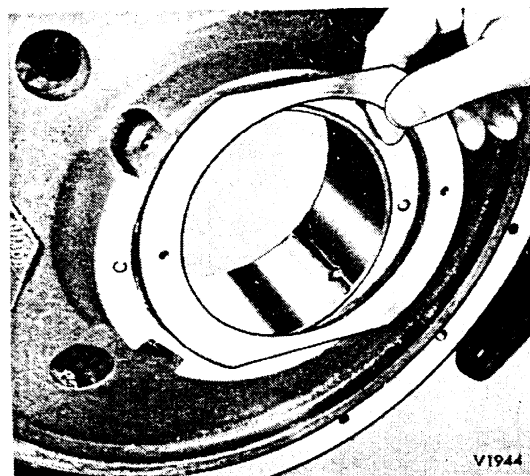
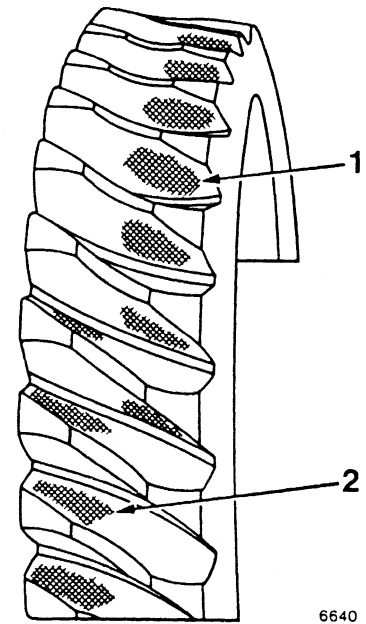


Fig 15 - Installing thrust washer to clutch housing

42 Rotate wormshaft in both directions to obtain a tooth marking on wormwheel. Remove inspection cover and examine the results. Reference to illustration will indicate type of contact required and if necessary adjustment obtained by varying number of shims located between wormwheel and wormwheel hub. Note that some backlash must exist between the worm and wheel, otherwise it will prove impossible to revolve wormshaft by hand. The wormshaft will have to be lowered in the wormcase as previously described to enable wormwheel assembly to be removed each time an adjustment is made.



1. Anti-clockwise wormshaft rotation
2. Clockwise wormshaft rotation

Fig 16 - Correct contact area on wormwheel teeth

43 After installing mainshaft O-ring housing and end plate, tighten bolts to 41 Nm (30 lbf ft).

44 Before installing oil seal housing to drum, pack cavity between oil seals with recommended grease. Tighten bolts to 45 Nm (33 lbf ft).

Installation

45 The torque bracket must be assembled loosely to crossmember before installing the winch.

46 Installation of winch is the reverse procedure of removal.

47 Adjust cable tensioner control valve as detailed in para 58 level 2.

48 Refill winch with recommended oil to correct level and recheck after initial running.

CHAPTER 18

CRANE

CONTENTS

Para

1	Drive unit/hydraulic pump assembly (Caution)
20	Lowering brake valves (Caution)
22	Load holding valves
24	Control valve block (WARNING)
30	Stabilizer rams (WARNING)
34	Crane sections (WARNING)
41	Crane assembly (WARNING)
50	Crane rams (Caution)
71	Crane centre column (Caution)
76	Slewing rams
84	Crane base

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2	Bearing extractor tool	3
3	Disassembling pump plungers	3
4	End plate securing bolts	4
5	Removing pump head plug	4
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21	Jib ram	15
22	Main lifting ram	17
23	Jib extension ram	18
24	Rotary banjo	19
25	Stabilizer ram	19
26	Crane centre column	20
27	Slewing rams	21
28	Crane base	23/24

TABLE 1 - SPECIAL TEST EQUIPMENT AND TOOLS

Ser	Tool No (where applicable)	NSN/Part No (where applicable)	Designation
(1)	(2)	(3)	(4)
1	JT 1483		Jig fixture, power take-off/hydraulic pump disassembly

DRIVE UNIT/HYDRAULIC PUMP ASSEMBLYCAUTION ...

Cleanliness is of the utmost importance where hydraulic systems are concerned. It is most important to exercise extreme care because the ingress of dirt or foreign matter will cause rapid wear of hydraulic components.

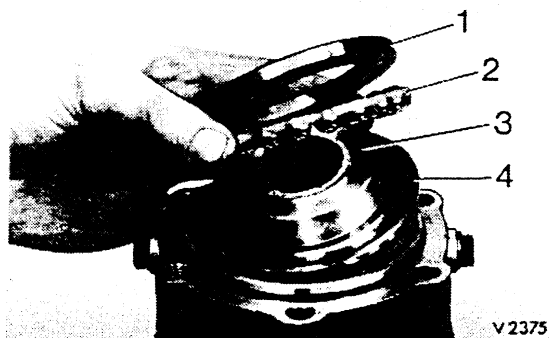
Disassembly

1 When assembling or disassembling the hydraulic pump from drive unit, it is necessary to use Jig Fixture JT 1483.

2 To install Jig Fixture JT 1483 remove three of the pump securing bolts. Adjust centre screw of jig fixture to hold pump unit against spring pressure whilst removing remaining securing bolts. Carefully release centre screw until spring pressure is relieved and remove jig fixture.

3 Separate hydraulic pump from drive unit, taking care not to displace any of the plungers or springs.

4 Remove outer thrust race (1) and bearings (2) from wobble shaft (3). Inner thrust race (4) on wobble shaft must only be removed if bearing assembly is to be renewed.



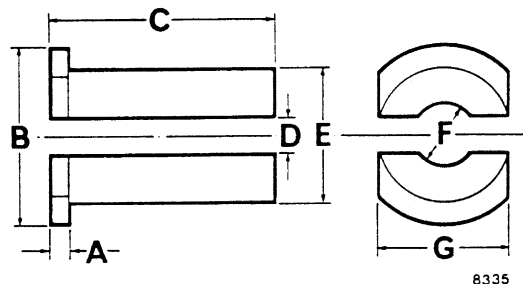
1. Outer thrust race
2. Bearings
3. Wobble shaft
4. Inner thrust race

Fig 1 - Removing wobble shaft bearing

5 Remove woodruff key and press wobble shaft out through the two bearings and spacer.

6 If the two bearings and spacer remain in housing extract the bearings as follows:

6.1 Working from the wobble plate end of the housing, insert the two halves of the locally manufactured bearing extractor (Fig 2) so that the flanges locate between the seals and bearing inner track.



A.	3.18 mm	(0.125 in.)
B.	37.29 mm	(1.468 in.) dia
C.	53.98 mm	(2.125 in.)
D.	5.52 mm	(0.218 in.)
E.	30.94 mm	(1.218 in.) dia
F.	11.10 mm	(0.437 in.) dia
G.	30.94 mm	(1.218 in.)

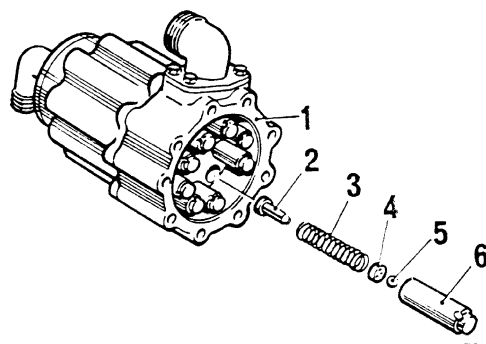
Fig 2 - Bearing extractor tool
local manufacture
(Material: Mild steel)

6.2 Slide a 11.10 mm (0.437 in.) x 76.6 mm (3.00 in.) bolt through centre of extractor, keeping the extractor halves in contact with the flanges lipped behind the bearing inner track.

