Section F

Transmission

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Contents **Page No.**

Contents **Page No.**

Technical Data

Synchro Shuttle Gearbox

Unit Identification

The gearbox serial number is stamped on the unit identification plate **1-A** as shown.

When ordering replacement parts, always quote the details on the unit identification plate. In the case of gear replacements, always check the part number stamped on the gear, and the number of teeth.

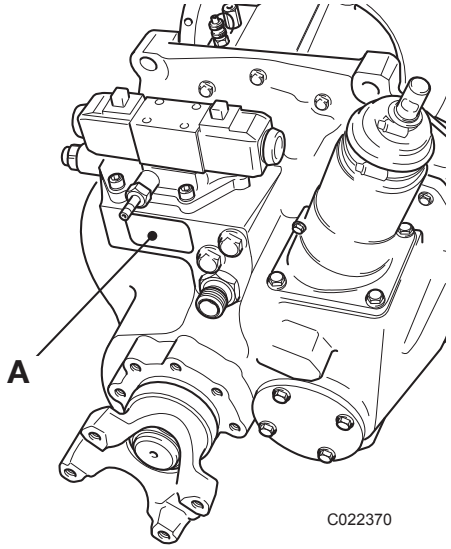

Fig 1.

SS600 4-speed (2 wheel drive)

Specifications

Table 1. SS600

Description	Combined torque converter, reverser and gearbox unit with optional four wheel drive output.	
Gear Ratios		
		Std Ratio
	1st	5.55 : 1
	2nd	3.45 : 1
	3rd	1.83 : 1
	4th	1.00 : 1
Torque Converter		
	Torque Converter Dia.	279 mm (11 in.)
	Torque Multiplication at Stall	2.20 : 1
	Minimum Engine Speed at Converter Stall	1650 - 1750 rev/min

Converter Pressures (in neutral)		**bar**	**kgf/cm²**	**lbf/in²**
Converter In at 50 °C	1000 rev/min	2.4 - 3.4	2.5 - 3.5	35 - 50
	2000 rev/min	5.9 - 7.9	6.0 - 8.1	85 - 115
Converter In at 100 °C	1000 rev/min	1.3 - 2.0	1.4 - 2.1	20 - 30
	2000 rev/min	5.2 - 5.9	5.3 - 6.0	75 - 85
Converter Out at 50 °C	1000 rev/min	1.0 - 1.7	1.1 - 1.8	15 - 25
	2000 rev/min	2.1 - 3.1	2.1 - 3.2	30 - 45
Converter Out at 100 °C	1000 rev/min	0.3 - 0.6	0.3 - 0.6	4.0 - 8.0
	2000 rev/min	1.0 - 1.7	1.1 - 1.8	15 - 25
Converter In Relief Valve Pressure (max)		7.9	8.1	115

Table 2. SS600

Lubrication Pressures (in neutral)		**bar**	**kgf/cm²**	**lbf/in²**
At 50 °C	1000 rev/min	0.2 - 0.3	0.2 - 0.4	3.0 - 5.0
	2000 rev/min	0.4 - 0.7	0.4 - 0.7	6.0 - 10.0
At 100 °C	1000 rev/min	0.1 - 0.2	0.1 - 0.2	2.0 - 3.0
	2000 rev/min	0.3 - 0.6	0.3 - 0.6	4.0 - 8.0
Main Line Pressure (in neutral)		**bar**	**kgf/cm²**	**lbf/in²**
At 50 °C	1000 rev/min	9.3 - 10.3	9.5 - 10.5	135 - 150
	2000 rev/min	10.7 - 11.7	10.9 - 12.0	155 - 170
At 100 °C	1000 rev/min	9.3 - 10.3	9.5 - 10.5	135 - 150
	2000 rev/min	9.3 - 10.3	9.5 - 10.5	135 - 150
Clutch Pressures		**bar**	**kgf/cm²**	**lbf/in²**
At 50 °C	1000 rev/min	8.3 - 9.0	8.4 - 9.1	120 - 130
	2000 rev/min	9.0 - 10.0	9.1 - 10.2	130 - 145
At 100 °C	1000 rev/min	8.3 - 9.0	8.4 - 9.1	120 - 130
	2000 rev/min	8.3 - 9.0	8.4 - 9.1	120 - 130
Flow Rates (in neutral)		**L/min**	**US gal/min**	**UK gal/min**
Cooler at 50 °C	1000 rev/min	11.4 - 13.6	3.0 - 3.6	2.5 - 3.0
	2000 rev/min	20.5 - 22.7	5.4 - 6.0	4.5 - 5.0
Cooler at 100 °C	1000 rev/min	10.2 - 12.5	2.7 - 3.3	2.3 - 2.8
	2000 rev/min	22.7 - 26.1	6.0 - 6.9	5.0 - 5.7
Pump at 50 °C	1000 rev/min	11.0 - 15.0	2.9 - 4.0	2.5 - 3.3
	2000 rev/min	22.5 - 29.5	6.0 - 7.8	5.0 - 6.5

Front Axle

Unit Identification

The axle serial number is stamped on the unit identification plate **2-A** or as applicable.

When ordering replacement parts, always quote the details on the unit identification plate. In the case of gear replacements, always check the part number stamped on the gear, and the number of teeth.

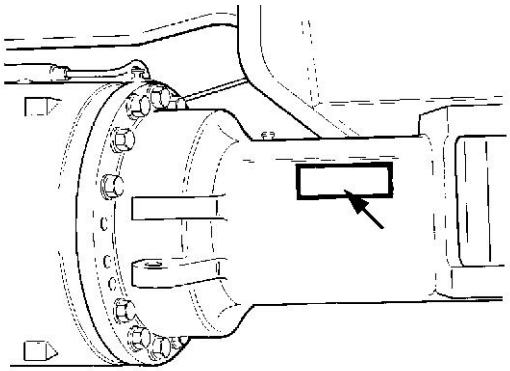

Fig 2.

Designation

PD70 Axle	
Hubs	70 Series
Hub swivels and drive shafts	70 Series
Drive head	80 Series

Specifications

Type	Epicyclic
Weight (approximate)	386 kg (852 lb)
Overall Gear Ratio	18.16 : 1 24.975 : 1 German

Rear Axle - 2WD Machines

Unit Identification

The axle serial number is stamped on the unit identification plate **3-A** as shown.

When ordering replacement parts, always quote the details on the unit identification plate. In the case of gear replacements, always check the part number stamped on the gear, and the number of teeth.

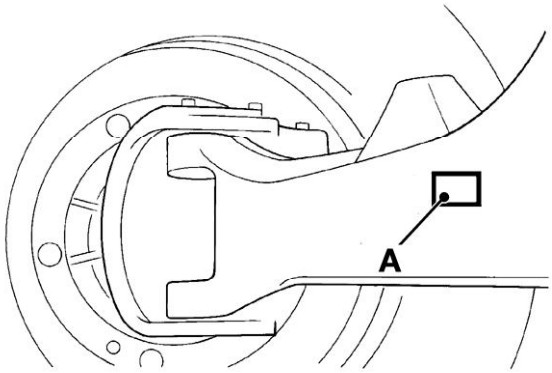

Fig 3.

Designation

S55 Axle	
Hubs	Dead Steer Hubs
Hub swivels and drive shafts	55 Series
Drive head	-

Specifications

Weight with Steer Rams (but without wheels)	278 kg (613 lb)
Toe-in	Zero
Camber Angle	3° Positive
Castor Angle	2°
King-pin Angle	Zero
Oscillation	+ 6°

Rear Axle - 4WD Machines

Unit Identification

The axle serial number is stamped on the unit identification plate or **4-A** as applicable.

When ordering replacement parts, always quote the details on the unit identification plate. In the case of gear replacements, always check the part number stamped on the gear, and the number of teeth.

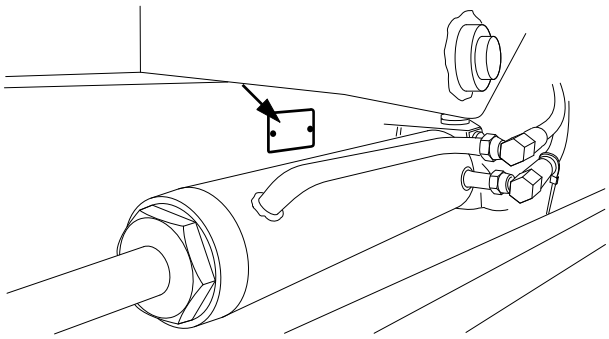

Fig 4.

Designation

SD55 Axle	
Hubs	55 Series
Hub swivels and drive shafts	55 Series
Drive head	55 Series

Specifications

Weight with Steer Rams (but without wheels)	352 kg (776 lb)
Overall Gear Ratio (JCB Syncro Shuttle)	18.6 : 1
Crownwheel and Pinion Ratio	3.44 : 1
Oscillation	+/- 9°
Castor Angle	2°
Camber Angle	2° Positive
King-pin Inclination	Zero
Toe-in	Zero

Tyre Pressures

Table 3. Front Tyres

	Bar	lbf/in²
15.5/80 x 24 x 10	3.0	44
15.5 x 25 x 8	3.0	44
16.5/85 x 24 x 8	3.0	44
16.9 x 24 x 12 (926 only)	2.0	29

Table 4. Rear Tyres - 926 Machines

	Bar	lbf/in²
9.00 x 16 x 8	3.9	57
10.5 x 18 x 10	2.5	36
11L x 16 x 10	3.6	52
12.5/80 x 18 x 8	1.5	22
12.5 x 18 x 10	1.7	25
12.5/80 x 18 x 10	1.7	25
14 x 17.5 x 10 (NORTH AMERICA 4WD only)	1.7	25

Table 5. Rear Tyres - 930 Machines

	Bar	lbf/in²
10.5 x 18 x 10	3.7	54
12.5/80 x 18 x 8	2.1	30
12.5 x 18 x 10	2.1	30
12.5/80 x 18 x 10	2.1	30
14 x 17.5 x 10 (NORTH AMERICA 4WD only)	2.4	35
14.5/75 x 16.1 x 10 (NORTH AMERICA 2WD only)	2.76	40

Basic Operation

General Description

Transmission

The powertrain includes the transmission unit (Syncro Shuttle), which is coupled directly to the engine, and the front axle. In four-wheel drive the rear axle is also driven.

