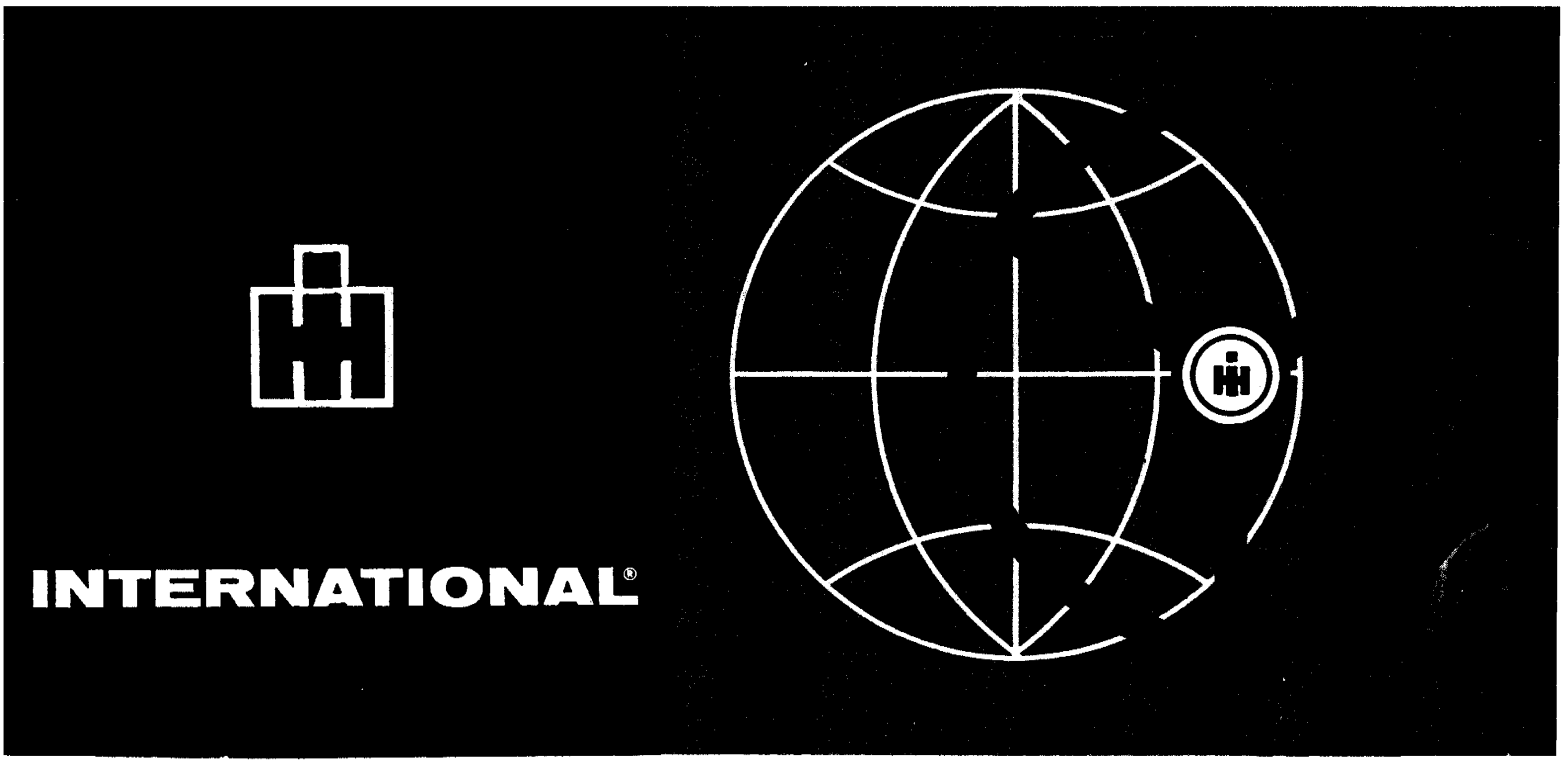


SERVICE MANUAL

Hydraulic Draft Control

DIESEL TRACTOR

523 + 624

724 + 824

SERVICE MANUAL

INTERNATIONAL®

Hydraulic Draft

and

Position Control System

Additional Control Valves

DIESEL TRACTOR
523/624
724/824

INTERNATIONAL HARVESTER COMPANY M.B.H.,
NEUSS AND HEIDELBERG

3 000 927 R2 11.71

Introduction

Sound engineering, good workmanship and extensive tests have made this IH–draft control system a reliable unit.

However, functional disturbances may still occur if dirt, the enemy No. 1 of any hydraulic system gets into the circulating fluid as for example through careless maintenance, etc. After years of operation natural wear, too, may present service problems. The use of wrong hydraulic fluid or fluid which has lost much of its lubricating properties through age may be the cause of trouble.

Service personnel is expected to be quick in spotting the source of any trouble that might develop and to take reliable corrective measures. This can only be done when the principle of operation is fully understood.

This manual has been prepared to familiarize service personnel with the operating principles and proper servicing techniques of the IH–draft and position control hydraulic system.

The procedures and "trouble shooting" techniques are based on the experience of the men responsible for developing and testing the draft control system. You, too, can take full advantage of their experience and offer an efficient service to your customer.

INDEX

IMPORTANT NOTICE

Operating pressure of the hydraulic system has been increased from 140 – 150 kg/cm^2 = 1990 – 2130 PSI to 160 – 170 kg/cm^2 = 2280 – 2420 PSI, effective from serial number R 11 130 up.

As a result of this increase, the hydraulic pump, Bosch, and draft control valve (spring of cut–out relief valve) have been changed. The opening pressure of the additional relief valve and of the relief valve within the mounting block (auxiliary circuit) has been increased from 160 – 170 kg/cm^2 = 2280 – 2420 PSI to 180 – 190 kg/cm^2 = 2560 – 2700 PSI.

The opening pressure of cylinder cushion valve has been reduced from 220 – 250 kg/cm^2 = 3130 – 3560 PSI to 180 – 190kg/cm^2 = 2560 – 2700 PSI; components of this valve have been changed, see Parts Catalog.

Note: When replacing a control valve or the mounting block for auxiliary circuit take care to select parts that correspond with the operating pressure of the system. For details see Parts Catalog.

For some time tractors have been regulary equipped with a pressure oil filter in place of the return filter in the lift housing. This pressure filter can also be fitted on tractors in the field. See instructions 1 090 655 R1.

Special Tools

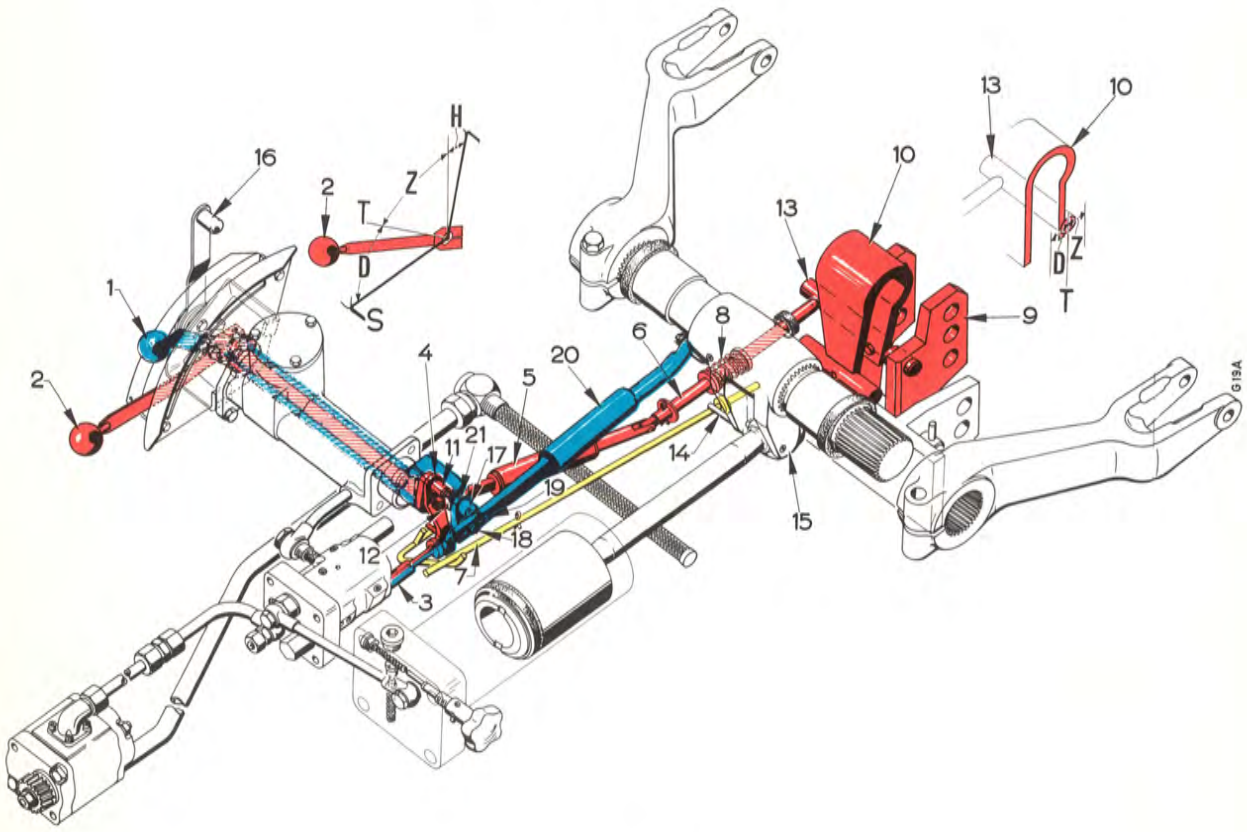
A minimum of special tools is required. Details are given in the Parts Catalog. A set of pressure gages and fast equipment with connections etc. has been added lately, for quick and efficient pressure checks. Since use of this test equipment is not restricted to the hydraulic system, and standardized test connections are being provided, no workshop should be without this equipment.