6.3 Place the housing complete with extractor under press and push out the two bearings and spacer.

7 Remove the two oil seals from housing.

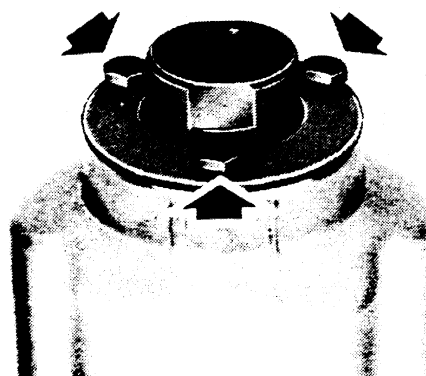
8 Remove plunger (6), ball valve (5), grid (4), spring (3) and spring guide (2) from pump (1). Repeat procedure for remaining plungers.



1. Pump
2. Spring guide
3. Spring
4. Grid
5. Ball valve
6. Plunger

Fig 3 - Disassembling pump plungers

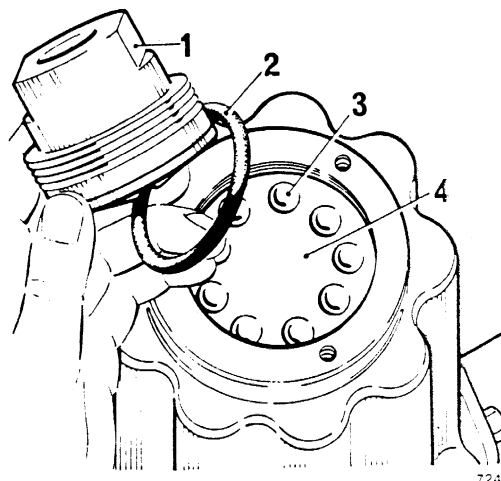
9 Remove angled connector from pump head plug. Remove end plate securing bolts (arrowed) and withdraw plate from pump.



V2041

Fig 4 - End plate securing bolts

10 Unscrew and remove pump head plug (1) and O-ring (2). Remove the ball valves (3) from outlet valve block (4).

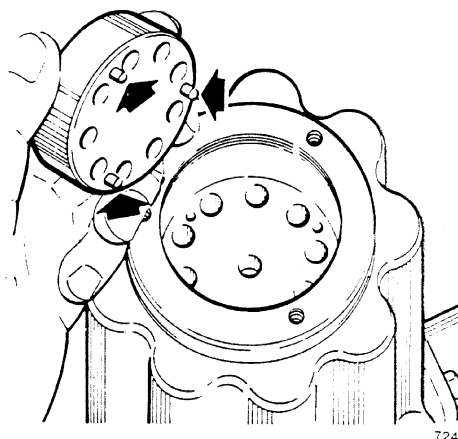


7241

1. Pump head plug
2. O-ring
3. Ball valves
4. Outlet valve block

Fig 5 - Removing pump head plug

11 Using a thin rod lightly tap out (through hole in open end of pump) the outlet valve block. Ensure that the two locating dowels (arrowed) are not displaced from valve block.



7240

Fig 6 - Outlet valve block
locating dowels

Inspection

12 Inspect the following items for wear, cracking, chipping and scoring.

12.1 wobble shaft, bearings and thrust races.

12.2 Plunger bores. Light scoring of plunger bores can be removed by lapping, the resultant loss in efficiency being negligible

12.3 Plunger springs. Check springs for length and wear against a new component. Renew springs if necessary.

12.4 Plunger balls and grids.

12.5 Plunger ball valve seat. A simple test is to place the ball on its seat and blow down the plunger. This will indicate whether or not the ball and seat are serviceable.

12.6 Pump head plug.

12.7 Outlet valve block (mind ball valves and seats).

12.8 Inlet and outlet union threads.

Reassembly

13 Install oil seals to housing with open sides of seals facing away from each other.

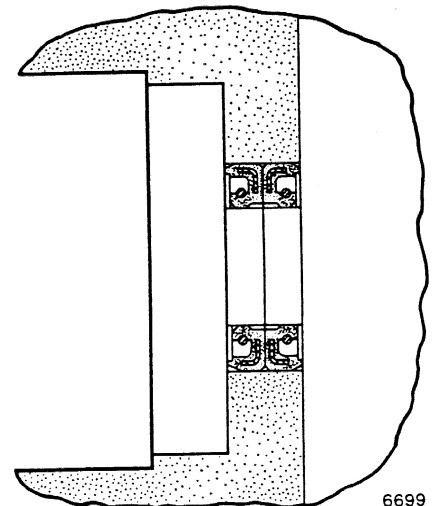


Fig 7 - Correct oil seal installation

14 Press wobble shaft bearing, with spacer into housing. The extractor tool, reversed, will ensure alignment of bearings and spacer.

15 Assemble thrust bearing to wobble shaft. Liberally lubricate the shaft and oil seals. Insert and press the shaft into the housing taking care not to damage the oil seal lips.

16 Support and secure housing with wobble plate uppermost and assemble thrust bearing on to wobble plate face.

17 Install outlet valve block to pump ensuring that dowels (arrowed) engage in locating holes in casing. Assemble ball valves to valve block. Install O-ring, pump head plug and end plate to pump.

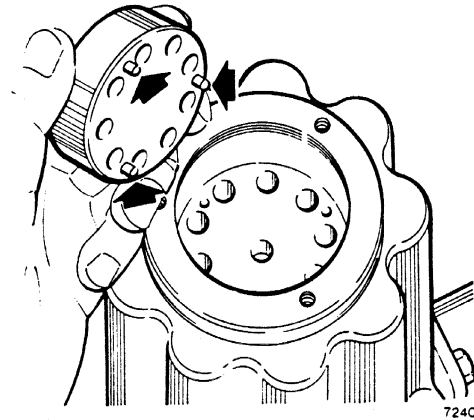


Fig 8 - Installing valve block to casing

18 Install ball valve to plunger followed by grid, spring and spring guide. Install plunger assembly to pump ensuring that plunger moves freely in bore. Repeat this procedure for the remaining plungers.

19 Carefully assemble pump to drive unit taking care not to dislodge the plungers from their bores. Pull both casings together using Jig Fixture (JT 1483) and install and tighten securing bolts.

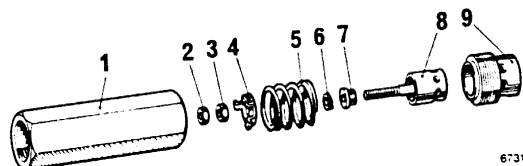
LOWERING BRAKE VALVES

CAUTION ...

Cleanliness is of the utmost importance where hydraulic systems are concerned. It is most important to exercise extreme care because the ingress of dirt or foreign matter will cause rapid wear of hydraulic components.

Disassembly

20 Unscrew bush (9) and withdraw piston and spring assembly from housing (1). Disassemble spring (5) and spring cage (4) from piston (8).