The JCB Syncro Shuttle combines a torque converter, a hydraulic reverser unit and a four-speed gearbox.

Forward and reverse drive are selected by a lever-operated switch on the steering column. The switch operates a valve on the Syncro Shuttle which directs the hydraulic oil pressure to the forward or the reverse clutch.

The gearbox has synchromesh on all four gears and is manually operated from a lever in the cab. To change gear on the move the drive is disengaged by a transmission dump pedal.

The final drive to the front road wheels is through a short output shaft to the drive axle. In 4-wheel drive a second output shaft drives the rear wheels. On standard machines, 2- or 4-wheel drive is selected by a lever in the cab.

All gears are available in forward and reverse drive and in 2- and 4- wheel drive.

Axle

The front axle consists of a centre casing (drivehead) and two axle arms. The drivehead houses the differential gearing and two sets of oil-immersed brake discs. The axle arms house the halfshafts. Specially shaped spider gears in the differential provide 'torque proportioning'. This means that drive power will be kept on one wheel if the other is slipping.

On two-wheel drive versions the rear axle is also known as the steer axle. On both versions the rear axle is connected to the machine by a horizontal centre pivot. This allows the wheels to ride up and down over uneven ground.

On four-wheel drive versions, the rear axle is known as the steer drive axle. It works on the same principle as the front axle, but has a single-piece casing which houses the differential and halfshafts. There are no brakes in the rear axle.

The wheel hubs are connected to the halfshafts through universal joints which drive sun-and-planet gears inside the hubs.

Moving a Disabled Machine

Do not tow a machine unless there is no alternative. Remember that further damage might be caused to the machine by towing it. If at all possible repair the machine where it stands.

If the machine must be towed, read the following CAUTION and use the procedure given below.

⚠ CAUTION

Towing a machine too far or too fast can damage the transmission. Do not tow the machine further than one mile. Use a trailer for greater distances. When towing do not travel faster than 15 mph (25 km/h).

Use a rigid draw-bar. If a towing chain must be used, then use two towing vehicles. One towing vehicle should be coupled to the front of the disabled machine. The other towing vehicle should be coupled to the rear of the disabled machine, to provide braking power.

The towing vehicle(s) must have enough pulling and braking power to move and stop the machine.

2-2-7-3-2

Preparation for Towing

1 Engage the Parking Brake.

2 Set the Gear Lever to Neutral (N).

3 Set the Two/Four Wheel Drive Lever to 2WD.

4 Prepare the Machine For Travel.

If the engine cannot be run, the mast and carriage must be hoisted and locked into the transport position. The procedure for doing this will depend on the machine's condition and its hydraulic circuits.

5 Attach the Tow Bar.

The machine is now ready for towing. If you will be steering the RTFL, make sure you understand what the towing driver will be doing. Obey his instructions and all pertinent regulations. Remember that the steering will be much stiffer if the engine is not running.

Synchro Shuttle Gearbox

Component Identification

See ⇨ *Fig 5. (F-11)*.

A	Forward/reverse clutch unit
B	Transmission oil pump
C	Torque relief valve
D	Oil pressure maintenance valve
E	Solenoid control valve
F	Mainshaft
G	Synchromesh unit - 3rd/4th gears
H	Layshaft
J	Synchromesh unit - 1st/2nd gears
K	Transfer gear, output shaft and yoke
P	Oil strainer
Q	Oil filter
R	Gear selection turret assembly
S	Torque converter
W	Oil pressure switch
X	Hose connection - to cooler
Y	Hose connection - from cooler

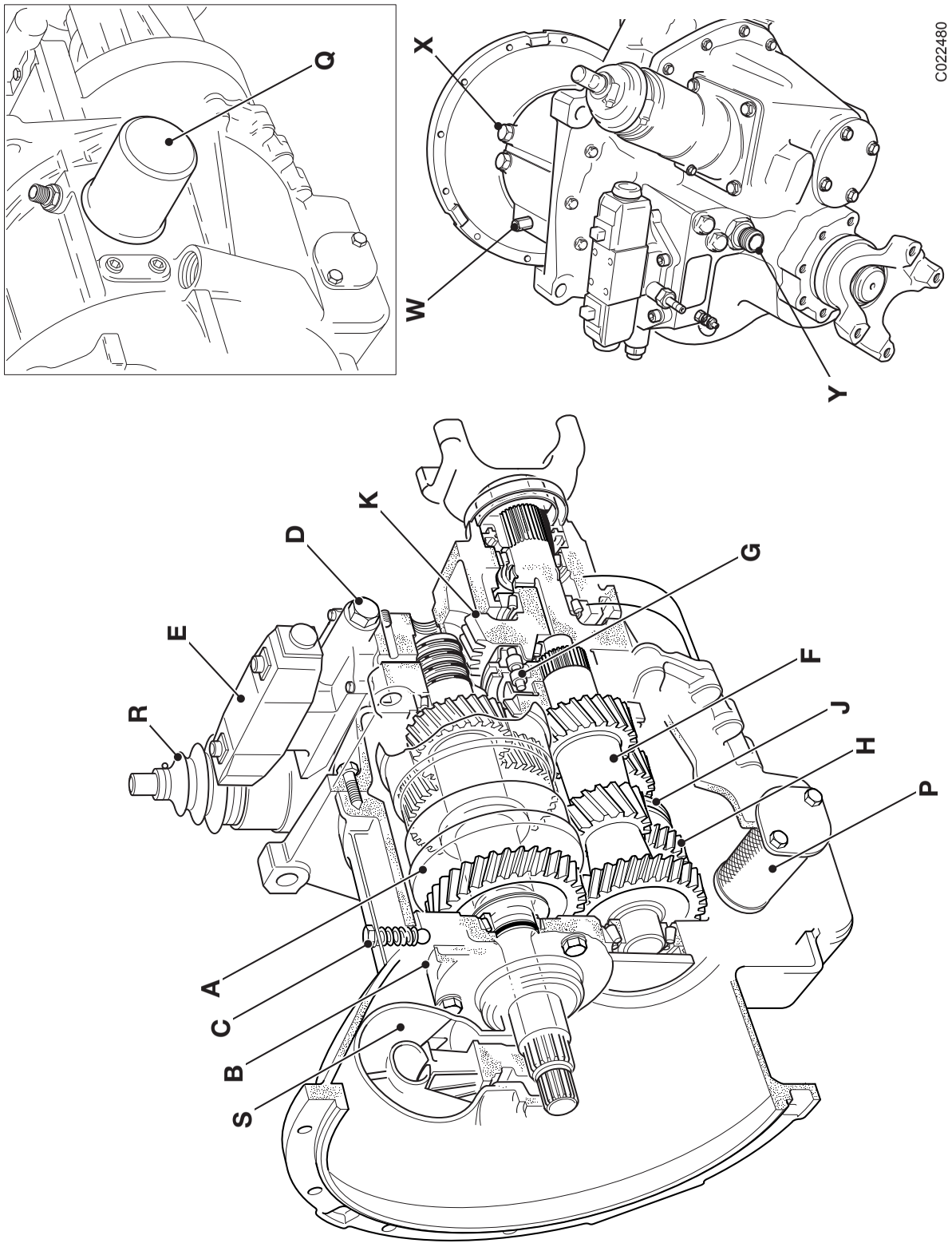

Fig 5. Synchro Shuttle Gearbox

Principle Of Operation

⇒ *Fig 5. (F-11)*.

The illustration shows a typical JCB Syncro Shuttle which consists of a torque converter, hydraulic reverser unit, and integral manual 4-speed gearbox.

The reverser unit **A** has a pair of hydraulically operated clutches giving forward - neutral - reverse drive. Oil pressure is provided by a crescent type pump **B** driven at engine speed by the drive lugs of the torque converter. The oil pressure is controlled by maintenance valve **D**, and clutch selection is achieved by means of an electric solenoid valve **E**.

Drive is transferred from the reverser unit by helical gears to the mainshaft **F**, which carries the 3rd/4th synchromesh unit **G**, and to the layshaft **H**, which carries the 1st/2nd synchromesh unit **J**. Synchromesh units are of the 'Blocking Pin' type, a full description of which is given in this section.

Drive is transmitted finally via the output shaft **K** to the front axle mounted drop box.

Gearbox oil is cooled by a liquid to liquid type cooler **Z**. The cooler is part of the rear mounted machine `cooling pack' and utilises the engine coolant as the cooling liquid.

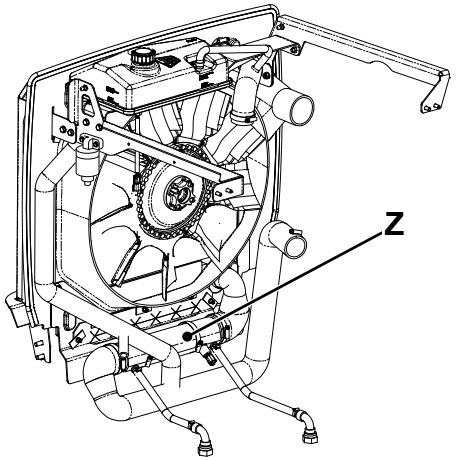

Fig 6.

