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CARRIER MAINTENANCE FULL TRACKED FV434 MK 1 AND 1/1 (BOWMAN)

TECHNICAL DESCRIPTION

BY COMMAND OF THE DEFENCE COUNCIL

Ministry of Defence
Issued by

DEFENCE LOGISTICS ORGANISATION

AMENDMENT RECORD

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TECHNICAL DESCRIPTION

Chapter

PREFACE

Sponsor: LAS IPT DLO Andover
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INTRODUCTION

1 Service users should forward any comments concerning this Publication through the channels prescribed in AESP 0100-P-011-013. An AESP Form 10 is provided at the end of this document; it should be photocopied and used for forwarding comments on this AESP.

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RELATED AND ASSOCIATED PUBLICATIONS

Related Publications

4 The Octad for the subject equipment consists of the Publications shown. All references are prefixed with the first eight digits of this Publication. The availability of the publications can be checked by reference to the relevant Group Index (see AESP 0100-A-001-013).

5 This publication has been produced in both hard copy and microfiche formats. Each page therefore carries a page number and a frame number.

Category/Sub-category			Information level			
			1 User/ Operator	2 Unit Maintenance	3 Field Maintenance	4 Base Maintenance
1	0	Purpose and Planning Information	101	101	101	101
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	1	Aid Memoire	*	*	*	*
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5	1	Failure Diagnosis	201	522	522	522
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7	1	Illustrated Parts Catalogues	711	711	711	711
	2	Commercial Parts Lists	*	*	*	*
	3	Complete Equipment Schedule, Production	*	*	*	*
	4	Complete Equipment Schedule, Service Edition (Simple Equipment)	741	741	741	741
	5	Complete Equipment Schedule, Service Edition (Complex Equipment)	*	*	*	*
8	1	Modification Instructions	811	811	811	811
	2	General Instructions, Special Technical Instructions and Servicing Instructions	821	821	821	821
	3	Service Engineered Modification Instructions (RAF only)	*	*	*	*

* Categories/Sub-categories not published

Associated Publications

Reference	Title
AESP 2300-A-100-201	Introduction to A, B and C vehicle hydraulic systems
AESP 2350-T-250-Octad	FV430 Series, Vehicles, All Marks
AESP 2350-T-252-Octad	Carrier, Maintenance Full Tracked, FV434 MK 1 and 1/1
AESP 5800-H-204-741	CES, Command control and communications and information system (C3I) FV434
AESP 6140-A-100-013	Secondary batteries, lead acid - Unit Care and maintenance
AESP 6920-D-100-101	Direct fire weapon effect simulator family (DFWES)
AESP 6920-D-102-201	Target weapon effects simulator (TAGWES)
AESP 6920-D-210-211	TAGWES on fighting vehicle FV432 and fighting vehicle FV434
Army Code 44900	IKEE CLANSMAN Basic Harness for FV434
Army Code 45268	IKEE CLANSMAN Basic Harness for FV434
Army Code 45317	MODIFICATION KIT, Electronic Equipment, Radio Station UK/VRC 353 for FV434
EMER Comms Inst H225	Installation instructions
EMER Power S 562/1	Technical description, 'K' series engine
IETP (TBA)	Bowman radio publication

ABBREVIATIONS

6 Throughout this Publication any reference to right or left is as seen from the rear of the vehicle looking forward, unless otherwise stated. Where non-standard abbreviations are used, the full meaning is written out in full the first time the subject is mentioned in the text, followed by the abbreviation in brackets.

CHAPTER 0

GENERAL TECHNICAL INFORMATION

CONTENTS

INTRODUCTION

1 The vehicle (Fig 1 and 2) is a Carrier Maintenance Full Tracked FV434 MK 1 and 1/1, designed to lift and carry major assemblies or replacement power packs for AFV casualties and to provide workshop facilities and services. A crew of four is carried, a commander, driver and two fitters.

2 The lifting device is a hydraulically operated crane, having a two piece hinged jib, with a telescopic extension. Stowage is provided on the vehicle for special tools and equipment to facilitate repair of damaged vehicles.

3 The rear part of the hull forms the load carrying compartment.

4 The vehicle is powered by a K60 multi-fuel engine, which drives the tracks via a six-speed automatic gearbox and a controlled differential type steering unit.

5 Braking is achieved by using the steering unit brakes.

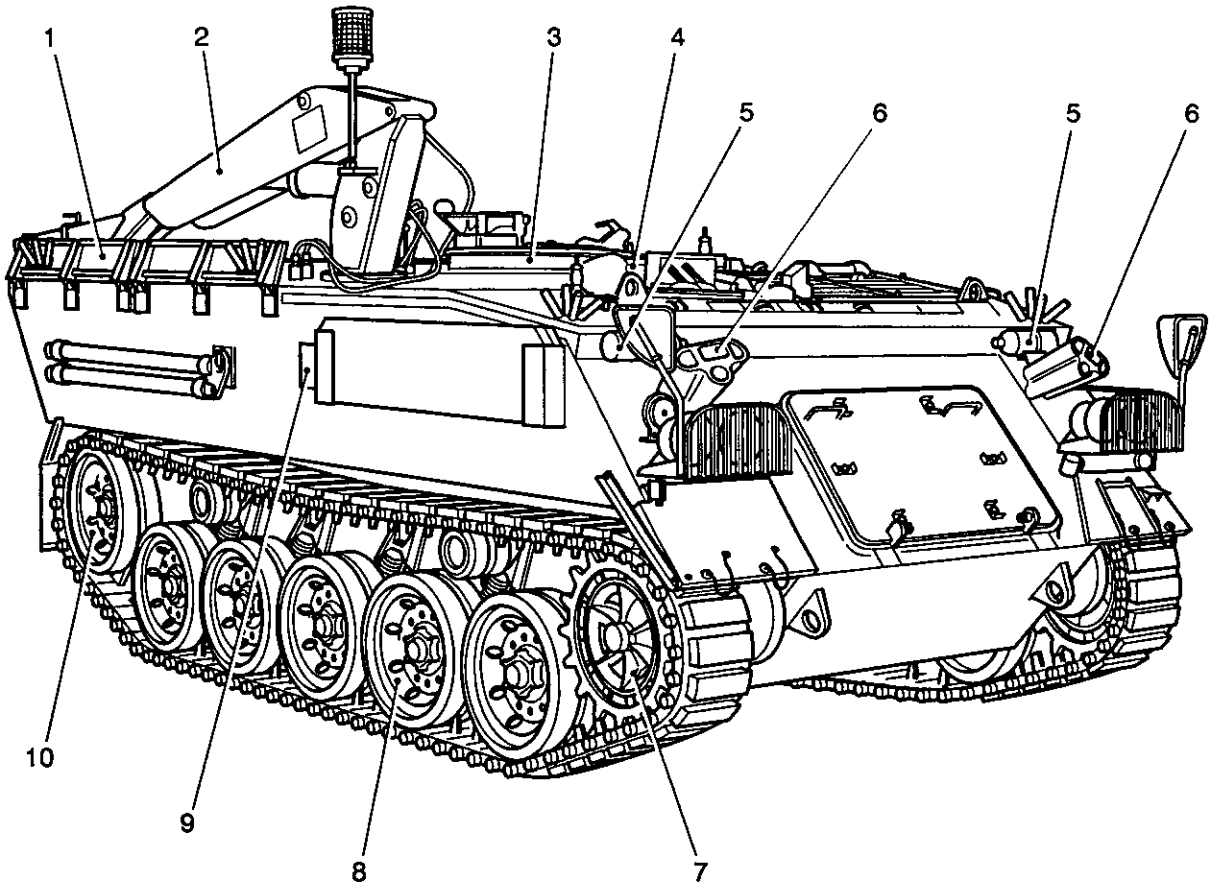
6 Torsion bar suspension is used. Hydraulic shock absorbers are fitted at the front and rear stations which can be lock hydraulically when the crane is being used.

7 The electrical system is ac and dc rectification for vehicle supply.

8 An air conditioning system provides protection against chemical and bacteriological attack and from radiological fall-out.

9 Multi-fuel heater kits are available for fitting to vehicles destined to operate in temperate or arctic climates.

10 Access to the interior of the closed down vehicle is via the crane operator's hatch, the other hatches being locked from inside the vehicle and operable only from the inside.



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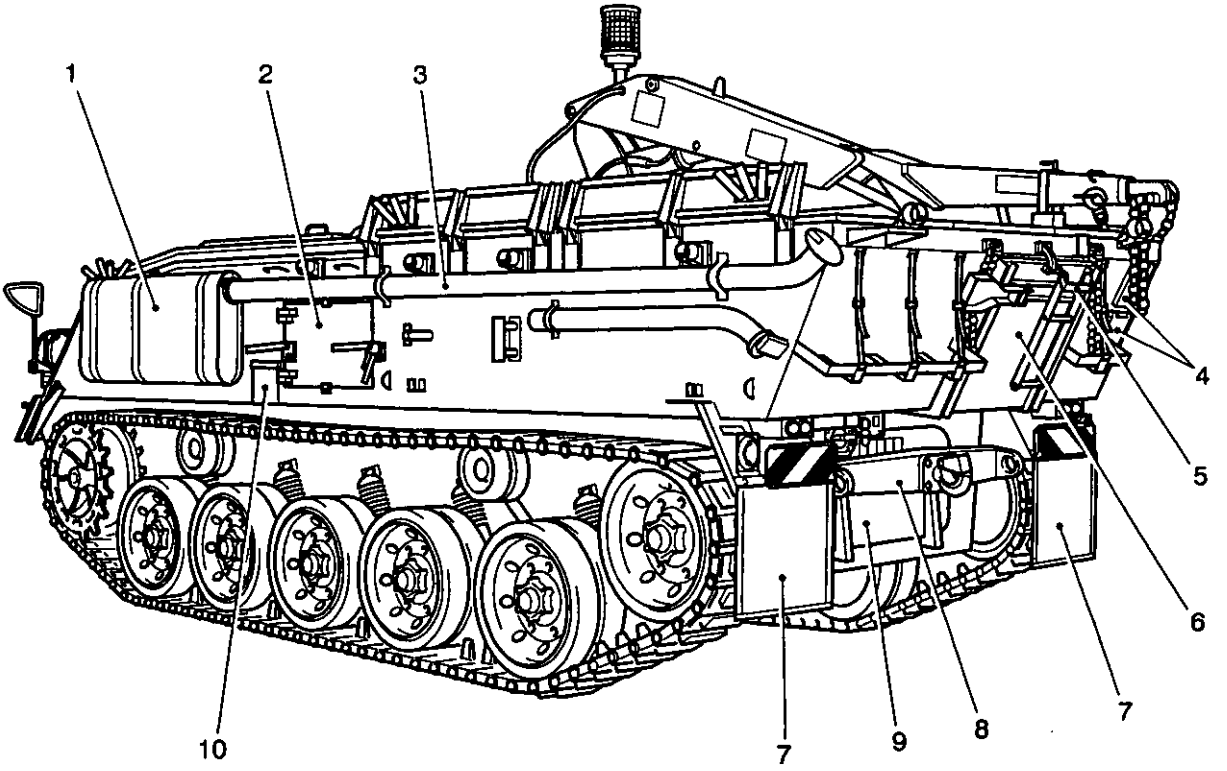
1	Catwalk	7	Final drive sprocket
2	Crane	8	Road wheel
3	Commander's cupola	9	Fixed fire extinguisher control cover flap
4	Driver's door	10	Track adjuster wheel
5	Fire extinguishers		
6	Smoke dischargers		

Fig 1 Three quarter front view



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1	Silencer	6	Workbench
2	Filter access door	7	Track pad deflector
3	Exhaust pipe	8	Tow bar
4	Stowage locker doors	9	Rear stowage bin
5	Bench step	10	Fixed fire extinguisher control cover flap

Fig 2 Three quarter rear view

Data

11 Table 1 details the physical data for Carrier Maintenance Full Tracked FV434 MK 1 and 1/1, Table 2 Lamps, Table 3 Fuses and Table 4 Circuit breakers fitted to FV434.

TABLE 1 PHYSICAL DATA

Serial (1)	Heading (2)	Detail (3)
1	Crew	Four, driver, commander and two fitters
2	Dimensions	Refer to Fig 3
3	Weights	
	Unladen (fully fuelled and with driver)	13,780 kg (13.55 tons)
	Laden	15,057 kg (14.81 tons)
	Payload	2,717 kg (2.67 tons)
4	Bridge classification	19

(continued)

TABLE 1 PHYSICAL DATA (continued)

Serial (1)	Heading (2)	Detail (3)
5	Engine	Rolls Royce K60 Mk 4F, two stroke, multi-fuel, compression ignition. Opposed piston type.
	Type	Two stroke, multi-fuel, compression ignition opposed piston.
	Cylinders	6
	Fuel	Diesel, gas turbine, MT gasoline premium grade motor spirit or a mixture of these fuels.
	BHP	240 at 3.750 rev/min at output shaft
	Max torque	2,500 rev/min (output shaft)
	Governed speed	
	Crankshaft	2,400 rev/min
	Output shaft	3,750 rev/min
	Idling speed	780-800 rev/min
	Aspiration	Scavenger blower
	Firing order	1, 5, 3, 4, 2, 6
	Bore	3.4375in. (87.30mm)
	Stroke	3.6in. x 2 (81.4mm x 2)
6	Gearbox	GM-Allison TX200-4A automatic gearbox having six forward gears and one reverse, with a torque converter operating in 1st, 3rd, and reverse.
7	Gear ratios and speeds	

Gear	Gearbox ratio	Steering unit bevel Ratio	Final drive ratio	Overall ratio	Speed km/h	Speed mile/h
1	5.294:1	2.07:1	4.58:1	50.19:1	8.9	5.56
2	3.810:1	2.07:1	4.58:1	36.12:1	12.3	7.72
3	2.691:1	2.07:1	4.58:1	25.51:1	17.5	10.93
4	1.936:1	2.07:1	4.58:1	18.35:1	24.3	15.20
5	1.39:1	2.07:1	4.58:1	13.81:1	33.8	21.16
6	1.0:1	2.07:1	4.58:1	9.48:1	47.2	29.42
Reverse	6.04:1	2.07:1	4.58:1	57.26:1	7.8	4.87

8	Performance	[redacted]
9	Fuel consumption	[redacted]
10	[redacted]	

(continued)

TABLE 1 PHYSICAL DATA (continued)

Serial (1)	Heading (2)	Detail (3)
11	Range of operation	[redacted]
12	Maximum gradient	30 degrees
13	Maximum vertical obstacle	609 mm (2 ft)
14	Trench crossing	2.06 m (6 ft 9 in.)
15	Minimum turning circle	5.334 m (17 ft 6 in.)
16	Suspension	
	Type	Torsion bar, five units on each side with axle arms in the trailing position. Idler at rear.
	Wheels	609 mm (24 in.) diameter, rubber tyred. Two on each suspension unit and track adjuster .
	Shock absorber	Hydraulic on front and rear stations. Lockable to give stability when using crane.
17	Tracks	Rubber bushed with rubber padded links, connected by hexagonal pins.
	Links per track (new)	90
	Condemnation limit	88 (with hydraulic ram fully extended).
18	Track guide rollers	Two for each track.
19	Steering	Lever operated controlled differential unit.
20	Armament	Pintle mounting on cupola for commander's machine gun in ground role.
21	Smoke protection	Two forward facing multi-barrelled smoke dischargers.
22	Ammunition	
	Machine gun	Eight boxes of 200 rounds , belted for GPMG.
	Smoke discharger	Six rounds (loaded in dischargers).
23	Vision	
	Driver	Head out for opened up position. Single wide angled AFV No. 33 Mk1 periscope.
	Commander	360 degree rotation cupola with three periscopes, both outer periscopes fixed. Centre AFV No. 32 Mk 1 periscope can be pivoted axially in vertical plane.

(continued)

TABLE 1 PHYSICAL DATA (continued)

Serial (1)	Heading (2)	Detail (3)	
24	Capacities	Litres	Imperial
	Engine lubrication system	33	58 pints
	Gearbox	15.6	26 pints
	Engine governor	1.15	2 pints
	Coolant system	44.3	78 pints
	Hydraulic fan drive	22.4	39 pints
	Steering unit	26.7	47 pints
	Final drives (each)	4.3	7.5 pints
	Road and track adjuster wheels (each)	1.7	3 pints
	Crane hydraulic system	45.5	80 pints
25	Crane		
	Type	HIAB 61 Hydraulic, two piece hinged jib three position telescopic extension.	
	Drive	Gear type pump driven from PTO in transverse gearbox.	
	Angle slew	190 degrees.	
	Load capacity main hook		
	2.261 m (7ft 5in.) radius	3,048 kg (7.00 ton)	
	2.591 m (8ft 6in.) radius	2,585 kg (2.54 ton)	
	2.896 m (9ft 6in.) radius	2,390 kg (2.35 ton)	
	Extension hook		
	3.20 m (10ft 6in.) radius	1,524 kg (1.50 ton)	
	3.96 m (13ft 0in.) radius	1,274 kg (1.23 ton)	
26	Electrical equipment		
	System	24V negative earth with AC generating system rectified for battery charging and general purposes.	
26.1	Batteries	Maintenance free	
	Number off	Four (two series connected for automotive purposes and two series connected for radio equipment).	
	Voltage	12V	
	Capacity	100Ah	

(continued)

TABLE 1 PHYSICAL DATA (continued)

Serial (1)	Heading (2)	Detail (3)
26.2	Alternators	2 off
	Main output	0.5 kVA, 3 phase, 0.95 Power factor, 25V, line current 81 amps within the speed range of 1,750 to 1,260 rev min (87.5 to 630 cycles sec).
	Cutting in speed	1,250 rev min alternator speed.
	Rotation	Reversible
	Phase rotation	A B C looking on the drive and with alternator rotating counter clock-wise.
	Field resistance	0.34 ohms to 0.37 ohms at 20 deg C.
	Number of poles	6
	Drive ratio (gearbox)	2.95:1
	Input torque	30.5 Nm - (22.5 lb ft (max))
	Input HP	6.37
	Cooling	Engine oil
	Bearing lubrication	Oil bled of main supply 500 cc per minute at 122 deg C.
	Weight	31.3 kg (69 lb)
	Gear teeth	22
26.3	Control panel, alternator	2 off
	Type	No. 1 Mk 1 - FV342587 static voltage regulator, silicon controlled rectifier.
	Voltage control	Normal 28.5V ± 2%
	Protection	
	Current limiting	30A max field current.
	Field over heat	Alternator output reduced when field temperature exceeds 250 deg C.
26.4	Rectifier unit	
	Type	No. 1 Mk 1 - FV342588 six half phase bridge rectifier.
	Input	165A, 22V, 3 phase
	Output	200A, 28,5V dc
	Frequency range	87.5 to 630 cycle sec
	Cooling	Engine oil
	Oil temperature	122 deg C (max)
	Minimum depth of oil	Oil level to be 0.5in. above any inlet hole at any angle of tilt.
	Fuse	250A
	Ammeter shunt	300A, 75mV
	Weight	13.8 kg (30.5 lb)

(continued)

TABLE 1 PHYSICAL DATA (continued)

Serial (1)	Heading (2)	Detail (3)
26.5	Distribution link box	
	Type	No. 1 Mk 1 - FV494570
	Relay No.1 (Radio battery)	
	Type	CAV BBNG
	Rating	Continuous
	Coil resistance	28.5 to 31.5 ohms at 20 deg C
	Pull in voltage	16V (min)
	Relay No. 2 (Alternator only load relay)	
	Type	CAV L6
	Coil resistance	64 to 70 ohms
	Pull in voltage	6 to 8 volts
26.6	Starter	
	Type	No. 3 Mk 1 - FV546101
	Rotation	Clockwise viewing DE
	Brake HP	11.5 (max) at 14V
	Torque	54.24 Nm (40 lb ft at max BHP) 149.2 Nm (110 lb ft stall (2,250A, 10V approx))
26.7	Distribution panel	
	Type	No. 6 Mk 1 - FV534891
	Relays (4 off)	Plessey 7CZ-106198
	Pull in voltage	15 to 18V
	Drop out voltage	12V (max)
	Coil resistance	165 ohms ± 5% at 20 deg C.
26.8	Relay (generator only load)	Hendry D4485
	Pull in voltage	15 to 18V
	Drop out voltage	12V (max)
	Coil resistance	123 ohms ± 5% at 20 deg C
26.9	Radio distribution box	
	Type	No. 1 Mk 3 - FV534890
	Relay	Plessey 7CZ-106198
	Pull in voltage	15 to 18V
	Drop out voltage	12V (max)
	Coil resistance	165 ohms ± 5% at 20 deg C
26.10	Fuel pump	
	Type	No. 2 Mk 1 - FV342593
	Rotation	Clockwise viewing pump end.
	Current	4.5A (max)
	Fuel pressure	1.7 bar (25 lb sq in)
	Fuel flow	136.4 ltr (30 gallon)per hour.
	Operating temperature	-40 deg C to 105 deg C
	Weight	5.5 kg (12 lb)

(continued)

TABLE 1 PHYSICAL DATA (continued)

Serial (1)	Heading (2)	Detail (3)
26.11	Ventilation fan motor	
	Type	No 8 Mk 1 FV481818
	Rating	Continuous
	Output	0.27 HP at 4500 rev/min (max.), 24V with zero external resistance (17 amps max.).
26.12	Fan controller	
	Type	No 2 Mk 1 FV546143

12 Table 2 details the lamps fitted to the FV434 vehicle.

TABLE 2 LAMPS

Light	Volts	Watts	Type
Head, Flood	26	50/50	British pre-focus
Tail/stop	28	30/7	SBC index pins
Side, Registration plate, Convoy, interior, locker and bulkhead.	26	6	SCC
Warning and instrument panel	28	0.04	Midget flange
IR	26	100	European cap
Turn and fire warning	24	24	SCC

13 Table 3 details the rating and location of the fuses fitted in the FV 434 vehicle.

TABLE 3 FUSES

NOTE

Spare fuses are carried in a container located adjacent to the gear range selector lever on the power pack compartment sill. Fuses of the correct rating must be used.

Location	Identification	Type and Rating	Circuits
Rectifier unit		250 English Electric GS 150/250	Charging
Radio distribution box	Load	100A Belling Lee Air fuse L1330/100	Radio circuits
Auxiliary junction box	F1	5A cartridge	Driver's periscope wiper motor and IR periscope.
	F2	5A cartridge	One interior light and bulkhead lights.
	F3	5A cartridge	Spotlight socket and inspection light socket (crane position).
	F4	5A cartridge	Three interior lights.
	F5	10A cartridge	Fuses F2 and F4.
Instrument panel	Fuse	5A cartridge	Instrument panel lights.

NOTE

Spare fuses are carried in a container located adjacent to the gear range selector lever on the power pack compartment sill. Fuses of the correct rating must be used.

14 Table 4 details the rating and location of the Circuit Breakers (CBs) fitted in the FV 434 vehicle.

TABLE 4 CIRCUIT BREAKERS

Serial (1)	Circuits (2)	Circuit breakers		
		Location (3)	Identification (4)	Type and rating (5)
1	Circuit controlled by fuses F1, F2, F3, F4 and F5 in auxiliary junction box and smoke dischargers.	Distribution panel No. 6 Mk 1	A	15 A
2	Horn, 12 point socket, Lights: head, side, tail, convoy, registration plate, turn stop, IR driving.		B	25 A
3	Fire alarm warning lights.		C	10 A
4	Distribution panel inspection light sockets.		D	10 A (not fitted)
5			E (Not fixed)	
6	External lighting sockets and bench light socket.		F	35 A
7	Ventilating fan motor relay.		G	5 A
8	Heater unit.		H	35 A
9	Fire alarm.		J	15 A
10	Circuits controlled by engine switch, instrument panel light fuse and DC supply to alternator field circuits.		K	15 A
11	Fuel pump, injection pump stop solenoid, battery analogue.		L	15 A
12	Engine coolant thermometer, fuel gauge, gearbox oil thermometer, oil pressure switch, alternator (GEN) warning lights (driver and crane operator), starter switch, alternator boost and instrument panel lights fuse.		M	10 A

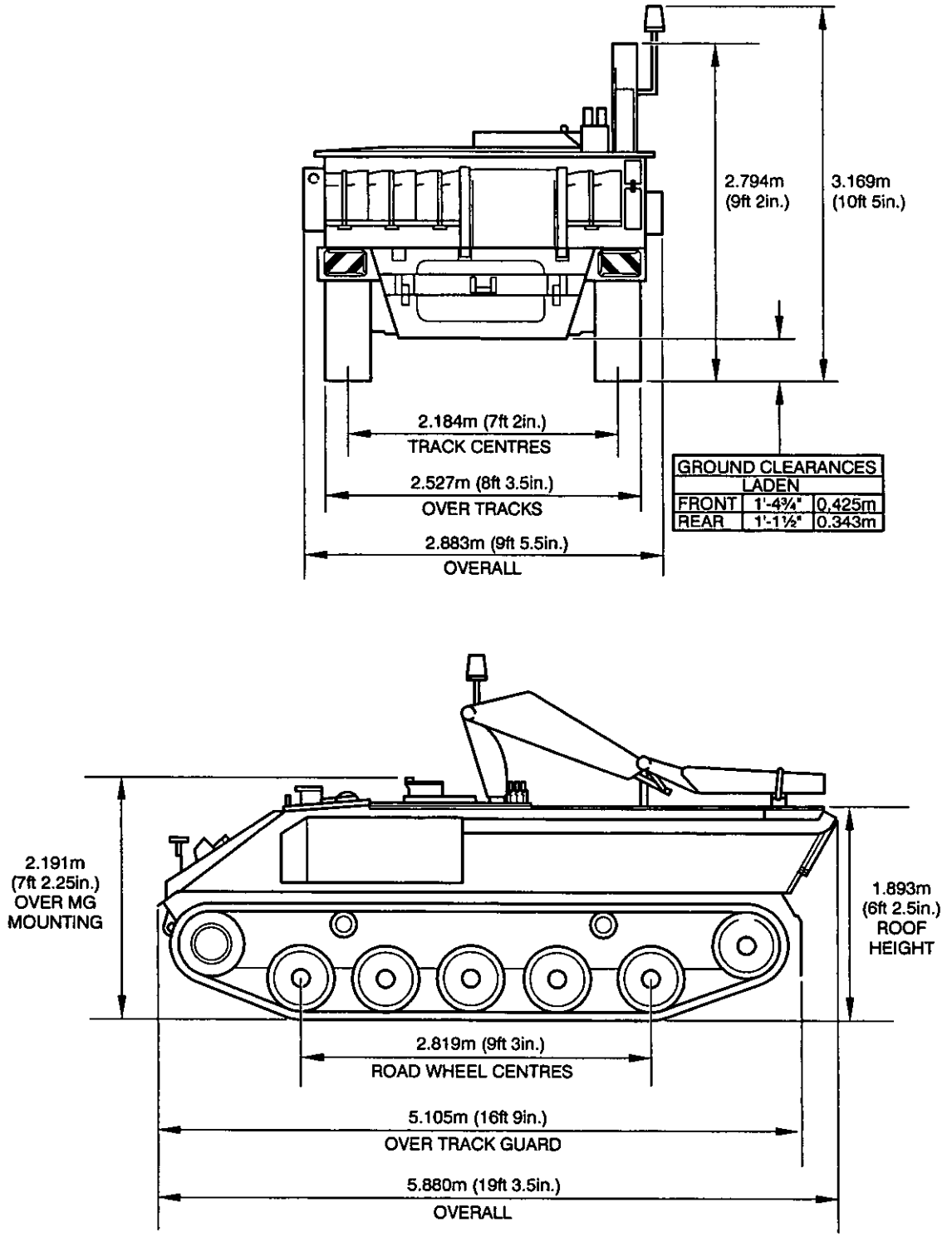

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Fig 3 Dimensional diagram FV434

CHAPTER 1-0

POWER PACK ASSEMBLY – LIST OF CHAPTERS

CONTENTS

LIST OF CHAPTERS

1 This chapter is further sub-divided as follows:

Chap

1-1 Power pack
1-2 Engine
1-3 Fuel system
1-4 Cooling system
1-5 Transmission

CHAPTER 1-1

POWER PACK

CONTENTS

GENERAL

1 The power pack for the Carrier, Maintenance Full Tracked, FV434 Mk 1 and 1/1 is identical to that used on the Carrier Personnel Full Tracked FV432 MK 2 & 2/1 except in this role, an additional power take off and hydraulic pump are fitted to supply power to the crane as detailed in Chap 6-1 of this publication. The common items technical description is detailed in AESP 2350-T-251-302 Chap 1-1.