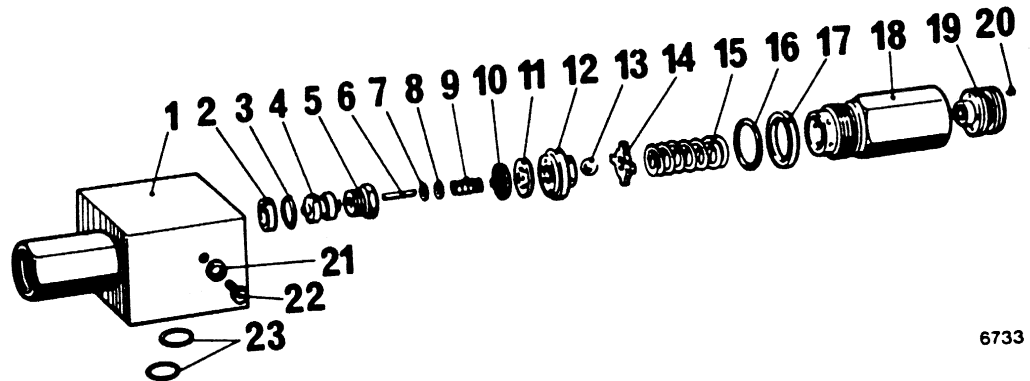
- | | |
|----------------|------------|
| 1. Housing | 6. Circlip |
| 2. Nut | 7. Bush |
| 3. Nut | 8. Piston |
| 4. Spring cage | 9. Bush |
| 5. Spring | |

Fig 9 - Exploded view of lowering brake valve

Reassembly

21 Reassemble valve in reverse order. Pressure testing and setting of valve must be carried out on the component test bench. Do not install valve to vehicle unless the pressure setting is correct.

LOAD HOLDING VALVES



1 Valve block	9 Compression ring	16 O-ring
2 Gasket	10 Filter	17 Thrust ring
3 O-ring	11 Valve plate	18 Spring housing
4 Piston	12 Valve seat	19 Threaded disc
5 Guide	13 Ball	20 Threaded pin
6 Push rod	14 Washer	21 Copper washer
7 Copper washer	15 Compression spring	22 Bolt
8 Ring		23 O-ring

Fig 10 - Exploded view of load holding valve

Disassembly

22 Unscrew spring housing (18) from valve block (1), and withdraw spring (15), washer (14) and ball (13), followed by valve seat (12), valve plate (11), filter (10) and spring (9).

Reassembly

23 Reassemble valve in reverse order. Pressure testing and setting of valve must be carried out on the component test bench. Do not install valve to vehicle unless the pressure setting is correct.

CONTROL VALVE BLOCKWARNINGS ...

- (1) FUNCTIONAL TESTING OF THE CRANE MUST ONLY BE CARRIED OUT BY AUTHORISED PERSONNEL. THOSE NOT FAMILIAR WITH CRANING OPERATIONS SHOULD REFER TO 'OPERATING THE CRANE' IN OPERATING INFORMATION AESP 2320-H-100-201.
- (2) ENSURE CRANE IS SAFE BEFORE REMOVING ANY PARTS. THIS IS PARTICULARLY APPLICABLE IF THE CRANE IS IN AN OPENED POSITION WHEN PIPES/HOSES ARE DISCONNECTED.

Removal

24 Remove clevis pins securing control rods to control levers.

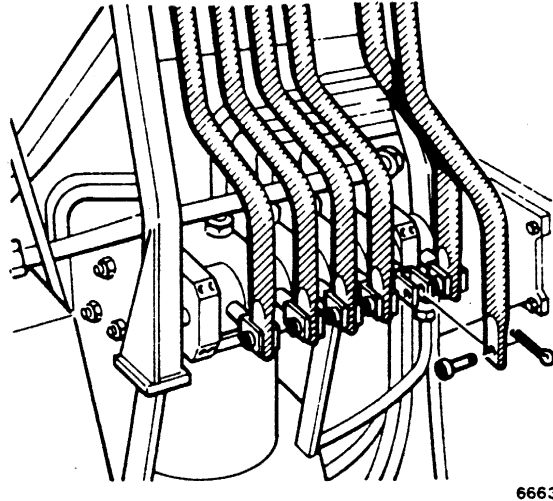
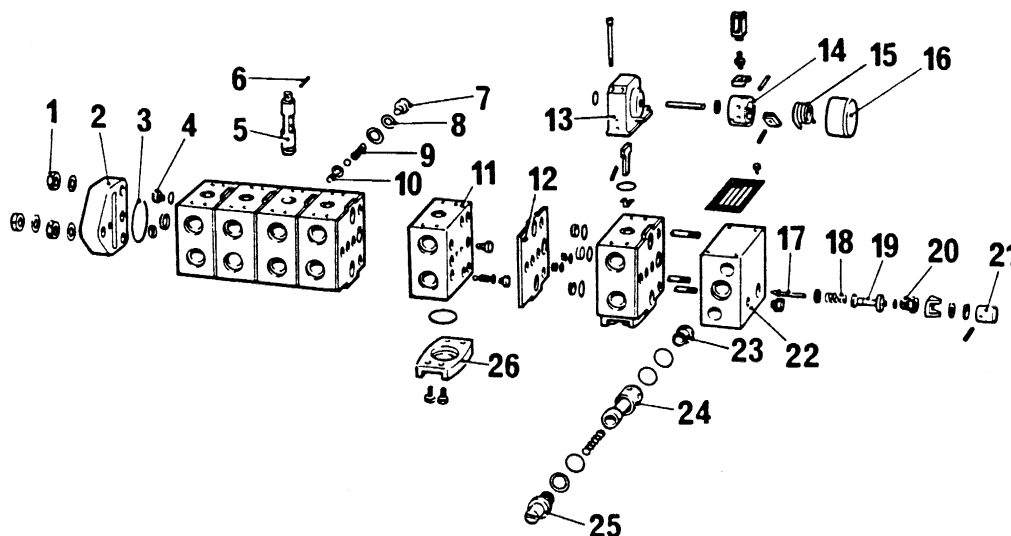


Fig 11 - Disconnecting control rods at control valve block

25 Disconnect hydraulic oil pipes to and from control valve block and cap all union connections in valve block and pipe ends. If in doubt as to pipe locations for refitting, mark and identify pipes before disconnecting.

26 Remove the four retaining screws securing valve block to support bracket and withdraw valve block complete.

Disassembly



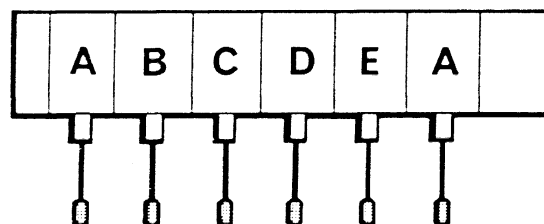
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- | | | |
|------------------------|------------------------|-------------------------|
| 1. Retaining nut | 10. Relief valve cone | 18. Relief valve spring |
| 2. End plate | 11. Valve section | 19. Adjusting screw |
| 3. O-ring | 12. Intermediate plate | 20. Guide bush |
| 4. Plug | 13. Lever housing | 21. Regulating knob |
| 5. Spool valve | 14. Lever hub | 22. Connecting block |
| 6. Pin | 15. Lever spring | 23. Bush |
| 7. Relief valve plug | 16. Hood | 24. Piston with bush |
| 8. Relief valve shim | 17. Relief valve cone | 25. Plug |
| 9. Relief valve spring | | 26. Cover plate |

Fig 12 - Exploded view of control valve block

27 Remove the valve section retaining nuts (1) and slide end plate (2) and valve sections as an assembly from the tie rods.

28 Carefully separate the sections keeping them in the order in which they are removed. Each valve section should be disassembled and reassembled separately to avoid the mixing of any parts.