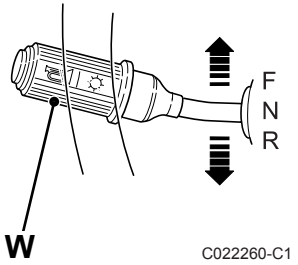

Fig 7.

Hydraulic and Electrical Operation

Key

⇒ *Fig 8. (F-14)*.

A	Forward/reverse clutch unit
A1	Forward clutch
A2	Reverse clutch
A3	Forward/reverse front shaft
B	Transmission oil pump
C	Torque converter pressure regulating valve
D	Oil pressure maintenance valve
E	Solenoid control valve
P	Oil strainer
Q	Oil filter
S	Torque converter
V	Torque converter relief valve
Z	Oil cooler

Key to Oil Flow & Pressure
Full Pressure
Pressure
Lubrication
Exhaust

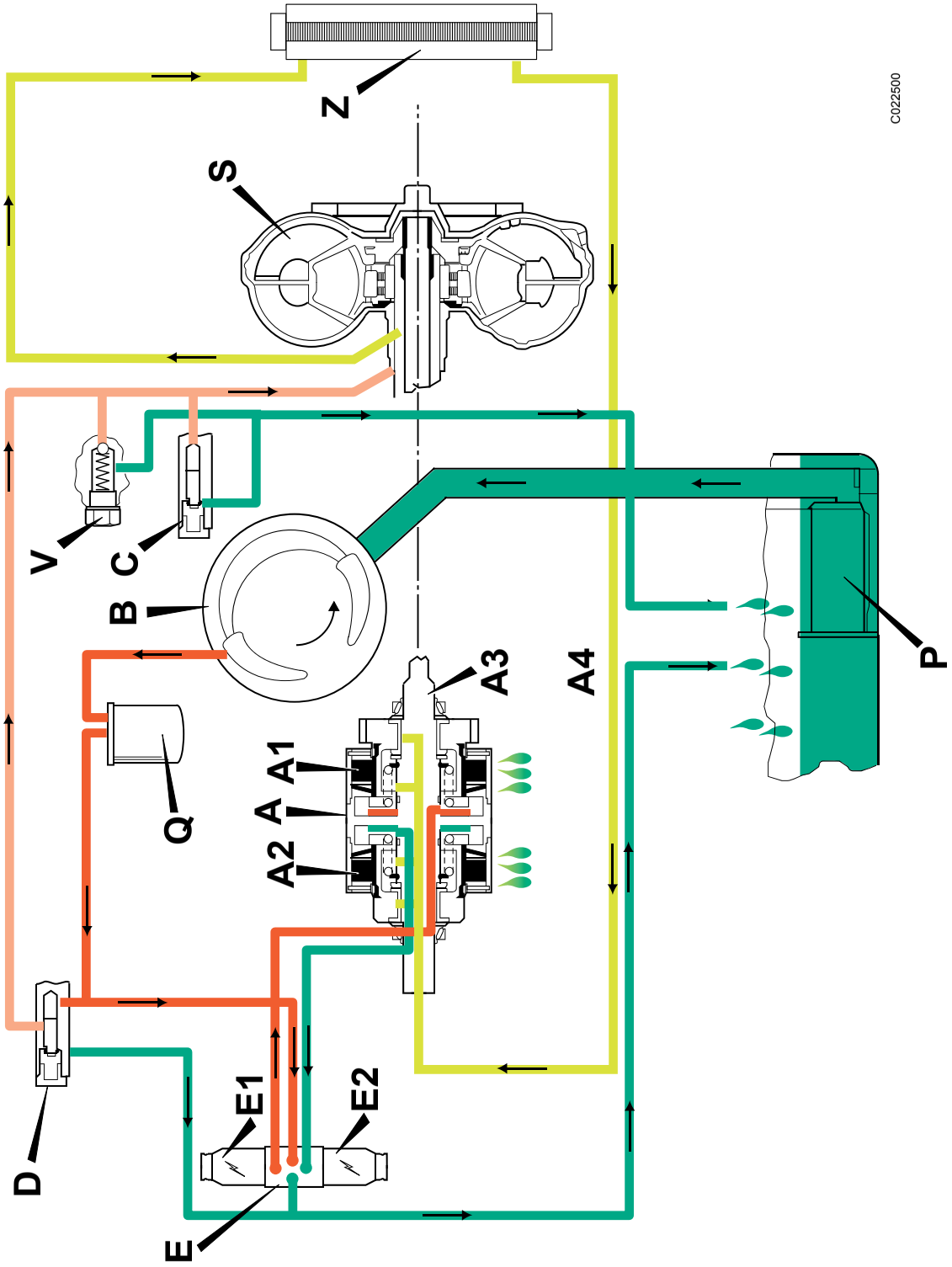

Fig 8. Hydraulic and Electrical Operation

Hydraulic Operation

Oil from the pump **B** is fed through an internal passage via the filter to the pressure maintenance valve **D**, which maintains pressure to the solenoid valve **E** for clutch selection. Excess oil from the maintainance valve flows back through the casing to the torque converter **S**. Oil enters the converter between the converter hub and the stator support, and leaves between the stator and the input shaft. Pressure in the converter is controlled by a regulating valve **C** which dumps oil from the converter line back to the sump.

Torque converter relief valve **V** acts as a safety valve should the system pressure suddenly rise obove normal, protecting the torque converter from being damaged.

Oil from the torque converter **S** flows out of the transmission to the external oil cooler **Z**, returning at the rear of the transmission unit to pass through the centre of the reverser shaft for clutch lubrication.

Pressurised oil at the solenoid valve **E** is used to control the forward/reverse clutches **A1** and A**2**.

Solenoid Valve (E) Operation

Forward:

In the diagram, electrical solenoid **E1** is energised by the forward/reverse control lever in the cab. Pressurised oil is diverted to the forward clutch **A1** and forward is selected. **A** restrictor orifice in the feed to the solenoid valve modulates the pressure to the clutch to smooth engagement. At the same time oil from reverse clutch **A2** is diverted back to the sump via solenoid valve **E**.

Reverse:

When the reverse is selected electrical solenoid **E2** is energised and pressurised oil is diverted to the reverse clutch **A2**. At the same time oil from clutch **A1** is diverted back to the sump.

Neutral:

When neutral is selected (via the control lever or the transmission dump button), the flow of the pressurised oil is blocked at the solenoid valve. No solenoids are energised and no clutches engaged.

For a further detailed description, see Systems Description, Synchro Shuttle Gearbox.

Front and Rear Axle

Cutaway of Front Axle

Note: *Machines from serial No 602798 (926) and 608419 (930) and all 940 machines (USA only) are fitted with single steer rams.*

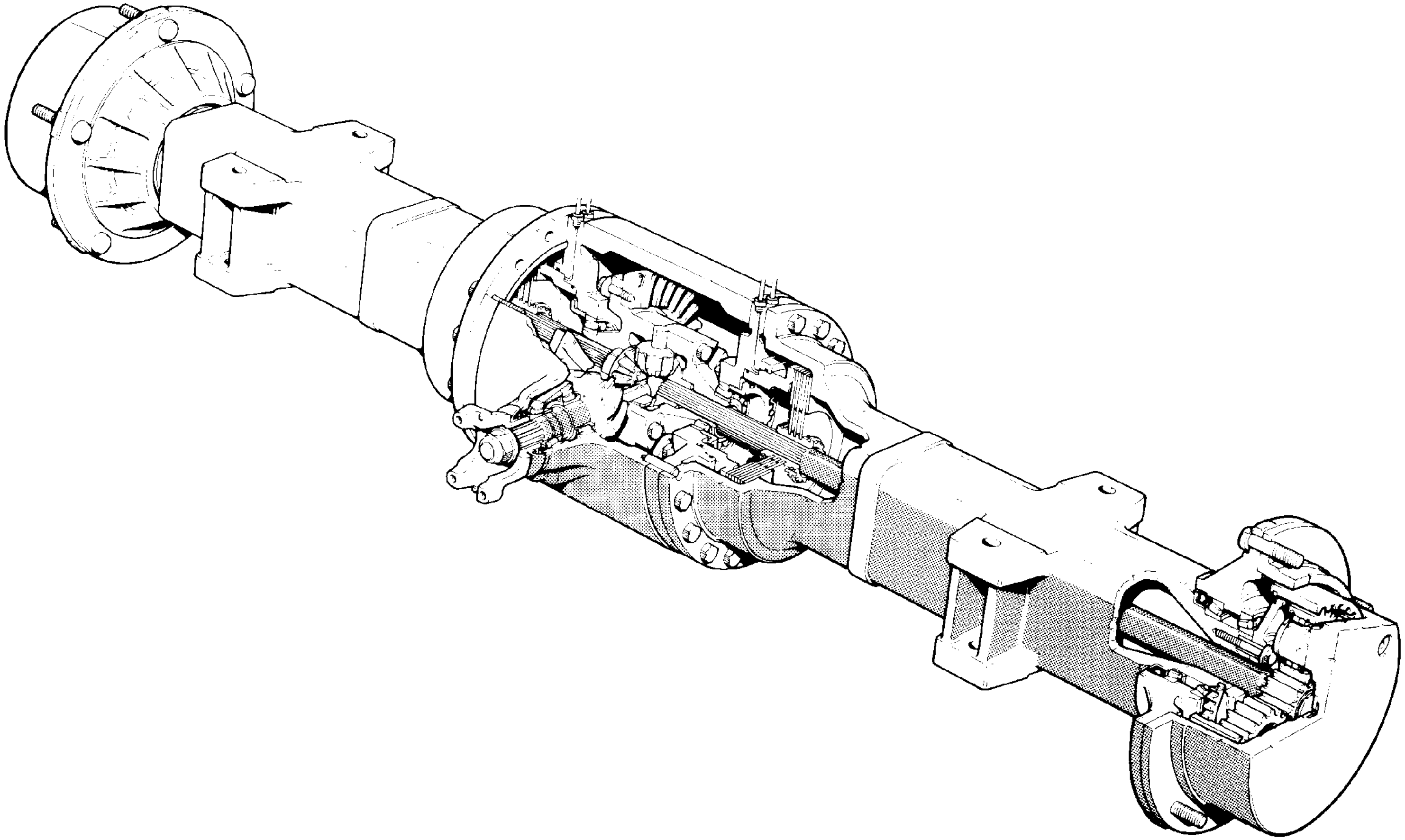

Fig 9.