CHAPTER 1-2

ENGINE

CONTENTS

GENERAL

1 The Rolls Royce K 60, No 4 Mk 4F and Mk 6F engine fitted to the Carrier, Maintenance Full Tracked FV434 MK 1 and 1/1 is identical to that used on the Carrier Personnel Full Tracked FV432 MK 2 & 2/1. The technical description is detailed in AESP 2350-T-251-302 Chap 1-2.

CHAPTER 1-3

FUEL SYSTEM

CONTENTS

GENERAL

1 The fuel system is shown diagrammatically in Fig 1.

2 The fuel is drawn from its tank by an electrically operated pressurizing pump which, when started by operating the engine switch, delivers the fuel to the fuel injection pump through a replaceable element type filter mounted on the power pack frame. Leak-off fuel from the injectors, injection pump and filter relief valve is returned direct to the tank.

3 The fuel tank is positioned under the load carrying compartment floor plate, immediately behind the bulkhead and forward of the rear stowage compartment. It is secured in position by eight straps made of galvanized cable with hexagonal fittings.

FUEL TANK

4 The rectangular fuel tank (Fig 2(9)) is made of welded sheet steel, with swaging at the ends to add strength. Swaging round the tank body is also utilized to locate and prevent the securing straps (8) from moving. Internal baffle plates (13) are fitted to curb the surge of fuel. The tank is shaped centrally at one side to accommodate the flange mounted fuel pressurizing delivery pump (15) below the outer surface.

5 Aperture facing pads are welded to the tank for fitting by screws, access plates, a fuel gauge unit (6), a flanged filler tube connector (19) to the top, and a drain valve (17) to the bottom. Also at the top of the tank, welded bosses are provided for two spill return pipes and a heater supply pipe to which an internal suction pipe is attached. The suction pipe (11) reaches almost to the bottom of the tank. Four hinged lifting handles (18) are provided on top of the tank to assist its installation or removal.

Drain valve

6 The drain valve (17) is identical to that described in AESP 2350-T-251-302, but differs in its installation. The valve housing is screwed direct to the underside of the fuel tank, therefore, the domed casing used in its installation in the FV432 is not required. The valve is accessible by removal of a circular plate under the hull bottom plate.

Fuel pressurizing pump

7 The fuel pump (15) is described in AESP 2350-T-251-302.

Fuel tank filter and connections

8 The tank filter assembly (12) comprises an element and an adaptor, the element is passed over an adaptor tube and sealed at each end by integral sealing rings, the adaptor tube being blanked at one end, and welded to an adaptor pipe (14). The adaptor pipe is coupled to the fuel pump body inlet connection. The fuel passes through the filter element gauze, through a single hole in the adaptor tube side, and passes through the tube into the pump body.

9 An external connection feed pipe (16) from the pump outlet is supported by an angle bracket welded to the tank, and is coupled to the main fuel feed line.

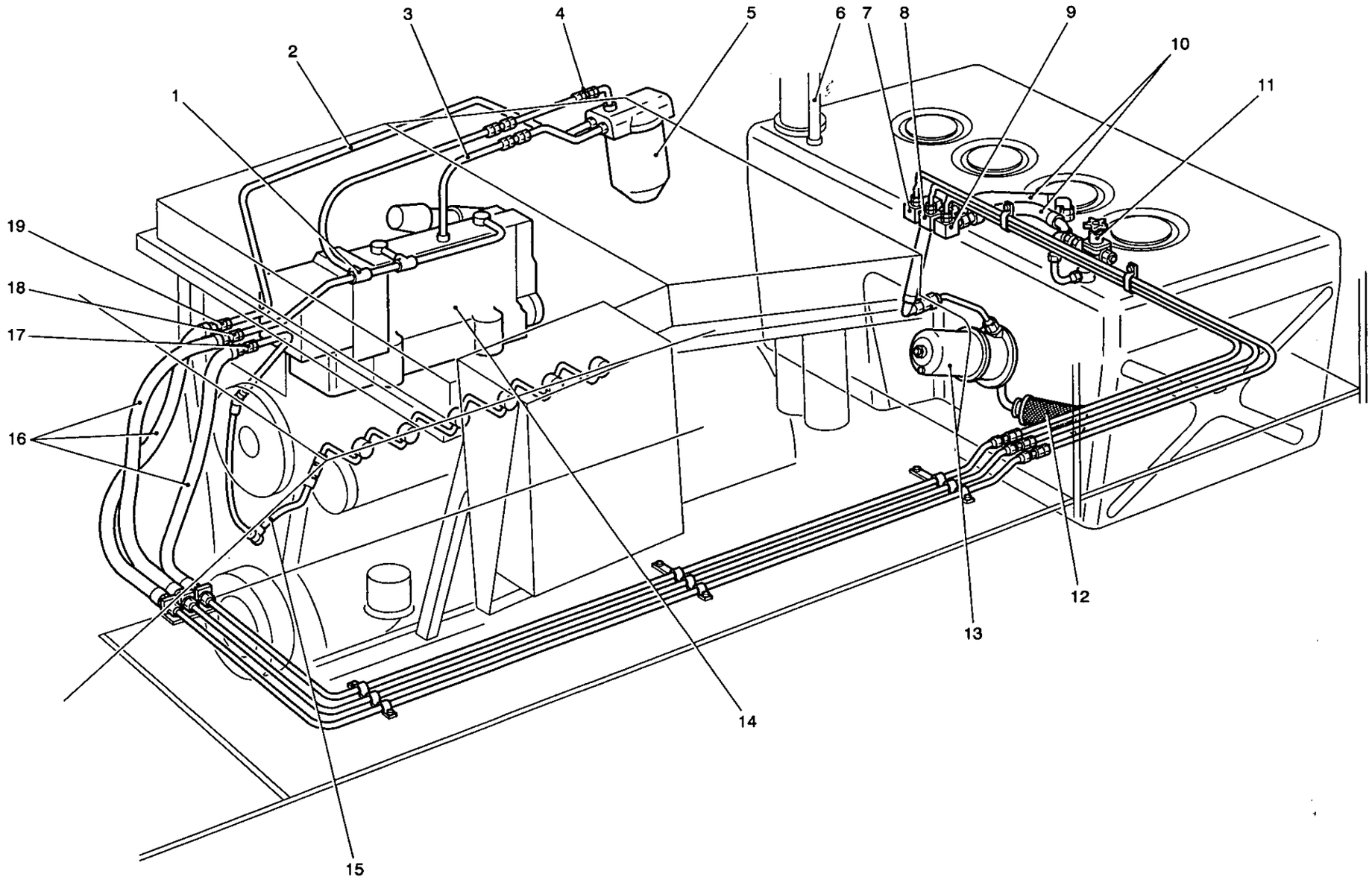
Fuel filler tube

10 A fuel filler tube (Fig 2(3) is on the right of the tank and extends upward near to the top of the bulkhead, to which it is attached. The filler tube is closed by a hinged cover (1), under which a filler cap (2) is retained by a screwed handle and locking device similar to that described in AESP 2350-T-251-302.

11 A vent pipe (21) from the tank is attached to the bulkhead alongside of the filler tube. Both the filler tube and vent pipe are connected by hose couplings (4) and (20) to two pipes on the tank.

FUEL FILTER

12 The fuel filter is described in AESP 2350-T-251-302.



1 Injection pump leak-off
2 Fuel feed line
3 Injection pump feed
4 Relief valve
5 Fuel filter
6 Tank vent pipe
7 Fuel feed connection
8 Injection pump leak-off connection
9 Injector leak-off connection
10 Flexible pipes
11 Heater connection valve
12 Fuel tank filter
13 Fuel pump
14 Fuel injection pump
15 Injector leak-off
16 Flexible pipes
17 Injector leak-off connection
18 Injection pump leak-off connection
19 Fuel filter feed connection

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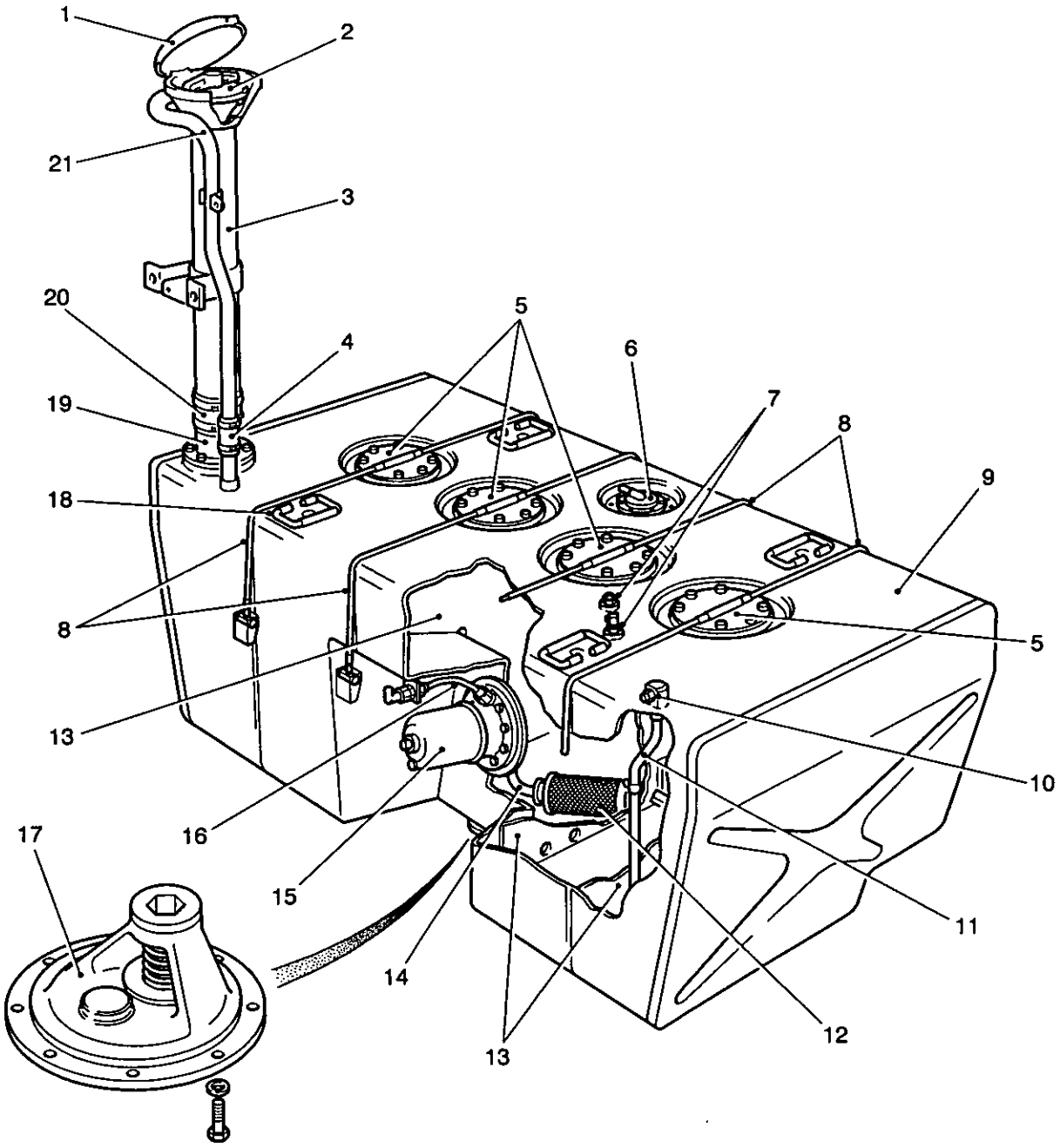
Fig 1 Fuel system diagram



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1	Fuel filler cove	8	Securing strap	15	Fuel pump
2	Filler cap	9	Fuel tank	16	Feed pipe
3	Fuel filler tube	10	Heater supply connection	17	Drain valve
4	Hose	11	Suction pipe	18	Lifting handle
5	Access plate	12	Filter	19	Filler tube connector
6	Fuel gauge unit	13	Baffle plate	20	Hose
7	Leak-off connection	14	Filter adaptor pipe	21	Fuel tank vent

Fig 2 Fuel tank

CHAPTER 1-4

COOLING SYSTEM

CONTENTS

GENERAL

1 The cooling system fitted to the Carrier Maintenance Full Tracked FV434 Mk 1 and 1/1 is identical to that used on the Carrier Personnel Full Tracked FV432 MK 2 & 2/1. The technical description is detailed in AESP 2350-T-251-302 Chap 1-4.

CHAPTER 1-5

TRANSMISSION

CONTENTS

GENERAL

1 The transmission fitted to the Carrier Maintenance Full Tracked FV434 Mk 1 and 1/1 is identical to that used on the Carrier Personnel Full Tracked FV432 MK 2 & 2/1 except in this role, an additional power take off and hydraulic pump are fitted to supply power to the crane. The technical description of the power take off and hydraulic pump is detailed in Chap 6 of this publication. The common items technical description of the transmission is detailed in AESP 2350-T-251-302 Chap 1-5.

CHAPTER 2-0

FINAL DRIVES, SUSPENSION AND TRACKS – LIST OF CHAPTERS

CONTENTS

LIST OF CHAPTERS

1 This chapter is further sub-divided as follows:

Chap

2-1 Final drives
2-2 Suspension and tracks

CHAPTER 2-1

FINAL DRIVES

CONTENTS

GENERAL

1 The final drives fitted to the Carrier Maintenance Full Tracked FV434 Mk 1 and 1/1 are identical to those used on the Carrier Personnel Full Tracked FV432 MK 2 & 2/1 except the final drive ratio is lower, because of the extra payload. The technical description is detailed in AESP 2350-T-251-302 Chap 2-1.

CHAPTER 2-2

SUSPENSION AND TRACKS

CONTENTS

GENERAL

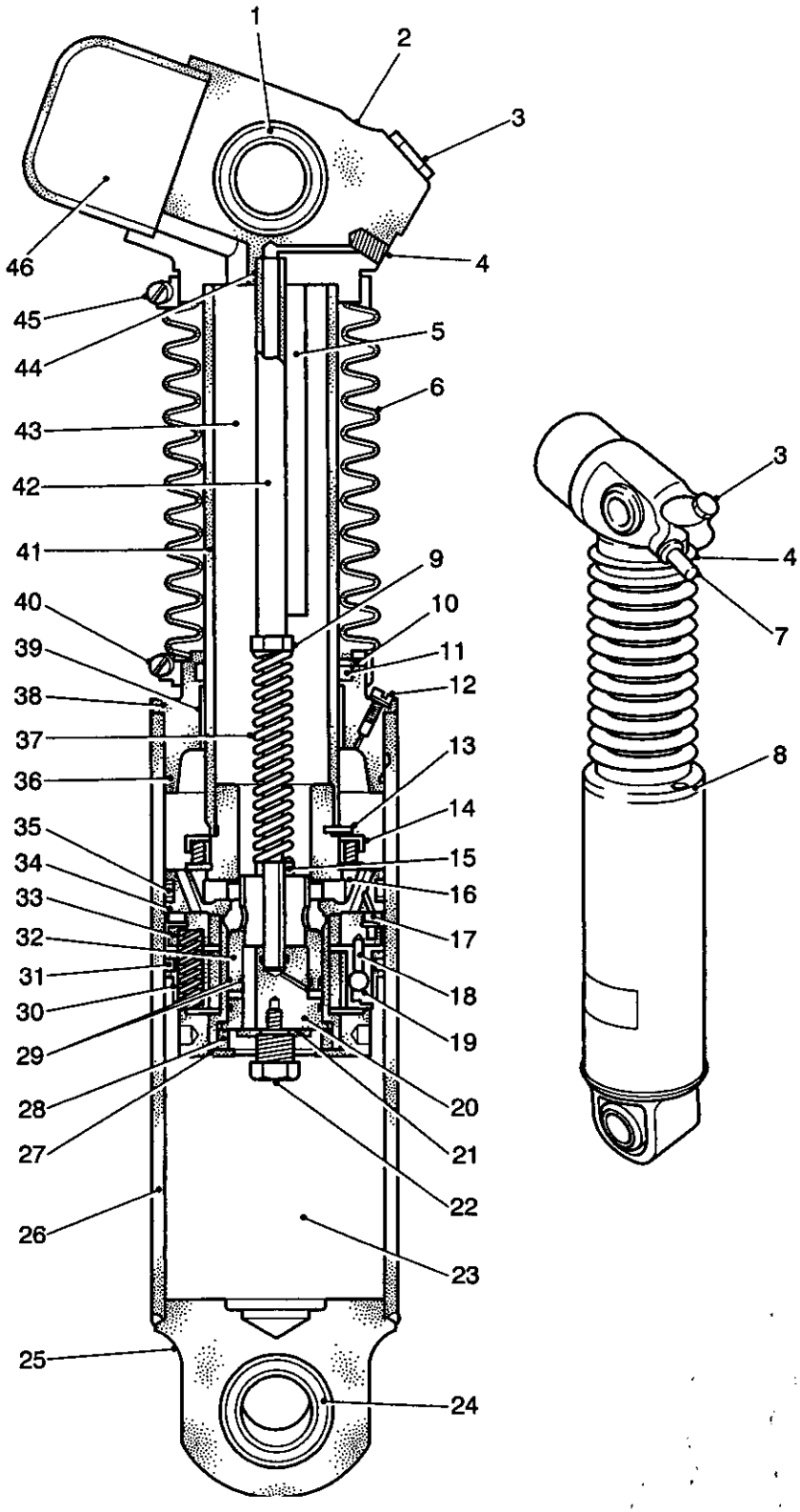
1 This chapter details the differences between the suspension and tracks of the FV434 vehicle and the rest of the FV430 range of vehicles. The differences being the type of shock absorber used and the number of links in the tracks. The technical description covering the common items of the suspension and tracks is detailed in AESP 2350-T-251-302.

2 The front and rear wheel stations are fitted with telescopic hydraulic shock absorbers, which have a built in lock out device, the shock absorbers operate as normal suspension dampers when the vehicle is travelling, but on the introduction of a controlled pressurized fluid supply from the crane hydraulic system (see Chapter 5 of this publication), the dampers are locked rigid to permit crane operation without the vehicle tilting.

3 Pivot bolts attach the rubber bushed ends of the dampers to their respective axle arm and hull mounting brackets. The top pivot bolt is smeared with jointing compound and screwed into a boss welded to hull plate, clamping the resilient bushed end of damper in its attachment bracket, the hexagon headed end of bolt is fitted with a locking plate. The lower bushed end of the damper is treated and attached to the axle arm lugs in a similar mode, the pivot bolt, however is retained by a self-locking nut.

SHOCK ABSORBERS

4 The shock absorbers (Fig 1) are a telescopic hydraulic type with a built in lockout device, which enables it to be used as a solid strut on selection. Hydraulic fluid acts as the damping medium and also as the actuating agent, when directed under pressure through a separate circuit to the lockout mechanism. The units are fitted on the front and rear stations of the suspension and differ only in that they are handed for installation purposes.



1	Metalastik bush
2	End fitting
3	Filler plug
4	Lockout connection
5	Filler plug
6	Rubber gaiter
7	Gaiter breather connection
8	Tab washer
9	Stop
10	Backing ring
11	Seal ring
12	Bleed screw
13	Circlip
14	Upper plate view
15	Retaining plate
16	Fluid passage
17	Lower plate valve
18	Limiting stop
19	Non-return valve
20	Lock piston guide
21	Plate valve
22	Bolt
23	Cylinder chamber
24	Metalastik bush
25	End fitting
26	Body
27	Nut
28	Spacer
29	Sealing rings
30	Relief valve
31	Sealing ring
32	Lockout piston
33	Recoil valve
34	Damper piston
35	Seal ring
36	Seal ring
37	Return spring
38	Bearing housing
39	Bearing sleeve
40	Clip
41	Piston rod
42	Lockout pressure tube
43	Piston rod chamber
44	Seal
45	Clip
46	Air chamber

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Fig 1 Shock absorber

5 The body (26), formed as a cylinder is closed at one end by an end fitting (25) welded in position, the fitting has a machined hole with integral Metalastik type rubber bush (24) for attachment to the vehicle, and a tapped filler hole with plug and seal washer. The opposite end is closed by a bearing housing (38) through which extends the damper piston rod (41). The piston rod is sealed by a seal ring (11) with backing ring (10), and is supported by a press-fit bearing sleeve (39). The seal rings and bearing sleeve fit into the annular grooved and stepped bore of the bearing housing. A threaded hole connecting with the cylinder bore houses the cylinder bleed screw (12). The bearing housing sealed by a seal ring (36) is screwed into the body with its flange abutting a tab washer (8) that locks it in position.

6 The end fitting (2) welded to the damper piston rod, has a machined hole with an integral Metalastik type rubber bush (1) for attachment to the vehicle, three tapped and faced holes each individually connected by drillings provide the filling, lockout (4) and gaiter breather (7) tappings. The filler hole tapping has a screwed plug (3) with seal washer. The small air chamber (46) welded to the angled head of the end fitting is connected by a drilling to the piston rod chamber (43), through which passes the lockout pressure tube assembly sealed in the end fitting by a rubber seal (44). The lockout pressure tube assembly consists of a tube (42), which has a stop (9), which abuts the shoulder, and a lock position retaining plate (15) with a return spring (37) secured between. The lower end of the tube is sealed in the bore of the lock piston guide (20). A pipe (5), the thread of which is smeared with 'Loctite', and screwed into the end fitting filler tapping, extends into the piston rod chamber (43) to approximately two thirds of its length, which assists the unit to be filled with fluid to its correct level. A rubber gaiter (6) fits over the piston rod and is secured to the piston rod at one end and the bearing housing at the other by worm drive clips (40) and (45).

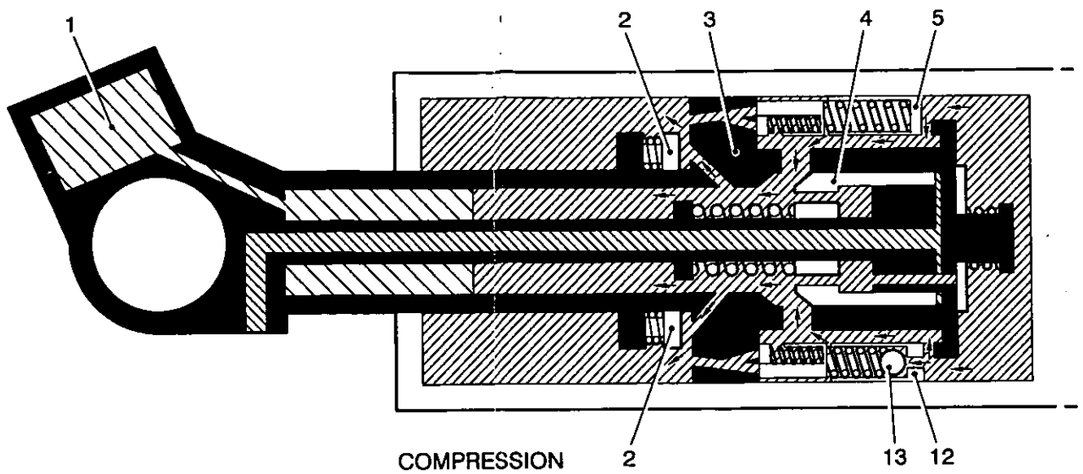
7 The damper piston (34), formed with fluid passages and threaded both ends, is screwed into and abuts the piston rod end, and is secured in position by a circlip (13). The upper plate valve (14), spring and spring plate also abuts and is retained by the end of piston rod. The piston is sealed in the cylinder bore by a seal ring (35) with two backing rings. The upper plate valve operates on compression, opening the fluid passage (16) from the piston rod chamber to the cylinder, whereas the lower plate valve (17), spring loaded by four springs and located over the stepped diameter of a recoil valve (33) on the opposite side of the piston head, operates on recoil.