6884

- A Stabilizer rams valve sections
B Main lifting ram valve section
C Jib ram valve section
D Slewing rams valve section
E Jib extension ram valve section

Fig 13 - Identification of control valve block sections

Inspection

29 Clean off all components with white spirit and dry with a lint free cloth or use compressed air.

29.1 Ensure that each section of the valve block is free from damage on the machined faces, particularly the locations for the O-ring seals.

29.2 Check that tie rods are not bent and do not have damaged threads.

29.3 Inspect lever housing and associated parts for wear or damage.

STABILIZER RAMS

WARNING ...

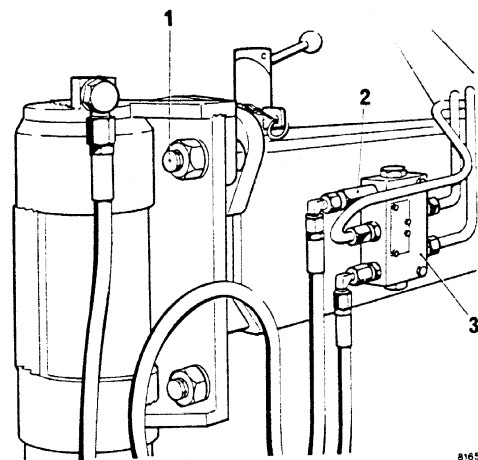
FUNCTIONAL TESTING OF THE CRANE MUST ONLY BE CARRIED OUT BY AUTHORIZED PERSONNEL. THOSE NOT FAMILIAR WITH CRANING OPERATIONS SHOULD REFER TO OPERATING THE CRANE IN OPERATING INFORMATION AESP 2320-H-100-201.

CAUTION ...

Cleanliness is of the utmost importance where hydraulic systems are concerned. It is most important to exercise extreme care because the ingress of dirt or foreign matter will cause rapid wear of hydraulic components.

Removal

30 Disconnect and cap pipe ends adjacent to restricted non-return valve (2) and double non-return valve (3). Remove bolts (1) securing stabilizer ram to support.



1. Bolt
2. Restricted non-return valve
3. Double non-return valve

Fig 14 - Stabilizer removal

Installation

31 Installation of stabilizer rams is a reversal of removal. After making pipe connections, operate stabilizer two or three times to fill rams with oil.

32 Check and if necessary top-up level of hydraulic fluid as described in Operating Information.

Leakage test

33 Pressure test all pipes/hoses to the stabilizer by actuating stabilizer control valve to bring rams into their final positions where they should be held whilst a visual check is made of all joints for leakage.

CRANE SECTIONS

WARNINGS ...

- (1) FUNCTIONAL TESTING OF THE CRANE MUST ONLY BE CARRIED OUT BY AUTHORIZED PERSONNEL. THOSE NOT FAMILIAR WITH CRANING OPERATIONS REFER TO 'OPERATING THE CRANE' IN OPERATING INFORMATION AESP 2320-H-100-201.
- (2) ENSURE CRANE IS SAFE BEFORE REMOVING ANY PARTS. THIS IS PARTICULARLY APPLICABLE IF THE CRANE IS IN AN OPENED POSITION WHEN PIPES/HOSES ARE DISCONNECTED.

34 The method of removing crane sections and/or hydraulic rams depends largely on the repairs necessary. In Fig 15 the crane has been opened and stowed in the fore and aft position with jib and boom sections over the platform body. From this position, with boom supported and hydraulic pressure relieved, the following units can be removed:

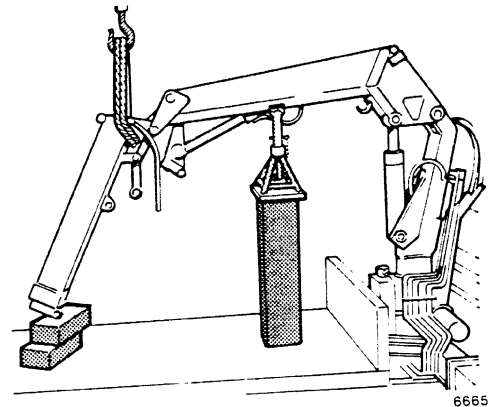
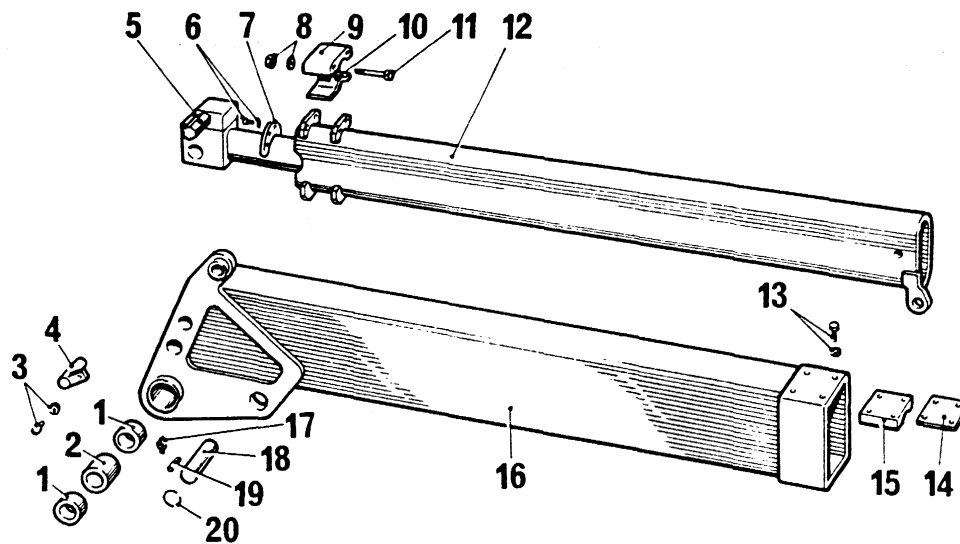


Fig 15 - Positioning crane for dismantling

- 34.1 Jib, jib extension and hydraulic ram.
- 34.2 Boom to jib ram.
- 34.3 Main lifting ram (centre column to boom).
- 34.4 Boom.

35 The crane sections and rams are secured with steel pins which are retained either by circlip, split pin or bolt. Where it is necessary to remove a number of pins they must be marked for identification to aid reassembly. Similarly, mark and identify all hydraulic hoses/pipes. All open hose/pipe ends and connectors must be capped to prevent the ingress of dirt or foreign matter.



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- | | | |
|------------------------------|-------------------------------|-------------------|
| 1. Bush | 8. Nut and washer | 14. Spacer |
| 2. Spacer | 9. Guide plate | 15. Guide plate |
| 3. Retaining bolt and washer | 10. Spacer | 16. Jib |
| 4. Securing pin | 11. Bolt | 17. Grease nipple |
| 5. Load holding valve | 12. Extension arm | 18. Anchor pin |
| 6. Retaining bolt | 13. Retaining bolt and washer | 19. Key |
| 7. Mounting plate | | 20. Circlip |

Fig 16 - Removing jib extension/hydraulic ram from jib

- 36 To remove jib extension and hydraulic ram from jib proceed as follows:
- 36.1 Disconnect and remove rotary banjos from jib.
 - 36.2 Remove retaining bolt and washer (3) and drive out securing pin (4).
 - 36.3 Remove bolts and washers (13) securing guide plate (15) and spacer (14) to jib. Jib extension and hydraulic ram can now be withdrawn from jib.
 - 36.4 To release hydraulic ram from jib extension, remove bolts and washers (6) securing mounting plate (7) to jib extension.