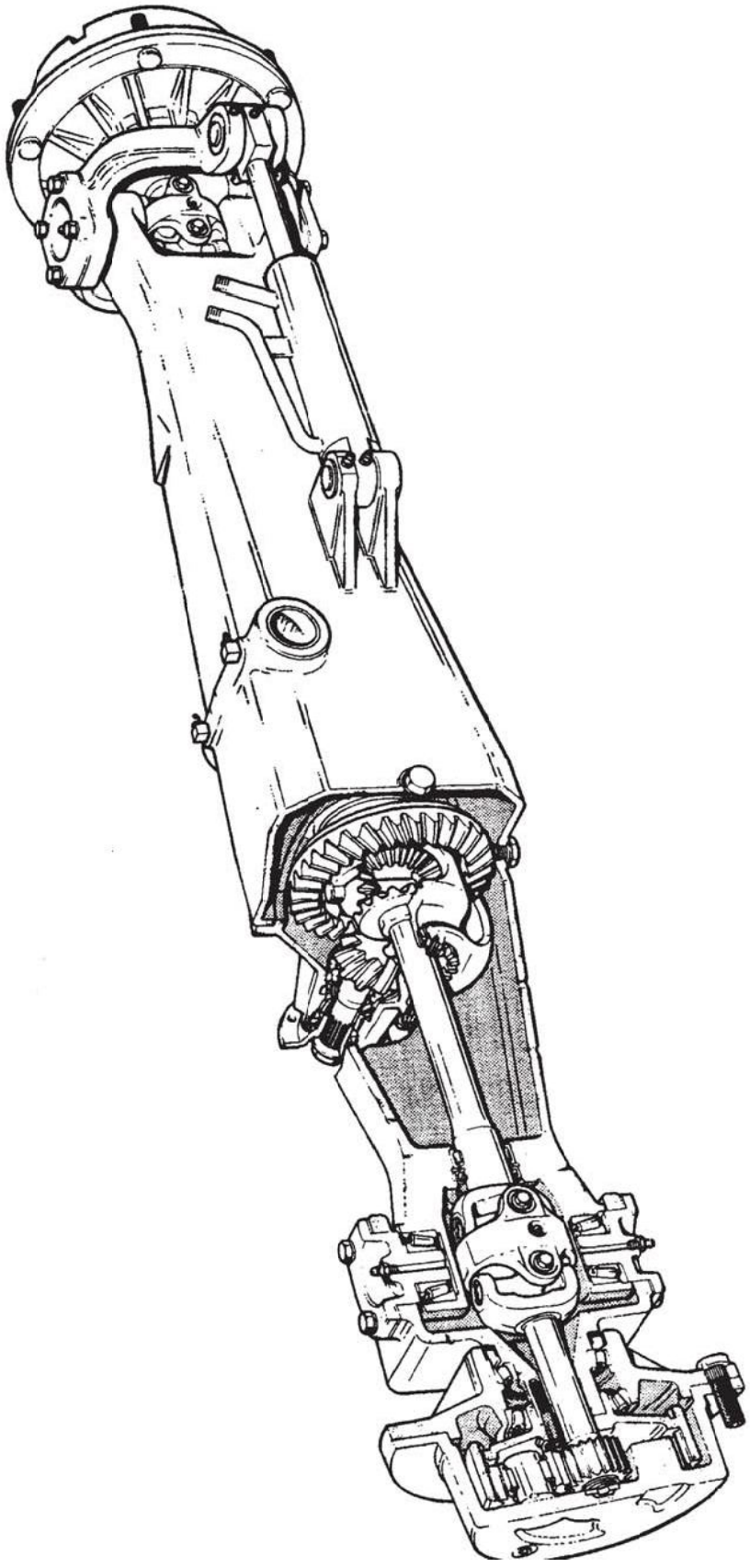

Fig 10.

Cutaway of Rear Axle - 4WD Machines

Note: *Later machines and all 940 machines (USA only) are fitted with single steer rams.*

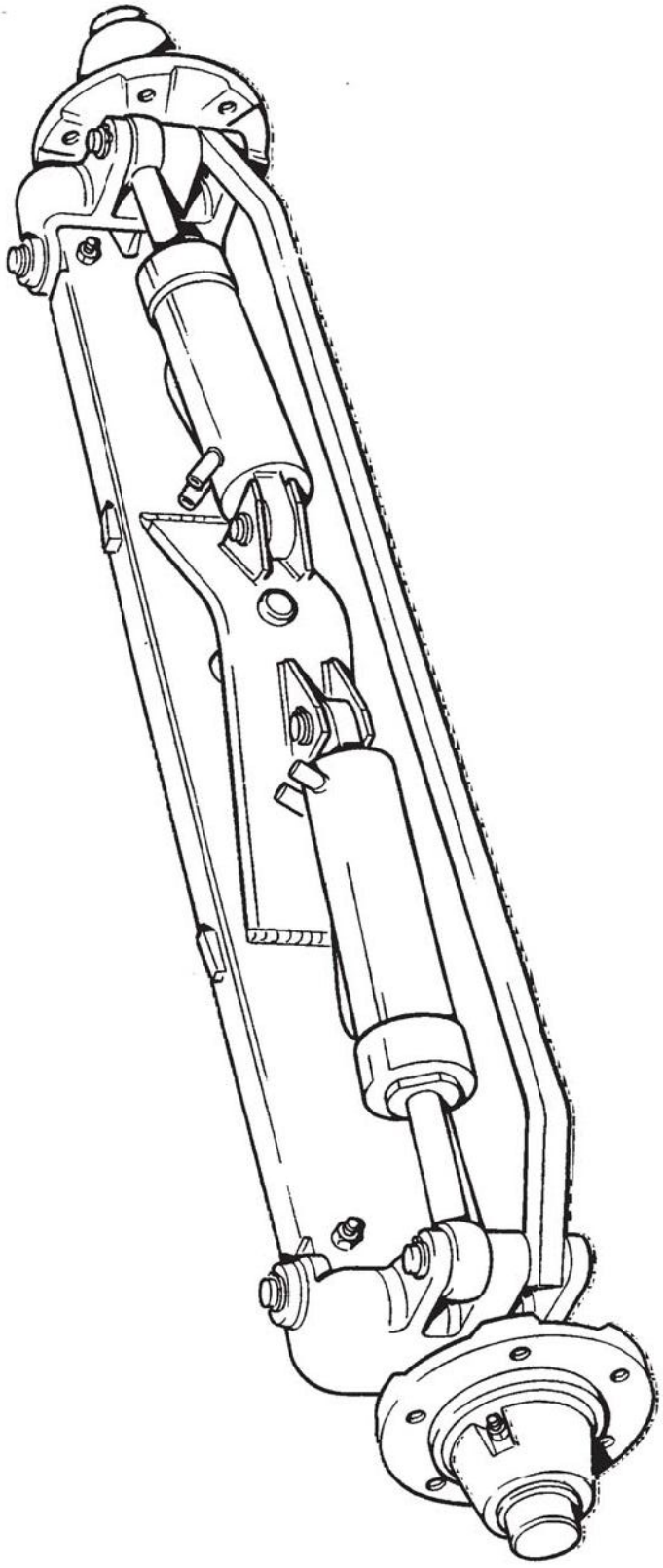

Fig 11.

Cutaway of Rear Axle - 2WD Machines

Note: *Machines from serial No. 602798 (926) and 608419 (930) and all 940 machines(USA only) are fitted with single steer rams.*

Systems Description

Synchro Shuttle Gearbox

Synchromesh (Blocking Pin Type)

The gearbox is fitted with 'Blocking Pin' synchromesh, comprising the following parts. ⇒ *Fig 12. (F-19)*.

SYNCHRO HUB (A) controls the operation of the synchromesh unit and gear selection, the selector fork fitting into the outer groove. Internal dog teeth link the selected gear to the drive shaft. Through the synchro hub centre are two sets of holes for the blocker pins **C** and the split energiser pins **D**, spaced alternately.

SYNCHRO RINGS (B) are rigidly joined by the blocker pins, with the split energiser pins held, in counterbores, between the two synchro rings.

BLOCKER PINS (C) have a narrow neck in the centre, against which the synchro hub transmits radial drive during gear changes. The edges of the blocker pin neck and their mating synchro hub holes are designed so that, as the radial loads are reduced, the synchro hub can slide over the shoulder of the blocker pin.

SPLIT ENERGISER PINS (D) take the initial axial load of the synchro hub on the shoulder of the split energiser pin neck. As the axial load reaches approximately 400 N (40.8 kg; 90 lb) the internal springs allow the split energiser pin to collapse and the synchro hub to move axially.