Specifications

Maximum lifting force on lower link balls	2140 kg = 4700 lbs
Lifting time over full range with 1500 kg = 3300 lbs load on lower link balls	2.8 sec. max.
Maximum permissible oil temperature	90° C = 190° F
Pump delivery at 3000 rpm (pump) free flow	24 – 24.5 l/min = 6.34 – 6.47 gpm
against 185 kg/cm^2 = 2600 PSI pressure	22 – 23 l/min = 5.8 – 6.1 gpm

Maximum system pressures	present		former		For checking pressures see Illust.:
	kg/cm^2	PSI	kg/cm^2	PSI	
Flow divider (pilot stream pressure)	6 – 7	85 – 100	6 – 7	85 – 100	29, 29a or 30
Cut–out relief valve (operating pressure)	160 – 170	2280 – 2420	140 – 150	1990 – 2130	29, 29a or 30
Additional relief valve (shock loads)	180 – 190	2560 – 2700	160 – 170	2280 – 2420	26
Cylinder cushion valve (static pressure)	190 – 210	2700 – 3000	220 – 250	3130 – 3560	
Relief valve – auxiliary hydraulic system	180 – 190	2560 – 2700	160 – 170	2280 – 2420	97

PRINCIPLE OF OPERATION



Illust. 1

Draft control linkage
Position control linkage
Limit stop mechanism

D = Pressure range
(lever range 45°, spring range 18 mm = .709")
T = Dead position
(possible deviation 10° to both sides)
Z = Tension range
(lever range 45°, spring range 18 mm = .709")
H = Lifting range (10°)
S = Float position

1 – Position control lever
2 – Draft control lever
3 – Control valve spool
4 – Draft spool lever
5 – Spring element
6 – Draft link plunger
7 – Limit stop rod
8 – Plunger spring
9 – Bellcrank
10 – Bellcrank spring
11 – Pivot point
12 – Spring element connection
13 – Bellcrank pin
14 – Limit stop pin in power arm
15 – Power arm
16 – Lever stop
17 – Pivot point
18 – Connection pin
19 – Lost–motion slot
20 – Position actuator rod
21 – Draft spool lever

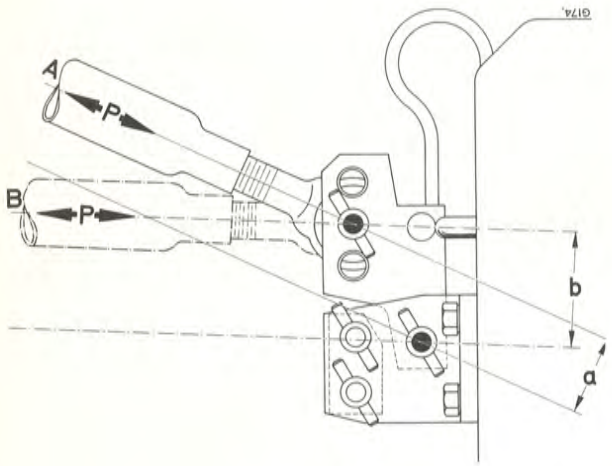
Draft Control

The draft control system operates on the principle of draft loads i.e. resistance acting on the implement while it is being pulled through the ground. These draft loads are transferred to the bellcrank (9) Illust. 1 by the upper link of the three–point hitch and can either be pressure or tension.

The bellcrank spring (10) partly balances the forces transmitted from the plow to the bellcrank, causing the latter to reciprocate. This reciproncal motion is taken up by the draft link plunger (6) and transmitted to the control valve, spool (3) via pin (13), spring element (5) and draft spool lever (4) to initiate lifting or lowering. The heavier and longer the signal the more the implement will raise or lower.

Auciliary Control

The auxiliary control operates automatically when working in soils of varying resistance to make for an even operating depth by changing the effective lever ratio, see Illust. 1a.



Illust. 1a

A – Regular operating position of upper link
a – Effective leverage on bellcrank 70 mm = 2.75 in.
B – Position of upper link with implement going deep in soft soil
b – Effective leverage on bellcrank 100 mm = 4 in.
P – Draft loads (pressure or tension)

In regular operating position of the upper link (A) effective leverage on bellcrank is 70 mm = 2.75".

As soil conditions change from heavy to light, the implement tends to go deeper (B), resulting in an increased effective leverage (b) 100 mm = 4" which amplifies draft load forces (P). The system is thus put into lifting position until the implement is again operating at its predetermined depth. This ensures a uniform depth control, even under varying soil conditions.
The auxiliary control is affected by the coupling height of the upper link. Other adjustments are not provided and none should be attempted.

Limit Stop Mechanism

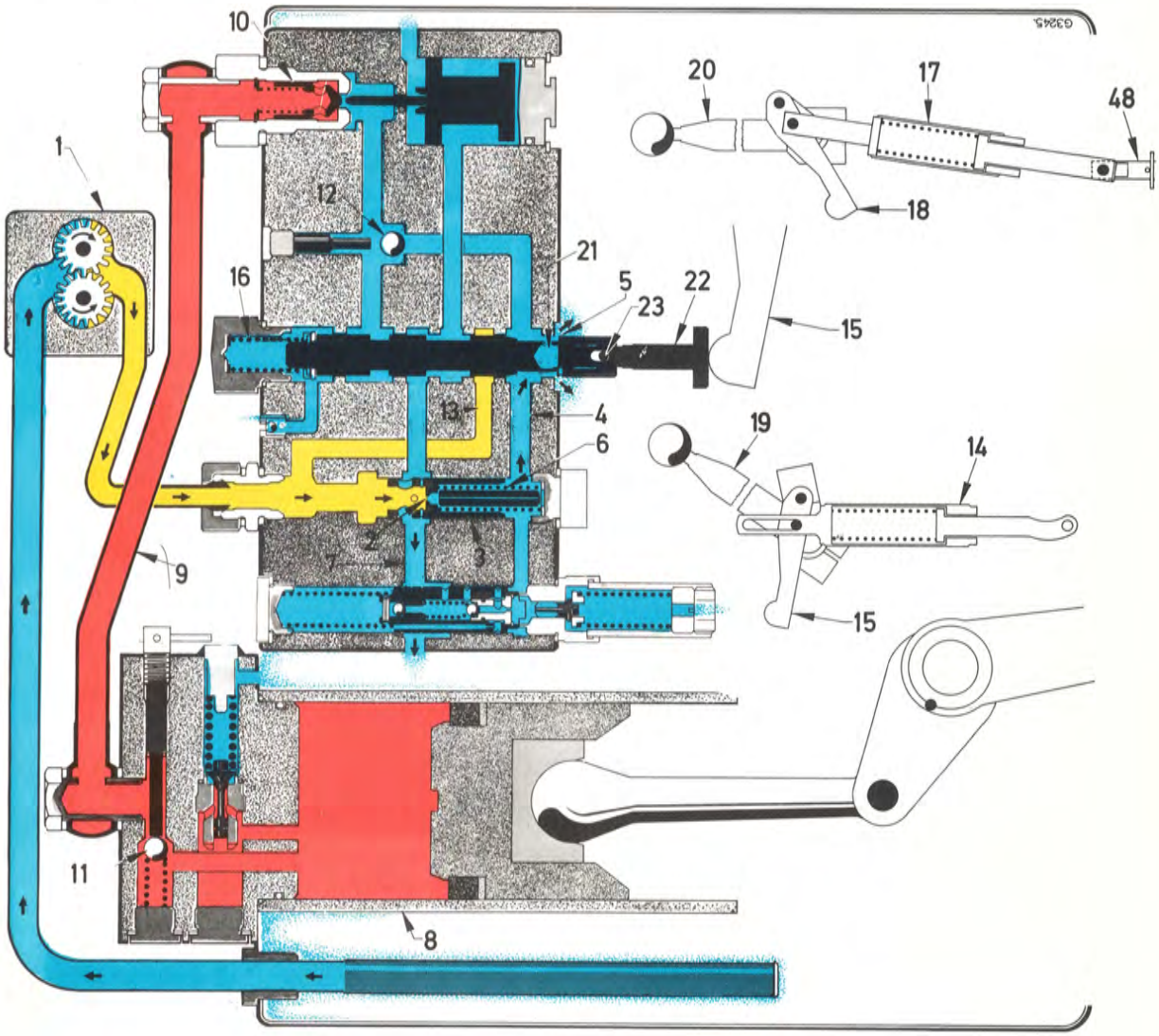
When raising the implement with the draft control lever (2) Illust. 1 to the upper limit, rod (7) is moved rearwards by pin (14) and pulls out spool (3) to stop the lifting operation. This is to prevent the power arm (15) from contacting the lift housing and causing damage.

