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Service Manual

801
Tracked Excavator

JCB HYDRAPOWER LTD. ©
UNIT 23/24, POWER STATION ROAD,
RUGELEY, STAFFORDSHIRE,
WS15 2YS, ENGLAND.
TEL. (0889) 585300

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Contents

Introduction

This publication is designed for the benefit of JCB Distributor Service Engineers who are receiving, or have received, training by JCB Technical Training Department.

It is assumed that these personnel have a sound knowledge of workshop practice, safety procedures and general techniques associated with the maintenance and repair of hydraulic earthmoving equipment. Therefore these basic subjects generally are omitted from this manual, the intention being to convey only more specialised information concerning particular aspects of a machine or component.

For example, renewal of oil seals, gaskets, etc., and any component showing obvious signs of wear or damage is expected as a matter of course, and therefore information of this nature is included only in the context of specialised procedures or where a range of wear tolerances is required. Similarly, it is expected that components will be cleaned and lubricated where appropriate, also that any opened hose or pipe connections will be blanked to prevent excessive loss of hydraulic fluid and ingress of dirt.

For convenience this manual is compiled in sections, e.g. "Hydraulics", "Electrics", etc. but, to find details of a specific component, reference should be made to the alphabetical index at the back of the book.

Illustrations which show a dismantled component are numbered as a guide to the dismantling sequence, which generally can be reversed for assembly.

Torque settings are given as a 'mean' figure which may be varied by plus or minus 3%. Torque figures indicated are for dry threads, hence for lubricated threads may be reduced by one third.

'Left Hand' and 'Right Hand' are as viewed from the rear of the machine.

References to alternative servicing intervals are to be treated on a "whichever occurs first" basis.

Colour Coding

The following colour coding, used on illustrations to denote various conditions of oil pressure and flow, is standardised throughout JCB Service Publications.

Neutral Circuit Pressure.

Pressure generated by the operation of a service. Depending on application this may be anything between Neutral Circuit Pressure and M.R.V. Operating Pressure.

Pressure that is above Neutral Circuit Pressure but lower than that denoted by Red.

Exhaust.

Oil subjected to a partial vacuum due to a drop in pressure (cavitation).

Oil trapped within a chamber or line, preventing movement of components (lock-up).

Oil pressure used in a controlling device (servo).

LUBRICANTS & CAPACITIES

Note: New engines DO NOT require a running-in period. The engine/machine should be used in a normal work cycle immediately; glazing of the piston cylinder bores, resulting in excessive oil consumption, could occur if the engine is gently run-in. Under no circumstances should the engine be allowed to idle for extended periods; (e.g. warming up without load). Engines of new machines are filled at the factory with JCB 10W/30 Multigrade oil. This oil should be drained after the first 50 hours operation and the engine filled with the appropriate recommended grade as shown in the lubrication chart. JCB 10W/30 Multigrade should also be used for the first 50 hours operation whenever a new or reconditioned engine is fitted to the machine. After the first 50 hours operation, it is essential that the 10W/30 oil is replaced by the lubricant recommended below.

FLUIDS, LUBRICANTS, CAPACITIES AND SPECIFICATIONS

ITEM	CAPACITY	FLUID/LUBRICANT Litres (Gal)	INTERNATIONAL SPECIFICATION
Fuel Tank	17.0 (3.75)	Diesel Oil (See **Types of Fuel**)	ASTM D975-66T Nos. 1D, 2D
Engine (Oil)			
First 50 hours only	3.5 (0.77)	**JCB 10W/30 Multigrade** above - 15 °C (5 °F)	MIL-L-46152, API CC/SF
		5W/20 - 15 °C to - 25 °C (5 °F to -13 °F)	API CC/SE (recommended)
After first 50 hours		**JCB 15W/40 Multigrade** above - 10 °C (14 °F)	SAE15W/40, MIL-L-46152B, API CD/SE MIL-L-2104D
		5W/20 - 10 °C to - 25 °C (14 °F to -13 °F)	API CC/SE or API CD/SE
Engine (Coolant)			
Canopy	4.5 (1.0)	**JCB Universal Antifreeze**/water	ASTM D3306-74
Cab		5.0 (1.1)	(See **Coolant Mixtures**)
***Track Gearbox (each)**			
to m/c no. 649729	1.6 (0.35)	**JCB HD90 Gear Oil**	API-GL-5, MIL-L-2105C
from m/c no. 649730	0.33 (0.07)	**JCB SAE 30 Engine Oil**	API-CD/SF, MIL-L-46152B, MIL-L-2104B
Slew Gearbox	0.6 (0.13)	**JCB HD90 Gear Oil**	API-GL-5, MIL-L-2105C
***Track Idler Wheels**	Sealed Unit	**JCB HD90 Gear Oil**	API-GL-5, MIL-L-2105C
***Track Rollers (bottom)**	Sealed Unit	**JCB HD90 Gear Oil**	API-GL-5, MIL-L-2105C
***Hydraulic System**	30 (6.6)	**JCB Hydraulic Fluid 46** (Below -10°C; 14°F) **JCB Special Hydraulic Fluid** (-10°C to 40°C; 14°F to 104°F) **JCB Hydraulic Fluid 46** (Over 40°C;104°F)	
Slew Ring			
Bearings		**JCB MPL Grease**	Lithium based, No. 2 consistency.
Gear Teeth		**JCB Slew Pinion Grease †**	
All OtherGrease Points		**JCB MPL Grease**	Lithium based, No. 2 consistency.

† WARNING: JCB Slew Pinion Grease is harmful as it contains bitumen compounds 2811. Excessive contact may lead to dermatitis or skin cancer. Always use a barrier cream or wear gloves; wash contaminated skin thoroughly with soap and water. In the event of eye contact, immediately wash with plenty of water and seek medical advice.

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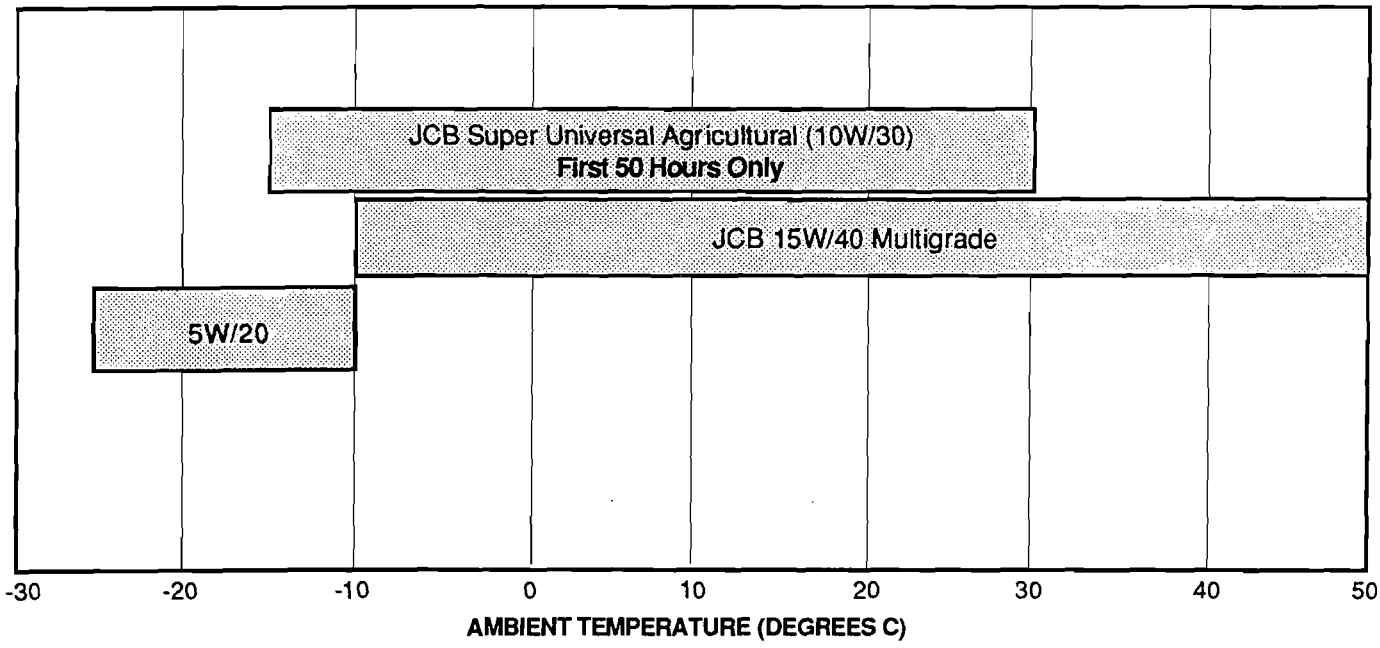
ENGINE LUBRICATION CHART