SYNCHRO CUPS (E) take the frictional drive from the synchro ring on their inner faces. The synchro cups are splined to drive their respective gears whilst synchronisation is taking place.

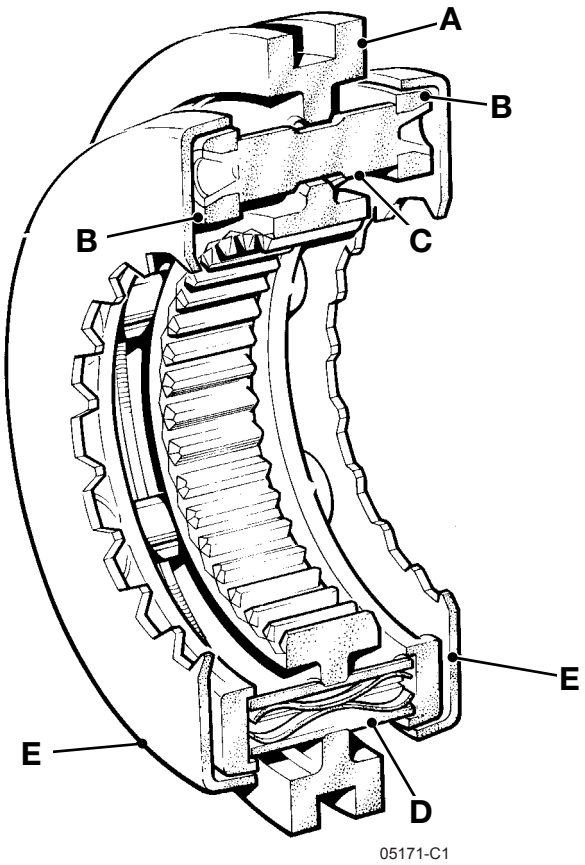

Fig 12.

Synchromesh Operation

⇨ *Fig 13. (F-21)*.

Diagram **F** shows the gearbox with first gear engaged. Synchro ring **B** is in contact with synchro cup **E** and the synchro hub dog teeth are linking first gear to the shaft gear. In this position the split energiser pins **D** are 'collapsed'.

When selecting second gear the synchro hub **A** slides along the split energiser pins until the pin recess and the synchro hub flange are in line. At this point the split energiser pins open and the synchro rings are moved by the synchro hub pushing on the split energiser pin shoulder.

Initial contact between the synchro ring and the synchro cup starts to synchronise the speed of the shaft and second gear. The rotational force of the synchro ring is taken by the blocker pin against the edge of the synchro hub hole, as at **G**.

As the axial load on the synchro hub increases, the split energiser pin 'collapses' and the conical faces of the blocking pin and synchro hub hole come into contact, as at **H**.

Further increases in the axial loads increase the frictional grip of the synchro ring and the synchro cup, causing the shaft and gear speeds to synchronise.

As the speeds are synchronised the radial load on the blocker pin and the synchro hub is reduced. This allows the synchro hub to slide freely along the blocker pin and engage its dog teeth with second gear, see diagram **J**.

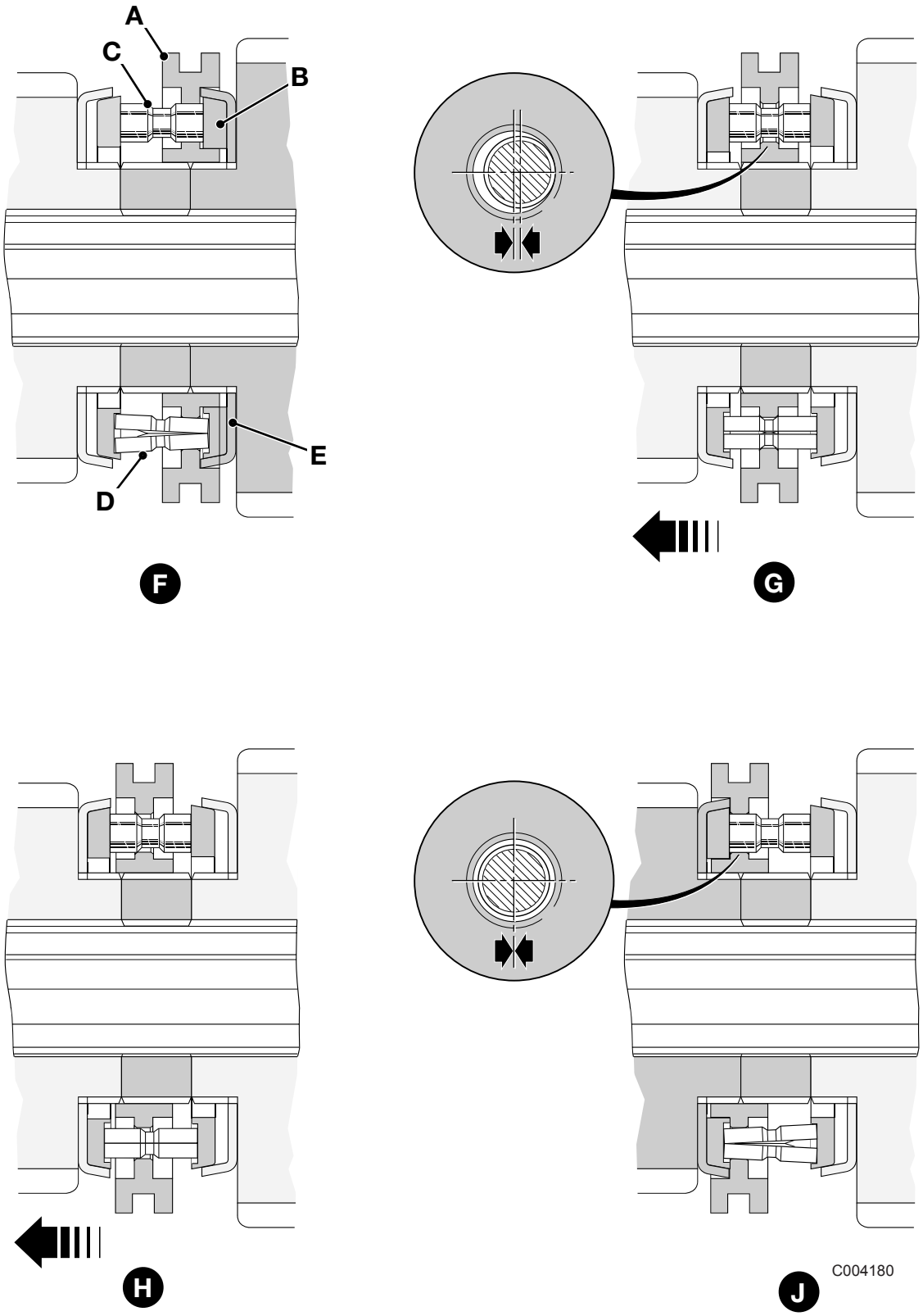

Fig 13. Synchromesh Operation

Clutch Operation

4 Wheel Drive Operation - Manual Deselect

This is a mechanical form of locking the 4WD output gear **14-F** to output shaft, driving the output yoke **14-E**.

2 Wheel Drive Mode

The spring **14-B** holds the selector fork **14-D** against the output cover and keeps selector ring **14-G** engaged onto the output shaft only. Gear **14-F** will rotate freely on the output shaft.

4 Wheel Drive Mode

When an external pulling force is applied to selector shaft **14-C**, because selector fork **14-D** is locked to the selector shaft, it will force selector ring **14-G** to engage with the dog teeth on output gear **14-F**. The movement is limited to 10 mm so that selector ring **14-G** is also engaged with the output shaft, driving yoke **14-E**.

Important: *Selection of 4WD should not be done when the vehicle is in motion. Selection on the move will result in damage to the dog teeth. If 4WD is difficult to engage, inch the vehicle forward to align the dog teeth and try again.*

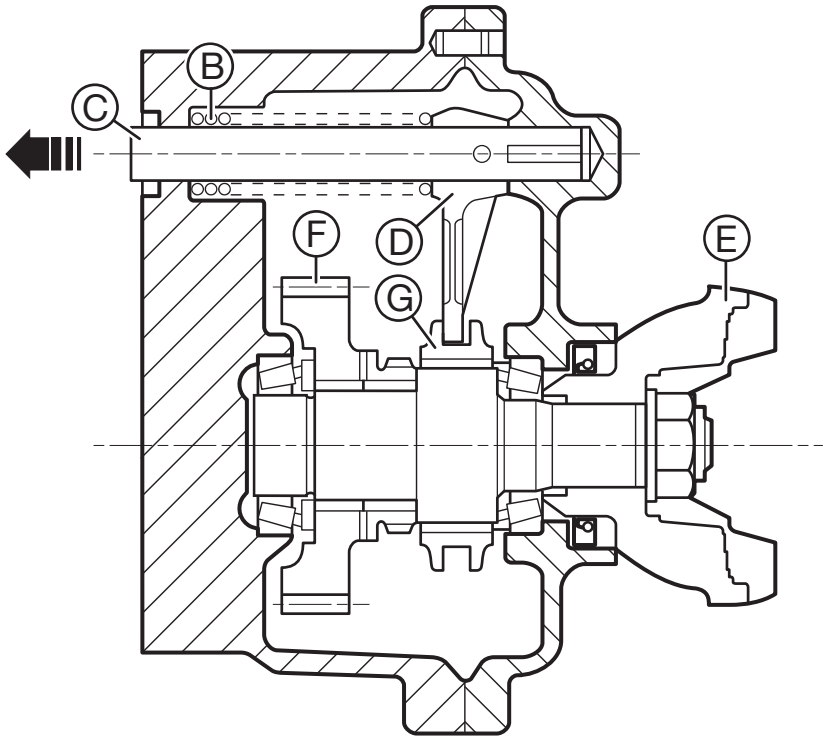

Fig 14.