Position Control

Mounted implements which operate above the ground are controlled entirely by the position control linkage (blue Illust. 1). The draft control lever (2) is down all the way and thus rendered ineffective. The height above the ground of any mounted implement is determined by the placement of the position control lever (1).

Should an internal leakage develop resulting in the rocker arms going down, the position actuator rod (20) being connected to the power arm (15) moves forward to correct the rocker arm position by moving the spool (3) towards the lifting position.

Neutral Position



Illust. 2

Operating pressure

Pilot stream pressure

Low pressure

Pump (1) operates against flow divider or pilot stream pressure. Pump delivery depends on engine rpm. Part of the oil flows through the orifice (2) of the flow divider (3), through passage (4) and drains into the lift housing past the spool at (5). As only a fraction (5 L/min = 1.3 US gpm) of the pump capacity goes through orifice (2), the flow divider (3) is forced back by the resulting pressure build–up against its spring (6) until the oil can escape through passage (7). The largest proportion of the pump delivery is displaced this way and returned into the lift housing. The control valve spool is approximately central. Main lift passage (13) is blocked.

Pressure in power cylinder (8) depends on the hitched load and the leverage ratio of the rocker arm mechanism. The block valve (10) is closed, preventing return flow. Non–return valve (12) is open. Draft control lever is down all the way. Position control lever is approx. half–way up.

Auxiliary Change–Over

This hydraulic device is designed to assist in a smooth change–over from "neutral" to "lifting" and from "lifting" to "neutral" without intermediate or restricted position.

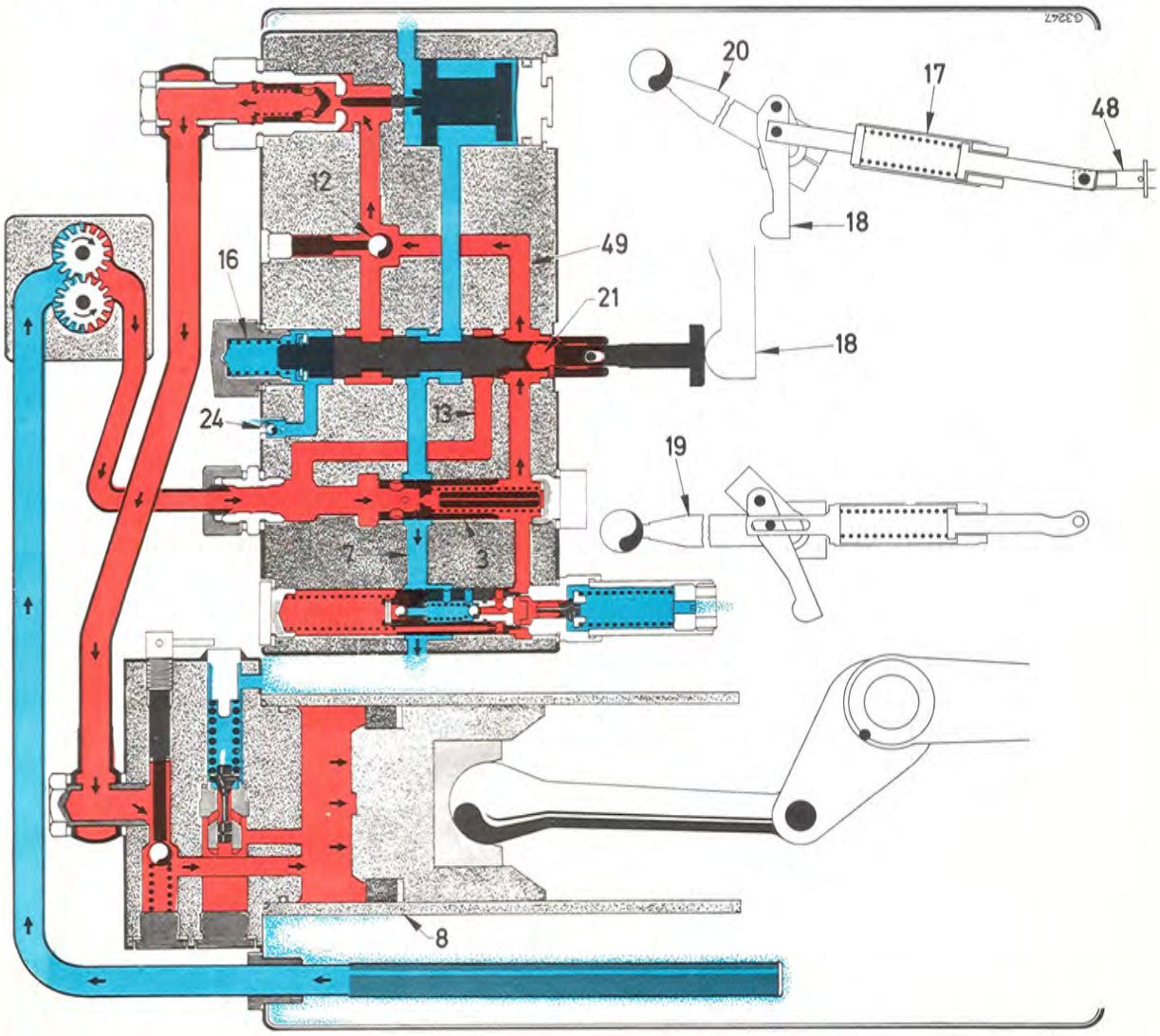
The internal spool cylinder (21) is filled through a small orifice from passage (4). In neutral position this fluid drains through three relief ports in the spool into the reservoir. Roll pin (23) in spool rests against rear end of lost–motion slot in tappet (22).

As the spool is moved in towards "lifting", pressure begins to build up in cylinder (21) as soon as the rear land of the spool begins to restrict in draining outflow. In this position, tappet (22) covers the three relief ports, preventing drainage. The rising pressure acting on tappet (22) forces the spool forward against spring (16) in a quick positive motion until the roll pin (23) rests against the front end of the lost–motion slot in the tappet (lifting position).

When changing from lifting position to "neutral", pressure fluid drains out through relief ports in cylinder (21). As pressure breaks down, spring (16) reasserts itself, forcing the spool rearwards with a quick positive motion until the roll pin (23) contacts the rear end of the lost–motion slot. The valve spool is now in "neutral".

Refer also to Illust. 3, 5 and 7 and compare tappet position.

Lifting with Pilot Stream



Illust. 3

= Operating pressure

= Low pressure

This condition will occur when operating with the draft control system and the sensing link of the implement gives a light signal for a minor correction of operating depth towards lifting. The pilot stream passing through the central orifice of the flow divider (3) is 5 L/min = 1.3 US gpm and makes for a precise depth control.