TORQUE SETTINGS

Only use following when no setting is specified in text of manual.

CAUTION: All bolts used on JCB equipment are high tensile and must not under any circumstances be replaced with bolts of a lesser tensile specification.

Metric Grade 8.8 Bolts

Bolt Size	(mm)	Hexagon (A/F) mm	Torque Settings Nm	kgf m	lbf ft
M5	(5)	8	7	0.7	5
M6	(6)	10	12	1.2	9
M8	(8)	13	28	3.0	21
M10	(10)	17	56	5.7	42
M12	(12)	19	98	10	72
M16	(16)	24	244	25	180
M20	(20)	30	476	48	352
M24	(24)	36	822	84	607
M30	(30)	46	1633	166	1205
M36	(36)	55	2854	291	2105

TABLE OF IMPORTANT TIGHTENING TORQUES

Tightening Points	Tightening Torque Nm	kgf m	lbf ft
Sprocket retaining cap	60.8 - 70.6	6.2 - 7.2	44.8 - 52.1
Track roller	77.5 - 90.2	7.9 - 9.2	57.1 - 66.5
Idler/yoke	77.5 - 90.2	7.9 - 9.2	57.1 - 66.5
Rotary coupling mounting	23.5 - 27.5	2.4 - 2.8	17.4 - 20.3
Rotary coupling reaction plate	23.5 - 27.5	2.4 - 2.8	17.4 - 20.3
Slew ring	77.5 - 90.2	7.9 - 9.2	57.1 - 66.5
Slew gearbox case	123.6 - 147.1	12.6 - 15.0	91.1 - 108.5
Oil tank	77.5 - 90.2	7.9 - 9.2	57.1 - 66.5
Fuel tank	77.5 - 90.2	7.9 - 9.2	57.1 - 66.5
Hydraulic filter cap	Max. 30	Max. 3.1	Max. 22
Piping clamp	27.5 - 29.4	2.8 - 3.0	20.3 - 21.7
Rod end - controls	39.2 - 45.1	4.0 - 4.6	28.9 - 33.3
Operating control support plate	48.1 - 55.9	4.9 - 5.7	35.4 - 41.2
Slew interlever pivot	48.1 - 55.9	4.9 - 5.7	35.4 - 41.2
Silencer band	6.8	0.7	5.1
Exhaust tail pipe	4.9	0.5	3.6
Engine shock absorber	48.1 - 55.9	4.9 - 5.7	35.4 - 41.2
Engine bracket	48.1 - 55.9	4.9 - 5.7	35.4 - 41.2
Engine support	48.1 - 55.9	4.9 - 5.7	35.4 - 41.2
Rear counterweight	77.5 - 90.2	7.9 - 9.2	57.1 - 66.5
Oil tank cover	15.7 - 17.7	1.6 - 1.8	11.6 - 13.0
*Track Gearbox Cover (Capscrews)	77	7.9	57
Rams			
Head nut (all except dozer)	314	32.0	232
Head nut (dozer)	345	35.2	255
End cap (all except dozer)	610	62.2	450
End cap (dozer)	400	40.8	295

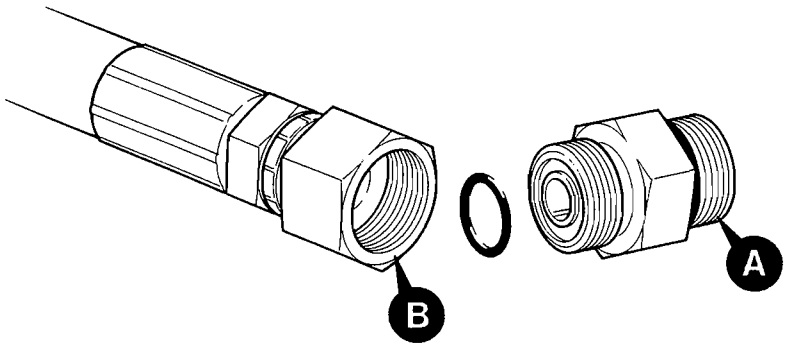
TABLE OF IMPORTANT TIGHTENING TORQUES (continued)

Tightening Points	Tightening Torque Nm	kgf m	lbf ft
Valve Block			
Tie rod (large)	45	4.6	33
Tie rod (small)	19	1.9	14
Spool spring retainer	10	1.0	7
End cap screw	7	0.7	5
Slew Motor			
Brake valve plug (10 AF hex key)	78 - 88	8.0 - 9.0	57 - 66
Brake valve plug (32 AF)	118 - 137	12.0 - 14.0	87 - 101
Relief valve plug	78 - 88	8.0 - 9.0	57 - 66
Check valve plug	24 - 29	2.5 - 3.0	17 - 20
Cap screws	58 - 69	5.9 - 7.0	43 - 51
Track Motor			
Counterbalance end cover plug	118 - 137	12.0 - 14.0	87 - 101
Counterbalance spool plug	24 - 29	2.5 - 3.0	17 - 20
Cap screws	58 - 69	5.9 - 7.0	43 - 51
***Pump**			
Drive coupling (Sundstrand)	44	4.5	32
Drive coupling (Dowty)	54	5.5	40
Tie bolts (Sundstrand)	54 - 61	5.5 - 6.2	40 - 45
Tie bolts (Dowty)	44 - 52	4.5 - 5.3	32 - 38
Engine			
Bearing holder bolts	24 - 30	2.4 - 3.1	19 - 22
Rear plate bolts	46 - 54	4.7 - 55	34 - 40
Flywheel bolts	59 - 69	6.0 - 7.0	43 - 51
Connecting rod nuts	29 - 34	3.0 - 3.5	22 - 25
Suction filter bolts	10 - 12	1.0 - 1.2	7 - 9
Sump bolts	10 - 12	1.0 - 1.2	7 - 9
Sump drain plug	29 - 40	3.0 - 4.1	22 - 29
Oil pipe banjo bolts	10 - 12	1.0 - 1.2	7.9
Crankshaft pulley nut	117 - 127	11.9 - 12.9	87 - 94
Cylinder head bolts (oiled)	49 - 52	5.0 - 5.3	36 - 38
Injection pump bolts	10 - 12	1.0 - 1.2	7 - 9
Injection pump nut	10 - 12	1.0 - 1.2	7 - 9
Rocker arm nuts	20 - 24	2.0 - 2.4	15 - 19
Head cover nuts	10 - 12	1.0 - 1.2	7 - 9
Cooling fan bolts	10 - 12	1.0 - 1.2	7 - 9
Injector nozzle	78 - 83	8.0 - 8.5	58 - 62
Injector pipe	20 - 24	2.0 - 2.4	15 - 19
Thermo switch	24 - 29	2.4 - 3.0	19 - 22
Oil pressure switch	15 - 20	1.5 - 2.0	11 - 15
Glow plug	15 - 20	1.5 - 2.0	11 - 15
Solenoid	15 - 20	1.5 - 2.0	11 - 15
Oil pressure switch	15 - 20	1.5 - 2.0	11 - 15