37 Reassembly of hydraulic ram to jib extension and jib extension to jib is a reversal of removal. If, however, excessive movement exists between jib and extension, shims must be installed between guide plate (15) and interior face of jib.

Installation

38 Installation of crane sections and lifting rams is a reversal of removal.

39 Top-up or refill the hydraulic oil reservoir as described in operating Information AESP 2320-H-100-201.

Leakage Test

40 Pressure test all pipes/hoses by actuating the control valve to bring each ram to its final position where it should be held whilst a visual check is made of all joints for leakage.

CRANE ASSEMBLY

WARNING ...

FUNCTIONAL TESTING OF THE CRANE MUST ONLY BE CARRIED OUT BY AUTHORIZED PERSONNEL. THOSE NOT FAMILIAR WITH CRANING OPERATIONS, SHOULD REFER TO 'OPERATING THE CRANE' IN OPERATING INFORMATION AESP 2320-H-100-201.

Removal

41 Removal of the crane assembly must only be carried out with the boom and jib in the stowed/travelling position.

42 Close stop valve in low pressure pipe from reservoir to pump. Disconnect pipe at pump side of stop valve and cap all open connections.

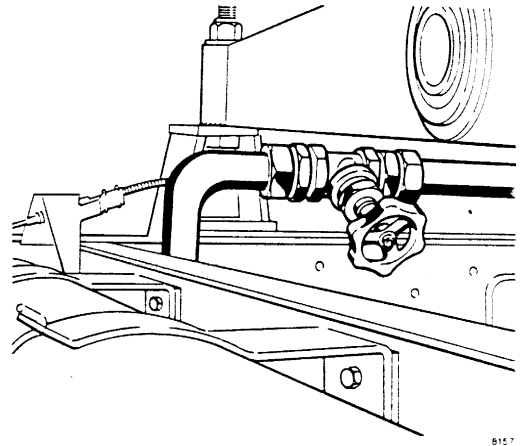


Fig 17 - Low pressure pipe and stop valve

43 Disconnect high pressure pipe at union (arrowed) and cap all open connections.

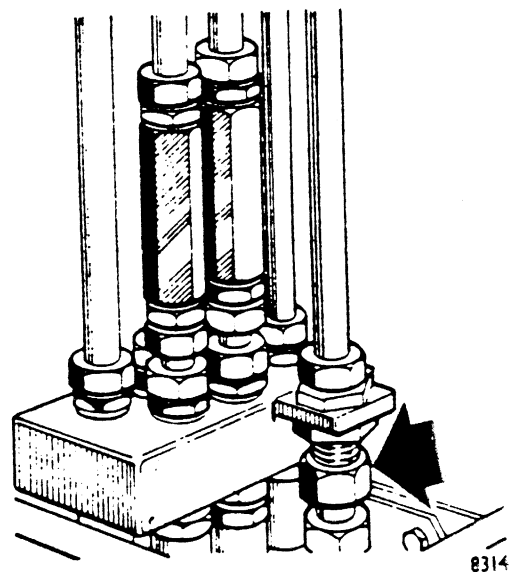
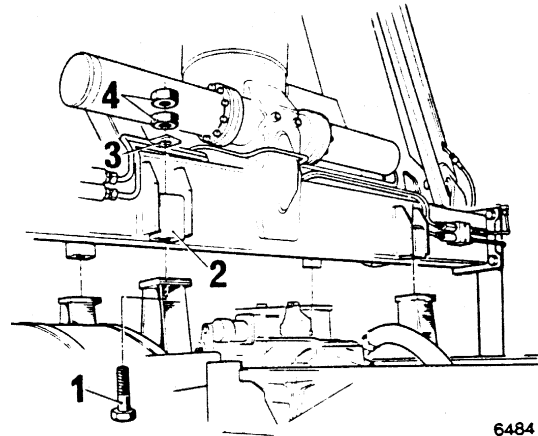


Fig 18 - High pressure pipe union

44 Remove the retaining nuts (4) and bolts (1) from the four crane mounting points (2).



1. Mounting bolt
2. Mounting point
3. Washer
4. Retaining nuts

Fig 19 - Crane mounting points

WARNING ...

THE CRANE ASSEMBLY WEIGHS APPROXIMATELY 1100 kg (2424 lb), THEREFORE IT IS IMPORTANT TO ENSURE THAT THE EQUIPMENT BEING USED TO LIFT THE ASSEMBLY IS CAPABLE OF DOING SO AND ALSO THAT PARTICULAR ATTENTION IS PAID TO THE METHOD OF SLINGING.

45 The crane must be slung for removal as shown.

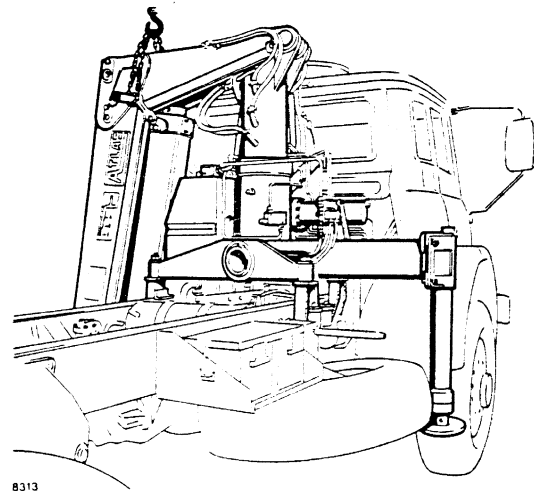


Fig 20 - Lifting crane from vehicle

46 If, when removing the assembly, there is not enough height available to enable the stabilizers to clear the chassis then they must be removed as described in para 30.

Installation

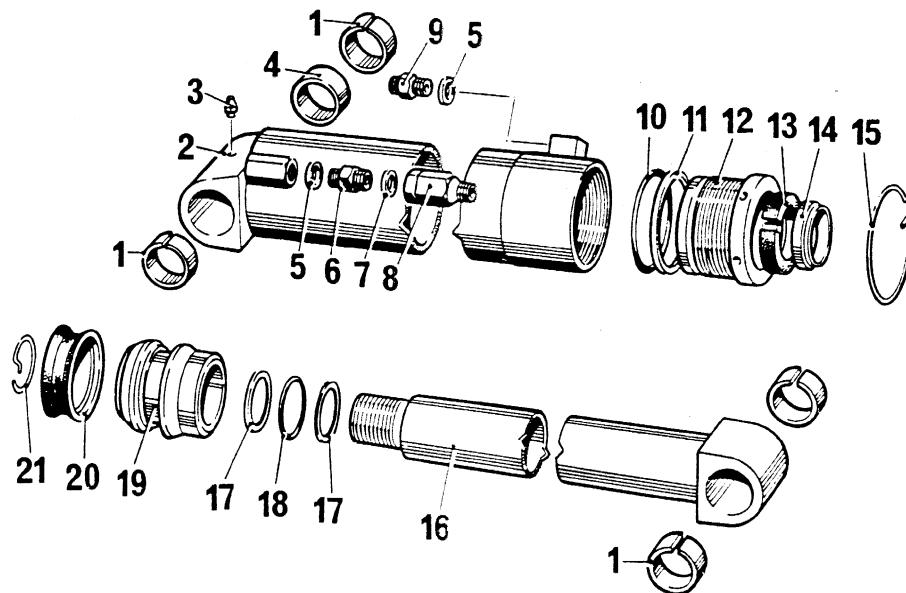
47 Crane installation is a reversal of removal with particular attention being paid to the following points.