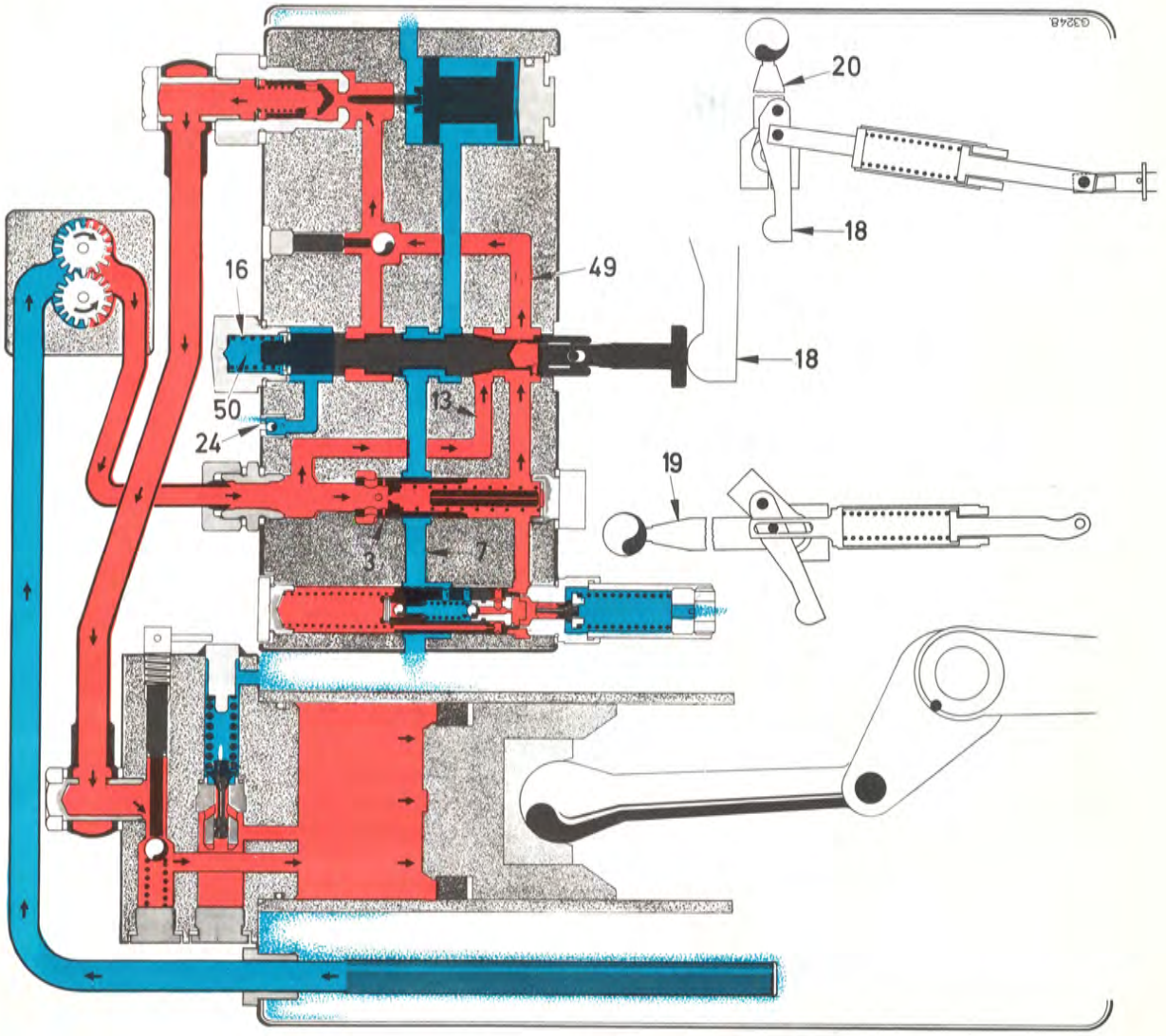
Position control lever (19) is down all the way and rendered ineffective. Draft control lever (20) is approx. one third up.

The draft link plunger gives the signal for lifting. The valve spool stops the drainage outflow of the pilot stream and the auxiliary change–over moves the spool towards lifting position. The pilot stream now goes through passage (49), dislodges non–return ball (12) and opens block valve toward the power cylinder. Pressure in front and behind the flow divider is determined by the resistance i.e. the back pressure from the power cylinder (8). Slowly the implement is lifted to its predetermined operating depth.

When lifting with pilot stream the flow divider piston (3) opens return passage (7) just sufficiently to maintain the required pressure, yet allows the large volume of oil to drain into the reservoir, via passage (7).

The flow divider is thus held in a state of hydraulic balance.

Lifting with Full Capacity



Illust. 4

= Operating pressure

= Low pressure

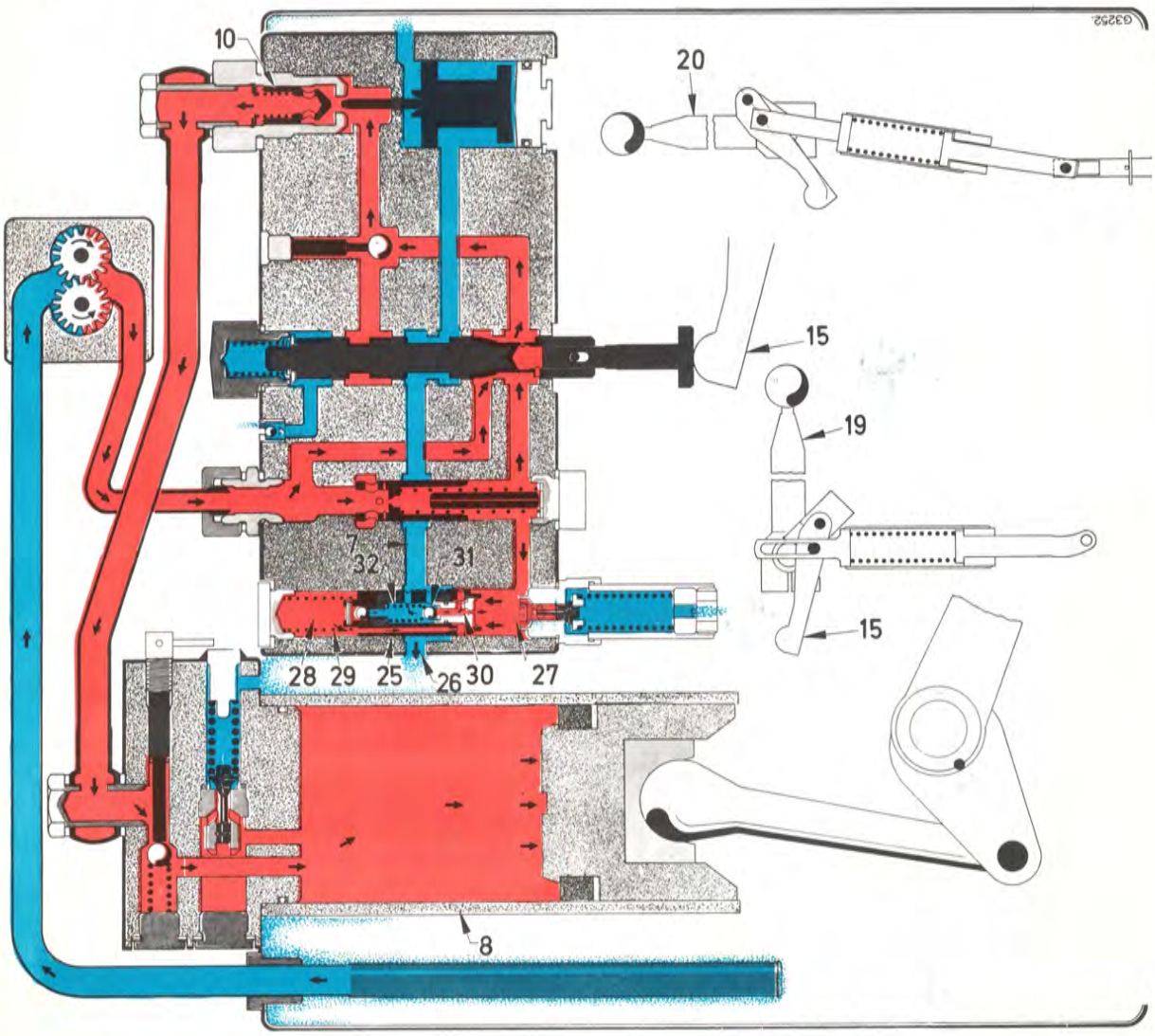
When "lifting with full capacity", the valve spool is run in all the way against spring (16). Main lift passage (13) is now open, allowing full flow to passage (49). Hydraulic pressure being equal in front and behind the flow divider (3), the spring expands, moving the flow divider forward all the way and blocking return passage (7). The full pump capacity flows to the power cylinder resulting in an increased lifting rate, as for example when lifting the plow at head lands.

Restrictor Orifice

The purpose of this orifice is to slow down spool speed while "lifting" by restricting the outflow from chamber (50), thereby making for a smoother operation of the entire draft control system.

When changing to "neutral" or "lowering", the non–return ball becomes unseated, allowing oil in large quantity to fill chamber (50), preventing a "suction" condition.

Cut–out Relief Valve



Illust. 5

= Operating pressure

= Low pressure

Illust. 5 shows the system in position "lifting with full capacity", actuated this time by the position control lever, see also Illust. 4.

Rocker arms are loaded to such an extent that pressure (red) in power cylinder and control valve rises to 2280 – 2420 PSI = 160 – 170 kg/cm^2.