HYDRAULIC FITTINGS & TORQUE SETTINGS

'O' ring Face Seal

All the hydraulic fittings on the JCB 801 Tracked Excavator use the 'O' ring face seal system which achieves a leak-proof, non loosening connection.



Adapters screwed to valve blocks etc. seal onto an 'O' ring which is compressed into a 45° seat machined in the face of the tapped port.

ADAPTER (A)

SAE Tube Size	SAE Port Thread Size	A/F mm	A/F in	Tightening Torque Nm	Tightening Torque lbf ft
4	7/16 - 20	15.9	0.625	20 - 28	16.5 - 18.5
6	9/16 - 18	19.1	0.750	46 - 54	34 - 40
8	3/4 - 16	22.2	0.875	95 - 105	69 - 77
10	7/8 - 14	27.0	1.063	130 - 140	96 - 104
12	1.1/16 - 12	31.8	1.250	190 - 210	141 - 155
16	1.5/16 - 12	38.1	1.500	290 - 310	216 - 230
20	1.5/8 - 12	47.6	1.875	280 - 380	210 - 280

OUTER SLEEVE NUT (B)

SAE Tube Size	Hose/pipe Thread Size	A/F mm	A/F in	Tightening Torque Nm	Tightening Torque lb f ft
4	9/16 - 18	17.5	0.688	20 - 30	15 - 21
6	11/16 - 16	20.6	0.813	31 - 39	23 - 29
8	13/16 - 16	23.8	0.937	45 - 55	33 - 41
10	1 - 14	28.6	1.125	80 - 90	59 - 67
12	1.3/16 - 12	35.0	1.375	105 - 125	77 - 93
16	1.7/16 - 12	41.5	1.625	155 - 175	114 - 130

SERVICE SCHEDULES

EVERY 10 OPERATING HOURS OR DAILY whichever occurs first

Clean

1 Machine generally

Check and adjust where necessary (engine stopped)

2 Generally for damage
3 Hydraulic oil level
4 Engine oil level
5 Engine coolant
6 Fuel system for leaks
7 Engine air filter pre-cleaner
8 Track adjustment

Check and adjust where necessary (engine running)

9 Operation of horn
10 Operation of all other electrical equipment
11 Exhaust (excessive smoke)
12 Dozer operation
13 Excavator operation
14 Track and running gear operation
15 Hourmeter operation

EVERY 50 OPERATING HOURS OR WEEKLY whichever occurs first

Do the daily jobs plus:

Clean

1 Drain and clean fuel filter
2 Drain fuel sediment bow
3 Radiator matrix

Check and adjust where necessary (engine stopped)

4 Fan belt adjustment

* **Note:** Failure to maintain correct fan belt adjustment can result in damage to timing case cover.

FIRST 50 HOURS ONLY

Do the jobs listed in 50 hours (above) plus:

Change

1 Engine oil and filter canister

Check

2 Track tension (rubber tracks only)

EVERY 100 OPERATING HOURS OR 2 WEEKS whichever occurs first

Do the daily jobs through to 50 hours plus:

Clean

1 Battery terminals

Check and adjust where necessary (engine stopped)

2 Hose and pipework for security and damage
3 Condition of ram piston rods
4 All grease seals
5 Track plate condition/rubber condition
6 Engine mounting bolts
7 Air cleaner hose security
8 Wiring for damage
9 Track tension

EVERY 250 OPERATING HOURS OR MONTHLY whichever occurs first

Do the daily jobs through to 100 hours plus:

Change

1 Engine oil
2 Engine oil filter canister

Grease

3 Slew ring grease nipples

EVERY 500 OPERATING HOURS OR 6 MONTHS whichever occurs first

Do the daily jobs through to 250 hours plus:

Clean

1 Fuel lift pump

Change

2 Fuel filter element
3 Hydraulic fluid return filter element
*4 Outer air cleaner element (very dusty conditions only)

*** Check and adjust where necessary (engine stopped)**

5 Exhaust system security
6 Slew gearbox oil levels
7 Injectors and test
8 Tighten cylinder head
9 Valve clearances

*** Check and adjust where necessary (engine running)**

10 Main relief valve pressure
11 Auxiliary relief valve pressure
12 Slew crossline relief valve
13 Engine pull down speed

TECHNICAL DATA

Pump Type

* Three element gear pump driven from the rear end of the engine crankshaft.

Pump Flow Rate

(at 2200 engine revs/min and M.R.V pressure)

No. 1 Element	8.8 litres/min (1.9 UK gal/min)
No. 2 Element	12.1 litres/min (2.6 UK gal/min)
No. 3 Element	12.1 litres/min (2.6 UK gal/min)

Relief Valve Operating Pressures	bar	kgf/cm²	lbf/in²
Main Relief Valves (M.R.V.'s)			
- Dipper / L.H. Track / Auxiliary	207	211	3000
- Bucket / Boom / R.H. Track / Auxiliary	207	211	3000
- Swing / Slew/ Dozer	155	158	2250
Auxiliary Relief Valves (A.R.V.'s)			
- Boom, Head side	240	245	3480
- Boom, Rod Side	240	245	3480
- Dipper, Head Side	240	245	3480
- Dipper, Rod Side	240	245	3480
- Dozer, Head Side	220	224	3190
Cross Line Relief Valves			
- Slew	147	150	2130

Rams	Bore		Rod Dia		Stroke	
	mm	in	mm	in	mm	in
Boom	50	1.97	30	1.18	360	14.17
Dipper	50	1.97	30	1.18	400	15.75
Bucket	50	1.97	30	1.18	286	11.26
Swing	50	1.97	30	1.18	340	13.39
Dozer	70	2.76	35	1.38	85	3.35

*Track and Slew Motor Leakage Test Data

Conditions of test	
- Oil temperature	50° C
- Counterbalance holding pressure	70 bar (1015 lbf/in²)
Acceptable rotation of track sprocket	1 revolution in 7 minutes, 15 seconds
Acceptable rotation of superstructure	1 revolution in 3 minutes

GENERAL DESCRIPTION

The main components of the hydraulic system are the tank, pump, control valve, rams and rotary coupling. The tank is mounted inside the machine cab and is filled through the filter. Tank fluid level is indicated by a sight tube viewed from the right hand side of the machine. The hydraulic pump is mounted directly to the engine crankshaft. Hydraulic fluid from the pump is directed to machine services through a control valve located beneath the cab floor plate. Selection of services is through a system of manually operated levers and foot pedals.