47.2 Retaining nuts and bolts must be tightened to a torque of 1633 Nm (1205 lbf ft).

Leakage test

CRANE RAMS

Cleanliness is of the utmost importance where hydraulic systems are concerned. It is most important to exercise extreme care because the ingress of dirt or foreign matter will cause rapid wear of hydraulic components.



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- | | | |
|------------------|---------------------------|-------------------------|
| 1. Split bush | 8. Emergency safety valve | 15. Spring ring |
| 2. Cylinder | 9. Coupling | 16. Piston rod |
| 3. Grease nipple | 10. O-ring | 17. Back-up ring |
| 4. Spacer | 11. Back-up ring | 18. O-ring |
| 5. Copper washer | 12. Cylinder nut | 19. Piston |
| 6. Coupling | 13. U-ring | 20. Compact piston pack |
| 7. Copper washer | 14. Wiper seal | 21. Spring ring |

Sep 83

50 Remove spring ring (15) from cylinder nut (12). Install a well fitting pin to cylinder assembly eye. With cylinder supported and pin gripped in a vice, unscrew cylinder nut (12) and withdraw piston rod assembly from cylinder (2). Keep piston rod (16) parallel to cylinder during removal and withdraw carefully to prevent damage of piston rod or associated parts against threaded end of cylinder.

51 With piston rod assembly resting on wooden V blocks remove spring ring (21) from end of piston rod.

52 Unscrew piston (19) and remove back-up rings (17) together with O-ring (18). Remove compact piston pack (20) from piston.

53 Slide cylinder nut (12) off piston rod and remove wiper seal (14), U-ring (13), O-ring (10) and back-up ring (11).

54 Emergency safety valve (8) may be removed but must not, under any circumstances, be disassembled.

Inspection

55 Clean all components in white spirit and dry with a lint free cloth or with compressed air. Ensure that:

55.1 Cylinder is free from deep scoring and that the threads for the cylinder nut are serviceable.

55.2 Bushes are not excessively worn.

55.3 Piston rod is free from scoring and the chrome is intact.

55.4 All seals, O-rings and U-rings are renewed.

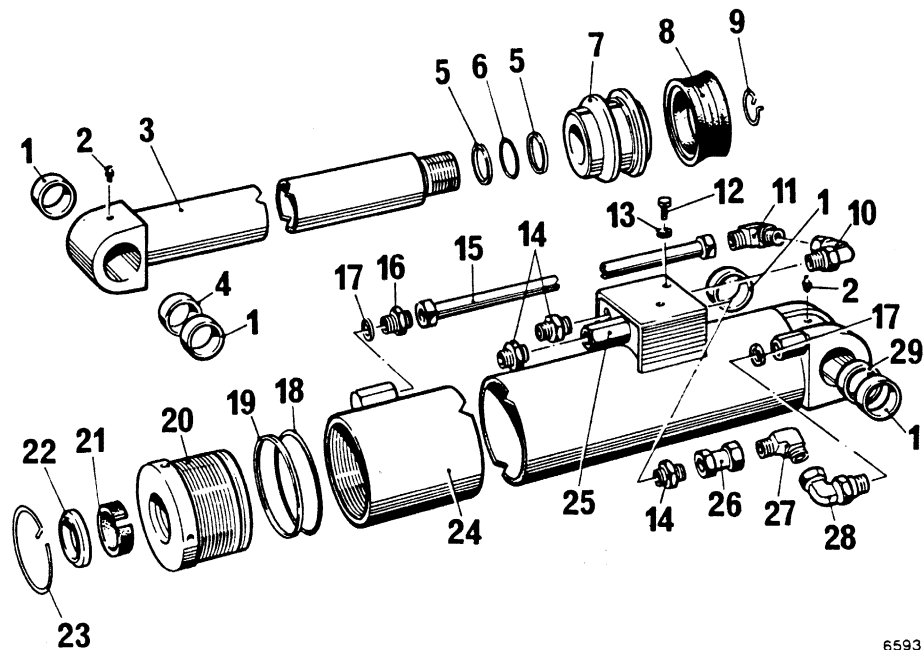
Reassembly

56 Reassembly of jib ram is a reversal of disassembly with special attention being paid to the following:

56.1 When installing piston rod assembly to cylinder take care not to damage compact piston pack on threads in end of cylinder.

56.2 When installing cylinder nut, hold cylinder in vice, as described in para 50, and tighten securely.

Main lifting ram



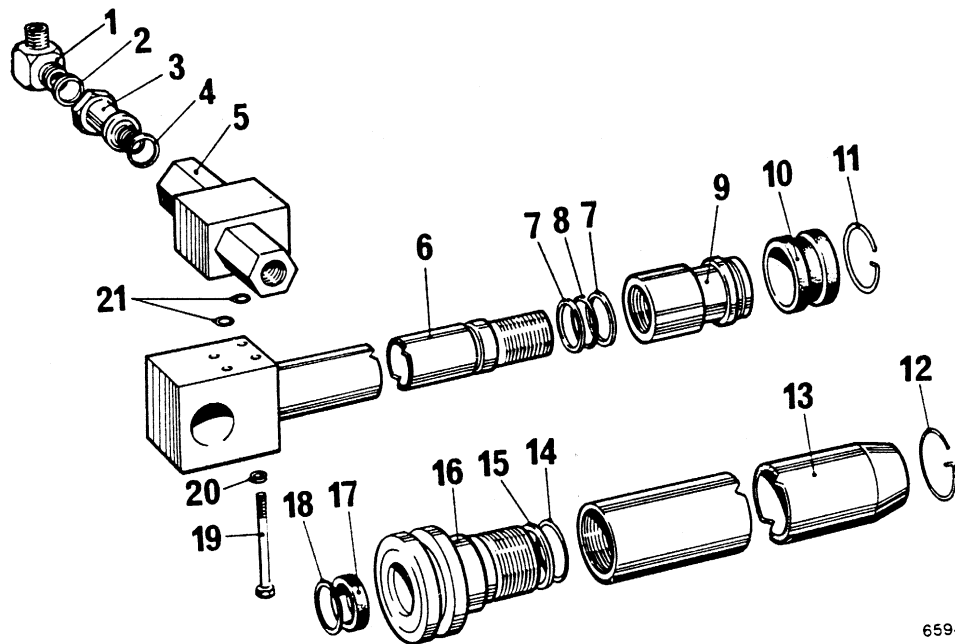
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- | | | |
|------------------------|-------------------|------------------------|
| 1. Bush | 11. Coupling | 20. Cylinder nut |
| 2. Grease nipple | 12. Bolt | 21. U-ring |
| 3. Piston rod | 13. Spring washer | 22. Wiper seal |
| 4. Spacer | 14. Coupling | 23. Spring ring |
| 5. Back-up ring | 15. Oil pipe | 24. Cylinder |
| 6. O-ring | 16. Coupling | 25. Load holding valve |
| 7. Piston | 17. Copper washer | 26. Oil pipe |
| 8. Compact piston pack | 18. O-ring | 27. Coupling |
| 9. Spring ring | 19. Back-up ring | 28. Coupling |
| 10. Coupling | | 29. Spacer |

Fig 22 - Main lifting ram

57 Disassembly, inspection and reassembly of the main lifting ram are as described in para 50 for the jib ram.

Jib extension ram



6594

- | | | |
|---------------------------|-------------------------|-------------------|
| 1. Rotary banjo | 8. O-ring | 14. O-ring |
| 2. Copper washer | 9. Piston | 15. Back-up ring |
| 3. Rotary banjo connector | 10. Compact piston pack | 16. Cylinder nut |
| 4. Copper washer | 11. Spring ring | 17. U-ring |
| 5. Load holding valve | 12. Spring ring | 18. Wiper seal |
| 6. Piston rod | 13. Cylinder | 19. Bolt |
| 7. Back-up ring | | 20. Spring washer |

Fig 23 - Jib extension ram

Disassembly

58 Support cylinder assembly as described in para 50. Remove rotary banjo (1) and load holding valve (5) from piston rod (6).