This pressure, being balanced in the whole pressurized system, also acts on pressure chamber (27), throttle chamber (28) and ball valve (31). As the pressure build–up continues this ball becomes unseated and moves against spring (32). Restriction orifice (50) Illust. 6 and orifice of passage (30) are designed in such a way that pressure in this passage is approx. 5 kg/cm^2 = 70 PSI lower than in pressure chamber (27) when the ball valve (31) is open. This results in fluid from both chambers (27) and (28) flowing into passage (30) and draining through valve (31) into the reservoir. As the volume in chamber (28) decreases, the complete valve (25) moves forward against spring (29), displacing the fluid through passage (50) and valve (31). As soon as the valve (33) Illust. 6 clears edge (34) pressure in the system breaks down and oil drains into the reservoir at port (26). The time lapse for the cut–out valve to open is .3 – .5 seconds. As pressure breaks down, ball valve

(31) is reseated. Pressure in chamber (27) is 8 – 9 kg/cm^2 = 115 – 130 PSI (brown in Illust. 6). The whole pump delivery is drained into the reservoir through port (26). The control valve spool remains in lifting position. Block valve (10) closes, preventing backflow and lowering.

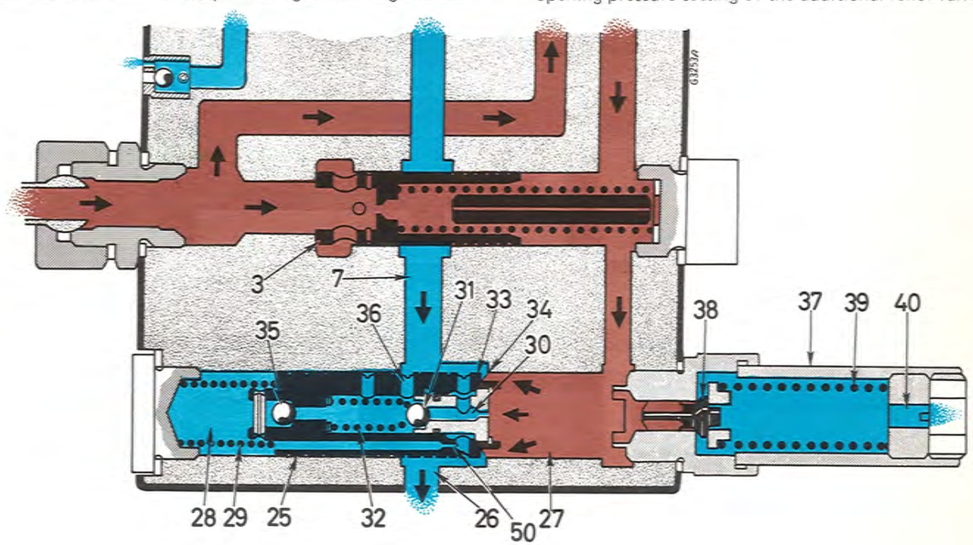
The cut–out valve does not reseat itself automatically. A constant residual pressure of 8 – 9 kg/cm^2 = 115 – 130 PSI remains in the system. By this "cutout action" the pump is protected from operating against continuous high pressure.

To make the system operable again, the cut–out valve must be retarded. Spring (29) can only reassert itself when chamber (27) is pressureless. To do this, the system must be briefly put in the lowering position to obtain "neutral", as shown in Illust. 2, i.e. the flow divider piston (3) must be run back, permitting most of the pump capacity to drain into the reservoir through return passage (7). As the cut–out valve slides back, chamber (28) must be filled with fluid. However, only a small quantity can pass through restrictor orifice (50), resulting in a suction condition in chamber (28). This unseats ball valve (35), permitting oil in large volume from passage (7) and (26) to fill chamber (28). Rising pressure in chamber (28), due to a pressure build–up in chamber (27), will reseat ball (35).

Additional Relief Valve

We have seen that the cut–out relief valve opens only when the pressure build–up exists for .3 to .5 seconds or longer. Shock loads of 180 – 190 kg/cm^2 = 2560 – 2700 PSI that might occur instantaneously are reduced by the additional relief valve (37). Poppet (38) thereby becomes unseated and moves against spring (39). The pressure oil from chamber (27) can now drain into the reservoir through apertures (40).

The additional relief valve also protects the system when the cut–out relief valve should fail. The hydraulic system must, however, not be used when the cut–out valve is known to be defective because of the higher opening pressure setting of the additional relief valve.

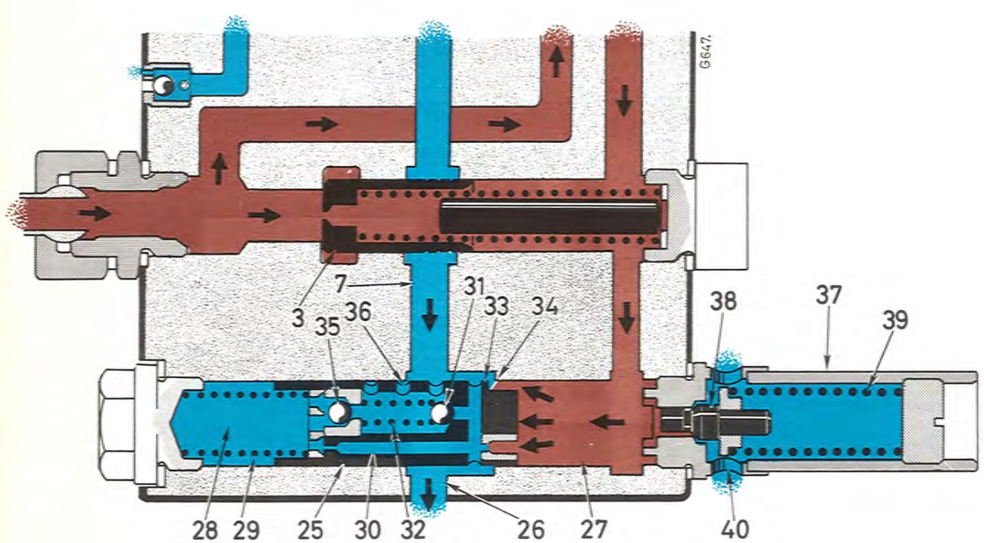


Illust. 6

Present design of flow divider, cut–out relief valve and additional relief valve.

= System pressure with cut–out valve open 8 – 9 kg/cm^2 = 115 – 130 PSI

= Low pressure



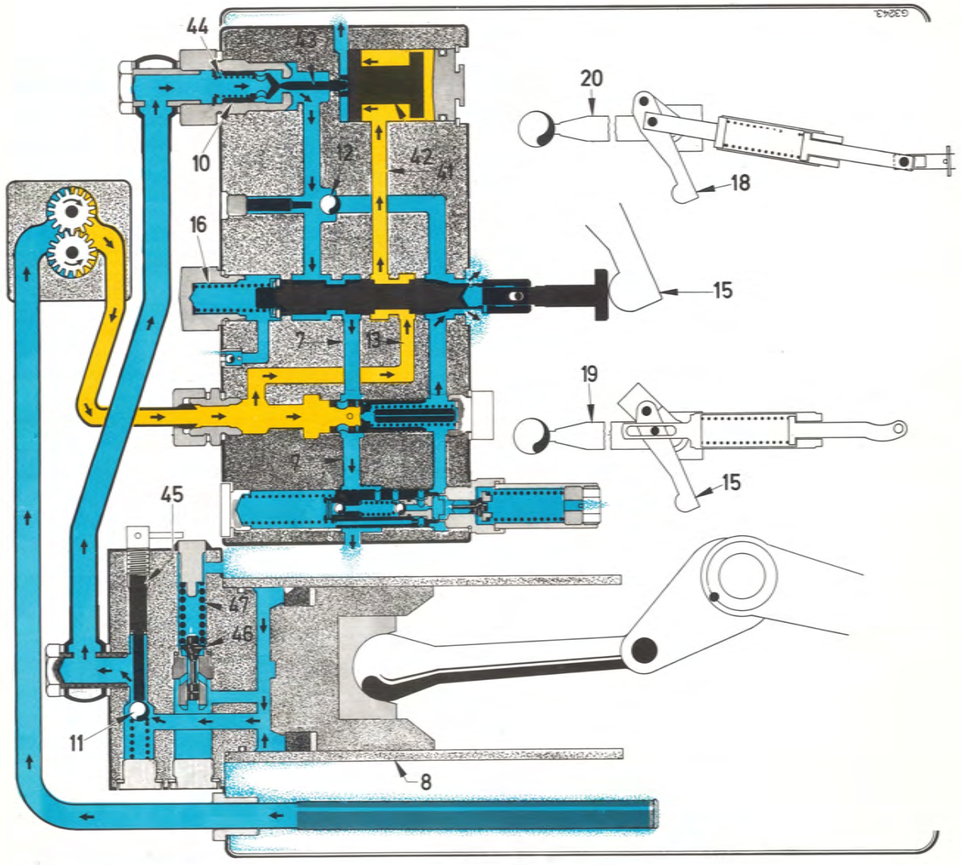
Illust. 6a

Displaced design of flow divider, cut–out relief valve and additional relief valve

= System pressure with cut–out valve open 8 – 9 kg/cm^2 = 115 – 130 PSI

= Low pressure

Lowering and Float Position



Illust. 7

= Pilot pressure 6 – 7 kg/cm^2 = 85 – 100 PSI

= Low pressure

When lowering, one of the levers (19) or (20), which is up in the quadrant, is shifted down. This will ease pressure on the spool lever (15), permitting the spool spring (16) to reassert itself and run out the spool to lowering position, Illust. 7. As the spool slides back, main lift passage (13) is connected with passage (41). Pilot stream pressure of 6 – 7 kg/cm^2 = 85 – 100 PSI begins to act on block valve piston (42), moving it forward. Thrust pin (43) transmits this motion and opens block valve (10). Hydraulic fluid from the power cylinder (8) now drains past closed non–return valve (12) through passage (7) into the reservoir.