EVERY 1000 OPERATING HOURS OR YEARLY
whichever occurs first

Do the daily jobs through to 500 hours plus:

Clean

1 Air filter dust valve

Change

2 Air filter element (outer)

Check

3 Cab frame
4 Track gearbox oil levels

Grease

5 Slewing pinion and slew ring

EVERY 2000 OPERATING HOURS OR 2 YEARS
whichever occurs first

Do the daily jobs through to 1000 hours plus:

Change

1 Air cleaner element (inner)
2 Track gearbox and slew gearbox oil
3 Hydraulic fluid and clean suction strainer
4 Engine coolant

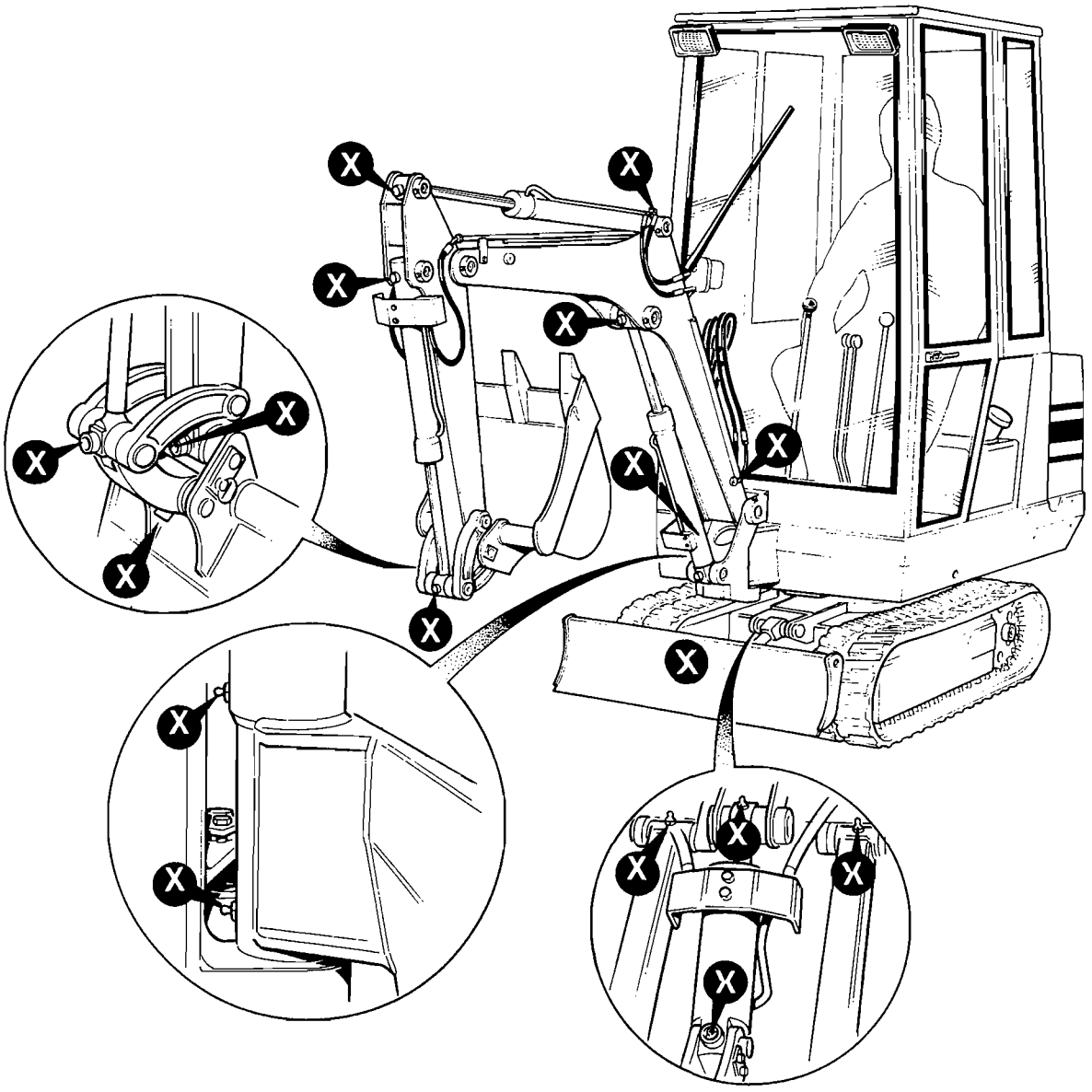
Check (engine stopped)

5 Battery electrolyte level (low maintenance)
6 Starter motor and alternator brushgear

GREASING

Daily

Normally two strokes of the grease gun should be sufficient.
Stop greasing when fresh grease appears at the joint.



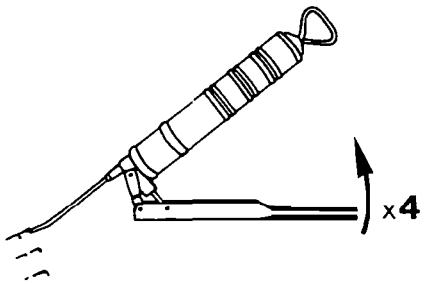
GREASING (cont'd)