8 The recoil valve, mounted over the end of the piston and spring loaded by twelve coil springs, closes off fluid passages, which are opened only at high velocities. The springs having location in the bores provided in the recoil valve at one end are seated in bores in the main closure relief valve at the other, spring loading this valve also.

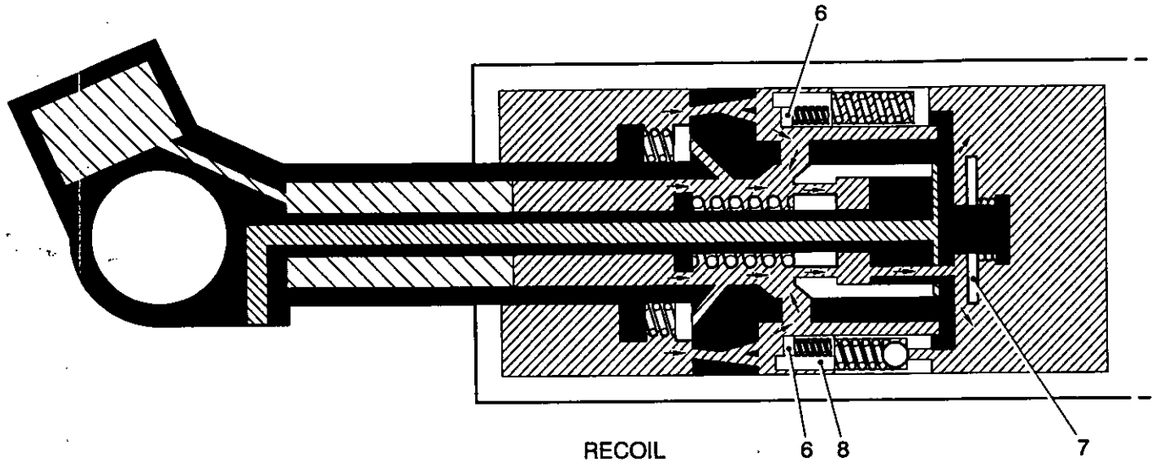
9 The relief valve (30) also mounted over the piston is retained by a nut (27) formed with a valve seat, and sealed in the cylinder bore by a composite rubber and PTFE sealing ring (31). Two spring-loaded non-return ball valves (19) are housed in the relief valve, their springs being located over two limiting stops (18) pressed into the recoil valves. The balls are seated on shoulders formed in the bores in which they are housed, sealing the fluid passages in the main compression relief valve on recoil.

10 The lock piston guide, (20) is located and sealed in the bore of the damper piston is retained by a nut (27), with an interposing spacer (28) against a shoulder in the damper piston (34). A drilling through the guide wall interconnects with a central drilling to form a fluid path to the lock piston chamber. The central drilling houses the lock pressure tube. A spring loaded plate valve (21) retained by a shouldered bolt (22) which screws into the guide, seals the fluid ports from the lower end of the damper piston to the upper on compression.

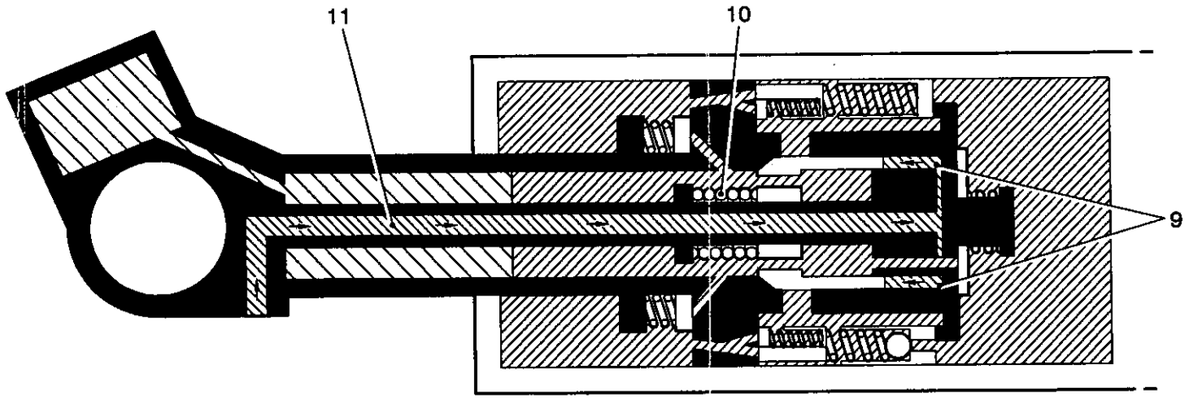
11 The lockout piston (32) formed with a reduced diameter and valve cone at mid length abuts the retaining plate of the lockout pressure tube assembly, and is spring loaded off the seat formed in the damper piston bore, when the lockout system is not pressurized. Ports through the lockout piston and damper piston wall allow the passage of fluid. The lockout piston is sealed in the damper piston bore and on the lock piston guide rubber sealing rings (29).



COMPRESSION



RECOIL



LOCKOUT

AIR

DAMPER HYDRAULIC FLUID

LOCKOUT HYDRAULIC FLUID

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1 Air chamber
2 Upper plate valve
3 Damper piston
4 Lockout piston
5 Relief valve
6 Lower plate valve
7 Plate valve
8 Recoil valve
9 Annular space
10 Return spring
11 Lock pressure tube
12 Relief valve
13 Non-return valve

Fig 2 Operation of shock absorber

OPERATION

Compression

13 At low velocities the movement of the damper piston (Fig 2(3)) displaces hydraulic fluid from the lower side of the damper piston forcing it through two spring-loaded non-return valves (13) and past the lockout piston (4). The fluid flow then divides, some of the fluid enters the annular side of the piston through the damper piston upper plate valve (2), and the remainder flows up the centre of the piston rod compressing the air in the piston rod air chamber (1).

14 At higher compression rates the main compression relief valves (5) and (12) open against their springs with the flow division occurring as at lower velocities.

Recoil

15 At low recoil speeds, fluid from the annular side of the damper piston forces the lower plate valve (6), mounted on the recoil valve (8), against its spring to open, allowing the fluid to flow through the open lockout piston to join fluid displaced by the return action of the expanding air in the upper chamber. The combined flow then passes through the plate valve (7) located on the lock piston guide, to the lower side of the piston.

16 At higher velocities the recoil valve opens against its twelve springs to allow fluid to join with that displaced by the expansion of air in the upper chamber.

Lockout

17 Fluid pressure directed through a rotary control valve (see Chapter 6 of this publication) is admitted to the annular space (9) behind the lockout piston via the central lock pressure tube (11), thus moving the piston against the coil spring (10) and onto its seat. This action seals both the upper and lower chamber of the unit to produce a hydraulic lock, thus maintaining the piston rod in a static position. When the pressure in the lockout circuit is released, the coil spring returns the piston to its original position for normal damper operation.

TRACKS

18 The number of track links fitted to each track when new is 90.

CHAPTER 3

HULL AND FITTINGS

CONTENTS

GENERAL

1 This chapter details the differences between the hull and fittings of the FV434 vehicle and the the Carrier Personnel Full Tracked FV432 MK 2 & 2/1. The technical description covering the common items of the hull and fittings is detailed in AESP 2350-T-251-302.

2 The hull is constructed of welded steel and armour plates, and is divided into four compartments; the power pack, the driver and commander, the crew, and load carrying.

3 The power pack compartment is at the front of the vehicle on the left hand side, the driver's and commander's compartment is to the right of it. Immediately behind the commander is a HIAB crane, with the crew compartment positioned transversely across the vehicle. The rear part of the hull provides the load-carrying compartment.

4 Brackets are welded to the outer surfaces of the hull to support and provide attachments of the suspension units, folding catwalks, work bench and stowage fitments. The hull bottom plates are strengthened by channel cross-members welded internally over the torsion bars. An aperture in the bottom plate positioned below the crew compartment is strengthened by a welded framework, which accommodates an escape hatch cover.

5 Bosses welded to the underside of the hull bottom plate accommodate the vehicle drain plugs. Holes drilled through the plate facilitate the retention of the power pack sub-frame by fixing bolts fitted from the underside of the plate. An aperture in the front sloping plate (glacis plate) gives access to the steering unit. A hinged door on the rear plate provides access to the rear stowage compartment. Lifting eyes are welded at each corner of the hull roof plate, and towing eyes to the front and rear plates. Welded to the towing eyes on the rear plate on either side of the stowage compartment door are brackets for attaching a tow bar (rear draught connector). A hinged door located on the hull left side plate, directly behind the silencer, gives access to the air filter.

COMMANDER'S CUPOLA

6 The commander's cupola is similar to that for the FV432 which is described in AESP 2350-T-251-302 but for the door catch assembly which retains the door in a move upright position when opened.

POWER PACK COMPARTMENT ROOF

7 The power pack compartment roof is similar to that for the FV432 described in AESP 2350-T-251-302. The air inlet louvre being identical, and the outlet louvre being similar. An additional pad welded to the outlet louvre provides a fixing for a catch to retain the crane operator's door in the open position.

REAR STOWAGE COMPARTMENT DOOR

8 The rectangular access door, behind the towing arm, is fabricated from armour plate and mild steel. The door closes the stowage compartment at the rear of the vehicle, which can be secured by a padlock.

9 Two hinges to the hull lower rear plate support the door. When opened, the hinge straps abut the rear plate and supports the door horizontally. Welded to the inner face of the door is a steel ramp, fabricated from mild steel sheeting which levels the door thickness to align it with the lower edge of the door aperture, to assist entry and removal of stowage.

10 Two rotatable handles fasten the door, when closed, each turning a spindle in a screwed bush in the door. As the handles are turned, one clockwise and the other anti-clockwise, catch arms attached to the spindles lock against the inner face of the hull rear plate door aperture. A torsion spring, fitted to each clamp arm, retains them in the opened position against their stops; clear of the door aperture to prevent damage as the door is being closed.

11 A gasket affixed by an adhesive to the rear plate provides a seal between the door, when closed, and the rear plate. Protection of the gasket is afforded by a metal landing strip welded around the aperture alongside of it.

12 For wading purposes the door is sealed by four clamps positioned around it on the hull rear plate, and fastened by a spanner.

CREW SEATS

13 A hinged seat with a separate back and headrest is provided at each end of the transverse crew compartment. Stowage brackets are fitted to the underside of the seat trays to accommodate a first aid kit and vehicle literature, which are retained by webbing straps. A chain and hook is attached to each backrest for the retention of the seats in the folded position.

14 Each seat base consists of a metal tray welded to a support, which hinges on brackets bolted to the hull lower side plates. The ends of the tray supports abut the side plates to position the seats in the lowered position. The seat squabs are secured to the trays by woodscrews. The squab consists of a foam rubber pad fixed to a plywood board by an adhesive and covered by PVC sheeting.

Back rests

15 Each backrest consists of a rectangular foam rubber squab, which is attached to a flat plywood board by an adhesive and covered with PVC sheeting. Support brackets screwed to the plywood and bolted to the lower hull side plate's position the back rests above their respective seats.

Head rests

16 Both headrests for the crew are similar except for their support brackets, which attach them to the vehicle.

17 Each headrest comprises a rectangular foam rubber pad, which is attached to a shaped sheet metal back plate by an adhesive and covered with VC sheeting.

18 The right seat headrest back plate is fixed to its support bracket by two screwed studs and nuts. The support bracket is a fabricated and welded assembly with two eyes for anchoring the seats safety harness shoulder straps and is bolted to the crew compartment roof.

19 The left seat headrest back plate is spot welded to its support bracket. The bracket consists of two of two angular metal strips welded at one end to a flat plate to form a side fixing by which it is bolted to the compartment bulkhead.

Harness

20 The safety harness provided for the crew and commander is anchored to brackets suitably positioned on the bulkheads, compartment roof and hull side plates

21 Each harness consists of a two-piece waistband and two-piece shoulder strap, fitted with quick release buckles.

22 The harness is identical to that provided for the driver which is described in AESP 2350-T-251-302.

ESCAPE HATCH

23 An escape hatch is provided in the hull bottom plate below the crew compartment as an alternative means of exit should the roof door be obstructed. The hatch cover is secured in a recess by a cruciform clamp fastened by a screw-on locking handle. A gasket interposed between the mating surfaces provides a watertight seal. A removable floor plate well covers the hatch.

24 The hatch cover (Fig 1(4)) consists of a flat rectangular plate reinforced by a frame welded to it, with a centrally located screwed stem for clamping.

25 The cruciform clamp (3) is of a welded construction having square boss with four arms radiating from it. The central boss has a clearance hole drilled through its centre, which allows it to fit over the screwed clamp stem. Each clamp arm has a welded pad which, when being clamped, bears on the top face of the cover retaining frame in the hatch well.

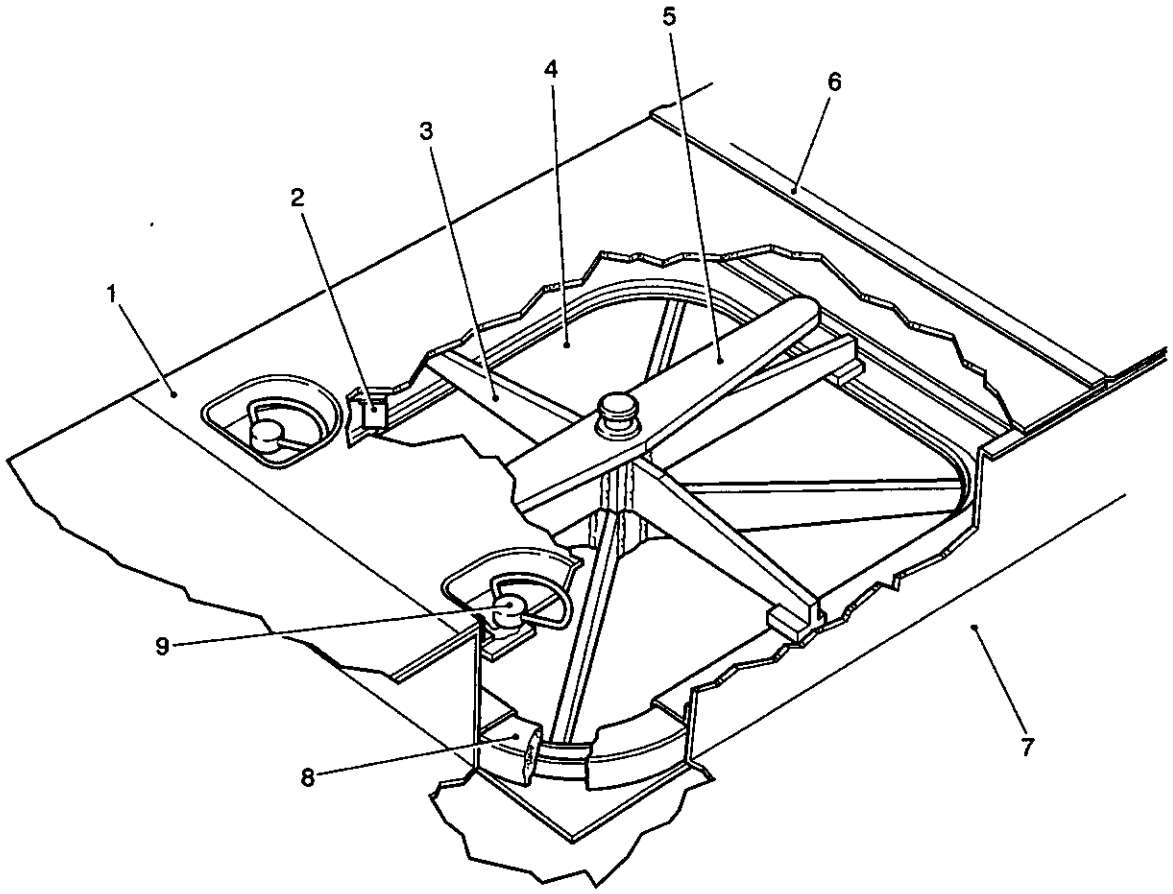
26 The locking handle (5) comprises a flat metal bar reduced at each end to form hand grips and having a welded flanged bush in its centre; the boss being threaded to screw on to the clamp stem.

27 The floor plate cover (1) comprises a flat rectangular plate with two cupped recesses accommodating rotatable catches (9). Two angle stop plates (2), welded to the underside of the cover, restricts the movement of the locking handle.

28 The cover is retained by a lip (6), formed along the left side floor plate, and locked by the catches on the right.

CRANE OPERATOR'S HATCH DOOR

29 The crane operator's hatch door (Fig 2(6)) closes the top of the crew compartment and provides the main entry to the vehicle. A spring loaded catch (20) on the air outlet louvre retains the door in the open position, against a support block (2) and pad (3), and is released by a handle on the catch. A hasp (9) welded on the door and a staple on the vehicle roof allows the door to be padlocked. The underside of the door is insulated against solar heat and arctic cold.



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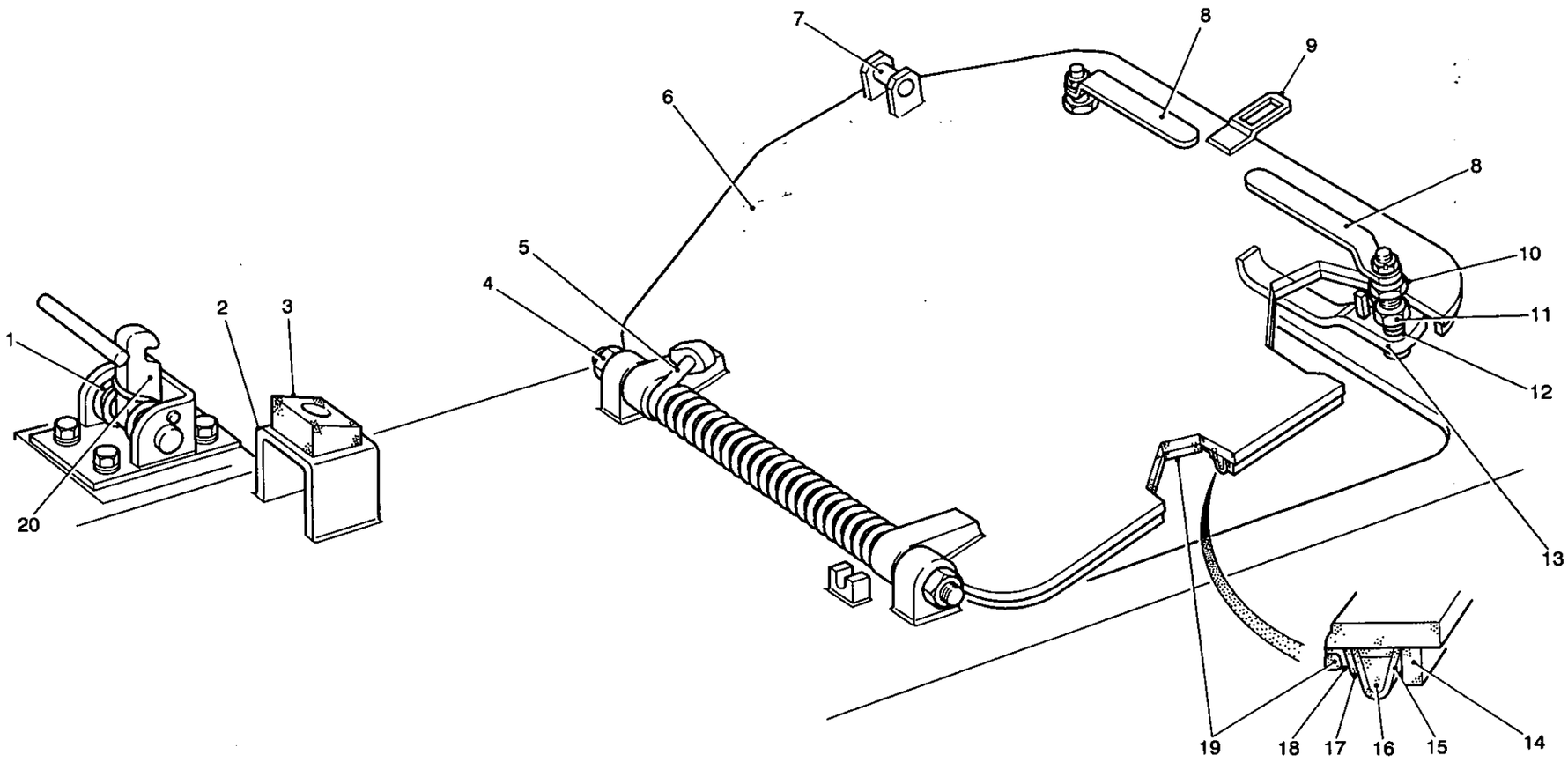
1	Floor plate cover	4	Hatch cover	7	Hull bottom plate
2	Angle plate stop	5	Locking handle	8	Gasket
3	Cruciform clamp	6	Retaining lip	9	Catch

Fig 1 Escape hatch

30 The door is a fabricated and welded construction from steel plate, which is strengthened by a landing strip (Fig 2(14)) welded all round the under edge of the plate. Welded to the plate is a seal retainer (18) which, with securing strips (15 and 17), retains a rubber seal (16). The door swings on a hinge pin (4) fitted through two lugs on the roof plate and two lugs welded on the hatch door.

31 In operation, the door is assisted by a torsion spring (5) fitted round the hinge pin on two sleeve bushes. The ends of the spring locates against the door and roof plate. When closed, the door is secured by two rotatable handles operated from inside or outside the vehicle.

32 Each internal handle (13) has a lip, which locates against the underside of the roof plate to lock. The handle is welded to a spindle, which is passed through a screwed bush (10) in the door. The top end of the spindle is threaded and has two flats on which the outer handle (8) is located and retained by a nut and split pin. The handles, when the door is opened, are retained in the open position by torsion springs fitted to the lower locking handles.



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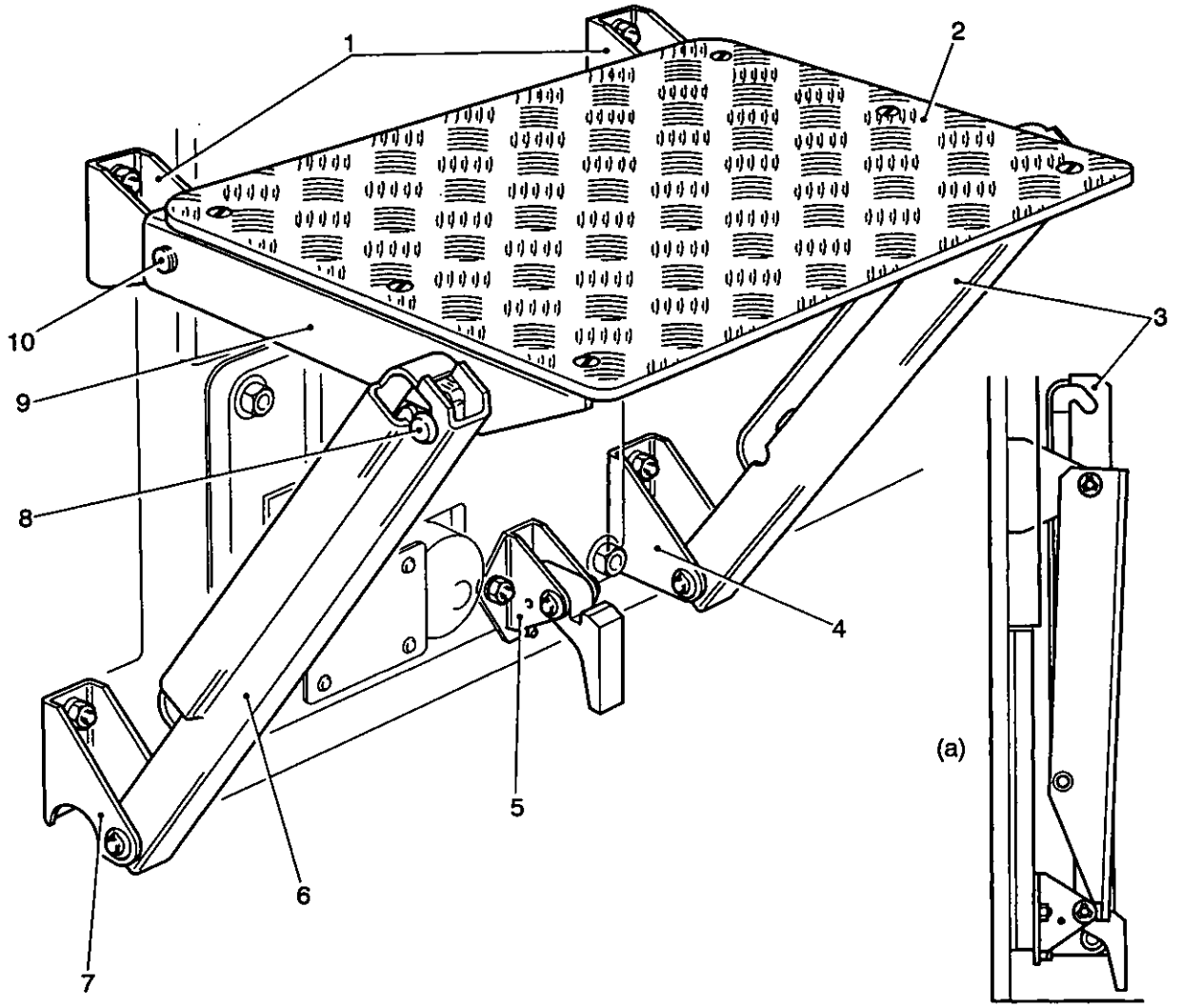
1	Torsion spring	6	Door	11	Lockout	16	Seal
2	Support block	7	Catch pin	12	Torsion spring	17	Securing strap
3	Support pad	8	Lever handle	13	Lever handle	18	Seal retainer
4	Hinge pin	9	Hasp	14	Landing strip	19	Insulation
5	Torsion spring	10	Screwed bush	15	Securing strip	20	Spring loaded catch

Fig 2 Crane operator's hatch door

CRANE OPERATOR'S PLATFORM

33 The crane operator's platform is provided to enable the operator to stand positioned through the hatchway to operate the crane. It is hinged to the bulkhead to allow it to be stowed.