Lowering operation is ended when the valve spool slides forward to "neutral", i.e. connections between passage (13) and (41) is broken and connection between passage (41) and return passage (7) is established. This allows the pressure fluid behind the pilot piston to escape and spring (44) reseats the block valve, pushing pilot pin (43) and pilot piston (42) back, see also Illust. 2.

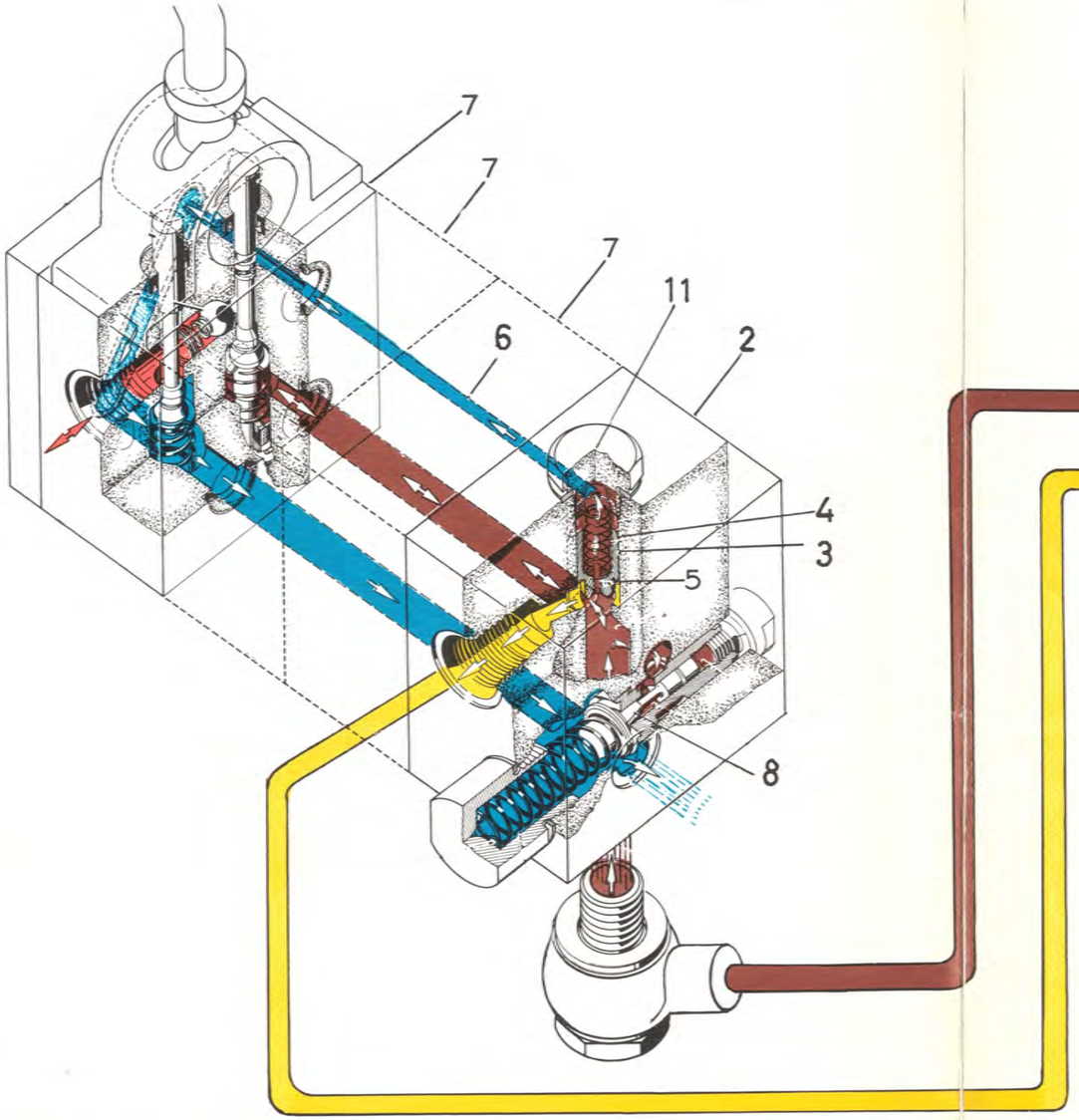
With both operating levers all the way down, the system is in float position. The circuit is the same as in the lowering position, i.e. spool is run out all the way, passages (13) and (41) are connected, pilot piston (42) is pressurized, keeping block valve (10) open. The piston in power cylinder (8) is in its forward position. The ball–type connecting rod is free to move inside the power cylinder, following the fluctuations of the floating implement.

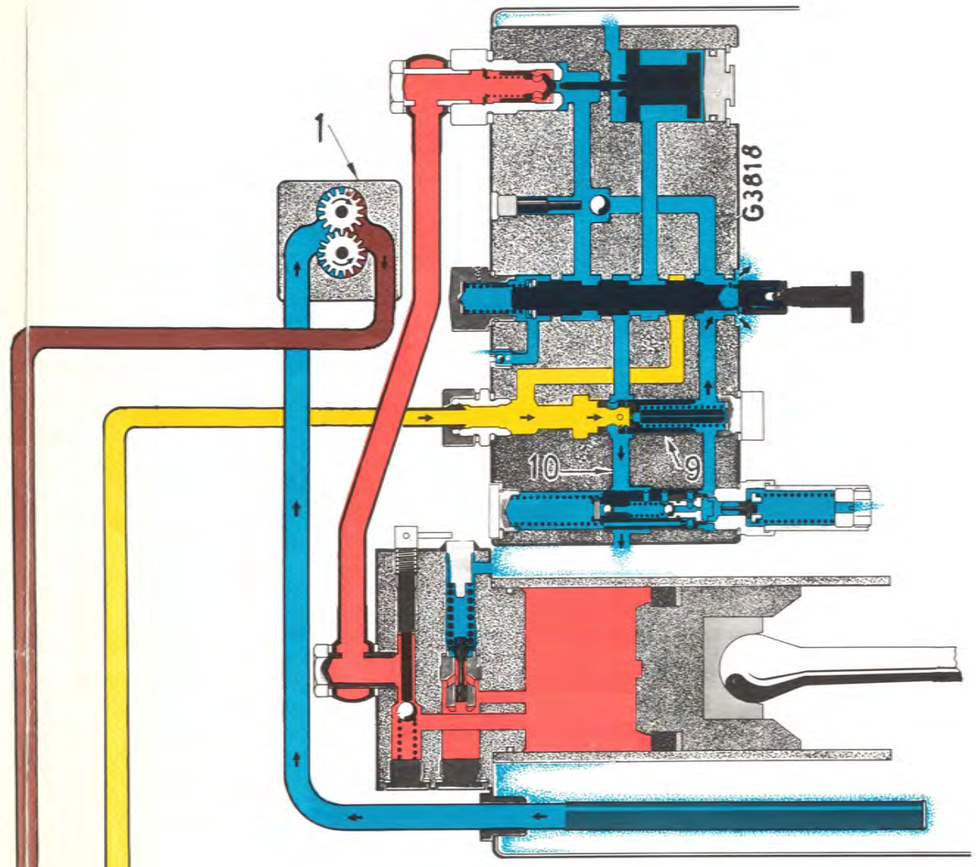
Cylinder Cushion Valve

The purpose of the cylinder cushion valve is to protect the system against shock loads when driving over a bumpy road with a bouncing implement. In this way, shock loads of many thousand PSI may result. As soon as these shock loads exceed 2700 PSI, the cylinder cushion valve (46) will become unseated, relieving pressure in the power cylinder. The valve is set to an opening pressure of 190 – 210 kg/cm^2 = 2700 – 3000 PSI.

Lowering Control Valve

Lowering rate is controlled by means of the manually operated lowering valve (45), located inside the cylinder head. With the spindle turned to the left all the way, this valve can be used as a lowering lock. The return oil passage is now completely closed by the ball–type valve (11). This is necessary when transporting long implements hitched on the 3 point linkage.