Every 250 Hours

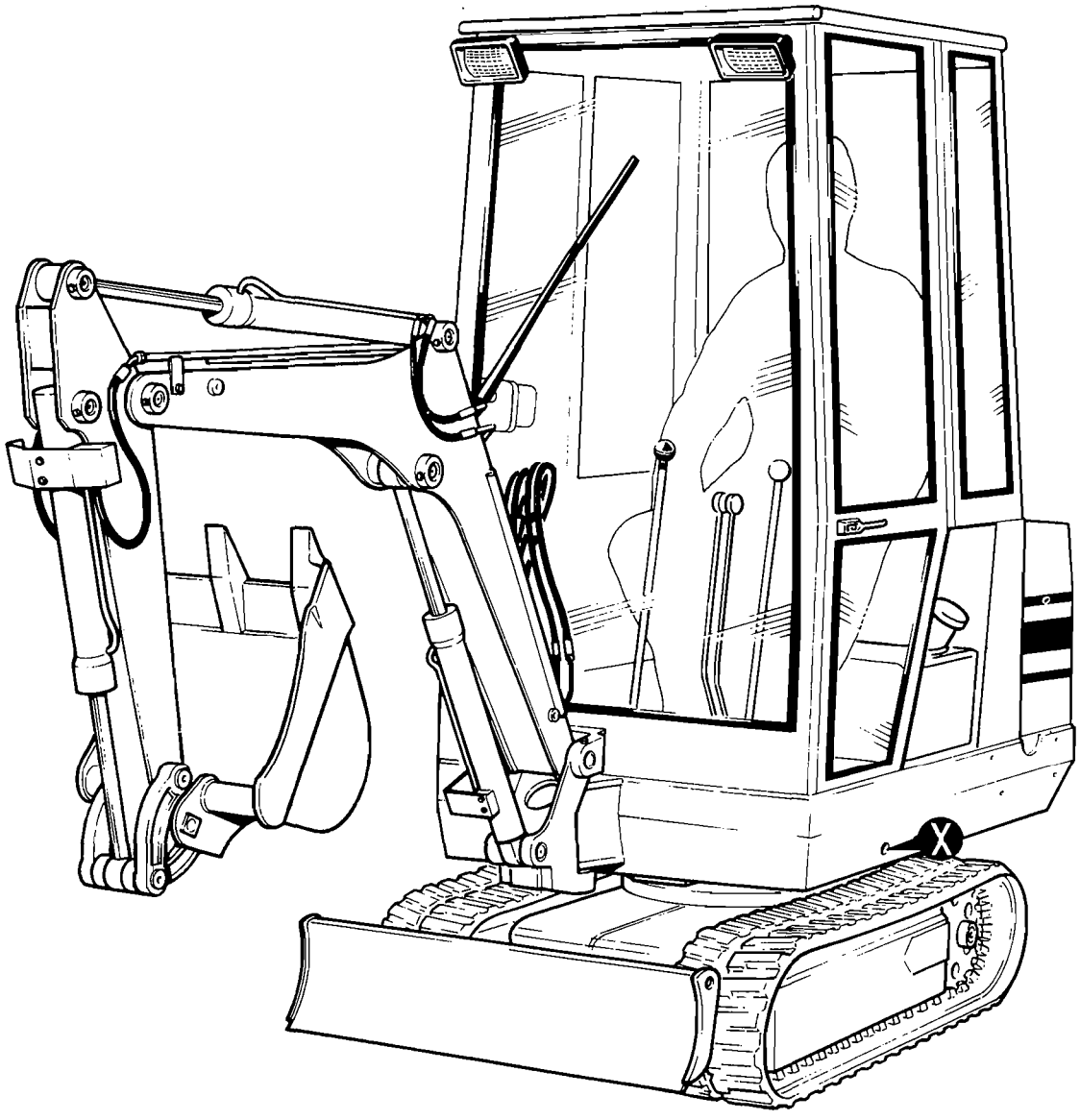
Slew Ring Bearings

Ensure the slew ring is kept full of grease.

Grease point on left hand side of mainframe.



To ensure distribution of grease.
i Grease in, rotate 180°
ii Grease in, rotate 180°
iii Grease in.



GREASING (cont'd)

Every 1000 Hours

Slew Ring Gear Teeth

⚠ WARNING

JCB Slew Pinion Grease is harmful as it contains bitumen compounds 2811. Excessive contact may lead to dermatitis or skin cancer. Always use a barrier cream or wear gloves; wash contaminated skin thoroughly with soap and water. In the event of eye contact, immediately wash with plenty of water and seek medical advice.

1 Raise machine and support the undercarriage.

2 Remove the bolts **A** and plate **B** in the underside of the undercarriage.

3 Apply the grease to the pinion using an applicator.

4 Remove personnel from the machine.

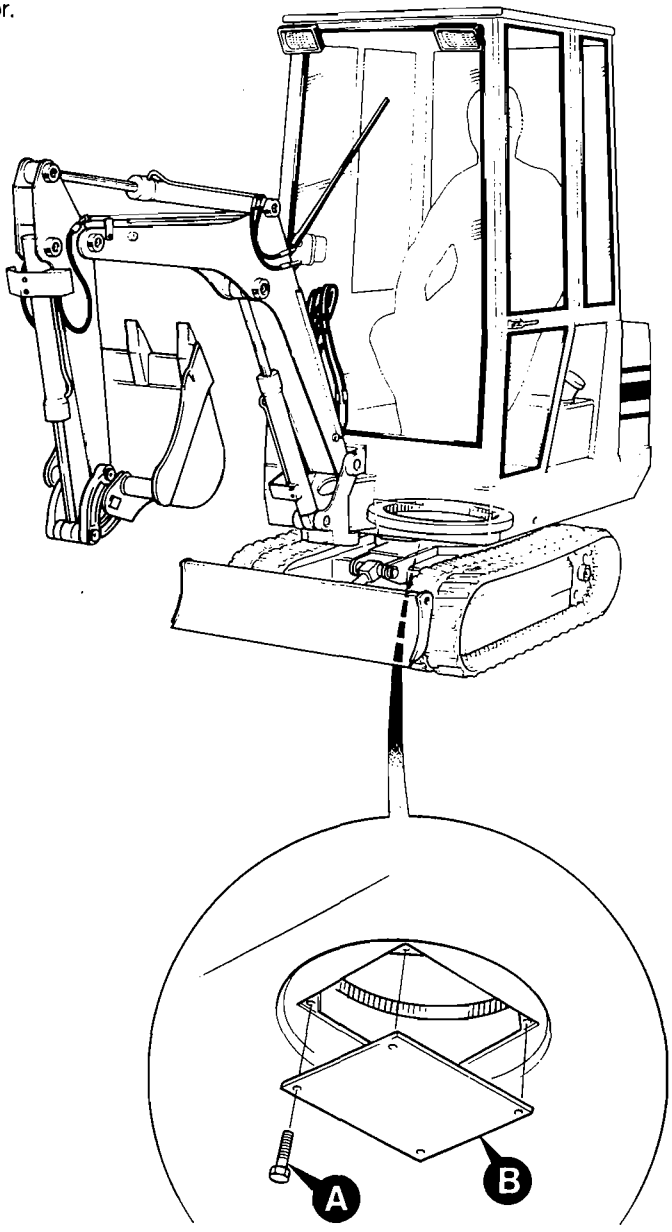
5 Rotate the main frame twice fully.

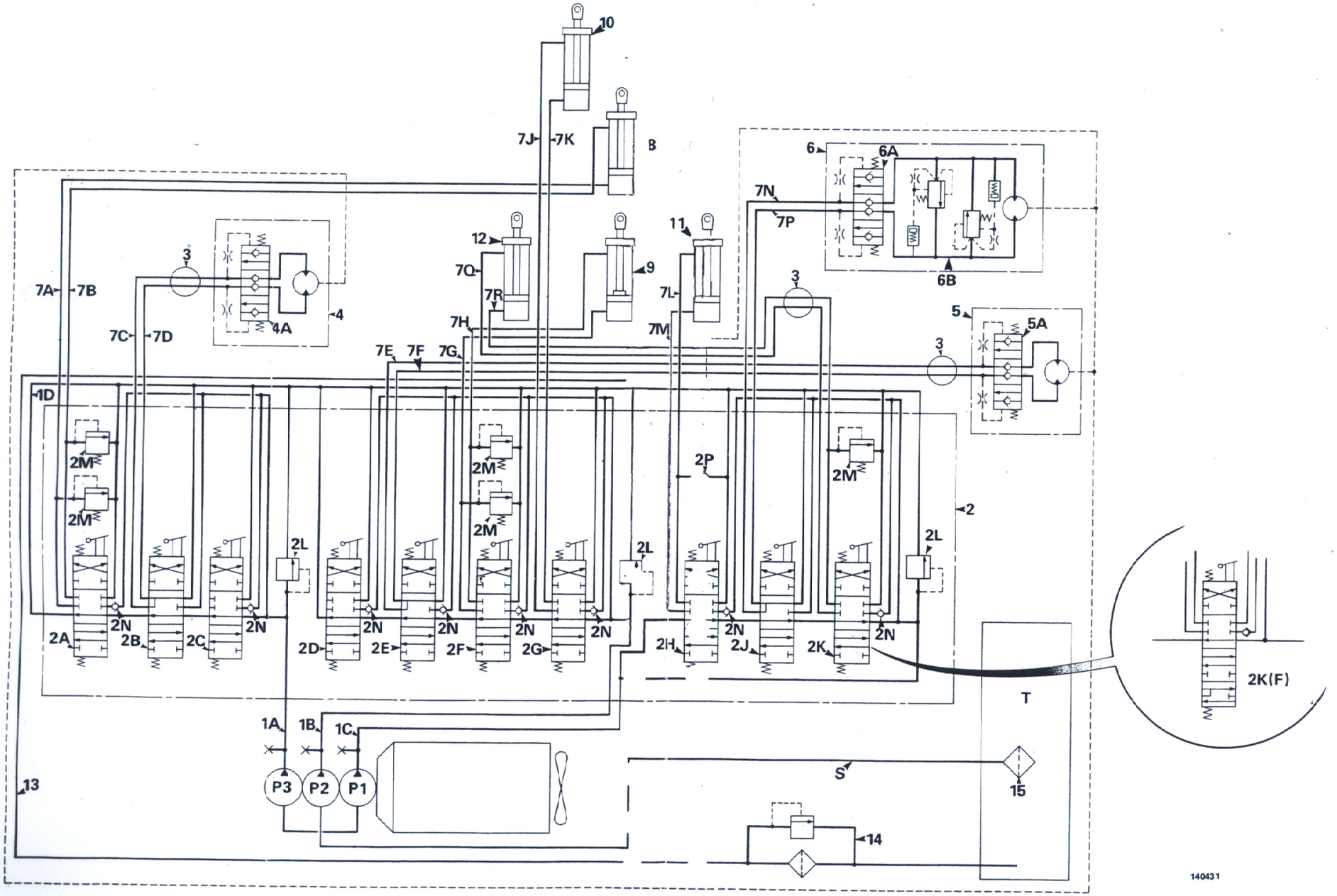
6 Stop the engine.