34 The platform (Fig 3) comprises a chequered plate (2), screwed to two channel section side rails (9), supported at the back by two hinged brackets (1) bolted to the bulkhead, and by two box channeled struts (3) and (6) at the front. The platform is linked to the struts by two pins (8), one each side of the platform. When the platform is raised to the horizontal position, it is secured by manoeuvring the struts so that the pins engage in slots in the top ends of the struts. The platform is lowered by lifting it to disengage the pins from the slot ends. A spring loaded catch (5) bolted to the bulkhead retains the platform in stowed position (a).



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1	Hinge bracket	5	Catch	8	Guide pin
2	Chequered plate platform	6	Strut	9	Side rail
3	Strut	7	Bracket	10	Hinge pin
4	Bracket				

Fig 3 Crane operators platform

CATWALK PLATFORM

35 Along each side of the load carrying compartment is a hinged platform of two sections. The platform surface is chequer plate and the two sections can be raised and secured, by means of drop-end pins, when not in use. Chains linked to the hinge brackets tether the drop-end pins.

EXTERNAL EXHAUST SYSTEM

Exhaust pipes

36 The external exhaust system is similar to that described in AESP 2350-T-251-302. The main difference being the outlet pipe connection from the silencer, which is positioned at the top rear end to give clearance to the ventilation filter access door in the vehicle side plate.

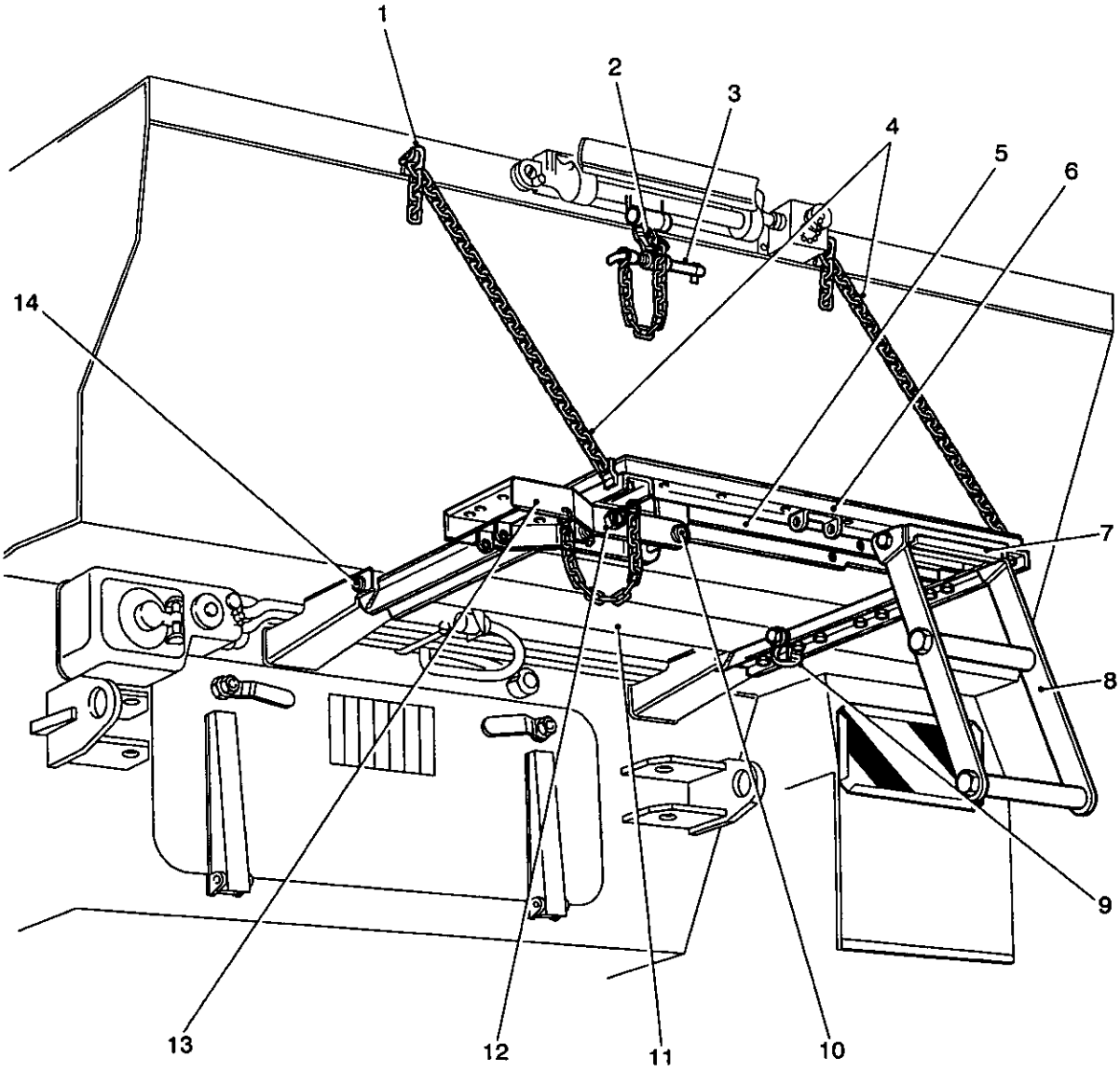
37 The exhaust pipe is clamped to the silencer outlet connection and supported horizontally by brackets attached to the side plate. The outlet end of the pipe has a slight bend positioned in the upward direction and it is fitted with a hinged cover plate to prevent the entry of rainwater.

WORK BENCH

38 The work bench (Fig 4) is located at the rear of the vehicle, it is hinged on two channel section brackets welded to the underside of the lockers, and when in use, is supported at two corners opposite the hinges by chains (4) which are hitched to hooks (1) welded to the top of the locker rear plate. When stored, the bench lies flat against the rear lockers and is retained by a hasp (2) and a captive drop end pin (3).

39 The workbench comprises a welded channel section base frame (5) which supports a closely boarded working surface in an angle iron frame (6), a vice mounting bracket and foot stirrup.

40 The vice mounting bracket (13) is hinged to the underside of the workbench base frame. A captive pip pin (12) secures it in either the working or stowed position.



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1	Chain support hook	6	Top frame	11	Wood board
2	Hasp	7	Bracket	12	Captive pip pin
3	Drop-end locking pin	8	Bench step	13	Vice mounting bracket
4	Chains	9	Catch		
5	Base frame	10	Hinge pin	14	Hinge pin

Fig 4 Work bench

41 The bench step (8), a welded steel two rung type is hinged to a support bracket (7) on the underside of the boarded frame which is retained by a reinforcement plate, coach bolts, nuts and washer. The stirrup folds flat when stowed held by a hooked catch (9).

42 Two tapped bosses and an electrical socket are provided on the rear plate of the locker above the bench to mount and connect a fluorescent light.

FIRE FIGHTING EQUIPMENT

43 Two types of fire fighting equipment are provided on the vehicle, a portable type and a fixed type.

44 The equipment is similar to that described in AESP 2350-T-251-302, but differs in the positioning of the extinguishers.

Portable type fire extinguishers

45 The vehicle is provided with six portable extinguishers.

46 The extinguishers are retained in quick release brackets, located as follows.

46.1 A portable BCF in the driver's compartment mounted on the power pack compartment plate.

46.2 Two 2kg portable BCF in the crew compartment, one mounted on the ventilation filter housing and the other on the power pack compartment rear plate above the fire warning light.

46.3 Two portable 2kg dry powder mounted on the front sloping plate, one above each of the smoke dischargers.

46.4 A portable 2kg dry powder on the vehicle rear plate, mounted above the power tools socket.

Fixed fire extinguishers

47 The two BCF cylinders are mounted on a bracket, which is repositioned on the rear plate of the power pack compartment towards the centre of the vehicle.

Fire alarm system

48 The system is similar to that described in AESP 2350-T-251-302.

CHAPTER 4

VENTILATION CONTROL SYSTEM

CONTENTS

GENERAL

1 The ventilation control system provides a supply of clean air to the crew, commander and driver's compartments. This chapter details the differences between the ventilation control system of the FV434 vehicle and the Carrier Personnel Full Tracked FV432 MK 2 & 2/1. The technical description for the common items of the ventilation control system is detailed in AESP 2350-T-251-302.

2 The air pressure relief valve (Fig 1 (33)) is positioned in the roof plate to the right of the driver's hatch. The pressure/suction gauge (5), test valve (6) and water trap (7) are mounted on the forward side of the partition plate behind the commander's seat. The ventilation fan control unit is positioned on the rear side of the partition plate in the crew compartment.

3 The system also incorporates external ducting and the vehicle's internal ducting is routed to serve the personnel compartment.

EXTERNAL DUCTING

4 The vehicles external ducting (13) is bolted across the bulkhead in the load-carrying compartment, and is insulated by sheet metal covers (11) lined with foil-backed asbestos (12). The dusting air intake is on the right and covered by a cowl (9). A hinged access door (17) is provided on the left, near the bulkhead louvred entry to the filter box.

FILTER BOX

5 The filter box (28) is welded to the interior of the vehicle on the left side plate adjacent to the crew compartment, and is closed by a single exterior door. A pedestal at the rear of the box and welded to its top and back plates supports the ventilation fan (14).

6 Accommodated in the filter box and supported on resilient mountings (19) is the filter housing.

FILTER HOUSING

7 The filter housing (20) contains a pair of filters, a particulate (22) and an anti-vapour (26). (A dummy insert may be used in lieu of the anti-vapour filter when training).

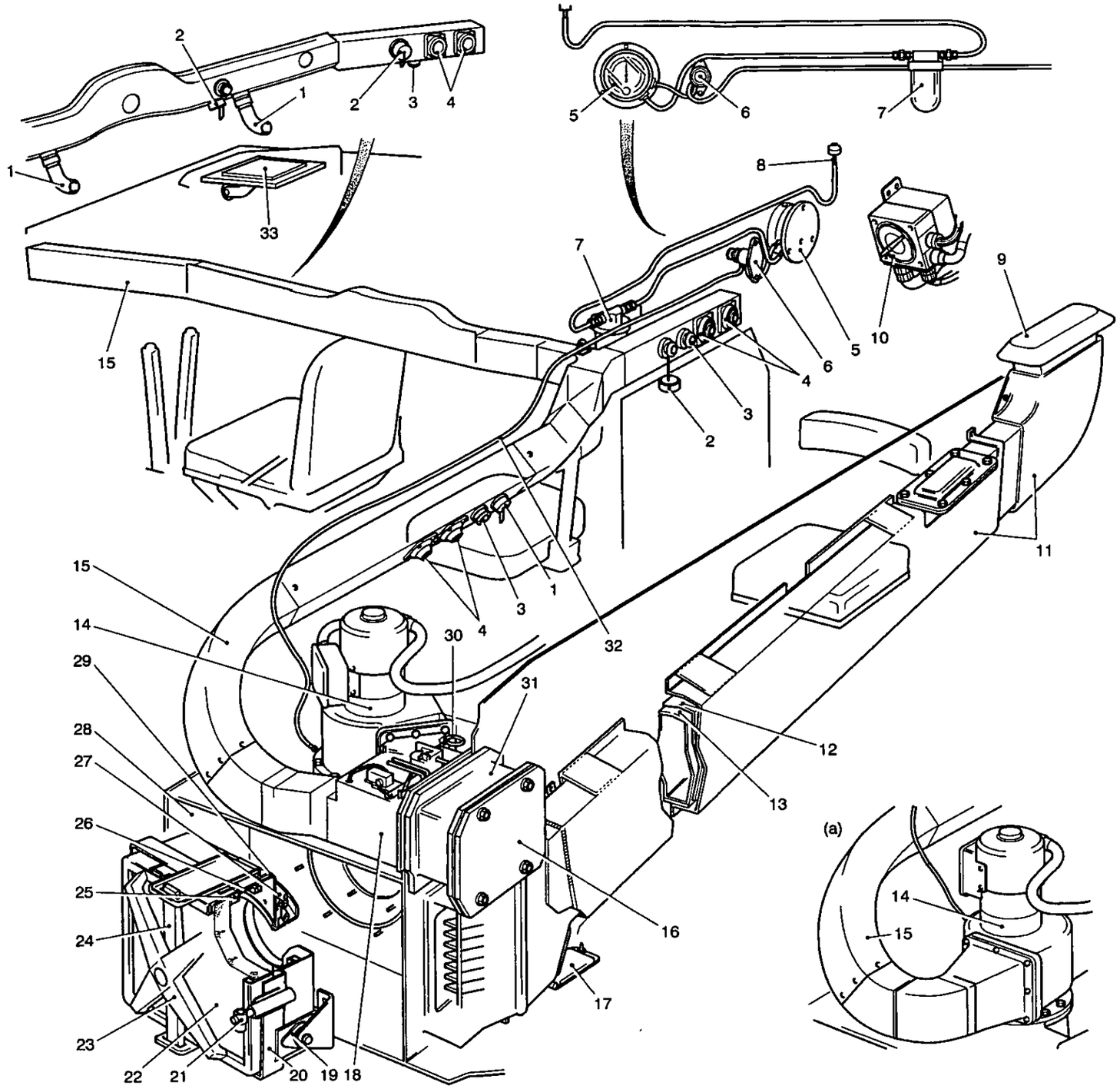
8 The filters are retained in their housing by a single cruciform clamp (23) and secured by a clamp bar, (24) which is locked by a central bolt. A box spanner (21) for the bolt is held in a holder welded to the housing and retained by a spring clip.

9 Two flanged tubular flexible connections are positioned; one (27) between the filter housing and the air duct of the fan pedestal, and one of a larger diameter connection (29) between the air filter housing and the filter box.

INTERNAL DUCTING

10 The vehicles internal ducting (15) from the fan is fitted to the roof of the crew compartment and extends into the commander's and driver's compartment.

11 Fitted to the ducting, in individual positions, are the air diffusers (4) and flexible nozzles (1) by which the air can be directed, and respirator adaptors (3) for attaching face masks. When the respirator masks are not connected, the adaptors are closed by quick release captive blanking caps (2).



1 Flexible nozzle
2 Blanking plug
3 Respirator adaptor
4 Air diffuser
5 Pressure/suction gauge
6 Pressure/suction gauge test valve
7 Water trap
8 Vent to atmosphere
9 Cowl
10 Fan speed control
11 Cover
12 Foil backed asbestos
13 Ducting
14 Ventilation fan
15 Ducting
16 Blanking plate
17 Access door
18 Change over flap housing
19 Resilient mounting
20 Filter housing
21 Spanner
22 Particulate filter
23 Cruciform clamp
24 Cross bar
25 Seal
26 Anti-vapour filter
27 Flexible connection
28 Filter box
29 Flexible connection
30 Heater manual override control
31 Heater connection duct
32 Connecting tubing (Fan to gauge and vent to atmosphere)
33 Air pressure relief valve
(a) Early type vehicles

434/130

Fig 1 Ventilation control system

CHAPTER 5

ELECTRICS

CONTENTS

GENERAL

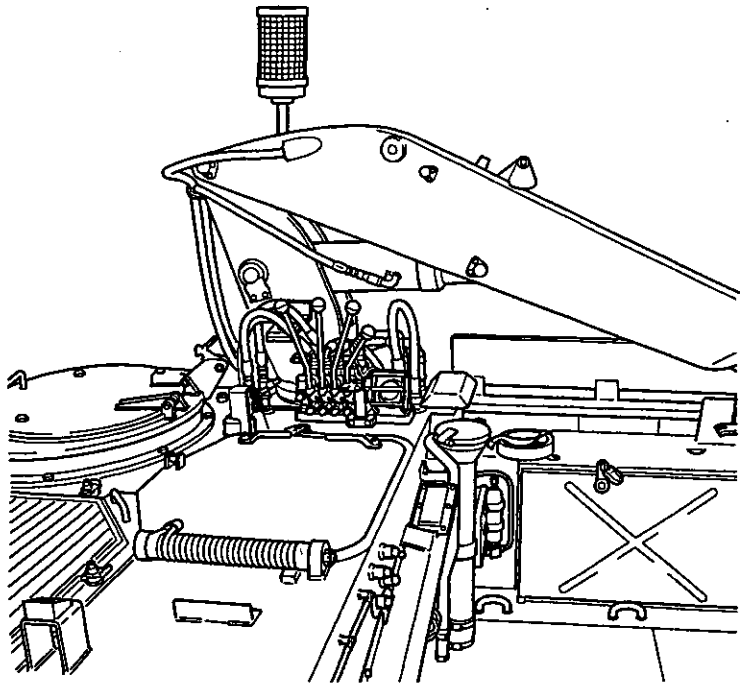
1 There is only partial information available relating to the specific electrical system for Carrier Maintenance Full Tracked FV434 MK 1 and 1/1.

2 The technical description for electrical items common to Carrier Personnel Full Tracked FV432 MK 2 & 2/1 is detailed in AESP 2350-T-251-302 Chap 5.

AMBER ROTATING BEACON

3 To comply with current road regulations, the vehicle is equipped with a rotating amber beacon (Fig 1), locked into a vertical pipe type mounting by a locking lever. The mounting is bolted to a bracket that is welded to the right hand side (outside) of the king post. Its associated electrical lead is tie wrapped to the flexible hydraulic pipes and plugs into the external lighting socket by the crane operator's hatch.

4 The rotating amber beacon, if connected, will operate whenever the vehicle road lights are turned on. When not in use the rotating amber beacon is stored within the vehicle.



434/170a

Fig 1 Location of amber rotating beacon

COMMUNICATIONS EQUIPMENT

5 The FV434 REME vehicle can be equipped with different configurations of Bowman equipment dependant on its role which can be adapted by additions (or removal) and repositioning to meet the requirements of the various roles the vehicle may be required to serve. Figure 2 details the vehicle with the basic Bowman equipment installed.

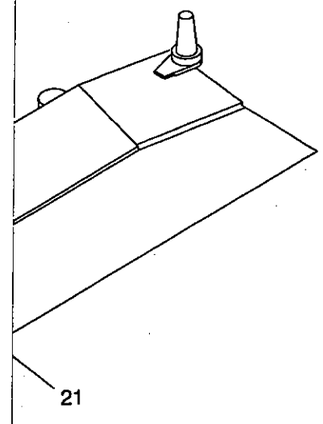
REDACTED

9 A description and full operating procedures for the equipment is contained in the Integrated Electronic Technical Publication (IETP) (TBA) Bowman Radio Publication.

Driver's station

REDACTED

REDACTED



430/20169

Fig 2 Communication equipment

CHAPTER 6-0

CRANE AND HYDRAULIC LOCKOUT SYSTEM - LIST OF CHAPTERS

CONTENTS

LIST OF CHAPTERS

1 This chapter is further sub-divided as follows:

Chap

6-1 Crane and hydraulic lockout system - vehicles equipped with control valve block assembly FV649488 – old type

6-2 Crane and hydraulic lockout system - vehicles equipped with control valve block assembly FV847574 – current type

CHAPTER 6-1

CRANE AND HYDRAULIC LOCKOUT SYSTEM - VEHICLES EQUIPPED WITH CONTROL VALVE BLOCK ASSEMBLY FV649488 – OLD TYPE

CONTENTS

(continued)

CONTENTS (continued)

CRANE

General

1 On initial issue the Carrier Maintenance Full Track FV434 Mk 1 was equipped with control valve block assembly FV649488, as spares for this equipment became obsolete the control block assembly was replaced by FV847574. This chapter details the technical description for those vehicles still equipped with control valve block assembly FV649488, Chapter 6-2 details the differences in the technical description for vehicles now equipped with control valve block assembly FV847574.

2 The hydraulically operated crane ('HIAB' Type 61) (Fig 1) mounted to the right of the vehicle comprises a reservoir (24) with integral crane king post pivot, inner boom (1), outer boom (5) and an extension to the outer boom that enables the handling of light loads at an extended radius. The hydraulic power is supplied by a gear type pressure pump (22) which is driven by a power take-off mounted on the engine transverse gearbox, fluid is gravity fed to the pump via a full flow filter (21). The controls (14) and adjacent flow valves, are positioned on the vehicle roof plate at the foot of the crane

3 The king post (31), with its pivot on the fabricated fluid reservoir, is capable of being slewed through 190 degrees by a rack that is actuated by two single acting hydraulic rams mounted on top of the reservoir.

4 The inner boom is pivoted from the king post and is raised by the main lift ram (32), which pivots from king post and boom. The outer boom and ram link (4) pivot from the same pin that connects with the inner boom. The outer boom is raised by the outer ram (3) which is attached by pivot pins to the inner boom and to the link that thrusts on the face of the outer boom. The hook (8), attached to the outer boom, is used for heavy lifting. Both rams are single acting type.

5 The extendable jib inserted in the end of the outer boom can be retained in any one of three positions by a locking pin. The extension carries a hook (7) and chain that can be manually adjusted for length.

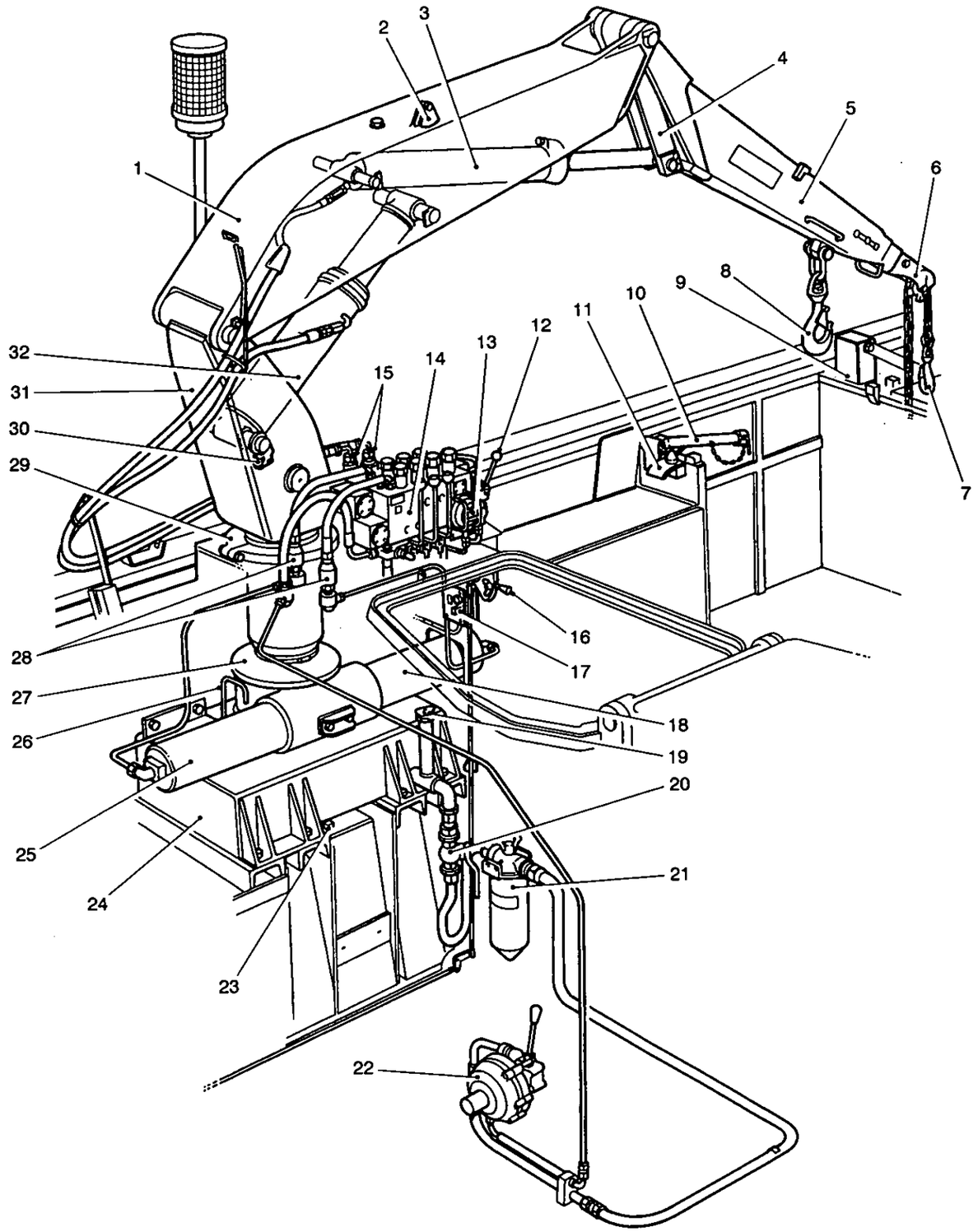
Reservoir (base)

6 The fabricated steel reservoir (Fig 2(21)) is rectangular in shape and is strengthened by two baffle plates, which prevent the fluid surging. The reservoir also provides the mounting facility (base) to which the crane pivot post (4) is welded. Mounting brackets welded to the front and upper faces provide the attachment points for fixing, by bolt, to the hull sill and side plates respectively. The pinion/rack housing (9) is welded to the top face and forms an integral part of the reservoir assembly.

7 The hydraulic fluid outlet (13) to the filter and pump, is located at the front, and is fitted with a vertical extension, which provides the filler orifice. The filler orifice has a winged filler cap/dipstick (14). An elbow with removable plug is screwed into the bottom plate enabling the reservoir to be drained. A pipe connection (23) is provided in the top plate to allow hydraulic fluid from the crane operating controls manifold block to be returned to the reservoir. Adjacent to the return connection is a short crooked breather pipe that permits displacement of air from the tank during crane operation and filling.