= Low pressure

= Pilot pressure 8 – 9 kg/cm^2 = 115 – 130 PSI controlled by flow divider piston (3) within mounting block (2)

= Pilot pressure 6 – 7 kg/cm^2 = 85 – 100 PSI controlled by flow divider (9) in draft control valve

= Static oil, pressure depending on load

Illust. 7a
Oil flow with draft control – and additional circuit in "Neutral position"

Note: For functional description of auxiliary circuit and components see "Additional Control Valves".

1 – Pump
2 – Mounting block
3 – Flow divider piston
4 – Spring
5 – Restrictor orifice
6 – Restricted passage
7 – Control valve
8 – System relief valve
9 – Flow divider
10 – Return passage
11 – Check point for system pressure

REMOVAL AND DISASSEMBLY

Before starting to remove hydraulic components, be sure to wash the tractor thoroughly. ***On a dirty tractor the hydraulic system must not be opened.*** Be sure to cap all ports and ends of hydraulic lines as they are removed. Cleanliness cannot be over–emphasized. Even the smallest particles of foreign matter may cause trouble.

Plan your work before starting to remove units.

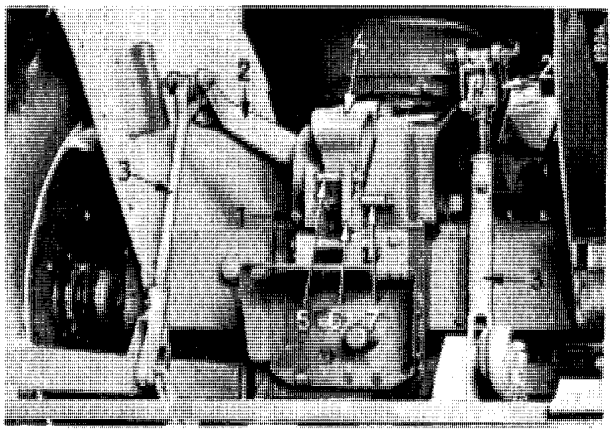
It is good practice to check all system pressures to reflect on the general conditions of the unit.

For test procedure refer to section "Checking and Adjusting Cut–out Relief Valve".

Note: Additional control valves, draft control valve and cylinder head may be removed and reinstalled without removing the lift housing from the tractor. It may, however, be of advantage to remove the complete unit for better accessibility. In the following procedure, it is assumed that the lift housing must be removed, as for example when it is necessary to remove the power arm. Proceed as follows:

Remove the operator's seat.

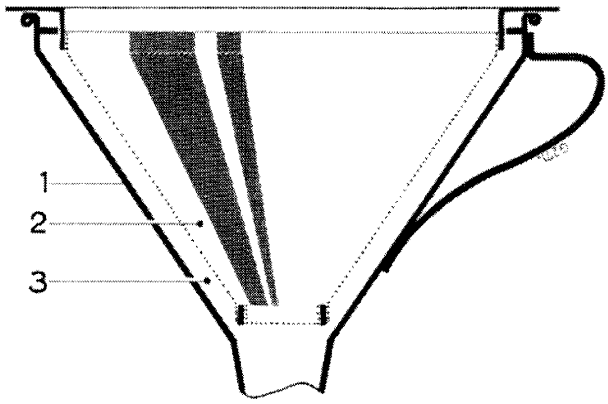
Disconnect lifting rods (3) Illust. 8 at the rocker arms (2). Disconnect upper link by removing cross pin (5). Remove the bolt connecting pin (7) to bellcrank spring (4). Pull out pivot pin and remove bellcrank (6).



Illust. 8

1 – Oil drain plug
2 – Rocker arms
3 – Lifting rod
4 – Bellcrank spring
5 – Cross pin for upper link
6 – Bellcrank
7 – Bellcrank pin

Drain hydraulic fluid. To do this, remove drain plug (1) Illust. 8 and filler plug (4) Illust. 9a. In order to drain the oil into a clean receptacle, it is good practice to use a suitable oil chute. Should the oil be reused, it must be strained through a fine mesh funnel (0.4 to 0.5 mm = .0015 to .002"). A suitable filtering device, as shown in Illust. 9, can be made locally.



Illust. 9

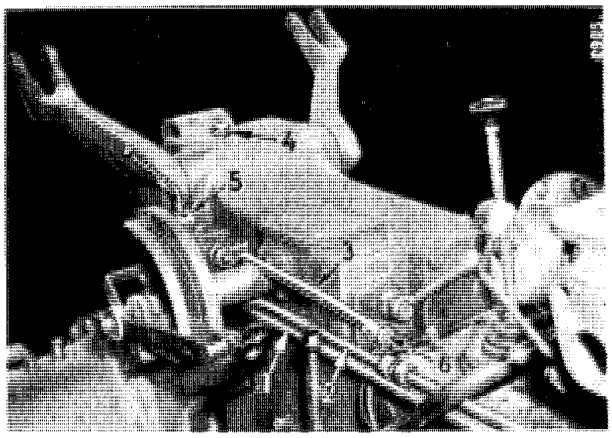
1 – Funnel
2 – Filter insert
3 – Clearance

The insert (2) rests on the upper funnel rim. This insert should be dimensioned in such a way that there is a minimum clearance (3), approximately 10 mm = .4", resulting in a large filtering area.

Remove pipe lines (1–3) Illust. 9a and any additional piping that might be mounted for front loaders, etc. Where no additional control valve is used, pressure line (2) is connected to draft control valve at port (6) by means of an elbow.

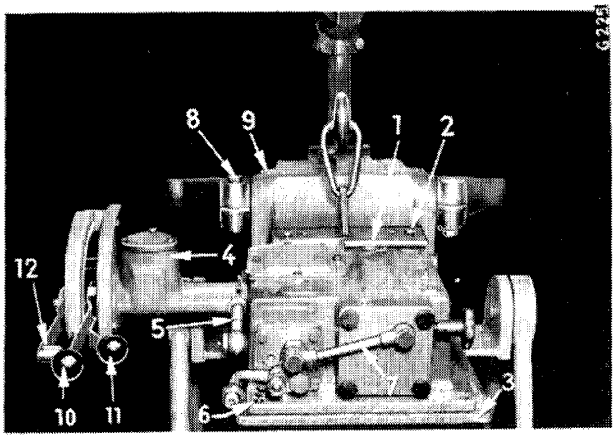
Remove the housing mounting bolts and carefully lift the housing off its dowel pins using a hoist.

To facilitate handling of the housing, it is advisable to make a stand with a swivelling base plate (3) Illust. 10. This plate should have four mounting holes for retainer bolts (6) and a cut–out large enough to make the housing accessible from the bottom, Illust. 19.



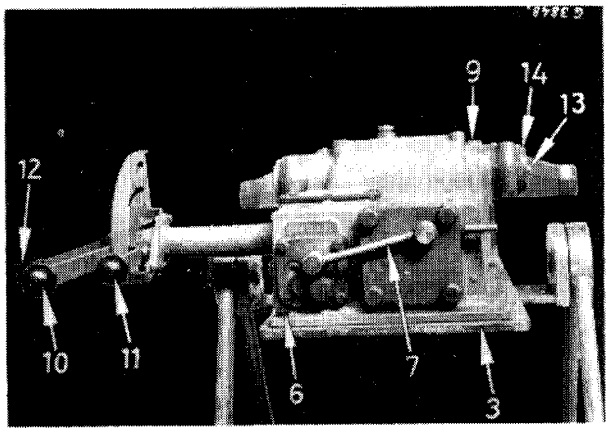
Illust. 9a

1 – Suction pipe
2 – Pressure pipe from pump
3 – Pressure pipe from mounting block to draft control valve
4 – Oil filler plug with breather filter
5 – Additional control valve
6 – Inlet port



Illust. 10
Hydraulic hitch (displaced design)

1 – Lifting plate with eye
2 – Mounting bolts
3 – Stand or trolley
4 – Return filter housing
5 – Return oil line
6 – Retainer bolt
7 – Connecting line
8 – Clamping bolts
9 – Dog point set screws
10 – Draft control lever
11 – Position control lever
12 – Marker lever

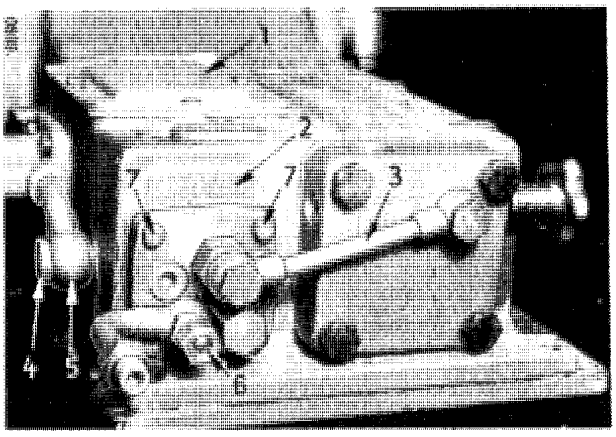


Illust. 10a
Hydraulic hitch
(present design)

13 – Mounting bolts
14 – Washers

The other reference numbers show the same components as in Illust. 10.