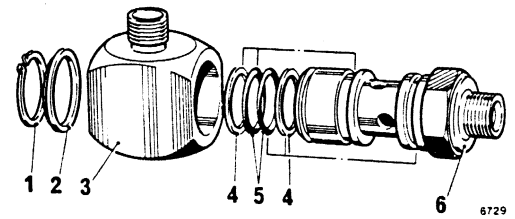
59 Unscrew cylinder nut (16) and carefully withdraw piston rod from cylinder (13).

60 With piston rod assembly resting on wooden v-blocks, remove spring ring (11) from end of piston rod.

61 Unscrew piston (9) and remove back-up rings (7) together with O-ring (8). Remove compact piston pack (10) from piston.

62 Remove cylinder nut from piston rod and withdraw wiper seal (18) and U-ring (17) from nut. Remove back-up ring (15) and O-ring (14) from cylinder.

63 If rotary banjo is disassembled ensure it is reassembled as shown.



- | | |
|------------|-----------------|
| 1. Circlip | 4. Back-up ring |
| 2. Washer | 5. O-ring |
| 3. Body | 6. Adaptor |

Fig 24 - Rotary banjo

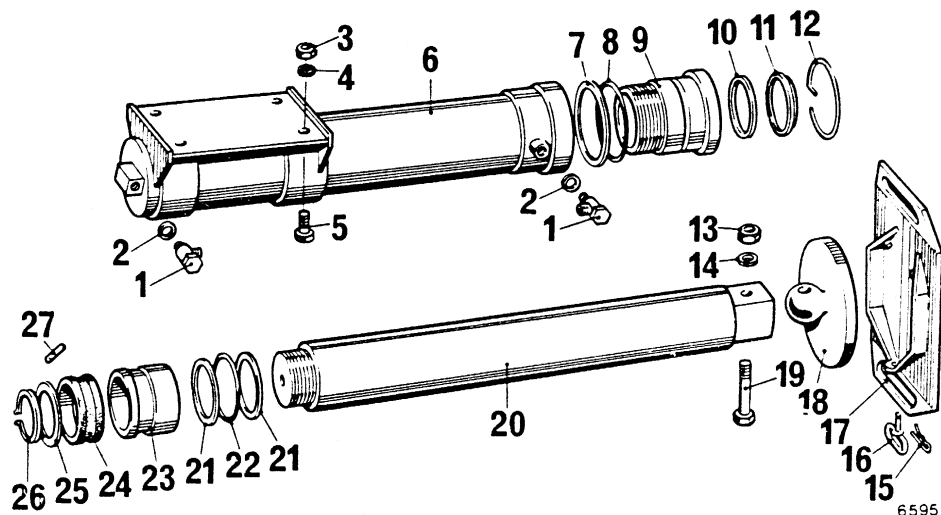
Inspection

64 Inspect components as described in para 55. Renew all O-rings and U-rings.

Reassembly

65 Reassembly is a reversal of disassembly taking care, when installing piston rod assembly to cylinder not to damage U-rings against threads in end of cylinder.

Stabilizer rams - Disassembly



- | | | |
|------------------|---------------------|-------------------------|
| 1. Coupling | 10. U-ring | 19. Bolt |
| 2. Copper washer | 11. Wiper seal | 20. Piston rod |
| 3. Nut | 12. Spring ring | 21. Back-up ring |
| 4. Spring washer | 13. Nut | 22. O-ring |
| 5. Bolt | 14. Spring washer | 23. Piston |
| 6. Cylinder | 15. Retaining clip | 24. Compact piston pack |
| 7. O-ring | 16. Retaining pin | 25. Washer |
| 8. Back-up ring | 17. Support plate | 26. Circlip |
| 9. Cylinder nut | 18. Stabilizer foot | 27. Dowelpin |

Fig 25 - Stabilizer ram

66 Remove spring ring (12) from cylinder nut (9). Unscrew cylinder nut and withdraw piston rod assembly from cylinder (6) taking care not to damage piston rod or associated parts against threaded end of cylinder.

67 With piston rod assembly resting on wooden V blocks remove circlip (26) from end of piston rod (20). Tilt piston rod and extract dowel (27). Unscrew piston (23) from piston rod and remove compact piston pack (24). Remove back-up rings (21) and O-ring (22).

68 Slide cylinder nut from piston rod and remove wiper seal (11) and U-ring (10).

Inspection

69 Inspect components as described in para 55. Renew all seals.

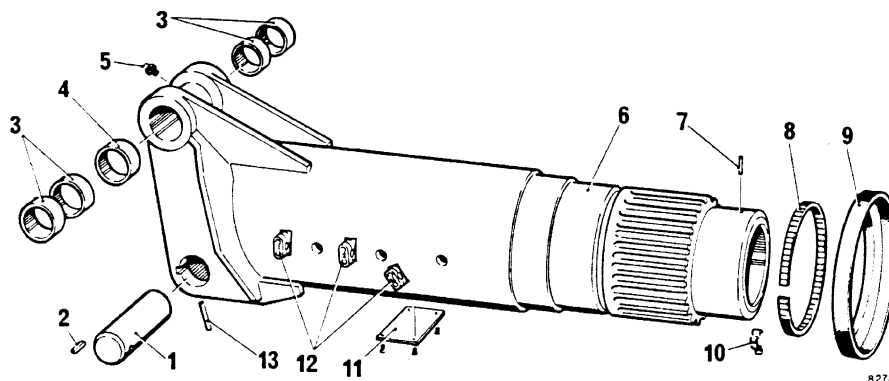
Reassembly

70 Reassembly is a reversal of disassembly taking care, when installing piston rod assembly to cylinder, not to damage piston rod or components against threads in end of cylinder.

CRANE CENTRE COLUMN

CAUTION ...

The dowel bolts are screwed into both the crane base and foot bearing. If bolts are removed there is a possibility of crane bearing becoming displaced when centre column is removed.



- | | | |
|-----------|------------------------|---------------------|
| 1. Pin | 5. Grease nipple | 10. Clamp |
| 2. Key | 6. Crane centre column | 11. Name plate |
| 3. Bush | 7. Dowel pin | 12. Clip |
| 4. Spacer | 8. Clamping band | 13. Cylindrical pin |
| | 9. Rubber collar | |

Fig 26 - Crane centre column

Removal

71 Remove jib and boom as described in para 34, with the jib and boom in the true fore and aft positions. This will ensure that slew pistons are in the central position when the centre column is removed.

72 Mark and identify flexible hoses which are routed through centre column and secured at connection block. It is essential that these hoses are marked otherwise errors may occur when reassembling.

73 Partially unscrew dowel bolts (Fig 28 (15)) sufficiently for dowel end of bolts (which fit into a peripheral groove at base of centre column) to clear groove.