King post

8 The fabricated king post (26) has a cylindrical lower or bearing section to the top of which is welded a box section, three sides of which extend and converge at the top. Welded to the plates at this point is a trunnion block that houses two self-lubricating bushes with an interposing spacer, from this block pivots the inner boom. A boss welded to each side is bored to accept the main lift ram pivot pin.



1 Inner boom
2 Safety catch
3 Outer ram
4 Link
5 Outer boom
6 Extension
7 Hook (light lift)
8 Hook (heavy lift)
9 Support bracket
10 Travelling strut
11 Clamp
12 Lockout control
13 Lockout pressure gauge
14 Control box
15 Reflux valves (lift rams)
16 Speed control lever
17 Engine switchboard
18 Slewing cylinder
19 Filler/dipstick
20 Stop cock
21 Filter
22 Pump
23 Drain plug
24 Reservoir
25 Slewing cylinder
26 Breather
27 Seal ring
28 Reflux or flow control valves (slewing rams)
29 Split ring
30 Anchor plate
31 King post
32 Main lift ram

Fig 1 Crane and fittings

434/041a

9 The cylindrical lower section has a slewing pinion (8) shrunk onto its end. Both pinion and king post are drilled and reamed on their mating diameters to accept Mills pin (7) which are driven in flush, this prevents the pinion turning on the king post.

10 The internal bore is fitted with top and bottom bushes, which mate with machined diameters on the pivot post. The top bush (2), a light push fit in the bore, abuts onto a welded plate and is supported by a loosely fitting lower ring (3). The bottom bush (6) has a radiused bore and is a press fit in its seating. The vertical loadings are supported by a thrust plate (1), located in the recess end of the pivot, and a nylon ring (17) at the base of the pivot. Both bushes are lubricated from a single nipple (25) in the side of the lower section.

11 Two thrust blocks (5) bolted diametrically opposite each other on the inside of the pinion/rack housing, are positioned to bear on the pinion wheel top face to prevent vertical movement of the king post.

12 A preformed sealing cover (24) is retained on the lower section by a worm drive clip, to perfect the seal between king post and pinion housing. The aperture between the hull roof and the king post has a neoprene seal ring that is located by a split ring (Fig 1(29)) clamped to the king post at aperture level; the seal is sandwiched between the locating ring and a split cover clamped to the king post. A splash ring welded around the aperture perfects the seal with the hull, and in conjunction with the split cover serves to assist in the support of the king post at roof level during crane operation.

Slewing rack and rams

13 The slewing rack (Fig 2(18)) with an integral ram head at each end is housed in the pinion/rack housing, which forms part of the reservoir assembly. The ram heads operate in their respective cylinders, (11) which are screwed into the housing.

14 The front face of the rack engages with the king post pinion, red markings on both rack and pinion assists the correct meshing for alignment of the king post. The back face of the rack engages with a semi-circular bearing (22) which is bolted to the inside of the housing. The bearing has four guide pins (20) that contact above and below a land formed on the rack, thus obviating any rotary movement of the rack. The bearing is lubricated from a single nipple (19), located between the two securing bolts.

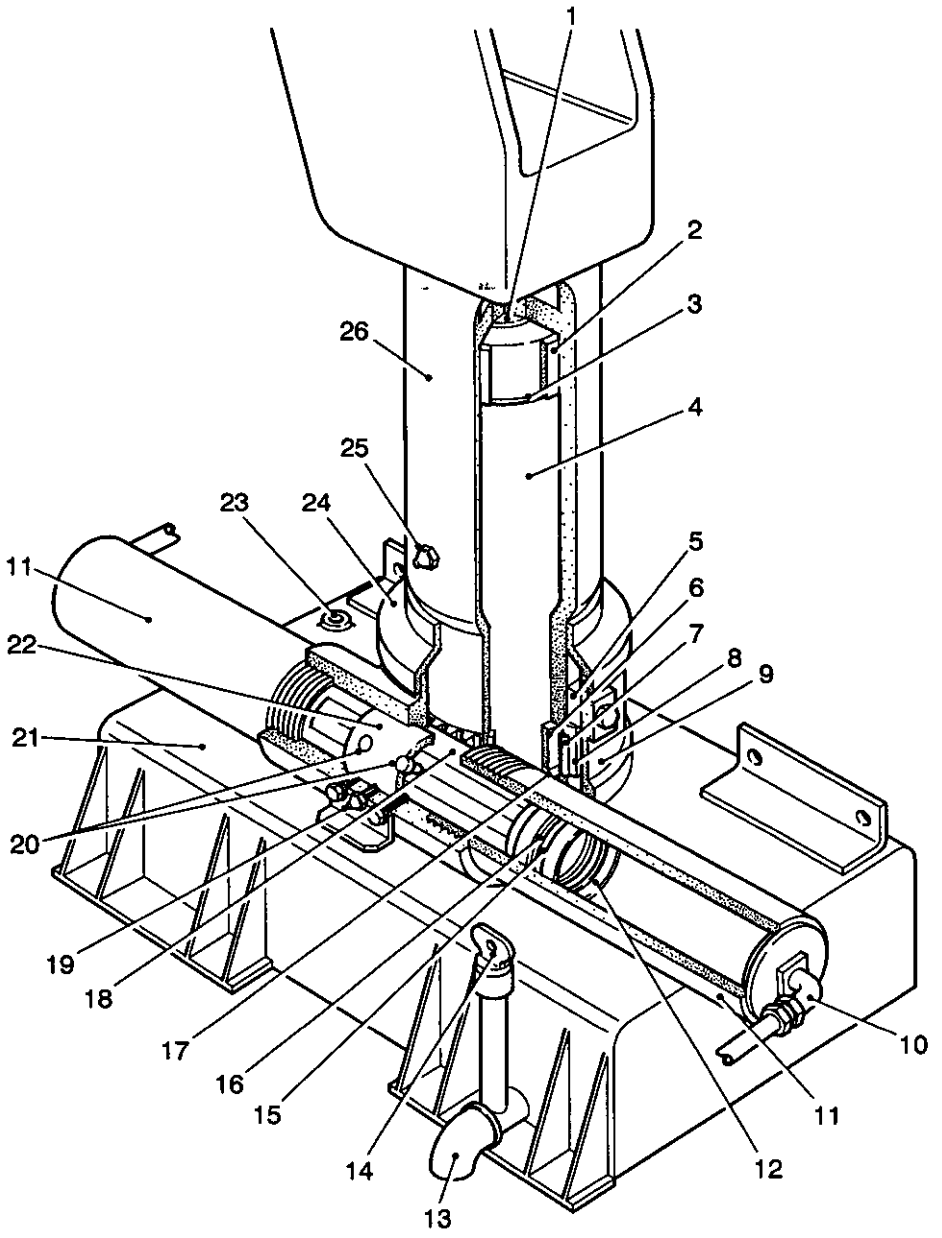
15 The ram heads are identical and have a machined annular groove that is stepped to house two support rings (16), a seal ring (15) and a retaining collar (12). An elbow (10), sealed with an O-ring, is screwed into the end of each cylinder to provide the hydraulic fluid feed connection. Access to the rear cylinder connection is obtained by removing the bulkhead extension located in the load compartment.

16 Pressurized fluid, regulated by the operating control, is fed to the selected cylinder, which reacts to the increased pressure; the resulting movement of the rack slews the crane via the pinion to the required degree. As the rams are interconnected single acting type, the opposite ram compresses the fluid in its cylinder which is released back to the reservoir, controlled by its respective reflux valve which enables the ram to have a damping effect and prevent any free; slewing movement of the crane.

Lift booms

17 The inner lift boom (Fig 1(1)), fabricated from steel plate into an inverted 'U' section, has welded strengthening plates, which divide the boom into lower and upper sections. The lower section has the attachment/pivot points to the king post and the lift rams. The upper section houses the outer boom lift ram (3), and has at its reinforced end the pivot trunnions for the outer boom, adjacent to which is welded the travelling strut attachment spigot. An elongated hole with guide plate is provided in the side plate, to allow the feed hose to reach the outer lift ram. Access to the ram hose connection is by an aperture, which is covered by manufacturers nameplate.

18 The outer boom (5), fabricated into a box section, has bushed trunnions, which connect by pivot pin with the inner boom. The bushed boom link (4) also pivots from this pin and is positioned between the trunnions. A lug welded to the underside of the boom provides the attachment for the main lift hook (8). The hook, which is fitted with a safety latch, is attached by bolt to the boom lug.



434/132

1	Thrust plate	10	Elbow	19	Lubrication nipple
2	Top bush	11	Ram cylinder	20	Guide rollers
3	Ring	12	Collar	21	Reservoir
4	Pivot post	13	Reservoir outlet connection	22	Bearing
5	Thrust block	14	Filler/cap dipstick	23	Fluid return connection
6	Bottom bush	15	Seal ring	24	Cover
7	Pin	16	Support ring	25	Lubrication nipple
8	Pinion	17	Nylon ring	26	King post
9	Pinion/rack housing	18	Rack		

Fig 2 Slewing rack and pinion

19 The boom extension (6) normally housed in the outer boom can be extended or removed. When extended, the boom extension is held in the required position by a captive locking pin, which passes through drilled holes in both extension and boom. The pin, which has a handle, is retained by a captive hairpin spring, which engages with the grooved nose pin.

20 The light lift hook (7) with its extendable chain is attached to the end of the extension and passes overt the chain wheel, the periphery of which is formed to accept the chain links. Two stop lugs on the wheel faces abut the extension boom when the wheel is rotated in a clockwise direction, and cause the chain to be trapped in the wheel housing. To alter the chain length, rotate the wheel to bring the clearance segment of wheel into contact with chain, the chain is then free to be lifted and pulled through to the required length. Returning the wheel to its former position and then locking the hook locks the chain.

21 The pivot pins for the inner and outer booms, boom link and lift rams, are of similar design and differ only in dimension. The pins are straight, headless and have a machined slot at one end which provides the seat for the bolted anchor plates (30), which retain the pins and prevent them rotating.

22 When in the travelling or ready position, both booms with extension are lowered and positioned to the right of the load compartment. The inner boom located by the spigot onto the travelling strut (10), is locked by a captive drop-nosed pin, the outer boom being lowered onto the rear support bracket (9) and secured by a gate type screw clamp, which pivots from the support bracket. A webbing strap to the lifting handle secures the main lift hook. The light lift hook and chain can be removed and stowed. If left in position, the free end of the chain is wound around the boom extension.

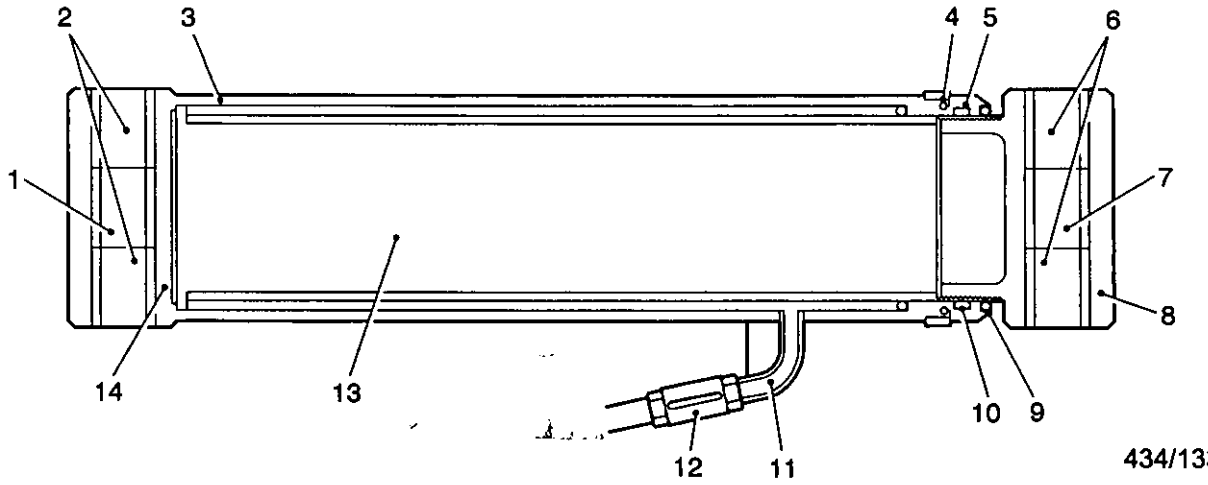
23 When the crane is required to be in the stowed position the outer boom extension must be retracted or removed, and light lift hook secured, the inner boom must then be raised high enough to enable the outer boom to be fully lowered so that the operating ram and its link are within the inner boom. The heavy lift hook must be secured and outer boom manually lifted and folded to lay on top of the inner boom where it is cushioned by a rubber pad and retained by a pendulum safety catch (2). The inner boom must then be lowered onto the top of the load compartment stowage locker and retained by a screw clamp (11) engaging with the inner/outer boom pivot.

Lift rams

24 The lift rams are single acting hydraulic types that are extended by the pressure of regulated hydraulic fluid, exerting force on the ram/piston head. The return of the ram into its cylinder is achieved by reducing the pressure inside the cylinder, by means of its control, which allows the weight of the boom to expel the fluid from the cylinder and through the single fluid port.

Inner ram

25 The inner lift ram cylinder body (Fig 3(3)), has a closed end which is formed and bored to accept the low pivot self-lubricating bushes (2), that are a press fit, and an interposing spacer (1). The other end of the cylinder is open and is internally threaded, screwed into it, and sealed by an external seal ring (4) with backing ring, is the ram sealing bush (5). The sealing bush has an annular groove machined in its bore to provide the seating for the ram seal ring (10) and two backing rings. The end of the bush is counter bored to accept the ram wiper ring (9). Holes are drilled in the bush periphery to accept a peg spanner, for installing or removing the bush. A fluid port elbow (11) in the side of the cylinder has screwed to it the hose failure valve (12), which provides the connection for the pressure feed hose. The ram, sealed in the cylinder by the bush, has its closed end flanged to form the pressure head (14). The open end of the ram has the pivot adaptor (8) screwed to its internal thread. The adaptor is bored to receive press fit self-lubricating bushes (6) and interposing spacer (7), that accept the ram/boom pivot pin. There is sufficient clearance between the cylinder bore and the ram flanged pressure head to permit the pressurized fluid that enters via the port in the sidewall of cylinder, to pass and act upon the end face of the pressure head.



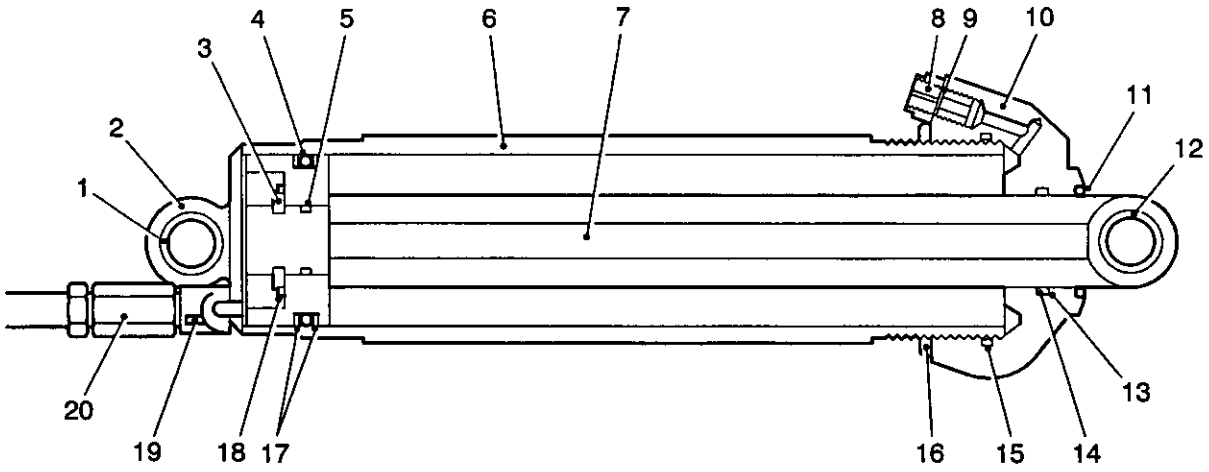
1	Spacer	6	Bush	11	Elbow
2	Bush	7	Spacer	12	Hose failure valve
3	Cylinder body	8	Pivot adaptor	13	Ram
4	Seal ring	9	Wiper ring	14	Pressure head
5	Sealing bush	10	Ram seal ring		

Fig 3 Inner lift ram

Outer ram

26 The outer ram cylinder has the boom yoke (Fig 4(2)) and fluid port union welded to its closed end. The yoke is fitted with four press fit self-lubricating bushes, the two outer bushes being longer than the inner bushes. The fluid port adaptor is fitted with a hose failure valve (20) that also provides the connection for the pressure feed hose. The open end of the cylinder is externally stepped, the larger diameter being threaded to accept the end cap (10), which is screwed on to abut the shoulder, where it is sealed by an O-ring (15) and locked by a threaded ring (16). A drilling from the inside of the end cap connects with a screwed adaptor (8), which houses the cylinder air release filter (9). The cap centre bore is annular grooved and counter bored to provide the seating for the sealing ring (14) with its backing ring (13) and the wiper ring (11) respectively. The piston rod (7) at its outer end is fitted with two press fit self-lubricating bushes, which connect, by pivot pin with the outer boom link. The piston end of the rod is shouldered and has two annular grooves machined on the reduced diameter to accommodate an O-ring (5) and two halves of the piston-retaining ring (3) respectively. The piston with external seal ring (4) with two backing rings (17) abuts the piston rod shoulder and is sealed by an O-ring. The split-retaining ring, held in its groove by a circlip (18), secures the piston at its recessed end.

27 The pressurized fluid enters the cylinder via the port and acts upon the recessed end of the piston, which causes the piston to move up the bore, the air behind the piston is expelled through a wire gauze filter element housed in the end cap. This filter also allows air to return to the space vacated in the cylinder as the piston moves back down the bore.



1	Bush	8	Adaptor	15	O-ring
2	Yoke	9	Filter	16	Locking ring
3	Split ring	10	End cap	17	Backing rings
4	Seal ring	11	Wiper ring	18	Pressure head
5	O-ring	12	Bush	18	Circlip
6	Cylinder	13	Backing ring	19	Adaptor
7	Piston rod	14	Seal ring	20	Hose failure valve

Fig 4 Outer ram

Crane operator's engine speed control

28 The crane operator is provided with a set of controls, located inside the crew compartment adjacent to the operators hatch, that permit independent starting and speed control of the engine and so provides the pressurized hydraulic fluid for crane operation and engagement of the suspension lock-out system.

29 The speed control (Fig 1(16) lever) with rubber knob pivots on the quadrant plate bolted to a bracket welded to the roof plate. The lever has a clamp bolt welded to it that passes through the slot in the quadrant plate, enabling the lever to be clamped by a wing nut in the required position, up for OFF, down for ON.

30 The upper coupling rod with knuckle attachments, runs vertically down the bulkhead from the operating lever to connect with the long leg of the 'L' shaped intermediate lever that pivots from the boss welded to the hull side plate. A second, lower coupling rod that runs close and parallel to the crew compartment floor plate, is connected by a knuckle joint at one end to the short leg of the intermediate lever, and at the other by a fork end that connects by clevis pin to the accelerator pedal linkage lower cross-shaft. The fork end is slotted to allow the accelerator linkage full movement when the crane operator's speed lever is clamped in the 'off' position. The knuckle joint lock nut also secures a wire extension return spring that is anchored to the side plate. Both coupling rods have twin rollered support plates located at their midway point, bolted to bulkheads and floor respectively, the rod being supported between the grooved rollers.

31 The engine can be started from either the driver's switchboard or the crane operator's switchboard (17), but can only be stopped by the control from which it is started.

32 The speed control lever should be locked when the engine speed reaches a recorded 1000-1200 rev/min on the driver's instrument panel tachometer. At this engine speed the pressure pump can supply the needs of the crane or lockout system.

33 The speed control lever must be released when not required, as it overrides the driver's control of the engine lower speed range, setting the tick-over speed too high.

HYDRAULICS

Power take-off drive and hydraulic pump

34 The power take-off (PTO) drive and hydraulic pressure gauge form a unit, which is mounted to the transfer gearbox case at the rear of the engine. The take-off has a dog clutch, which must be engaged to actuate the pressure pump. The spur gear displacement type pressure pump has an operational capacity of 4-gal/min and supplies hydraulic fluid at pressure to operate the crane and to engage the suspension lockout system.

35 The power pack compartment pump access cover, from which the pump engagement lever protrudes, is fitted with a hinged gate that prevents accidental engagement of the PTO drive.

Power take-off drive

36 The PTO drive consists of an inner housing and an outer housing bolted together, compressing a sealing gasket. The inner housing (Fig 5(29)) fits over the transfer gearbox intermediate gear shaft (26) and is bolted to the transfer gearbox casing (27). An oil seal (28) is located in the inner housing and bears on the intermediate gear shaft. The outer housing (24), which supports the hydraulic pump and dog clutch engagement gear, has an oil filler/level plug (23) in its outer face and is secured by bolts which screw into 'helicoil' inserts in the inner housing.

37 The splined drive shaft (1), seated in the splined bore of the intermediate gear, is retained by the interference fit of the O-ring and a thrust button (30). The thrust button is a press fit in the counter bore of the driven dog (19), which is woodruff keyed to the tapered pump drive shaft (17) and retained by a nut with locking tab washer.

38 The splined coupling sleeve (31) disengages on selection the protruding drive shaft, and is operated by a fork (3) engaged with a an annular groove (32) machined in the sleeve periphery. The fork is secured by a Mills pin to the operating shaft (4), which passes through the outer casing and connects by clevis pin to the forked end of the operating lever (7).

39 The lever with rubber knob and lock nut pivots from a bridge link (5) that is attached to both lever and link bracket (6) by clevis pins. The crescent shaped link bracket is secured to the outer casing by two of the casing attachment bolts. The dog clutch mechanism is retained in the 'free' position or on selection the 'drive, position by a spring-loaded detent ball (9) which engages with ground depressions (8) in the operating shaft. An operating instruction plate is affixed with adhesive to the top of the outer casing.

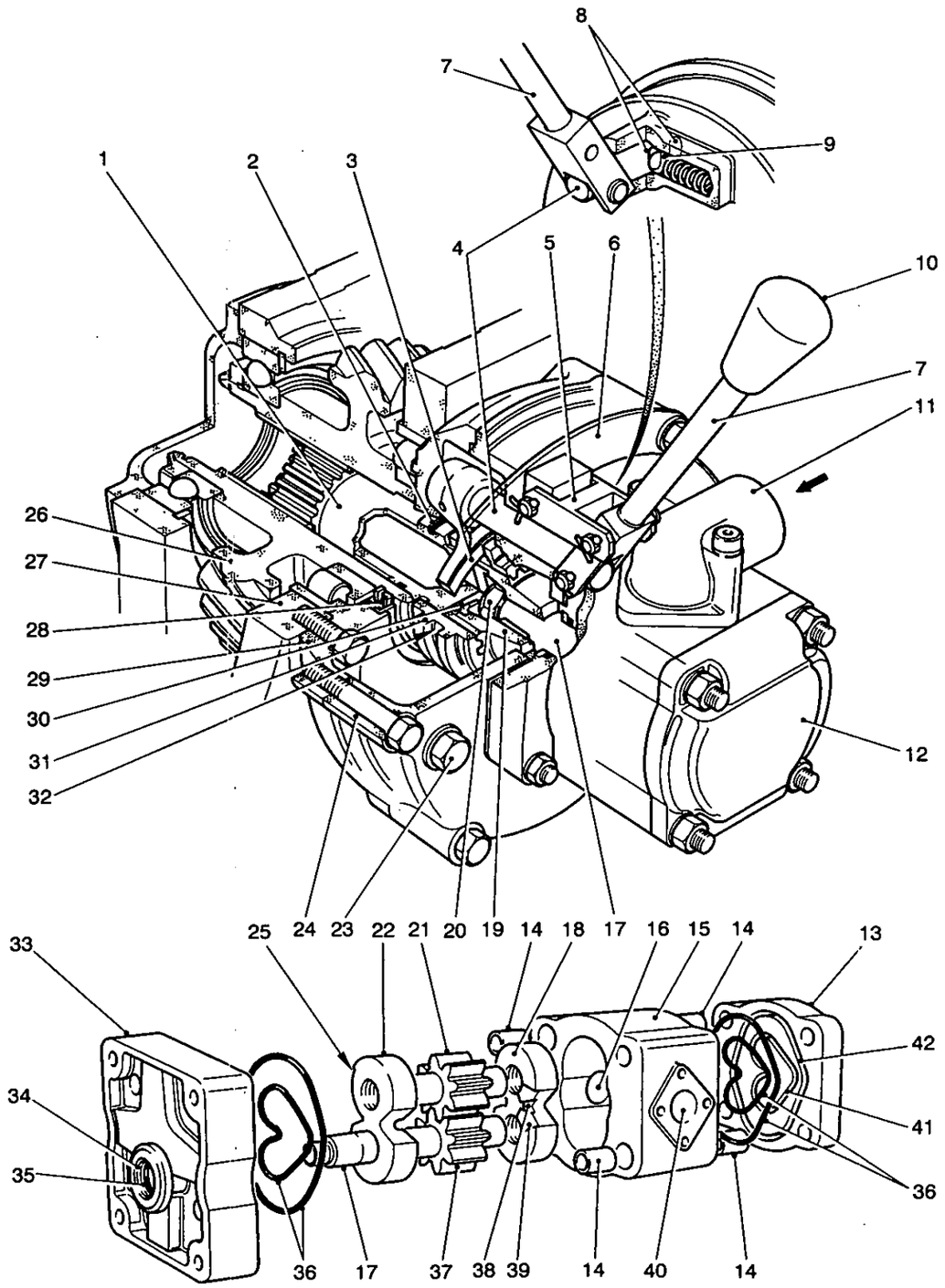
Hydraulic pump

40 The hydraulic pump consists of a mounting flange, body, drive and driven shafts, end cover and bearing plates is secured by bolts to the PTO drive housing. The body (15) has a ported centre chamber, which accommodates the drive (21) and driven (37) spur gears, the gears are supported at each end by the aluminium-tin alloy bearing plates (18 and 22). The mounting flange (33) and end cover are located by hollow dowels (14) and are secured to the body by four bolts, spring washers and nuts. Connection elbows (11), secured to the body by socket headed screws, align with the inlet port (40) and outlet port (16).