7 Repeat step 3 as necessary.

8 Refit the plate **B** and bolts **A**.

9 Put the machine back on the ground.

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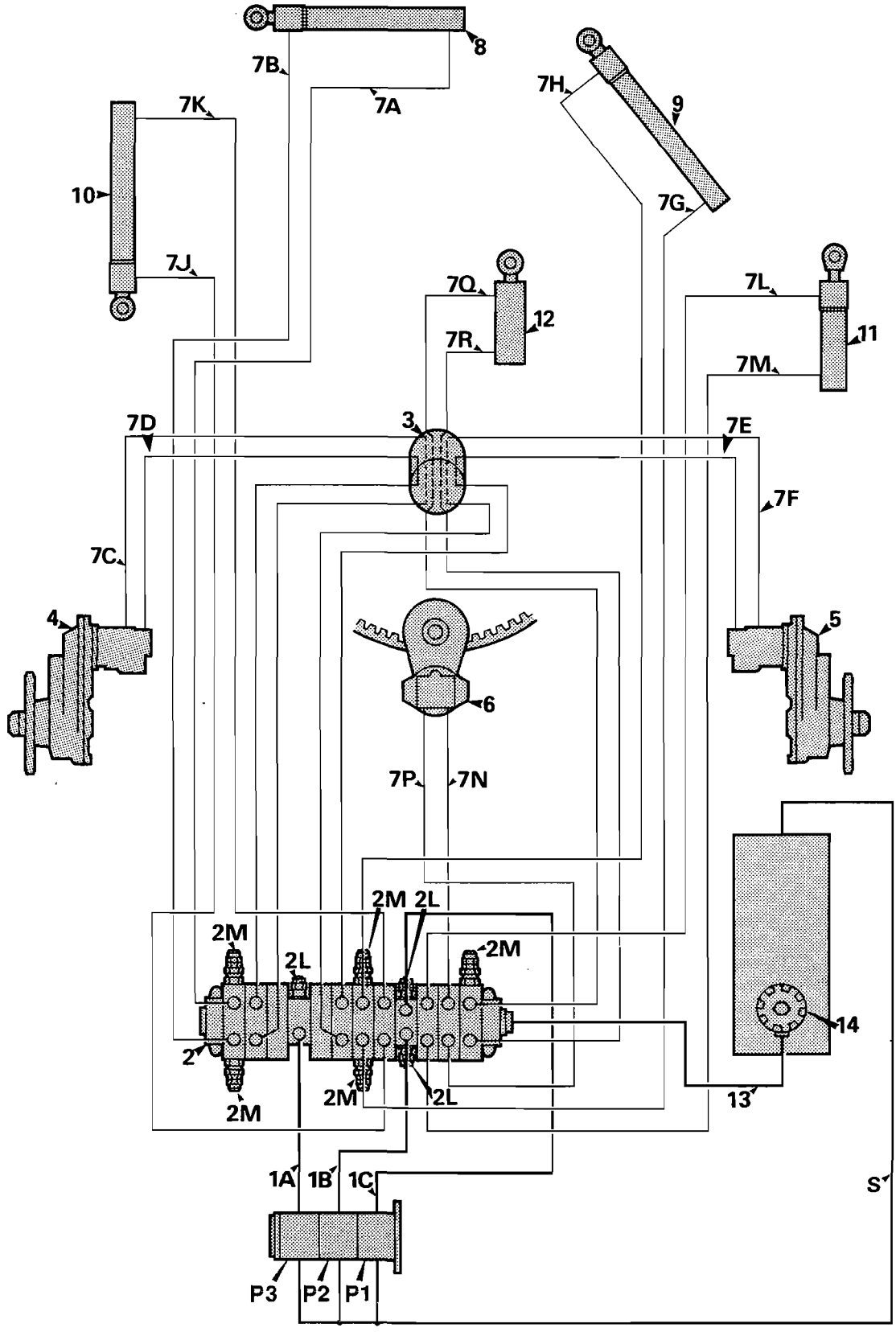
HYDRAULIC CIRCUIT

Component Key

P1	Pump Section 1
P2	Pump Section 2
P3	Pump Section 3
T	Tank
S	Suction Line
1A	Neutral Circuit Lines
1B	Neutral Circuit Lines
1C	Neutral Circuit Lines
1D	Neutral Circuit Lines
2	Control Valve
2A	Dipper Spool
2B	L.H. Track Motor Spool
***2C**	Auxiliary Spool
***2D**	Auxiliary Spool
2E	R.H. Track Motor Spool
2F	Boom Spool
2G	Bucket Spool
2H	Swing Spool
2J	Slew Motor Spool
***2K**	Dozer Spool (standard)
***2K(F)**	Dozer Spool with float (optional)
2L	Main Relief Valves
2M	Auxiliary relief Valves
***2N**	Load Hold Check Valve
2P	Anti-cavitation Valve
3	Rotary Coupling
4	L.H. Track Motor
4A	Counterbalance Valve
5	R.H.Track Motor
5A	Counterbalance Valve
6	Slew Motor
6A	Counterbalance Valve
6B	Brake Valve
7A/7R	Service Lines
8	Dipper Ram
9	Boom Ram
10	Bucket Ram
11	Swing Ram
12	Dozer Ram
13	Return Line
14	Return Filter
15	Suction Strainer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P3
P2
P1

HYDRAULIC CIRCUIT

The 1.4 Tonne mini-excavator hydraulic circuit is fed from a 30 litre (6.6 UK gal) capacity tank, **T**, located in the operator's cab on the right hand side of the seat.

The system is powered by a three section gear pump, **P**, mounted directly to the engine crankshaft.

When the engine is running the pump draws fluid from the tank and routes it through a control valve, **2**, that comprises ten service sections.

Pump section **P1** supplies the control valve sections for:
- Dozer ram, **12**.
- Swing ram, **11**.
- Slew motor, **6**.

Pump section **P2** supplies the control valve sections for:
- Right hand track motor, **5**.
- Boom ram, **9**.
- Bucket ram, **10**.

The fourth section supplied by **P2** is normally blanked off but can be used to provide service for additional machine attachments, refer to Chapter 3, Attachments.