74 Mark position of centre column relative to crane base. Sling and lift centre column clear of base.

Installation

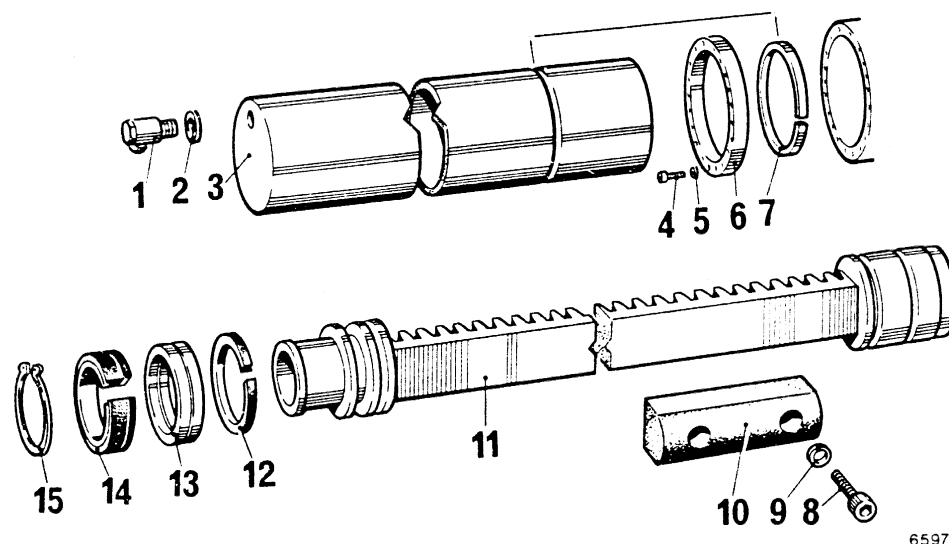
75 Installation of centre column to crane base is a reversal of removal paying particular attention to the following:

75.1 Slew pistons must be in the central position.

75.2 when installing centre column, identification marks made prior to removal must be correctly aligned.

75.3 Align clamping band (Fig 26 (8)) in crane base to allow dowel pin (7) on centre column to locate in clamping band.

SLEWING RAMS



1. Coupling
2. Copper washer
3. Cylinder
4. Allen screw
5. Spring washer

6. Flange ring
7. Holding ring
8. Allen screw
9. Spring washer
10. Guide block

11. Slew rack
12. Wiper seal
13. Piston guide ring
14. U-ring
15. Circlip

Fig 27 - Slewing rams

Disassembly

76 Slew piston seals can be renewed without removing slew rack (11) from crane base.

77 Disconnect and cap pipe connections at banjo coupling (1). Remove coupling from cylinder.

78 Remove socket headed bolts (4) securing flange ring (6) to crane base. Release fastening ring (7) and withdraw cylinder tube (3) to expose piston head and components.

79 Release circlip (15) and remove U-ring (14), guide piece (13), and wiper seal (12), noting which way round they are installed.

80 If removal of slew rack is required, it is necessary to first remove centre column as described in para 71-73.

81 Prior to removal of slew rack measure and record the distance that piston head protrudes from flange face of crane base so that rack can be repositioned correctly on installation.

82 Remove screws (8) and carefully withdraw slew rack and guide block (10).

Reassembly

83 Reassembly of slewing rams is a reversal of disassembly with particular attention being paid to the following:

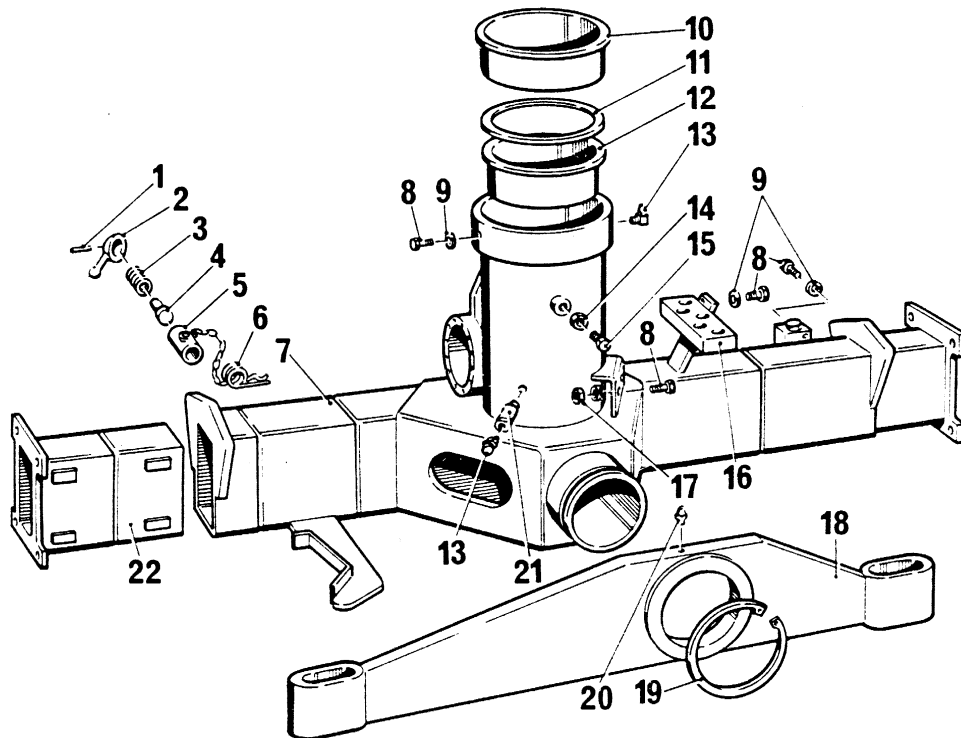
83.1 When installing rack to crane base and cylinder to crane base, care is taken not to damage seals.

83.2 The slew rack must be placed in crane base in the same position as it was before removal.

83.3 Ensure that after cylinder installation the hydraulic oil reservoir is topped up as described in Operating Information.

83.4 The slew ram control valve is operated and the slewing rams exercised a few times to fill them with oil.

CRANE BASE



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- | | | |
|-----------------------|-------------------|-----------------------------|
| 1. Adaptor sleeve | 8. Belt | 16. Duct block |
| 2. Lever | 9. Spring washer | 17. Nut |
| 3. Compression spring | 10. Neck bearing | 18. Bearer |
| 4. Pin | 11. Thrust washer | 19. Circlip |
| 5. Housing | 12. Foot bearing | 20. Grease nipple |
| 6. Spring pin | 13. Grease nipple | 21. Grease nipple extension |
| 7. Crane base | 14. Nut | 22. Extension box |
| | 15. Dowel bolt | |

Fig 28 - Crane base

84 Access to upper bearing in crane base can only be gained after removal of crane centre column as described in para 71.

85 Access to lower bearing in crane base can only be gained after removal of slewing rams as described in para 76.

86 Upper bearing is retained by dowel bolts (15) which are locked in position by nuts (14). Lower bearing is similarly retained.

87 When installing new bearings it is necessary to proceed as follows:

87.1 Install lower bearing in crane base and drill and tap bearing to accept dowel bolts. It is most important to note that upper and lower bearings are manufactured from 'Tufnol'. To prevent swelling of bearing during drilling or tapping only sharp drills and taps must be used.

87.2 Repeat procedure for upper bearing.

88 Crane base bearer (18) can be removed from crane base after releasing circlip (19).