Service Procedures

Front and Rear Axles

Renewing the Pinion Oil Seal

The pinion oil seal **15-3** may be renewed without removing the axle from the machine.

⚠ WARNING

A raised and badly supported machine can fall on you. Position the machine on a firm, level surface before raising one end. Ensure the other end is securely chocked. Do not rely solely on the machine hydraulics or jacks to support the machine when working under it.

Disconnect the battery, to prevent the engine being started while you are beneath the machine.

GEN-1-1

1 Remove the roadwheels and uncouple the axle propshaft. Measure the axle rolling torque and record the reading.

2 Using Service Tool 892/00812, remove the drive flange **15-1** together with its stake nut **15-2**.

3 Remove the seal **15-3** and fit a new one. Pack between the lips of the new seal with grease before fitting.

4 Fit the coupling yoke and a new stake nut:

- **a** Using Service Tool 892/00812, tighten the nut to 200 Nm (148 lbf ft; 20.4 kgf m).
- **b** Measure the rolling torque. The reading should be 0.5 to1Nm (0.37 to 0.74lbf ft; 0.05 to 0.1kgf m) more than that recorded in Step 1 (see Note).
- **c** If necessary, progressively torque tighten nut to achieve correct rolling torque.
- **d** Stake the nut using a square ended staking tool.

Note: *If the rolling torque figure (new pinion seal fitted) exceeds the reading recorded in step 1 by 1Nm (0.74 lbf ft; 0.1 kgf m) or more, then the collapsible spacer mounted on the axle pinion MUST be renewed.*

5 Refit the roadwheels and couple the propshaft.

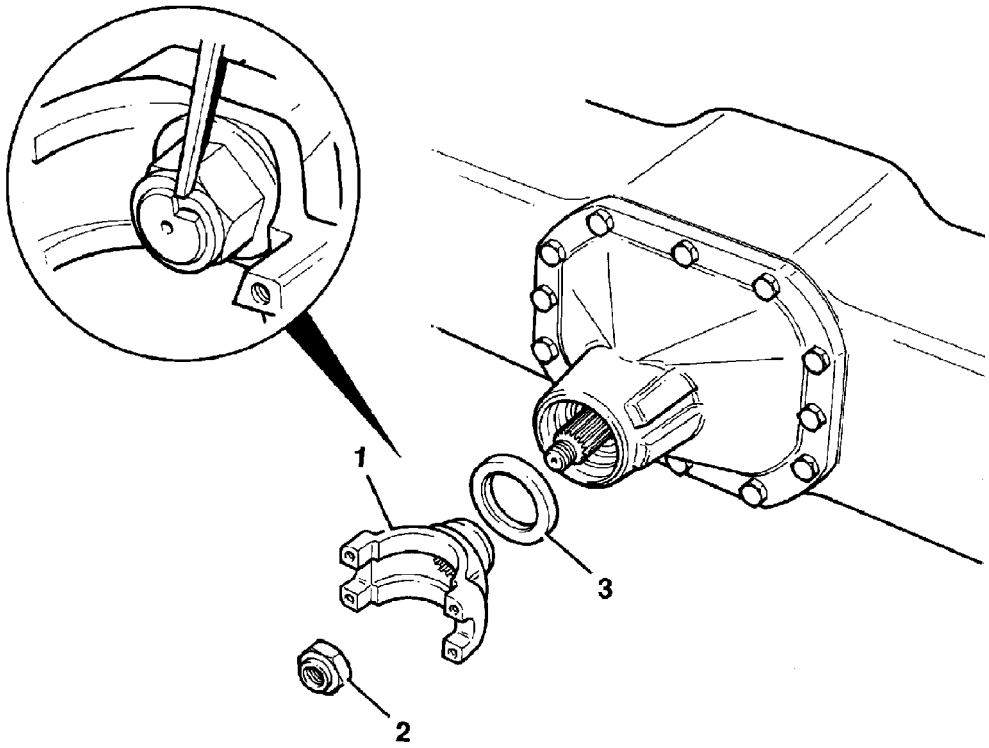

Fig 15.

Fault Finding

Gearbox Fault Finding

Before carrying out the checks listed the machine should, if possible, be operated to determine the fault area(s), and bring the systems to their normal working temperatures.

Ensure that the correct quantity and grade of oil is used and that there are no obvious leaks.

A If the transmission is noisy, start at check 1.

B If the transmission is overheating, start at check 4.

C If the transmission will not pull, start at check 12.

D If there is no drive in one or both directions, start at check 17.

E If the transmission is jumping out of gear, start at check 29.

F If the transmission is sticking in gear, start at check 39.

G If ratios are 'crash changing', start at check 41.

Action		Yes	No
1	Is there noise when selecting direction?	Check 3.	Check 2.
2	Is there noise when running with direction selector in neutral and ratio selector in 1st?	Check 9.	Check 19.
3	Is there air in the hydraulic system?	Continue running to expel air.	Check 4.
4	Is the fluid level correct?	Check 5.	Check level only when machine is cold and top up as required.
5	Are the oil passages restricted?	Clear the restriction.	Check 6.
6	Is the suction strainer restricted?	Remove and clean strainer.	Check 7.
7	Is pump pressure as specified?	Check 9.	Check clutch pressure maintenance valve is free to operate.
8	When flow testing pump, is output low?	Renew pump.	Check converter sprag clutch for wear or slip.
9	Does the noise continue when direction selector is in forward or reverse?	Check 10.	Check 11.
10	Is transmission misaligned?	Renew mountings and check position.	Check 'converter out' pressure and flow.
11	Are the pump bushes worn?	Renew.	Check converter for wear or cooler for restriction to flow.
12	Is the transmission not pulling in one direction only?	Check 16.	Check 13.
13	Is the transmission not pulling in both forward and reverse?	Stall test machine, Check 14.	Check 16.

Action		Yes	No
14	Is 'converter in' pressure as specified?	Check 15.	Inspect converter relief valve for damage.
15	Is pump being driven by converter?	Check pump pressure.	Renew damaged parts.
16	Are clutch sealing rings damaged?	Tap pressure gauge into clutch feed lines to monitor pressure.	Check clutch plates for damage.
17	Is there drive in one direction only?	Check 19.	Check 18.
18	Is the start switch in the run position and supplying current to the neutral start relay?	Check 19.	Rectify.
19	Is the fault only when the transmission is hot?	Dismantle solenoid and check components.	Check microswitches, relay and wiring loom.
20	Is the noise a growl, hum or grinding?	Check gears for damage or wear.	Check 21.
21	Is the noise a hiss, thump or bumping?	Check bearings for damage or wear.	Check 22.
22	Is the noise a squeal?	Check free running gears for seizure.	Check 23.
23	Is the noise present when in neutral or when in gear?	NEUTRAL:Check 24.	IN GEAR:Check 27.
24	Is the countershaft or its bearings worn or damaged?	Renew damaged parts.	Check 25.
25	Is there excessive backlash in the gears?	Adjust by checking shaft end float.	Check 26.
26	Is the mainshaft pilot bearing worn?	Renew.	Check gear teeth for scuffing.
27	Is the mainshaft rear bearing worn?	Renew.	Check 28.
28	Are the sliding gear teeth worn or damaged?	Renew gears.	Check 29.
29	Are the selector forks loose?	Tighten screws.	Check 30.
30	Are the selector fork pads or grooves in gears worn?	Renew worn parts.	Check 31.
31	Are the dog gear teeth worn?	Renew.	Check 32.
32	Are the selector rod detent springs broken?	Renew.	Check 33.
33	Are the selector rods worn or damaged?	Renew.	Check 34.
34	Are the selector fork pads out of position?	Reposition or renew (check interlock).	Check 35.
35	Is there excessive end float in gears or shafts?	Adjust.	Check thrust washers and mating faces.
36	Is the synchroniser bronze worn?	Renew synchro pack.	Check 37.
37	Are steel chips embedded in the bronze?	Continue using, chips will either embed below bronze or be rejected.	Check 38.
38	Are the synchroniser components damaged?	Renew.	Check free running gears for seizure or damage.

Action		Yes	No
39	Are the sliding gears tight on the splines?	Free or renew.	Check 40.
40	Are chips wedged between splines of shaft or gear?	Remove chips.	Ensure that clutch is disengaged when dump pedal is pressed.
41	Are steel chips embedded in the bronze?	Continue using, chips will either embed below bronze or be rejected.	Check 42.
42	Are the synchroniser spring pins damaged?	Renew synchro.	Check 43.
43	Is the synchroniser bronze worn?	Renew synchro.	Check blocker pins.

Transmission Oil Cooling

Fault Finding

The following procedure details the Fault Finding, Oil Cooler Testing and Flushing of the transmission oil cooling system.

Note: *The causes of water ingress could be contamination during filling/top up, working in deep water or oil cooler failure. If in doubt see* ***Testing Oil Cooler****.*

Table 6. Emulsified oil.

Probable Cause	Action
Water ingress. Maximum water content 0.10%.	Find source and rectify, carry out Flushing procedure and refill with JCB Transmission Fluid.

Table 7. Dipstick blown out, oil leaking from dipstick tube.

Probable Cause	Action
Water ingress.	Find source and rectify, carry out Flushing procedure and refill with JCB Transmission Fluid.
Steam generated by heat from torque converter causing pressure build up.	
Over filling the transmission oil system.	Drain the oil level to the correct level, see ***Checking Transmission Oil Level***.
Incorrect dipstick fitted.	Check correct dipstick is fitted.

Table 8. Friction lining separation from clutch plate.