41 Both mounting flange and end cover have machined elliptical (42) and heart (41) shaped grooves in their inner face, to provide a seating for sealing O-rings (36) that seal the body and bearing plates into high and low pressure areas respectively. The heart shaped seal has its point positioned to the inlet port (low pressure side of pump).

42 The displacement gears are straight-toothed type. The drive gear shaft tapered and woodruff keyed to accept the drive dog, in mounted in the flange boss that has an oil seal (35) retained by circlip (34). The boss also serves as a location for the pump assembly, which is bolted to the PTO drive casing and sealed by a gasket.

43 The bearing plates, similar to each other but handed, have a relieved radius (25) on the outlet, high-pressure side, and a double recess (38) at the waist on the face adjacent to gears. The recess at the inlet, low-pressure side, has two shallow channels (39) connecting it with each bearing bore, to assist gear journal lubrication.



1	Drive shaft
2	O-ring
3	Fork
4	Shaft
5	Link
6	Bracket
7	Lever
8	Depressions
9	Ball
10	Knob
11	Pump inlet elbow
12	Pump
13	End cover
14	Hollow dowel
15	Body
16	Outlet port
17	Drive shaft
18	Bearing plate
19	Driven dog
20	Nut
21	Drive gear
22	Bearing plate
23	Filler/level plug
24	Outer housing
25	Relieved radius
26	Intermediate gear
27	Casing
28	Oil seal
29	Inner housing
30	Thrust button
31	Coupling sleeve
32	Groove
33	Mounting flange
34	Circlip
35	Oil seal
36	O-rings
37	Driven gear
38	Recess
39	Channel
40	Inlet port
41	Heart shaped groove
42	Elliptical groove

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Fig 5 Power take-off and hydraulic pump

44 The pump is self-lubricating and gravity fed to the low-pressure chamber via the inlet port, from the reservoir, where it is displaced by the drive and driven gears to the high-pressure chamber, then out through the port. The drive gear being driven in a clockwise direction, when viewed from the drive end, by the engine PTO drive.

45 The bearing plates floating on a fine film of oil, fed from the high-pressure chamber via the relieved radii, which enable a pressure load balance to be maintained between both faces of plates. The oil film on the inner faces giving the required working clearances for the rotating spur gears. The gear journals are lubricated from the low-pressure chamber, which is sealed from the high-pressure area by the heart shaped seal ring, the shallow channels and bearing scrolls providing the oilways for lubrication. The double recess at the waist of each plate is provided to relieve shock loading and turbulence at the point of gear tooth engagement.

Oil filter

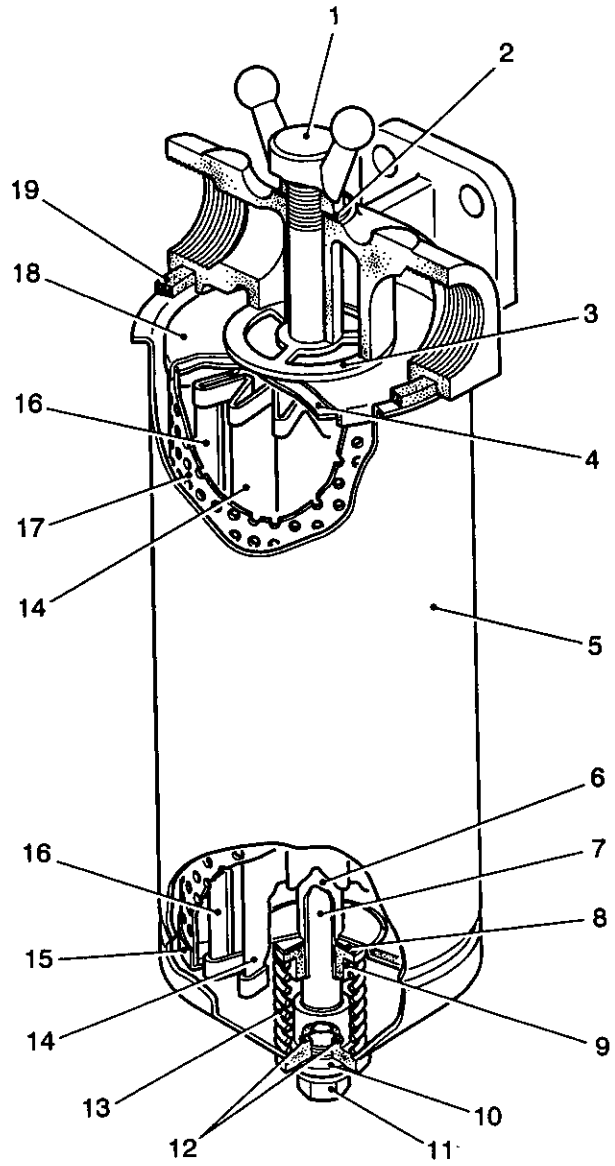
46 A full flow replaceable element type oil filter, mounted on the crew compartment bulkhead, serves the delivery line from the hydraulic oil reservoir to the pressure pump.

47 The filter consists of a corrugated element (Fig 6(14)) contained in a detachable steel bowl (5), which is retained against a filter head joint ring (19) on the underside of the die-cast filter head by a centre bolt (7) and wing nut (1).

48 The element is encased in a perforated tube that has a top (18) and bottom (15) cap which positions the element centrally over the locating tube (6), which is retained by a knurled nut (9) with seal washer (8). The element assembly fits over the retaining bolt, which is secured in a boss at the bottom of the bowl. The boss has ports that open onto the drain hole (12), which is sealed by a plug (11) and washer. A compression spring (13) located over the boss retains the element assembly against the filter head, and a joint washer (3) seals the element inner chamber against the filter head outlet port.

49 Filtration is achieved by oil flowing through the inlet port, to the outside of the replaceable element, percolating through to the inner formed chamber, and leaves by a central passage in the head to the outlet port.

50 A stopcock inserted in the line between the reservoir and filter facilitates servicing of the filter. Both filter and pump feed lines being positioned at a lower level than the reservoir, are primed by gravity.



434/054

1	Wing nut
2	Washer
3	Joint washer
4	Pad
5	Bowl
6	Centre tube
7	Centre bowl
8	Washer
9	Knurled nut
10	Washer
11	Drain plug
12	Drain holes
13	Spring
14	Element
15	Bottom cap
16	Element clip
17	Perforated case
18	Top cap
19	Filter head joint ring

Fig 6 Filter

HYDRAULIC CONTROL VALVE ASSEMBLY (FV649488) – OLD TYPE

Crane controls

51 The crane operations are controlled from a spool type valve with attached manifold block (Fig 7), located on the roof plate adjacent to the crane king post. The valve block houses three valve spools which control slewing, lifting and lowering, each spool being directly connected to its respective operating lever. A system relief valve mounted in the valve block protects the operating system from excessive pressures from the high-pressure line from the pump. By-pass valves located in the manifold block are provided to limit their respective systems to permissible pressures and prevent damage occurring if a ram is driven to the end of its stroke at full hydraulic pressure.

Control valve

52 The cast valve block (Fig 8(4)) with its complex system of internal oilways which connect and channel pressurized and exhausting hydraulic fluid to and from the rams, has six two-way ports. These ports are brought into use in pairs to connect with appropriate oilways, on selection, and allow the free flow of fluid from the inlet port (27) at one end to the outlet port (6) at the other. A bore threaded at both ends connects with and runs at 90 degrees to the block inlet port and the two pressurized oilways. This bore houses the system safety relief ball valve and the two nylon check balls. The nylon balls float freely in their respective locations until required to seal off their respective high pressure oilway if, by overloading the crane or some other cause, the feed back pressure should exceed the pressure supplied by the pump. One ball (28) is held in its bore by a threaded ball stop (29) which is sealed by a copper washer, while the other ball (26) is retained by an O-ring sealed valve seat (25) which also provides the seating for the safety valve ball (23), the safety valve being screwed into the block and sealed by a copper washer (21).

53 Three equi-spaced lapped bores, at 90 degrees to the internal oilways, housed the controlling spools. Each spool (Fig 9(13)) is sealed at both ends in its respective bore and has three annular grooves, the two outer grooves serve to connect the two-way flow ports (7) and (10) (two per spool), located in the top face of the block (8), with the internal oilways on selection, the centre groove permits free flow of pressurized fluid through the block until required to operate its selected system. The cone shouldered shank of each spool is drilled to accept the control lever connecting pin, and the opposite reduced end has a coil return spring (3), which is housed in its bore, which is sealed by a rubber cap (1), the spring abutting a seat washer (4) is positioned by a guide sleeve (14) which is retained by and abuts a circlip (2), which seats in the grooved bore. The spool is retained by a circlip (15), which also makes contact with the spring guide, thus imparting the spring tension to the spool.

54 The cranked control levers (11) pivot from links (12) which connect at the lift ram control levers lower connections, the upper connection for the slewing control lever, with adjacent lugs on the valve block, the lever yoke is connected to its appropriate spool by a pin which transmits the movements of lever to the spool.

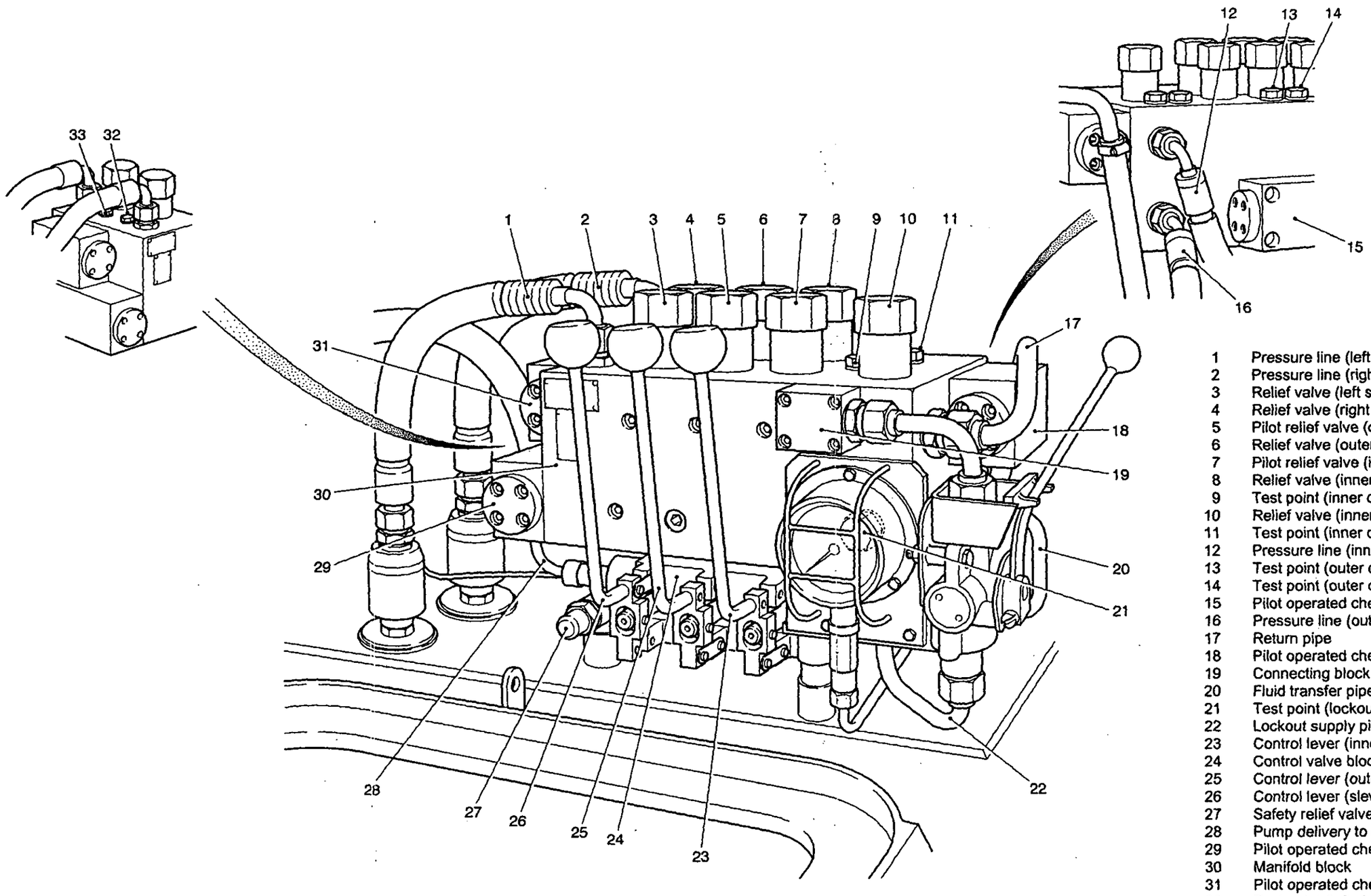
55 With all controls set at neutral (Fig 8 and 9), pressurized fluid from the pump enters the manifold block to the reservoir, leaving the ram (Fig 9(7)) and pilot (10) ports isolated in their respective spool grooves.

56 With the lift ram control set to 'Raise', the movement of the spool causes three simultaneous operations to be performed:

56.1 The centre groove land cuts off the free passage of pressurized fluid through the block.

56.2 The ram port (7) groove opens up the pressurized oil way (A) which allows the fluid under pressure to enter the flow port and pass on to actuate the ram.

56.3 The pilot port (10) groove opens the return flow oil way (B), which allows the pilot supply to exhaust.



1 Pressure line (left slew cylinder)
2 Pressure line (right slew cylinder)
3 Relief valve (left slew cylinder)
4 Relief valve (right slew cylinder)
5 Pilot relief valve (outer cylinder)
6 Relief valve (outer cylinder)
7 Pilot relief valve (inner cylinder)
8 Relief valve (inner cylinder)
9 Test point (inner cylinder pilot)
10 Relief valve (inner cylinder)
11 Test point (inner cylinder)
12 Pressure line (inner cylinder)
13 Test point (outer cylinder)
14 Test point (outer cylinder pilot)
15 Pilot operated check valve (outer cylinder)
16 Pressure line (outer cylinder)
17 Return pipe
18 Pilot operated check valve (inner cylinder)
19 Connecting block
20 Fluid transfer pipe
21 Test point (lockout system)
22 Lockout supply pipe
23 Control lever (inner cylinder)
24 Control valve block
25 Control lever (outer cylinder)
26 Control lever (slewing)
27 Safety relief valve
28 Pump delivery to control valve
29 Pilot operated check valve (left slew cylinder)
30 Manifold block
31 Pilot operated check valve (right slew cylinder)
32 Test point (left slew cylinder
33 Test point (right slew cylinder)

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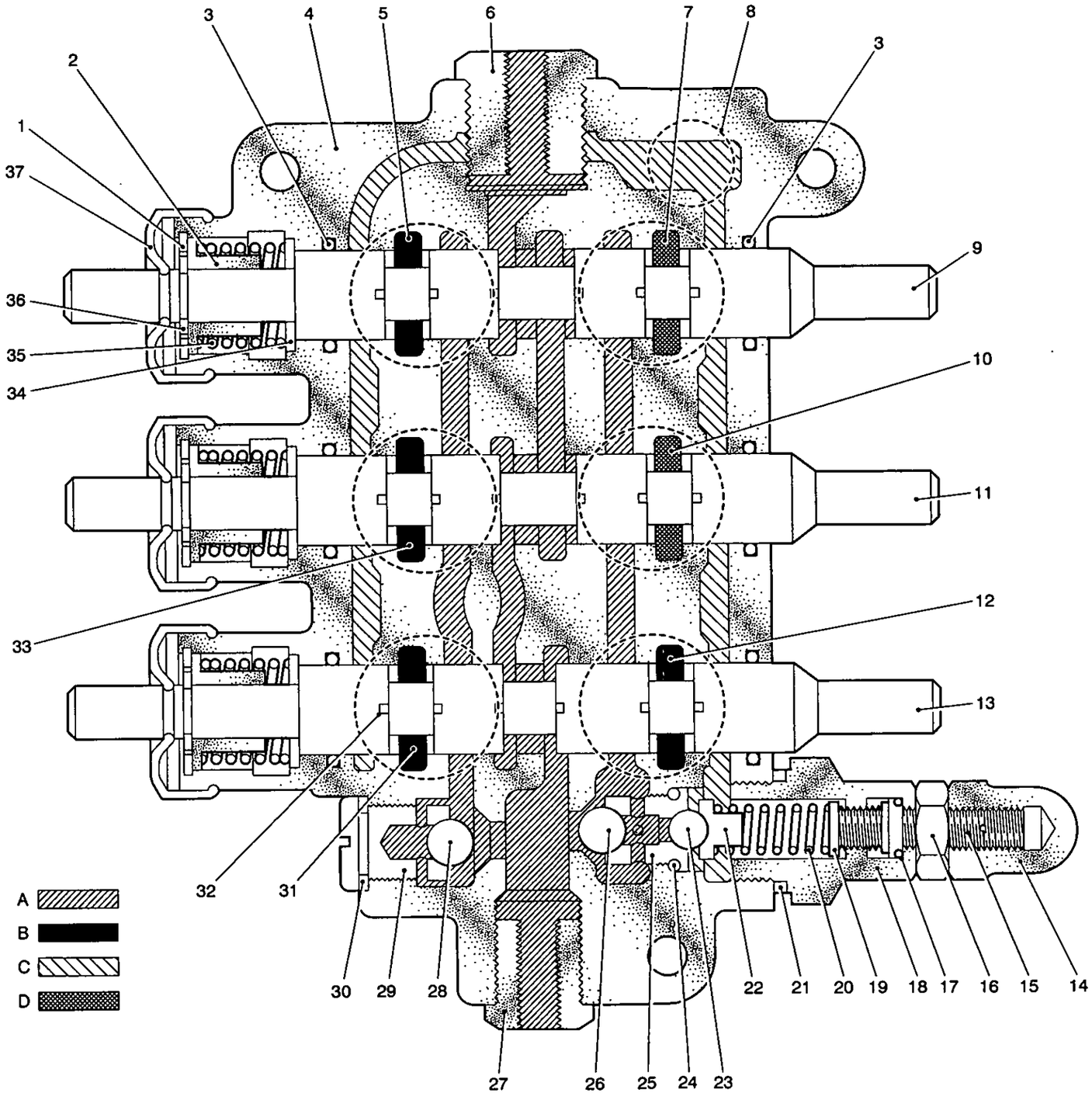
Fig 7 Control valve/manifold block – FV649488



1 Circlip
2 Guide sleeve
3 Seal
4 Block
5 Ram port
6 Outlet port adaptor
7 Pilot port
8 Exhaust port
9 Spool (inner ram)
10 Pilot port
11 Spool (outer ram)
12 Slew ram port
13 Spool (slewing rams)
14 Cap
15 Adjusting screw
16 Locknut
17 O-ring
18 Housing
19 Spring seat
20 Spring
21 Copper washer
22 Ball retainer
23 Ball
24 O-ring
25 Valve seat
26 Nylon ball seal
27 Inlet port adaptor
28 Nylon ball
29 Ball stop
30 Copper washer
31 Slew ram port
32 Groove
33 Ram port
34 Seat washer
35 Spring
36 Circlip
37 Rubber cap

A Pressurized hydraulic fluid
B Ram operating flow
C Return flow to
D Pilot operating flow reservoir

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Fig 8 Control valve, top view

57 With the control set to LOWER, the operation of the spool is reversed.

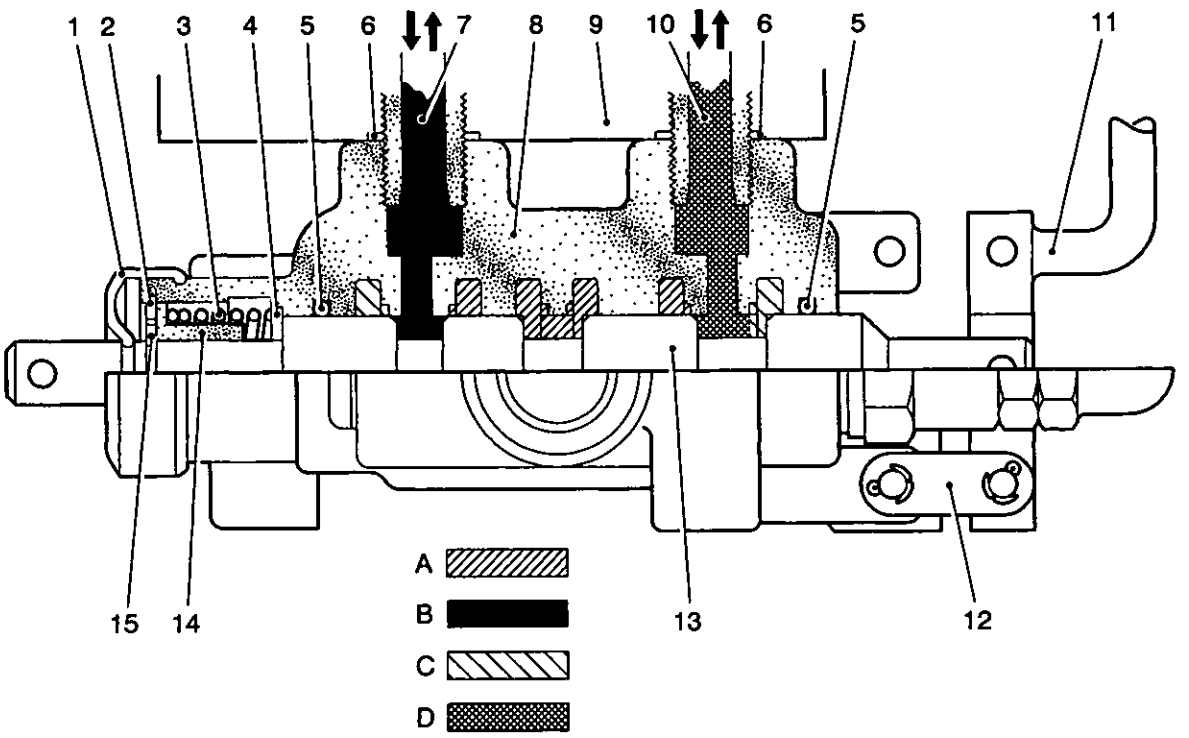
57.1 The free passage of fluid is cut off by the centre groove land.

57.2 The pressurized oilway is connected with the pilot port permitting the pressurized fluid to be channelled, via the manifold block oilways, to the pilot operated check valve which in turn releases the ram from its hydraulic lock.

57.3 The flow port groove opens the return flow oilway, allowing the ram to exhaust.

58 The intersection of each oilway and spool bore is provided with a small groove to coincide with grooves (Fig 8(32)) machined in the corners of the spool lands, these grooves allow the initial flow of fluid to occur upon the operation of control, thus preventing shock loading of system at the commencement of the pressurized flow.

59 The operation of both ram controls is identical, whereas the slewing control spool brings into operation, one or the other dependant on selection, two slewing rams mounted in opposition. The slewing control spool has the same basic function as the lift control spools, but the two flow ports it controls supply their own individual ram, the pilot supply for each cylinder pilot operated check valve being derived from a tapping taken from the flow port oilway in the manifold block.



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1	Rubber cap	8	Block	14	Guide sleeve
2	Circlip	9	Manifold block	15	Circlip
3	Spring	10	Pilot port		
4	Seat washer	11	Operating lever	A	Pressurized hydraulic fluid
5	Seal	12	Connecting link	B	Return flow to reservoir
6	Seal	13	Spool (lift ram)	C	Ram operating flow
7	Ram port			D	Pilot operating flow

Fig 9 Control valve, side view

60 With the slewing control operated to slew 'clockwise' (right) the operation of spool is as follows:

60.1 The land of the centre groove cuts off the free flow through the control block.

60.2 The flow port (31) groove reveals the pressurized oilway allowing the pressurized fluid to enter the flow port and pass on to actuate the ram and also provide the required pressurized supply to the pilot operated check valve, releasing the opposing cylinder from its hydraulic lock.

60.3 The flow port (12) groove reveals the return flow oilway, which allows the opposing, ram-displaced fluid to exhaust.

61 To slew anti clockwise (left), the operational sequence is similar to that described for clockwise operation, but with the role of the ports reversed. (The flow through the control valve is illustrated diagrammatically in Fig 11).

Safety relief valve

62 The safety or system relief valve is provided in the main oilway of the control valve block to limit the pressure of the fluid flowing into the valve block from the pressure pump to 2500 lbf/in². This pressure will not normally be reached as the pressure supplied by the engine driven pump is below the relief pressure. The various systems required for crane operation being protected by their own individual relief valves.