Pump section **P3** supplies the control valve sections for:
- Left hand track motor, **4**.
- Dipper ram, **8**.

The third section supplied by **P3** is normally blanked off but can be used to provide service for additional machine attachments, refer to Chapter 3, Attachments.

*Main relief valves (M.R.V.'s), **2L**, fitted to the inlet sections of the control valve, dump over-pressure fluid through the control valve exhaust chamber to tank **T**.

Auxiliary relief valves (A.R.V.'s), **2M**, are fitted to protect the dipper, boom and dozer rams from damage that might be generated through over-pressure conditions during operation.

*When the A.R.V.'s are open, over pressure fluid is routed to the control valve exhaust chamber and back to tank.

The service lines **7Q**, **7R** to the dozer ram, **7C**, **7D** and **7E**, **7F** to the track motor are routed through a rotary coupling **3**. This device allows the machine cab to turn without causing damage to hose connected services mounted on the undercarriage.

The remaining services lines connect directly to their relevant devices. Return fluid from services or from the neutral pressure circuit is routed back to tank through exhaust line **13** and return filter **14**.

HYDRAULIC FLUID LEVEL

Check Level - *for interval see Service Schedule*

⚠ WARNING

Fine jets of hydraulic oil at high pressure can penetrate the skin. Do not use your fingers to check for hydraulic oil leaks. Do not put your face close to suspected leaks. Hold a piece of cardboard close to suspected leaks and then inspect the cardboard for signs of hydraulic oil. If hydraulic oil penetrates your skin, get medical help immediately.
HYD001

Position the machine on level ground with the rams half extended. Check that the hydraulic fluid level, indicated at the check gauge, is halfway between the markers **A**. Remove hydraulic tank cover. Unscrew cap from return filter, top up. Replace filter cap and hydraulic tank cover.

HYDRAULIC FILTER

Renew Filter - *for interval see Service Schedule*

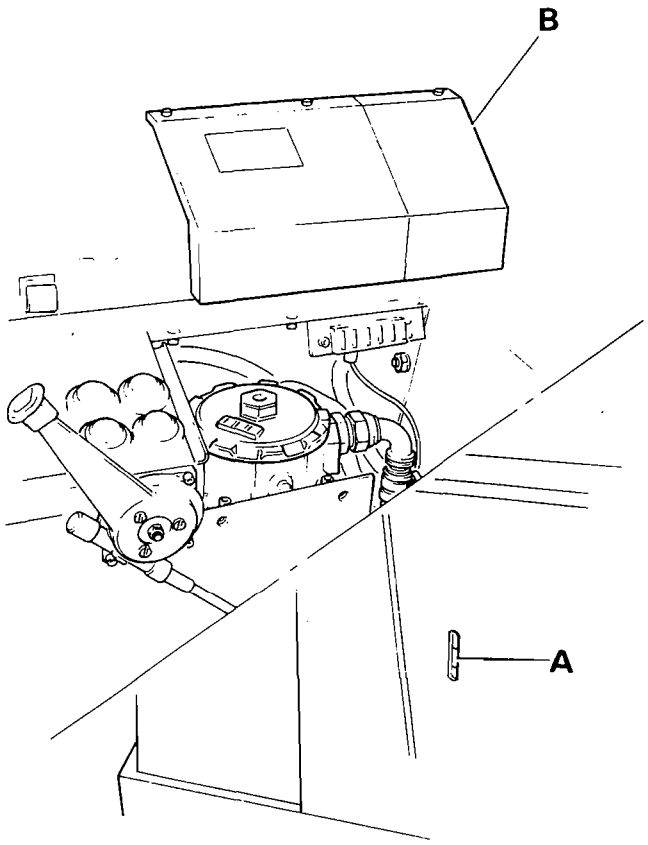
1 Remove hydraulic tank cover **B**.

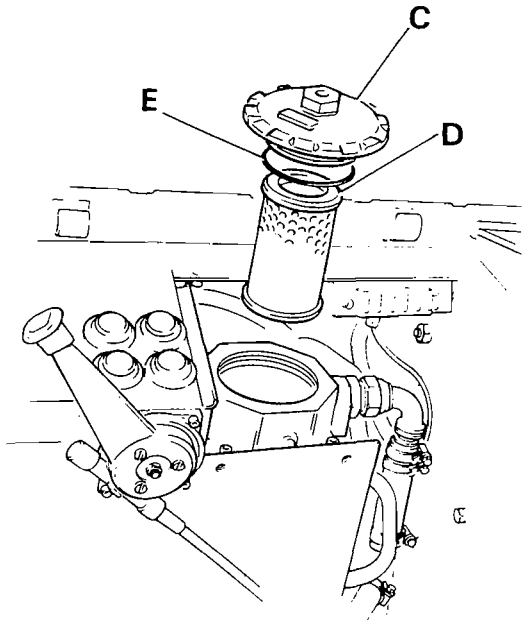
2 Unscrew cap **C** from return filter. Withdraw filter element **D** from body.

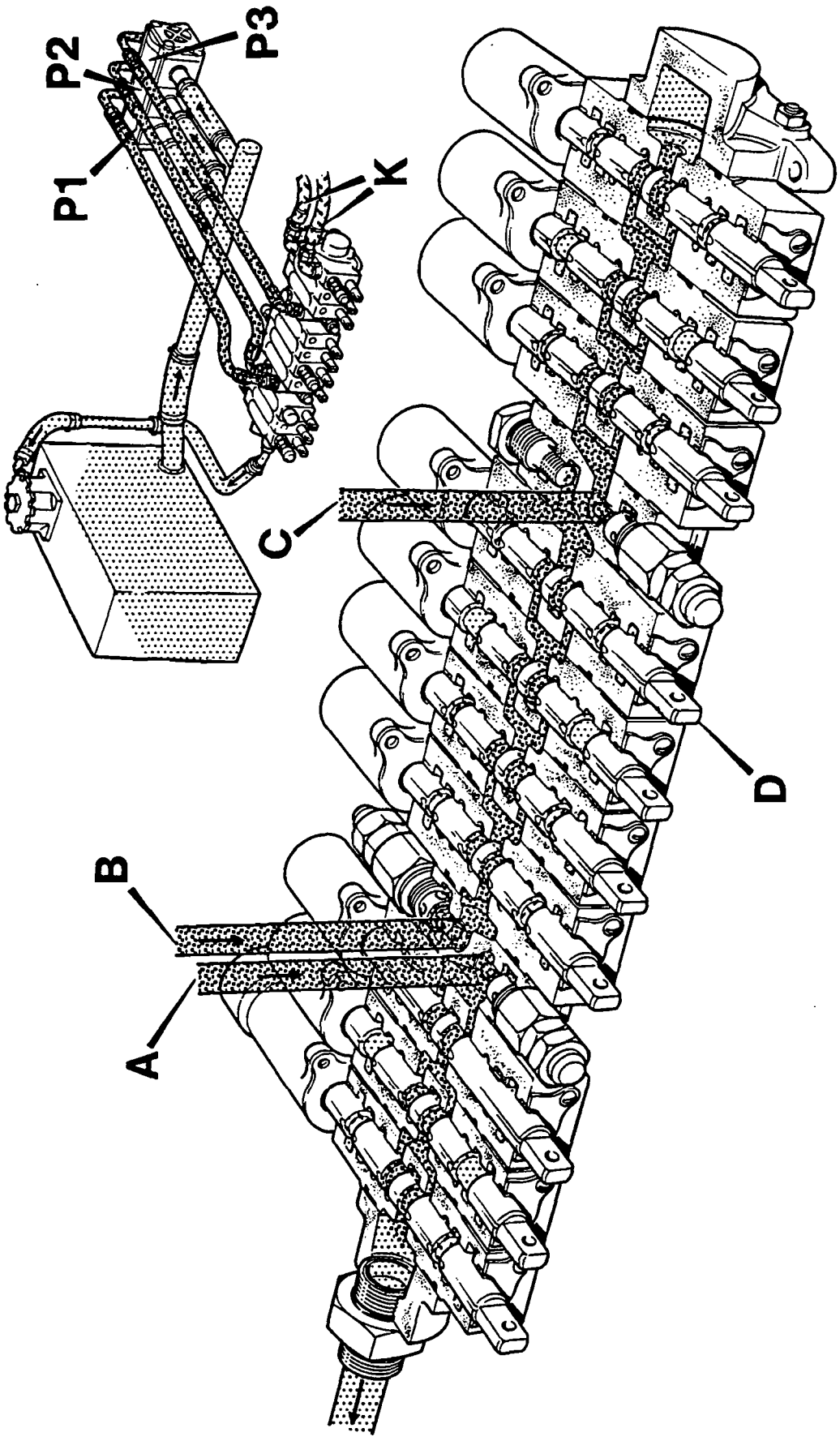
* 3 Clean all metal parts. Reassemble using new filter element **D** and seal **E**.