Probable Cause	Action
Water ingress.	Renew friction plates, carry out Flushing procedure and refill with JCB Transmission Fluid.

Table 9. Badly worn/noisy bearings.

Probable Cause	Action
Water ingress.	Fit new bearings, carry out Flushing procedure and refill with JCB Transmission Fluid.
Insufficient lubrication.	Fit new bearings and refill with JCB Transmission Fluid.

Table 10. Clutch piston seizing.

Probable Cause	Action
Water ingress causing Verton material to swell, when hot, and stick.	Carry out Flushing procedure and refill with JCB Transmission Fluid. ***Note:*** *If after a period of service without water contamination seizing still occurs, renew piston.*
Overheating transmission oil.	Check machine cooling system, rectify as required.

Synchro Shuttle Gearbox

Dismantling, Inspection and Assembly

The procedures for dismantling, inspection and assembly are described in a separate publication, see ***Transmissions Service Manual*** (publication No. 9803/8610) for full details. Make sure that you identify the gearbox correctly, see ***Technical data - Unit Identification*** in this section for details.

Front and Rear Axles

Front Axle Hub and Driveshaft

Dismantling and Assembly

The procedures for dismantling and assembly are described in a separate publication, see ***Transmissions Service Manual*** (publication No. 9803/ 8610) for full details. Make sure that you identify the Front Axle Hub and Driveshaft correctly, see ***Technical data - Unit Identification*** in this section for details.

Front Axle Drivehead

Dismantling and Assembly

The procedures for dismantling and assembly are described in a separate publication, see ***Transmissions Service Manual*** (publication No. 9803/ 8610) for full details. Make sure that you identify the Front Axle Drivehead correctly, see ***Technical data - Unit Identification*** in this section for details.

Front Axle Brakes

Dismantling and Assembly

The procedures for dismantling and assembly are described in a separate publication, see ***Transmissions Service Manual*** (publication No. 9803/ 8610) for full details. Make sure that you identify the Front Axle Brakes correctly, see ***Technical data - Unit Identification*** in this section for details.

Rear Axle - 2WD Machines

Dismantling and Assembly

The procedures for dismantling and assembly are described in a separate publication, see ***Transmissions Service Manual*** (publication No. 9803/ 8610) for full details. Make sure that you identify the Rear Axle - 2WD Machines correctly, see ***Technical data - Unit Identification*** in this section for details.

Rear Drive Head - 4WD Machines

Dismantling and Assembly

The procedures for dismantling and assembly are described in a separate publication, see ***Transmissions Service Manual*** (publication No. 9803/ 8610) for full details. Make sure that you identify the Rear Axle - 4WD Machines correctly, see ***Technical data - Unit Identification*** in this section for details.

Rear Axle Hub and Driveshaft

The procedures for dismantling and assembly are described in a separate publication, see ***Transmissions Service Manual*** (publication No. 9803/ 8610) for full details. Make sure that you identify the Rear Axle Hub and Driveshaft correctly, see ***Technical data - Unit Identification*** in this section for details.

Mechanical 4 Wheel Drive Unit

Dismantling and Assembly

Dismantling

The following procedures show the transmission removed from the machine, however, it is possible to remove the 4 wheel drive unit with the transmission still fitted to the machine; Remove prop shaft. Select 4 wheel drive (using the control lever) and engage the parking brake. Chock both sides of all wheels. Loosen nut **A**, do not remove. Unscrew bolts **B** and remove the the 4 wheel drive unit. Continue to step 2.

Note: *Use illustration from step 1 as a reference.*

1 Using tool 892/00812 to hold output yoke coupling, unscrew nut **16-A**. Unscrew bolts **16-B** and remove 4 wheel drive unit.

Note: *The illustration shows a yoke output coupling; To loosen nut A on units fitted with a flange output coupling: Select 4-wheel drive (use a suitable bolt and spacer threaded into the end of the selector shaft, see inset) and use tool 992/04800 to hold the main drive output flange. Loosen nut **16-A**.*

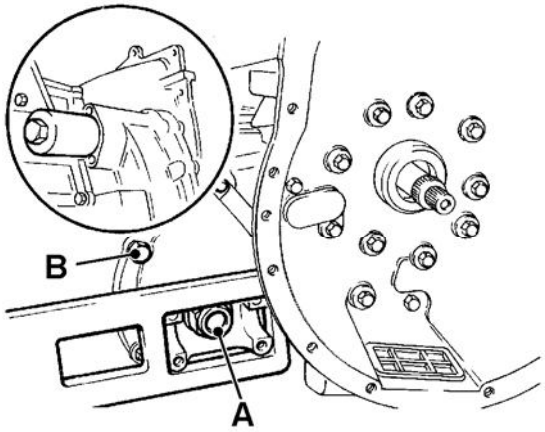

Fig 16.

2 Remove 4 wheel drive selector spring. Remove loosened nut and output yoke (or flange) and remove oil seal.

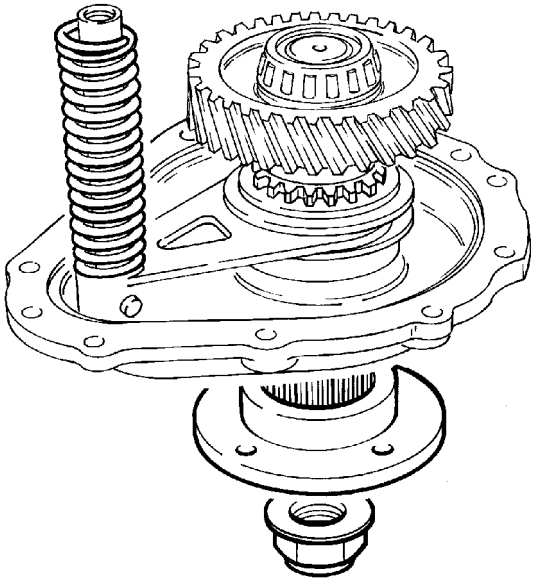

Fig 17.

3 Withdraw the gear shaft and selector shaft. Pull off gear and inner bearing.

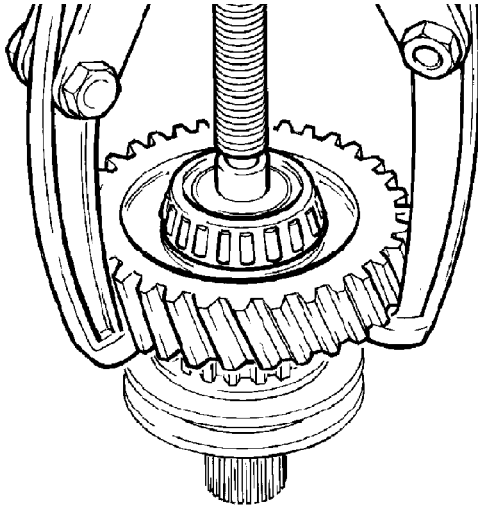

Fig 18.

4 Lift off bearing spacer and gear. Remove needle roller bearing from gear.

5 Lift off selector hub.

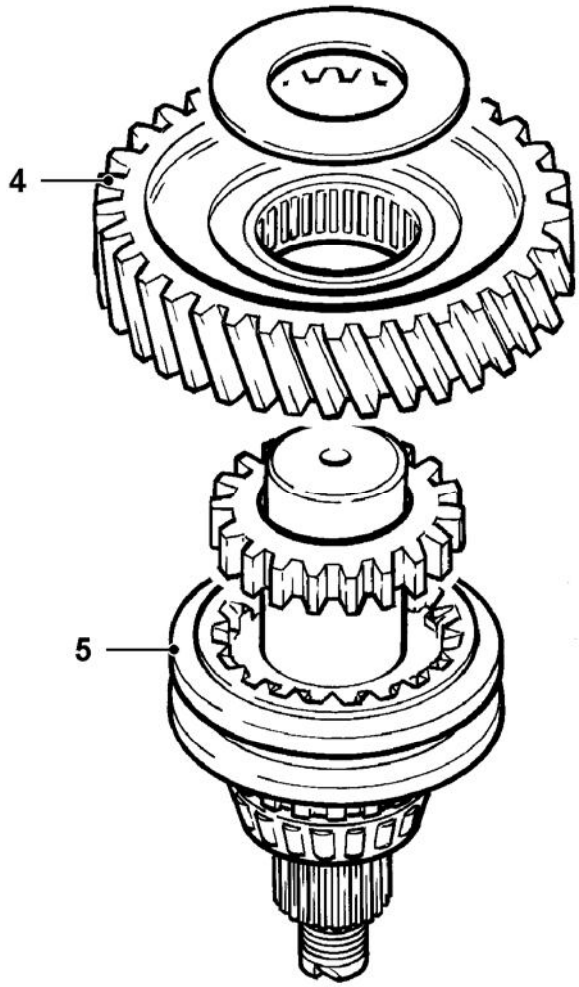

Fig 19.

Assembly

1 Assemble 4 wheel drive selector hub onto shaft. Smear needle roller bearing with oil, and install with gear and spacer.