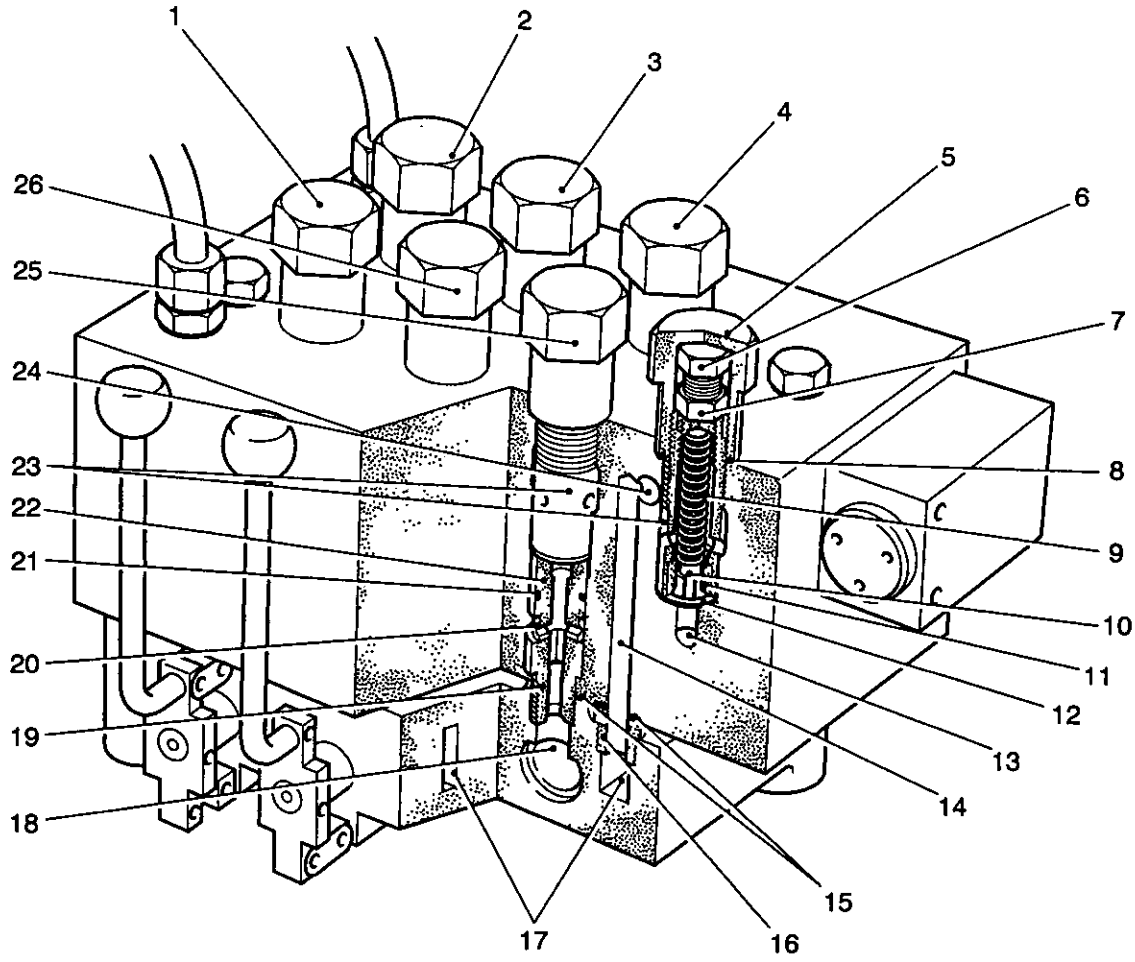
63 The valve housing (Fig 8(18)) screwed into the control block and sealed by a copper washer (21), is bored and internally threaded to accept the valve spring (20) and its adjusting screw (15). The screws smaller threaded diameter screws into the housing and engages with the spring seating washer. The larger diameter thread of screw, annular grooved, to seat the O ring (17), and slotted for insertion of screwdriver blade, has screwed to it the locknut (16) and dome cap nut (14). The steel check ball (23) with its retainer (22) is loaded by the spring against its seating (25) provided by the nylon balls valve seat.

Control valve manifold block

64 The manifold block (Fig 7(30)) as its name suggests provides the means of channelling pressurized hydraulic fluid from the controlling valve to the selected operating ram service line connection, and conversely enabling returning fluid, from the rams, to be channelled back to the reservoir, located at the base of the crane. The block also provides the mount for the pilot operated check valves and pressure relief valves required for efficient crane functioning.

65 The block, rectangular in shape, is attached and sealed to the two way flow ports of the control valve block by six adaptors (Fig 10(19)) located in the flow bores which also house the six relief valves (Fig 7(3), (4), (5), (6), (7), (8)), a seventh relief valve (10) mounted adjacent to the others limits the operating pressures of the suspension lockout supply to 1500 lbf/in². Both inner and outer ram relief valves, in common with the pilot supply relief valves are set to operate at 2500 lbf/in², whereas the slew rams which operate at a lower pressure have their relief valves set to operate at 2000 lbf/in². In addition to the relief valve bores, which are capped, the top face of the block is drilled and tapped to connect with the appropriate internal oilways, two of the drillings, fitted with unions, provide the connections for the slew rams pressure lines (1) and (2), the rest fitted with sealed plugs are pressure gauge test points for the individual operating systems.

66 The slew ram pilot operated check valves (29) and (31) are screwed to the left face of block with their O-ring sealed tappings corresponding to oilways drilled in the block, the outer and inner lift ram pilot operated check valves (15) and (18) are attached and sealed in a similar mode and located on the rear and right faces of block respectively. The rear face of the block adjacent to the check valve is drilled and tapped to accept the inner (12) and outer (16) lift ram service line unions, whereas the right face of block also drilled and tapped accepts the two unions which connect with the return and fluid transfer pipes (17) and (20). The lower pipe transfers the returning free flow fluid from the outlet port and the control valve block to the manifold block, it is then transferred back to the reservoir via the upper pipe.



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1	Left slew ram RV	14	Fluid return oil way
2	Right slew ram RV	15	O rings
3	Outer boom ram RV	16	Exhaust port adaptor
4	Inner boom ram RV	17	Fluid exhaust channel
5	Cap (lock nut RV)	18	Spool bore (inner ram)
6	Adjusting screw	19	Adaptor
7	Lock nut	20	Manifold oil way
8	O-ring	21	O-ring
9	Spring	22	Distance piece
10	Valve head	23	Valve body
11	Valve seating ring	24	Oilway
12	Copper washer	25	Inner boom ram pilot RV
13	Oilway	26	Outer boom ram pilot RV

Fig 10 Relief valves

67 The front face of the block has two tappings, the upper of which has a connecting block (19) screwed and sealed to it which provides the return flow connection from the lockout control valve, whereas the plugged lower tapping is the pressure gauge test point (21) for the lockout system pressurized supply. This supply has its outlet in the bottom face of the block the outlet, with union, connects by pipe (22) with the lockout control valve. A bore (Fig 10(14)) sealed by a rubber washer connects with the return flow oil way in the control valve block, this bore enables the control valve to exhaust and also permits the relieved fluid from the lockout system Relief Valve (RV) (10), in the event of it being lifted from its seating by excessive pressures, to be channelled back to its reservoir. The ram and pilot supply relief valves exhaust via a common internal oil way back to the reservoir.

Pressure relief valve

68 The pressure relief valves, seven in number, are provided in the control manifold block to limit their individual systems to permissible pressures. All seven valves are similar in design and manufacture, the only difference being the relief spring tension, which is adjusted to suit the particular requirements of its own system.

69 The valve body (23) screwed into the bore provided in the manifold block, clamps down upon the distance piece (22) sandwiching it between body and manifold attachment adaptor (19). The O-ring (21) sealed distance piece has transfer ports drilled in its reduced diameter which connect with its centre bore permitting the two way flow of fluid between control valve, via adaptor, and manifold oil way (20). The adaptor and distance piece are not required in the bore provided for the lockout relief valve, as this operates in a bored out tapping from the lockout pressurizing oil way. The valve seating ring (11), a press fit in the body and copper washer (12) sealed against the distance piece, provides a seat and guide for the spring loaded valve head (10). The valve head has a cone seating face, which extends to form a three-point guide. The spring tension is adjusted by a rotating hexagon headed screw three point guide. The spring tension is adjusted by a rotating hexagon headed screw (6), which must be locked by the locknut (7) when the spring is correctly tensioned. A cap (5) screwed onto the threaded body engages with the top face of the manifold where it seals by an O-ring (8) the relief valve in its bore.

70 Excessive fluid pressures lifts the valve head from its seating and exhausts via body ports to the main manifold fluid return oil way, which also connects with the control valve block return oil way.

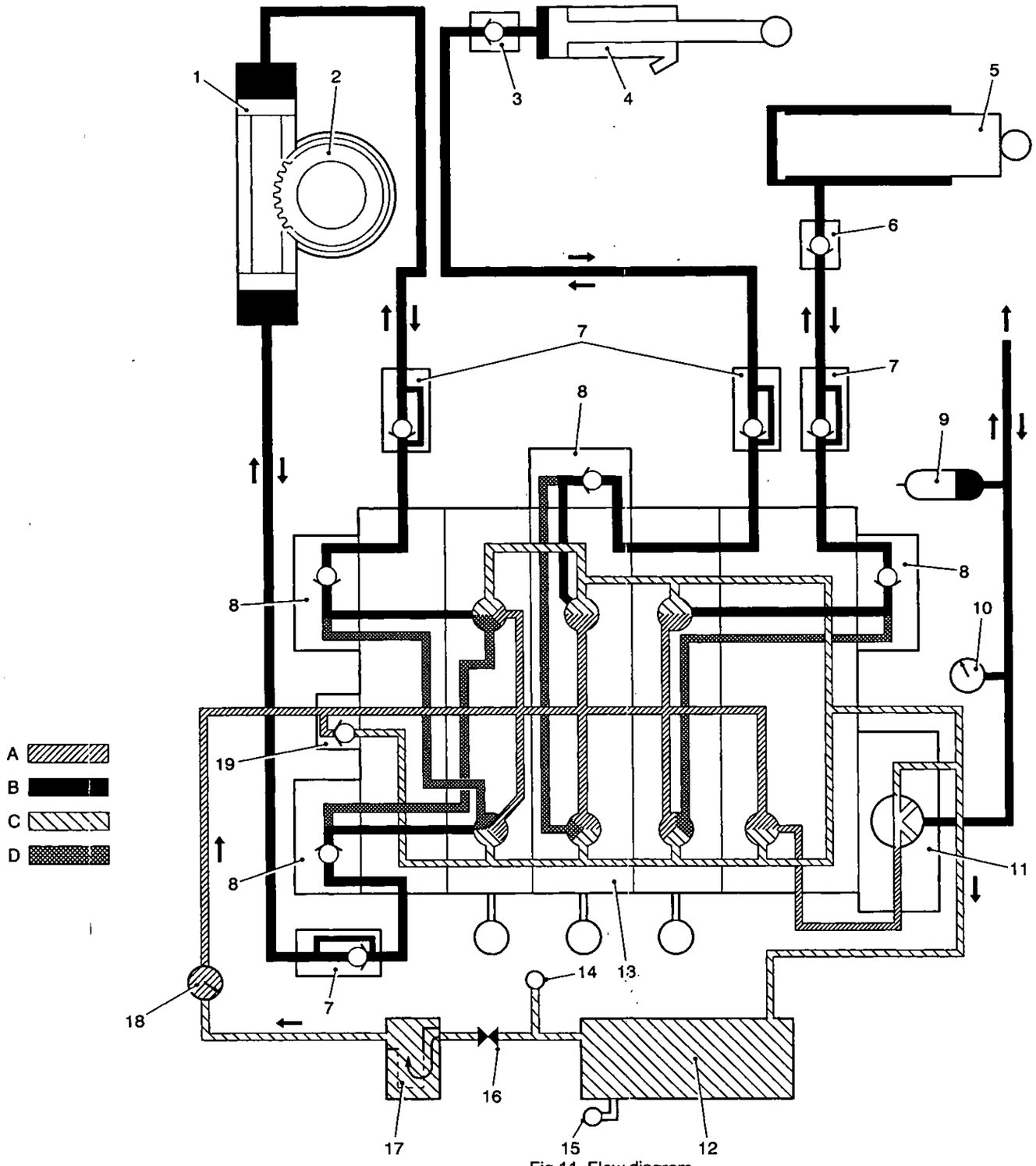
Hydraulic circuit diagram

71 The hydraulic fluid flow and layout of components is illustrated diagrammatically in Fig 11.

Hose failure valves

72 The ball check valves, one on each boom cylinder, prevent sudden descent of load in event of hose failure. Back pressure from gradual discharge of fluid through the reflux valves, assisted by a tapered coil spring, keeps the check ball off its seating during normal functioning of the equipment, but should a hose burst, release of back pressure in the service line causes pressure generated by weight of load on the ram to close in the valve and prevent descent of load.

73 The valve body (Fig 12(1)), bored and internally threaded at one end for connection to the ram cylinder, houses the check ball (2) which is retained by a retaining pin (4). The tapered end of a coil spring (5) contacts the ball, keeping it from its seating. The spring is retained by a service line connection (6), which is attached to the externally threaded end of valve body.



1 Slewing rack
2 Crane king post
3 Hose failure valve
4 Outer boom ram
5 Inner boom ram
6 Hose failure valve
7 Reflux or flow control valve
8 Pilot operated check valve
9 Accumulator
10 Pressure gauge
11 Lockout control valve
12 Reservoir
13 Control valve block
14 Filler/dipstick
15 Drain plug
16 Stop cock
17 Filter
18 Pump
19 System relief valve
(A) Pressurized fluid from pump
(B) Low pressure/return flow
(C) Service lines
(D) Pilot supply

Fig 11 Flow diagram

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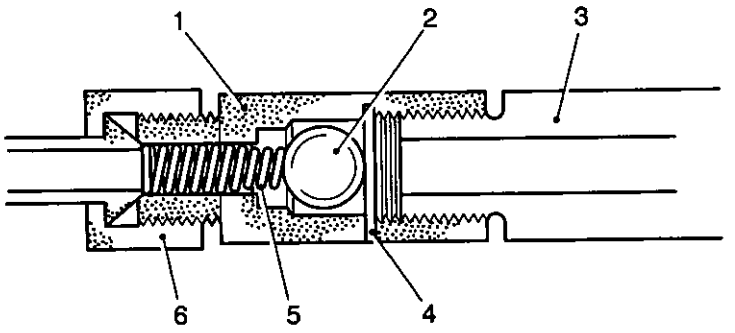

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1	Body	4	Retaining pin
2	Check ball	5	Tapered spring
3	Cylinder union	6	Service line connection

Fig 12 Hose failure valve

Reflux valve

74 The reflux valve (Fig 13) is a flow control valve with an integral spring loaded check, and is used one per service line for the inner and outer boom rams, and also the left and right slewing rams. The valves are adjustable and give a degree of control during slewing and load lowering operations.

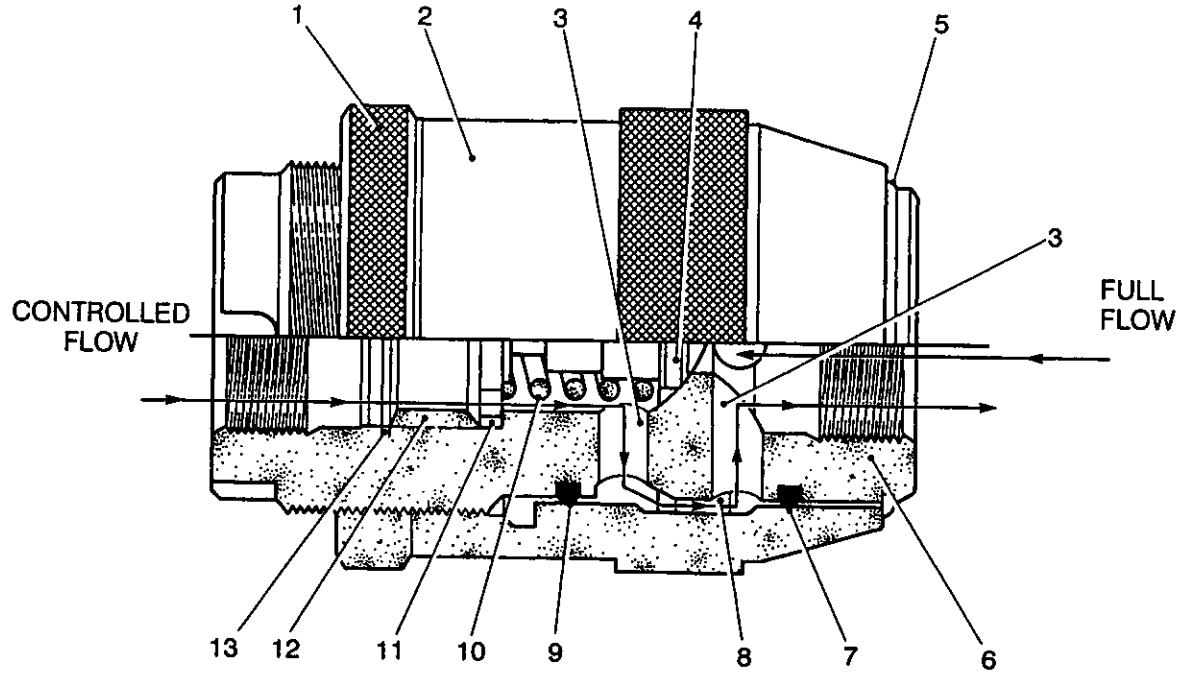
75 The valve body (6), bored and internally threaded at both ends to accept the service line connections, has a spring loaded valve head (4), which seals the full flow bore. The valve head is supported by a guide plate (11), which has drilled ports to allow the free passage of fluid. The guide plate also retains the valve spring (10) and abuts the bore shoulder where it is retained by a spacer (12) and circlip (13). The outside of the body is threaded and annular grooved, and has eight drilled transfer ports (3), which connect with the internal bore, four ports each side of valve seat. The thread provides the attachment and adjustment for the outer sleeve (2) and its locking ring (1). The sleeve has a shallow internal annular groove (8), which serves as a metering channel between the two rows of transfer ports. The channel and ports are sealed by two O-rings (7) and (9) that seat in the grooved body. The sleeve is retained at its tapered end by a circlip, which is positioned at the full flow end of the body.

76 The hydraulic fluid under regulated pressure from the control manifold block, enters in the direction of 'full flow', lifts the valve head from its seat and passes through the guide plate ports to operate the respective ram.

77 With the pressure released, by the control, on the valve head it returns by the reaction of the spring onto its seat, sealing the full flow bore. The fluid returning under pressure from the loaded boom ram or opposing slewing ram, enters in the direction of 'controlled flow', passes through the guide plate and is diverted through the metering channel via the transfer ports, the port area can be increased or reduced by releasing the outer sleeve and rotating it in the appropriate direction to obtain the required degree of control. This must be set before the crane is used for normal operations.

NOTE

The reflux valve must be connected in its respective circuit the correct way round, i.e. with the full flow connection (tapered end) toward the control manifold block. This is important, as incorrect fitting of valve will cause faulty operation of equipment and possible breakdown.



1	Locking ring	8	Metering channel
2	Outer sleeve	9	O-ring
3	Transfer ports	10	Return spring
4	Valve head	11	Guide plate
5	Circlip	12	Spacer
6	Valve body	13	Circlip
7	O-ring		

Fig 13 Reflux valve

Flow control valve

78 When a reflux valve fails all four valves are replaced by flow control valves.

79 The flow control valve (Fig 14) is used one per service line for the inner and outer boom rams, and the left and right slewing rams. The valves are adjustable and give a degree of control during slewing and load lowering operations.

80 The valve body (4) is bored and internally threaded at both ends to accept the service line connections. The valve adjuster is housed on the side of the body and allows flow to be increased or decreased by screwing the adjuster (2) in or out and is held in place by a locknut (3). A domed nut (1) protects the adjuster.

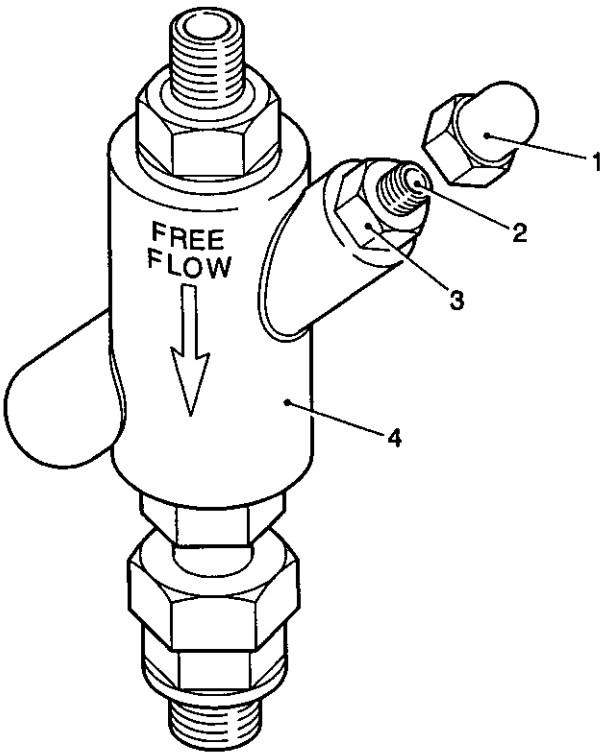
81 Regulated flow can be increased or decreased and must be set before the crane is used for normal operations, free return flow is not adjustable.

NOTE

(1) Flow control valves replace reflux valves on failure. Flow control valves must only be fitted as a vehicle set, one for each hydraulic circuit, four off per vehicle.

(2) Crane slew flow control valves must be connected with the free flow arrow on the valve body pointing towards the vehicle connection. This is important, as incorrect fitting of the valve will cause faulty operation of equipment and possible breakdown.

(3) Inner and outer jib flow control valves must be connected with the free flow arrow on the valve body pointing away from the vehicle connection. This is important, as incorrect fitting of the valve will cause faulty operation of equipment and possible breakdown.



1 Domed nut Locknut
2 Adjuster
3 Locknut
4 Body

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Fig 14 Flow control valve

Pilot operated check valves

82 The pilot operated check valves, four in number, screwed to the control manifold block, one per operating ram system, permit the free flow of pressurized fluid for ram operation, but form a check for returning fluid from the ram, which enables the ram to be held rigid until the check is released by the pilot fluid supply.

83 The valve block (Fig 15(1)), rectangular in shape, is longitudinally bored, the bore being O-ring (10) sealed and capped at both ends by plates (9) retained by four socket headed screws. Three drillings each faced and sealed against corresponding oilways in the manifold block, connect with the centre bore to provide the fluid flow to and from the valve. The first, or 'controlled flow' tapping (7), provides the flow to and from the ram and connects with the annular grooved bore which is cone faced to provide the seating for the valve cage (11).

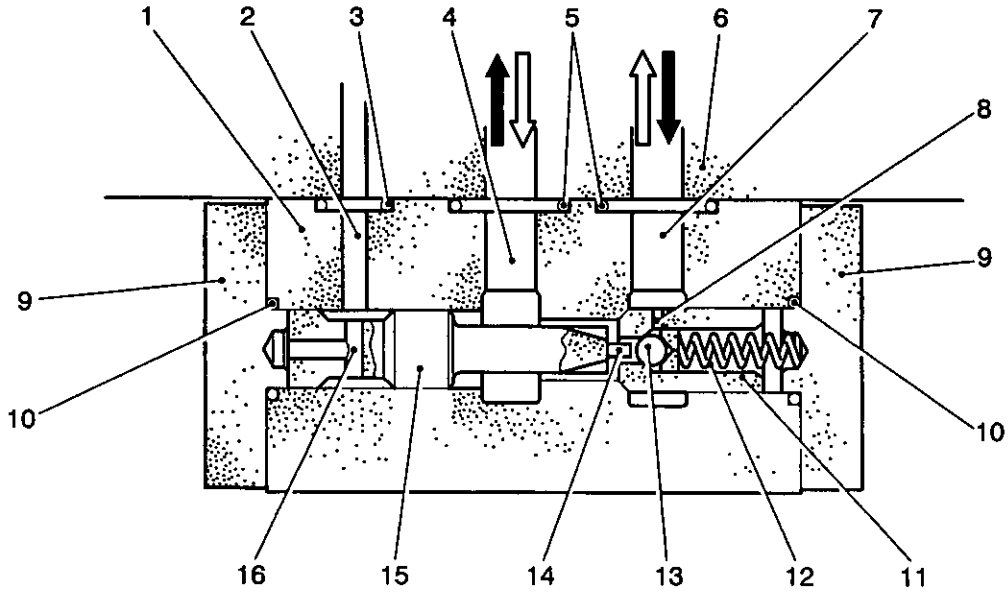
84 The cylindrical valve cage, the hollow body of which has a reduced passage at the cone seat end, houses the check ball (13), which is spring, loaded against the reduced passage. Transfer ports (8) radiate from the cage bore to connect with the controlled flow tapping annular groove.

85 The centre of 'free flow' tapping (4) connects with the annular grooved bore, the end 'pilot' tapping (2) also connects with the centre bore which houses, at this end, the pilot piston (15). The piston is reduced at one end and further reduced to form a spigot (14), which engages with the reduced passage of valve cage.

86 Pressurized fluid from the control manifold block enters the bore via the 'free flow' tapping, passes into the valve cage reduced bore lifting the check ball from its seat, which allows the fluid to enter the 'controlled flow' tapping, via the cage transfer ports and on to respective ram. As the fluid pressure increases the valve cage is lifted from its seat allowing full flow through the valve.

87 With the pressurized fluid cut-off by the control, from the free flow tapping, the cage and check ball return to their seatings holding the ram in a hydraulic lock. To release the lock, a pressurized fluid, 'pilot', supply is directed by the control into the block centre bore, where is passes via tappings (16) to react on the end of the piston moving it in the bore. The piston spigot lifts the check ball from its seat allowing the fluid flow through the valve to prevent shock loading of the system before the spigot shoulder lifts the valve cage from its seat, allowing the fluid to flow through the valve and out via the free flow tapping.

88 With the 'pilot' supply cut-off by the control, the returning pressurized fluid within the valve bore causes the pilot piston to return, exhausting its pilot fluid back to the manifold allowing the valve cage to close followed by the check ball, the slight delay slows down the speed of returning fluid, thus preventing shock loading of system.



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1	Block	9	Cap
2	Pilot tapping	10	O-ring
3	O-ring	11	Valve cage
4	Free flow tapping	12	Spring
5	O-rings	13	Check ball
6	Manifold block	14	Spigot
7	Controlled flow tapping	15	Pilot piston
8	Transfer port	16	Transfer tappings

Fig 15 Pilot operated check valve

HYDRAULIC LOCKOUT SYSTEM

General

89 To enable the crane to operate from a rigid platform the vehicle suspension is fitted with shock absorber legs that can, on being locked, become rigid struts. This is achieved by a device fitted in each absorber leg (see Chapter 2-2, Suspension and tracks), which becomes operative by inducing pressurized fluid from the crane hydraulic system, the fluid being controlled by a valve (Fig 16(15)) located adjacent to crane controls.