4 Top up hydraulic fluid level through filter.

5 Replace filter cap **C**. Do not exceed 30 Nm (22 lbf ft) on tightening. Replace and secure hydraulic tank cover **B**.






P3
P2
P1
K
C
D
B
A

NEUTRAL PRESSURE CIRCUIT

With the engine running, but no service selected, the machine's neutral hydraulic circuit operates.

Fluid is routed through pump sections **P1**, **P2** and **P3** to valve inlet ports **A**, **B** and **C**.

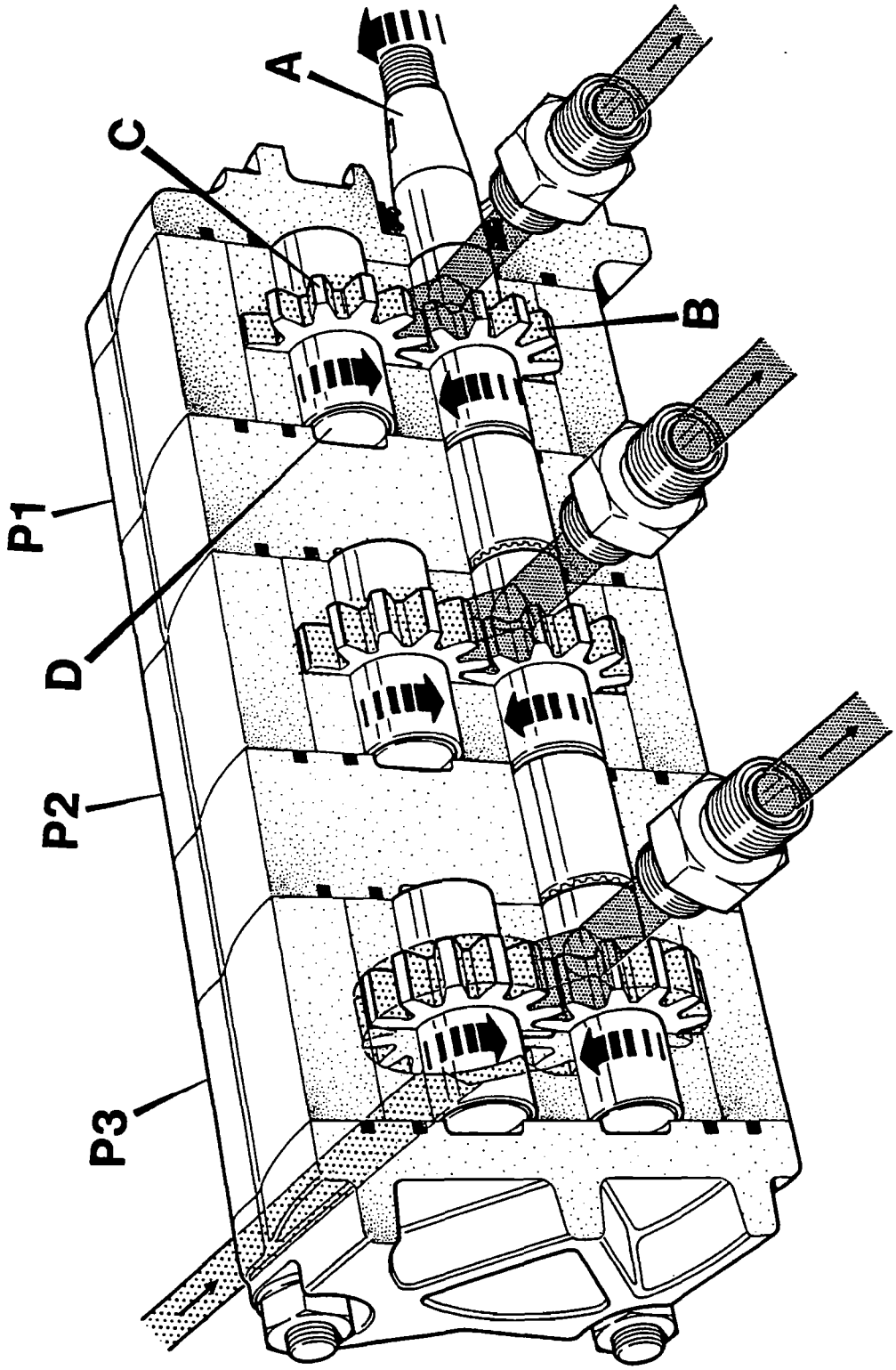
In neutral circuit the valve spools, **D**, are spring loaded to the centre position.

The spools allow fluid to pass through the valves central flow path and back through the exhaust chamber to exhaust port, **E**.

Spools in the slew and track valve sections allow return fluid in exhaust chamber to enter the motor valves operating path. This fluid is routed to the relevant motor through the motors counterbalance valve, set in neutral position, to the motor. As equal pressure is applied to each side of the motor no rotation takes place.

Excess pressure in the neutral circuit or when operating causes the MRV associated with the valve section supplied to open and vent excess pressure back to tank.

A second, parallel, gallery in to valve supplies fluid to the valve operating paths. With spool in central position, neutral circuit, the operating paths from the valve section to service lines, **K**, are closed.


A
C
B
P1
D
P2
P3

HYDRAULIC PUMP - OPERATION

The three section gear pump is driven directly from the engine crankshaft **A**.

Drive is transmitted through a three section pump drive shaft, linked by splined bushes between each pump section **P1**, **P2**, **P3**.

In each pump section the drive shaft carries a gear wheel **B**, which meshes with a second gear **C**, carried below the drive shaft on an independent idler shaft **D**.

The pump is arranged so that as the drive shaft turns under engine power the gear teeth on the inlet side of the pump 'unmesh' creating a partial vacuum. The vacuum causes fluid to be drawn into the pump from the hydraulic lines.

The fluid is then carried by the gears to the outlet side of the pump. As the gear teeth 'remesh' on the outlet side, pressure increases and fluid flows from the pump into the machine service circuit.