2 Press inner bearing onto shaft and smear with HP Grease.

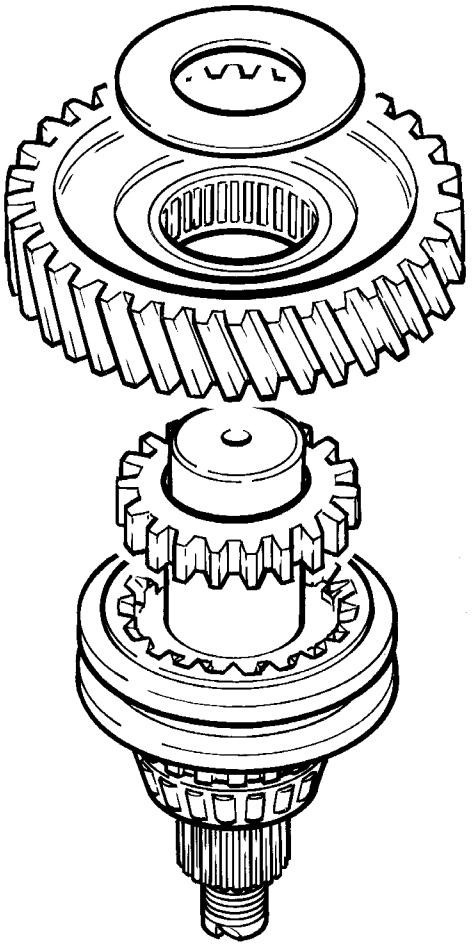

Fig 20.

3 Assemble shaft with selector fork into housing. Do not fit oil seal at this stage but fit output flange (or yoke) and leave nut finger tight.

4 Fit spring over selector rod.

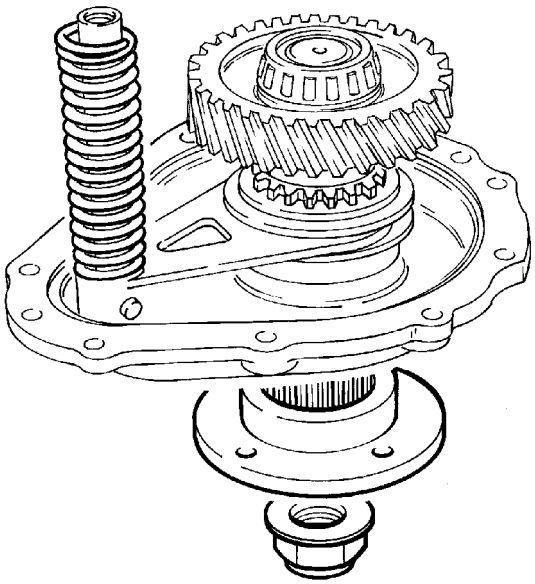

Fig 21.

5 Fit the 4WD assembly to the transmission using a new gasket. Apply JCB Threadlocker and Sealer to mounting bolts D and tighten to 56 Nm (42 lbf ft).

6 Tighten output yoke (or flange) nut to 400 Nm (295 lbf ft). Check shaft end float which should be 0.03 mm (0.001 in) maximum.

Note: *Rotate shaft whilst measuring to seat bearings fully.*

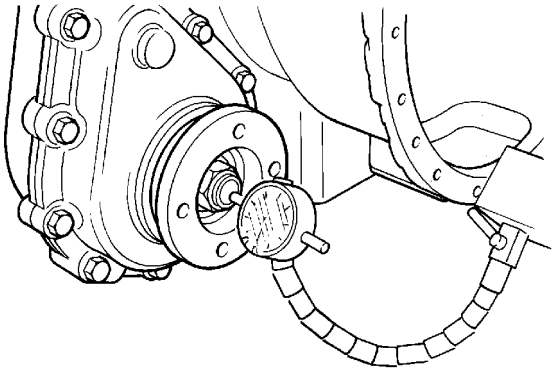

Fig 22.

7 If the end float is incorrect, remove output yoke (or flange) and bearing retaining circlip.

8 Add or subtract shims **23-Z** to correct end float. Shims must be installed only between bearing outer race and spacer. Replace circlip and yoke (or flange) and re-check end float.

9 When shaft end float is correct, remove yoke (or flange) and fit new oil seal.

10 Refit output yoke (or flange), tighten nut to 400 Nm (295 lbf ft) and stake into slot.

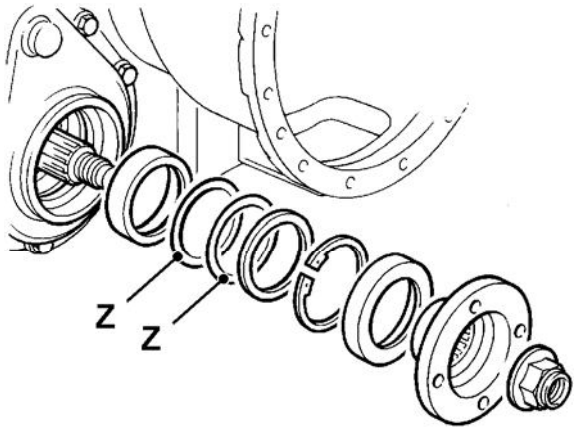

Fig 23.

Torque Converter

Removal and Replacement

Removal

See the relevant gearbox removal procedure for torque converter removal.

When Replacing

1 Ensure that flywheel face, drive plate, and hardware are clean and free from burrs or other surface imperfections.

2 Offer drive plate **24-1** to the torque converter.

3 Place the torque converter alignment tool **24-A** over the torque converter spigot, make sure that the tool locates in two of the converter bolt holes as shown.

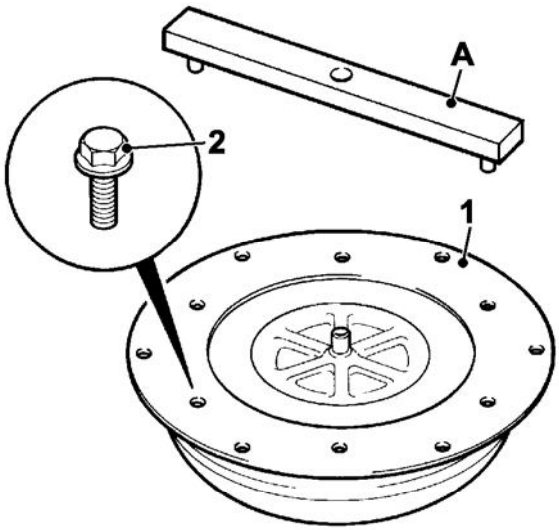

Fig 24.

Note: *It is important that the converter drive tube is protected against damage or contamination at all times.*

4 Fit four of the flanged bolts **24-2** and torque tighten to 84 Nm (62 lbf ft). Remove the alignment tool and fit the remaining two retaining bolts **24-2**.

5 Offer the torque converter and drive plate assembly to the flywheel, bolt the drive plate to the flywheel (use only 3 bolts). Check the converter run-out as shown at **25-B**, which should not exceed 0.38mm (0.015 in.).

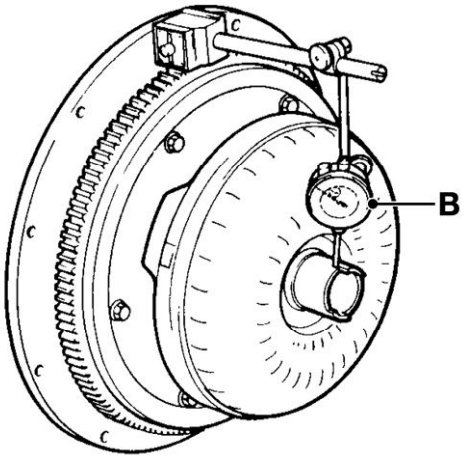

Fig 25.

Note: *In the unlikely event that the run-out exceeds 0.38 mm (0.015 in.), remove the converter and check the spigot for burrs, remove the drive plate and rotate it 180° on the torque converter, repeat steps **2** to **4**.*

6 Remove the torque converter and drive plate assembly from the flywheel.

7 Install the torque converter with its drive plate assembly onto the transmission input shaft, make sure that the dogs on the converter pump drive shaft engage with the recesses in the pump, also take care not to damage the oil seal. Rotate the engine flywheel so that one bolt hole is in a six O' clock position.

8 Rotate the torque converter and drive plate assembly so that one bolt hole is in a six O' clock position.

9 Install the transmission and torque converter assembly to the engine. See the relevant gearbox replacement procedure. **It is vitally important that the torque converter is fitted at the gearbox and**

engine flywheel correctly. Failure to locate the converter correctly will result in damage to the gearbox oil pump on engine start up.

10 Apply JCB Threadlocker and Sealer to flanged bolts **26-3**. Remove the access plate from the bottom of the engine flywheel housing and through the access hole fit and hand tighten one flanged bolt (item **26-3**) in the six 'O' clock position.

11 Rotate the flywheel until the next bolt hole is accessible, fit and hand tighten the next bolt **26-3**. Repeat the operation until all bolts are fitted. Finally torque tighten bolts **26-3** to 44 Nm (32 lbf ft), rotating the flywheel each time to align bolts **3** with access hole. Refit access plate.

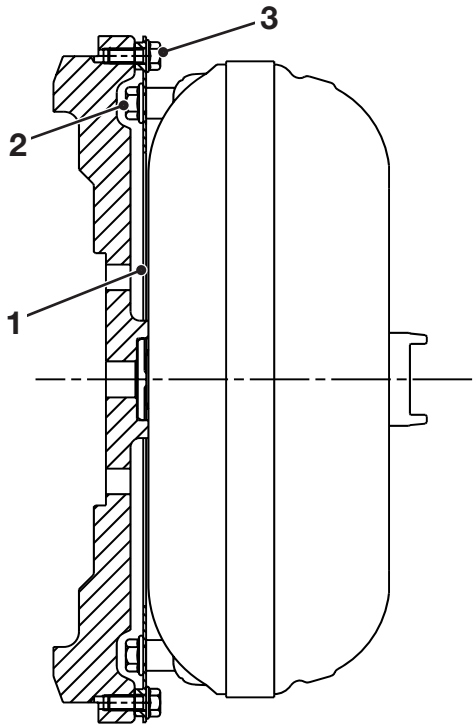

Fig 26.

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