90 A fluid passage in the manifold block, protected by a relief valve set at 1500 lbf/in^2, is connected by a 'U' shaped pressure pipe (16) to port '3' of the control valve. The valve fluid return port '1' is connected with the fluid return passage in the manifold block by a short pipe (13) and connecting block. This connection provides the free return of fluid to the reservoir as permitted by the control valve. The valve port '2' is connected by the lockout pressurizing pipe (10) to the accumulator 'tee' piece, the accumulator (11) being clamped to the bulkhead extension in the load compartment. A pipe (9), with a branch connecting with the lockout system pressure gauge, provides the connection between the accumulator and an adaptor (8) positioned in the hull roof forward of the crane controls. This adaptor provides the connection with the lockout pipe (5) system inside the hull, which is interconnected by pipes 'tee' pieces and a union to run either side of the hull terminating at four connection blocks (3) welded to the hull side plates, the blocks being positioned adjacent to their respective shock absorber leg (1). The outside section of each block connects, via an armoured flexible hose (2), with the lockout connection on the shock absorber leg. All connections are threaded and unions have sealing washer.

91 Running adjacent to the internally located lockout system pressure pipes are the shock absorber gaiter breather pipes (17), which are of a larger diameter than the lockout pipes and connect the two left and the two right shock absorbers in pairs, each pair having its own vent (6) welded in the left and right sloping roof plates forward of load compartment bulkhead. A rubber hose (4) secured by worm drive clips connects the hose adaptor screwed into the shock absorber head and the hose adaptor screwed into the vent pipes connection block welded to the hull side plate. The pipes are connected and sealed in a similar mode to that used for lockout system.

Lockout control

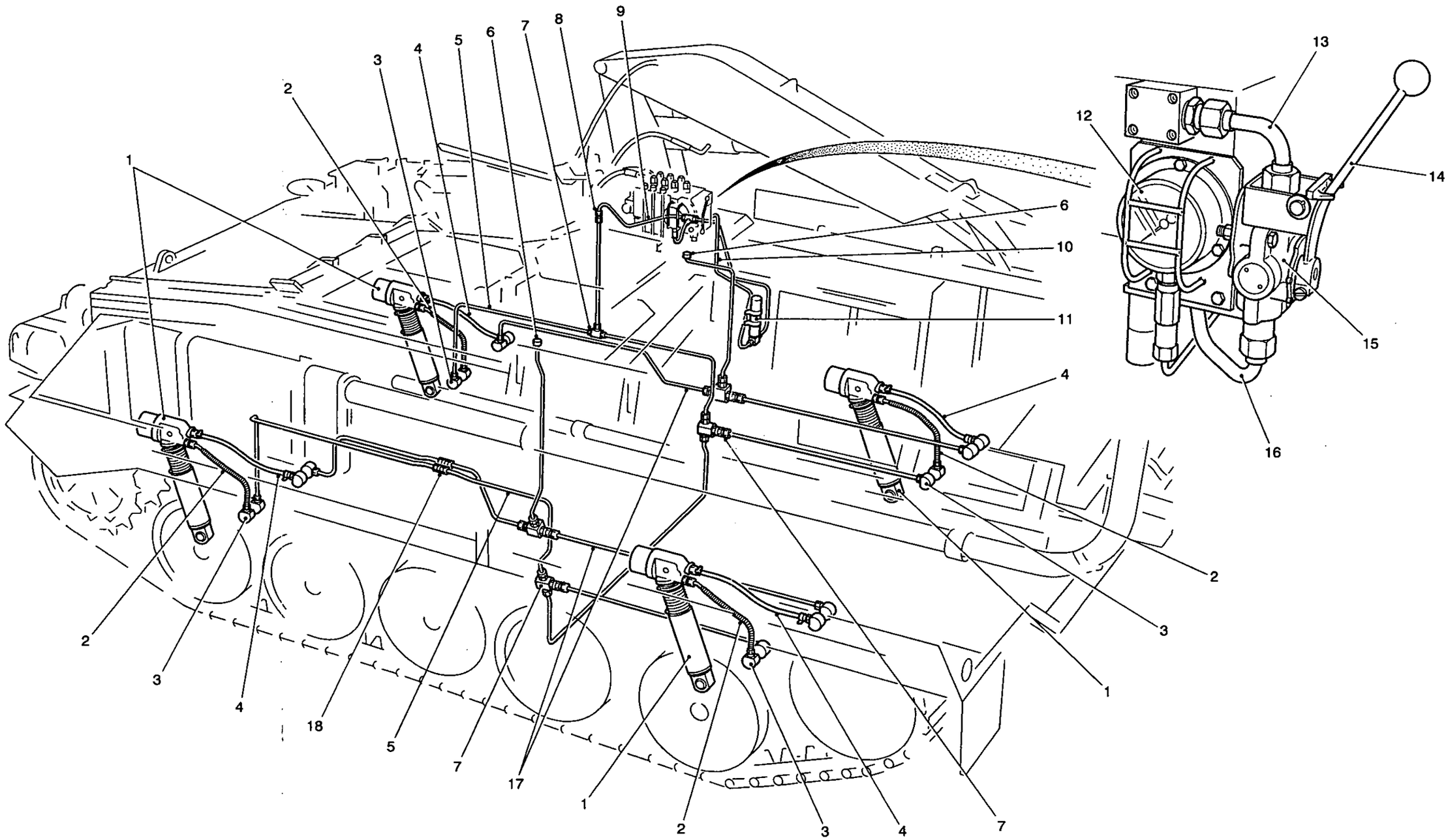
92 A rotary valve of pressure retention type which is bolted to an angle bracket attached to the crane operating controls manifold block, provides the control for the pressurization and release of the suspension dampers lockout device.

93 The cast valve block (Fig 17(17)) has a centre bore from which radiates four numbered ports, each port is internally threaded to accept the fluid pipe connecting unions, with the exception of port '4' which, not being required, is fitted with a blanking plug (15). All four ports have a main cylindrical seal (7) with bonded seat which is sealed in the port bore by seal ring (6) and backing O-ring (16), the seals being retained by their respective unions or blanking plug, the unions and plug are locked with a grub screw. The bonded seals engage with and seal the ball section of the valve spindle (14) and also provide the flow connection with the spindle fluid passages.

94 The valve spindle housed in the central bore is formed into three sections. The centre, or ball, section has bored fluid transfer passages, which connect to form a 'K'. The two outer sections are annular grooved to provide the seating for seal rings (9) with backing rings, which seal and retain the spindle in the centre, bore of block. To bring the required transfer passage in line with the selected outlet port, the spindle is rotated by a lever (3) clamped to the squared end of spindle. The end of square is engraved to denote the position of transfer passages. A stop plate (12) with relieved segment, which engages with a stop peg (13), restricts the operating lever movement to the limits required for valve operation. The plate is located on the square spindle behind the lever and is retained by a circlip (8). A hinged safety gate (2) is provided to hold the operating lever in the vertical or neutral position, and prevent accidental operation of the valve.

Neutral position (Lever vertical) (a)

95 Fluid from the pressure pump via system relief and manifold block flows into rotary valve via port '3' (10) and out through port '1' (18), thence directly back to the crane hydraulic fluid reservoir. The lockout cylinders and circuit are closed off from pressurized circuit. The lockout system pressure gauge indicating 'zero'.



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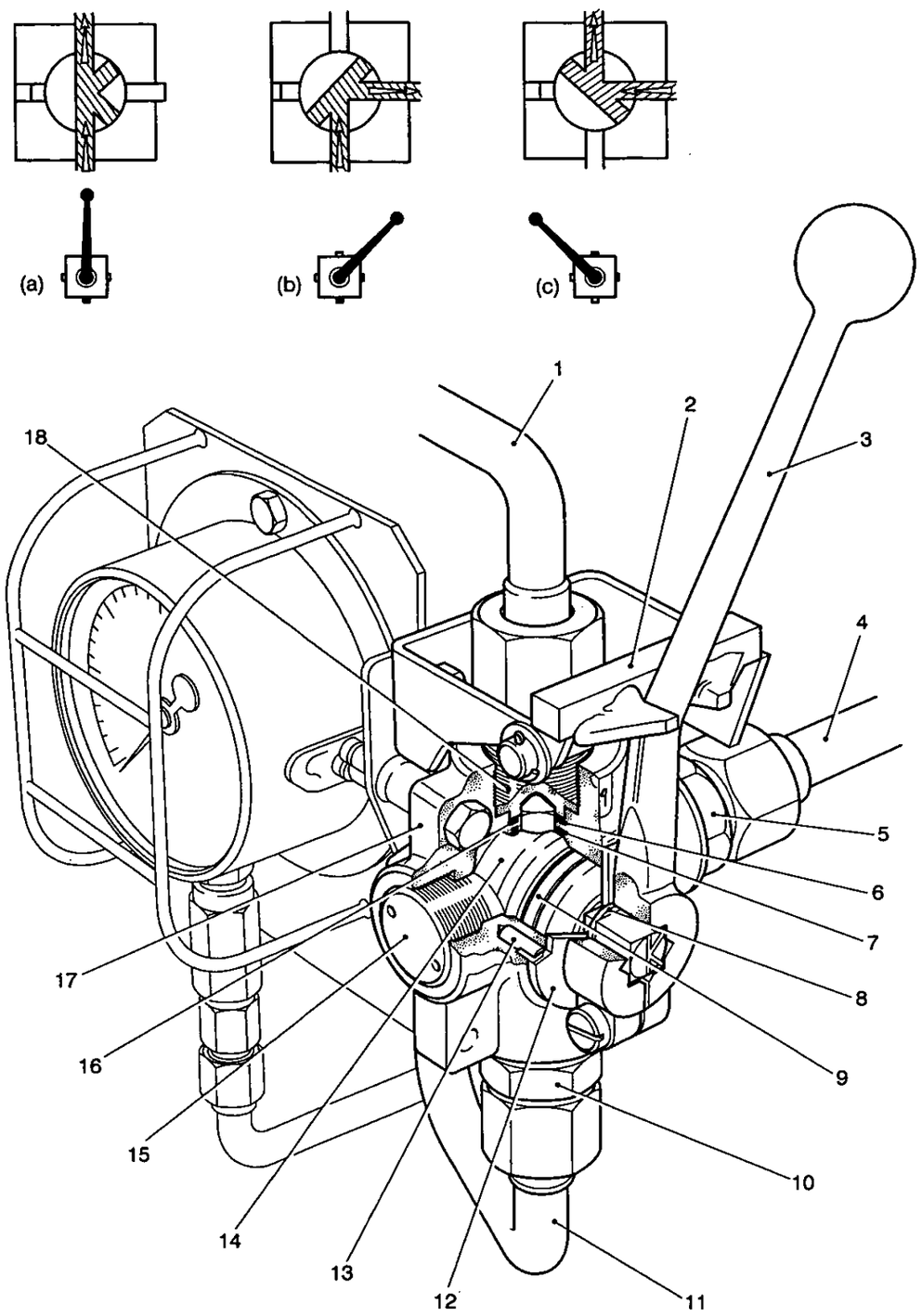
1	Shock absorber	5	Lockout pipes	9	Pipe	13	Return pipe	16	Pressure pipe
2	Flexible hose	6	Vent	10	Pressurizing pipe	14	Control lever	17	Breather pipes
3	Connection block	7	Tee piece	11	Accumulator	15	Control valve	18	Union
4	Rubber hose	8	Adaptor	12	Pressure gauge				

Fig 16 Lockout system



1 Return pipe
2 Safety gate
3 Lever
4 Lockout pressurizing pipe
5 Port '2' union
6 Seal ring
7 Cylindrical seal
8 Circlip
9 Seal ring
10 Port '3' union
11 Pressure pipe
12 Stop plate
13 Peg
14 Valve spindle
15 Port '4' plug
16 O-ring
17 Valve block
18 Port '1' union
(a) Neutral position
(b) Engage position
(c) Disengage position

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Fig 17 Lockout control

Engage position (Lever forward)

96 Fluid delivered from the pump enters the rotary valve via port '3' and is directed to lockout cylinders via port '2' (5). Pressure in excess of 1500 lbf/in² brings into operation a spring-loaded relief valve, mounted in the manifold block, which relieves the fluid back to the reservoir. With the pressure gauge indicating 1500 lbf/in², the lockout devices are pressurized; this causes the shock absorbers to become rigid. The lever is returned to centre position and retained, leaving lockout system fluid at 1500 lbf/in² indicated pressure, which is maintained by the accumulator.

Disengage position (Lever back) (c)

97 Pressurized fluid is relieved from the lockout device and system back to the reservoir via port '2' and out through '1', assisted by the lockout device return spring and pressure exerted from accumulator. On completion of discharge, with indicated pressure 'zero', the control lever is returned to centre position, and the safety gate engaged.

Accumulator

98 A 10 cubic inch bag type accumulator is connected into the suspension damper lockout cylinder circuit on the cylinder side of the rotary control valve, and is charged with air to 1000 lbf/in², to maintain pressure in the lockout system when the cylinders are locked and shut off from the pressure pump delivery. Padded clamping clips bolted to the load compartment forward bulkhead extension adjacent to the fuel filter pipe secure the accumulator.

99 The accumulator has a steel cylindrical body (Fig 18(3)) closed at one end by the outlet port assembly and an air valve with separator bag at the other. The port assembly with spring loaded valve (5) is retained by two ring halves (7) which are jointed by a dowel pin at one side to facilitate fitting and removal, a securing nut (8) screwed on the threaded port body clamps on a gland ring (11) which also compresses a sealing ring (12) with backing washer. A two-way adaptor block (9) is screwed onto the port body and sealed by an interposing O-ring (10). The separator bag (4) positioned inside the cylinder is attached by an integral valve stem (1) that is secured with a nut (2), the valve stem is fitted with an 'Schrader' type valve core (15) and dust cap (16).

100 The separator bag charged with compressed air exerts pressure on the hydraulic fluid that occupies the remaining space (13) in the cylinder and in the lines to the lockout cylinders, thus keeping the lockout system pressurized to 1500 lbf/in² when the fluid from the high pressure pump is shut off. When the control valve releases the lock pressure, the fluid flows from the cylinder under pressure from the separator bag, the expanding bag makes contact with the valve closing it against its spring on to its seat thus preventing the separator bag rupturing.

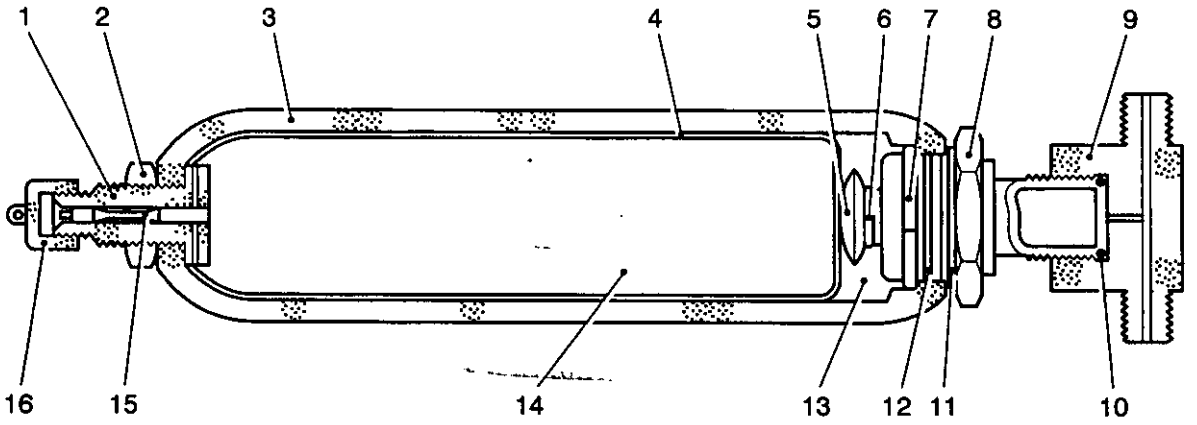
OPERATION

101 Before the crane can be operated, the following must first be brought into operation:

101.1 The reservoir cock (Fig 1(20)) must be set at 'open', to allow the fluid to be gravity fed to the inlet port of the pump via a full flow filter.

101.2 With the engine stopped, the pump engagement lever must be pulled back to engage the pump drive with the transfer gearbox gear train. The engage must be restarted at the crane operator's switchboard (17) and the engine speed set by the operator's hand throttle (16), to register 1000/1200 rev/min on the driver's instrument panel tachometer.

101.3 Pressurized fluid from the pump enters the control (Monsun) block, system relief valve and manifold block, and until required for crane or lockout operation the fluid is returned via the manifold outlet port to the reservoir.



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1	Valve stem	9	Adaptor block
2	Nut	10	O-ring
3	Body	11	Gland ring
4	Separator bag	12	Seal ring
5	Valve	13	Hydraulic fluid space
6	Spring	14	Compressed air space
7	Ring halves	15	'Schrader' valve
8	Nut	16	Dust cap

Fig 18 Accumulator

102 The lockout system operating lever (12) must be pushed forward, to allow pressurized fluid from the manifold block to be diverted to the four suspension dampers lockout pressure gauge (13), located adjacent to the control lever must then be returned to its central position, this cuts off fluid supply to the dampers and permits the fluid to flow through the control and return to reservoir via manifold. The pressure gauge will then indicate 1500 lbf/in², a pressure maintained in the lockout system by the accumulator, which is located in the load compartment. A relief valve set at 1500 lbf/in², located in the manifold block, protects the flow from manifold to control. The vehicle is then set for crane operation.

103 With the crane in the travelling or ready position, the booms must be released from the outer boom clamp, and the drop-nosed pin removed from inner boom strut.

104 To lift the crane initially, the inner ram must be actuated by easing back the inner ram control lever, which connects with its respective valve spool in the control block. The spool directs the high pressure fluid from its oil way in the control block allowing it to pass through the port into the manifold block, where the individual fluid passage is protected by a relief valve set at 2500 lbf/in², and on to a pilot operated check valve located on the right face of manifold.

105 Fluid enters the check valve and lifts the spring loaded ball from its seat in the valve cage, this permits the fluid to pass out from the valve into manifold and be directed by internal oil way and external hose to the left valve of the inner and outer rams reflux or flow control valves (15) which are located on the roof plate at the rear of control unit.

106 The fluid enters the tapered end of reflux valve; there to divide and pass through the transfer ports and metering channel until the pressure build up is sufficient to lift the check valve from its seat and permit the free flow of fluid through the valve. The fluid leaves the reflux valve and, via service line hose, passes on to the ram connection.

107 The ram connection, positioned in the side of cylinder, houses a hose failure valve which allows the free flow of pressurized fluid which then enters the ram cylinder where the pressure built up in the cylinder acts upon the ram head to extend the ram, which lifts the inner boom and attached outer boom.

108 The sequence of operation of outer ram is similar to that described for inner ram, the difference being that the service line connection with integral check valve is positioned in the end cylinder, allowing the pressurized fluid to act directly on the ram piston head. The pilot operated check valve is located on the rear face of manifold.

109 The action of returning the ram control lever to the vertical or stop position, brings the respective spool across the high pressure oil way cutting off the pressurized fluid from the ram circuit. The ram and its circuit remain pressurized and static. A condition achieved by the control spool and the spring-loaded ball and cage of the pilot operated valve. Assisted by the reflux valve, which with its full flow valve closed by return spring and back pressure, only permits reverse flow through the metering ports.

110 To lower the booms, the operating lever is eased forward, moving the spool to uncover the low pressure discharge oil way, which channels the returning fluid to reservoir. A pressurized oil way is also revealed, the fluid from which provides the pilot supply to the pilot operated check valve.

111 The pilot spool in the check valve is actuated by the pilot fluid supply and lifts the check valve cage from its seating permitting the free passage of returning fluid through valve.

112 The reflux valve metering ports and channel restrict the return flow of the pressurized fluid from ram and provide a controlled descent of boom. The ram being single acting relies on the weight of load or boom to react on the ram forcing the fluid from the ram cylinder.

113 The hose failure valve, as its name suggests, only becomes operative as a check if a hose fails or a major leak occurs in the ram system, the resultant pressure on the check ball causes the ball to close onto its seating against the spring as it is no longer supported by back pressure in the service line. The valve then traps the fluid in the ram cylinder holding it rigid. Back pressure from the reflux valve keeps the valve off its seating, assisted by the valve spring, allowing fluid to flow for normal operations.

CHAPTER 6-2

CRANE AND HYDRAULIC LOCKOUT SYSTEM - VEHICLES EQUIPPED WITH CONTROL VALVE BLOCK ASSEMBLY FV847574 - CURRENT TYPE

CONTENTS

GENERAL

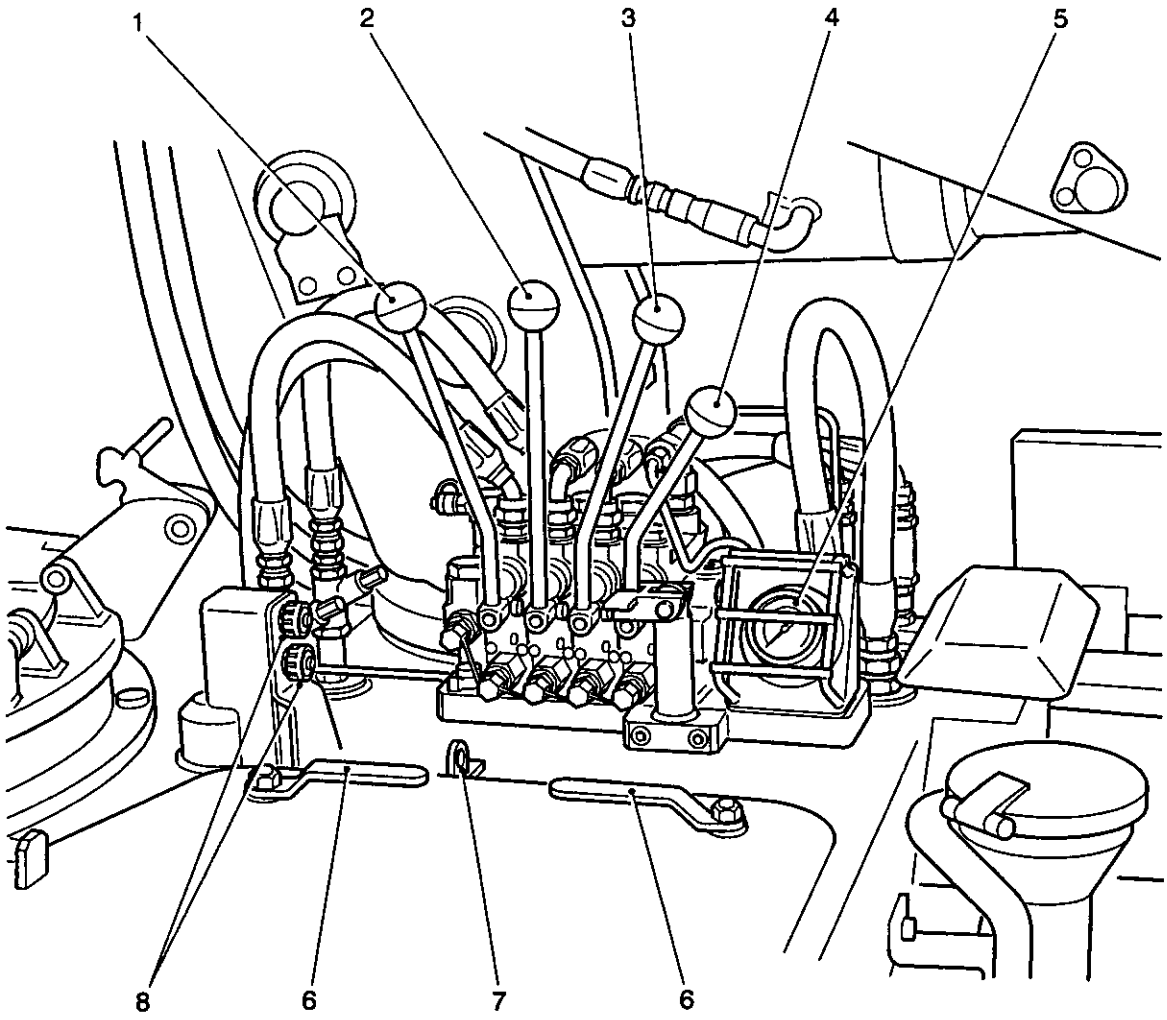
1 On initial issue the Carrier Maintenance Full Track FV434 Mk 1 and 1/1 was equipped with control valve block assembly FV649488, as spares for this equipment became obsolete the control block assembly was replaced by FV847574. This chapter details the technical description for those vehicles equipped with control valve block assembly FV847574, Chapter 6-1 details the technical description for vehicles still equipped with control valve block assembly FV649488.

CONTROL VALVE BLOCK ASSEMBLY FV847574 - CURRENT TYPE

2 The crane operations are controlled from a control valve block (Fig 1), located on the roof plate adjacent to the crane king post. The block contains valves which control slewing, lifting and lowering.

3 To enable the crane to operate from a rigid platform the vehicle suspension is fitted with shock absorber legs that can, on being locked, become rigid struts. This is achieved by a device fitted in each absorber leg (see Chapter 2-2, Suspension and tracks), which becomes operative by inducing pressurized fluid from the crane hydraulic system, the fluid being controlled by a valve (Fig 1(4)) located adjacent to crane controls.

4 The control valve block assembly FV847574 is a non-repairable item and as such is replaced on failure.



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1	Slewing lever	5	Lockout pressure gauge
2	Outer ram lever	6	Operators door padlock hasp
3	Inner ram lever	7	Operators door locking handle
4	Lockout lever	8	Light sockets

Fig 1 Control valve block assembly FV847574 - current type

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