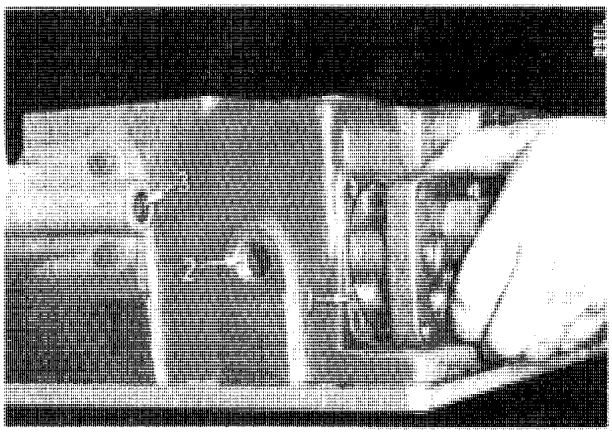
Draft Control Valve



Illust. 11

1 – Top cover
2 – Serial number
3 – Connecting line
4 – Female bolt with hose adapter
5 – Return oil line
6 – Pressure test connection
7 – Retainer bolts

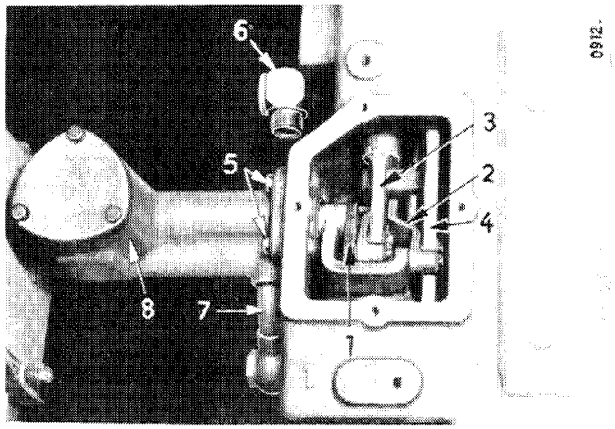
Remove connecting line (3) Illust. 11 and back out female bolt (4). Removal of return oil line (5) and pressure test union (6) is not necessary. Take out the four retainer bolts (7) and remove the control valve. To do this, tilt the control valve slightly forward to disengage the limit stop rod from the valve tappet, see Illust. 12.



Illust. 12
Removing draft control valve

1 – Gasket
2 – Return oil port
3 – O-ring

Control Lever Assembly

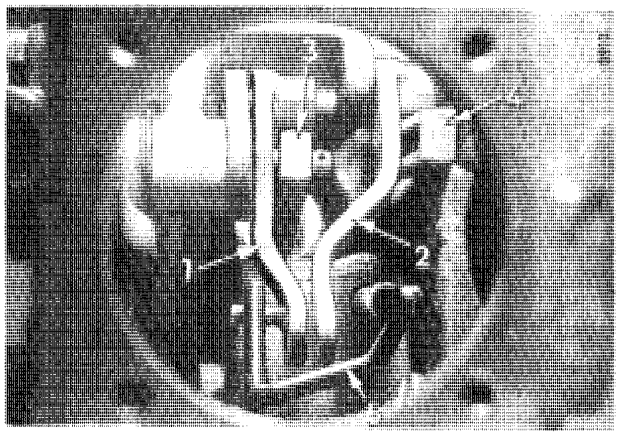


Illust. 13

1 – Draft spool lever
2 – Position spool lever
3 – Spring element, draft control
4 – Position actuator
5 – Retainer bolts
6 – Suction screen, suction pipe connection
7 – Return oil line
8 – Return oil filter

Disengage return spring, loosen clamping bolts and remove draft and position control levers (10 and 11) Illust. 10.

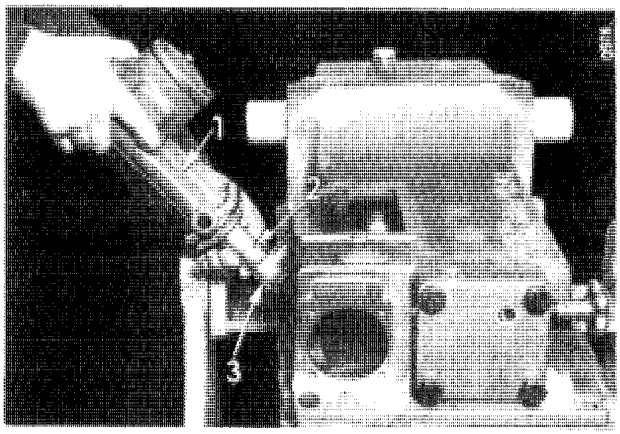
Remove retainer bolts (5) Illust. 13. Take out cotter pins and washers securing spool levers. Remove spool levers (1 and 2) Illust. 13 and 14.



Illust. 14

1 – Draft spool lever
2 – Position spool lever
3 – Spring element, draft control
4 – Position actuator
5 – Limit stop rod

To do this, slide levers (1 and 2), spring element (3) and actuator (4) from their respective pins while moving the bearing assembly (1) Illust. 15 outwards.



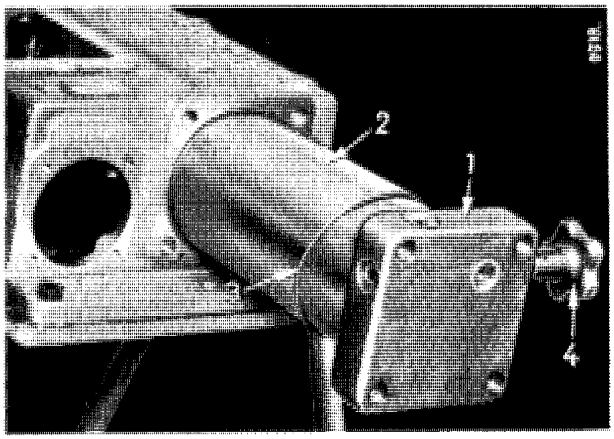
Illust. 15

1 – Bearing assembly
2 – Position control tube
3 – Bottom edge

Pull bearing assembly (1) out and swivel in such a way that bottom edge (3) clears the housing aperture. Take care that the draft control shaft does not slide out of tube (2).

Cylinder Head and Power Cylinder

To remove the cylinder head, it is necessary to take off the connecting line from the control valve, see (3) Illust. 11. Remove the four retainer bolts and pull out the cylinder head.



Illust. 16

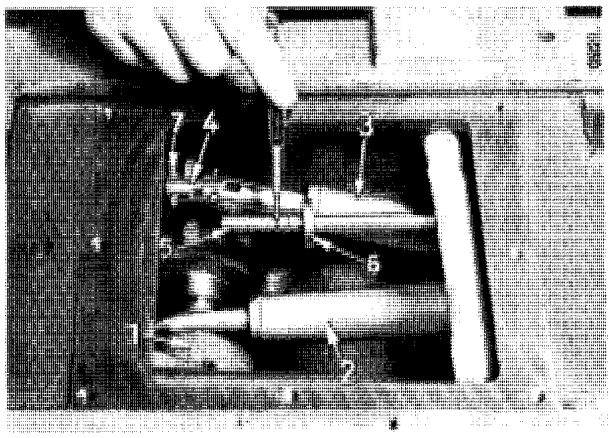
1 – Cylinder head
2 – Power cylinder
3 – O–ring
4 – Hand wheel, lowering control valve

The cylinder head is sealed in the power cylinder by means of an O–ring which has a light pressure and keeps these parts together. When removing the cylinder head, the power cylinder and piston slides out also.

Spring Element, Draft Link Plunger and Limit Stop

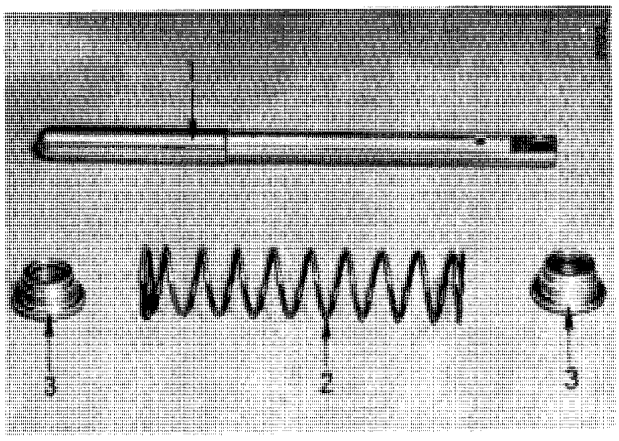
Remove rockshaft assembly, see Illust. 19. On hitches with one–piece limit stop rod, remove front cotter from limit stop rod, permitting forward movement of this rod, see (5) Illust. 17. Remove the two snap rings which secure stop disc (6) using a suitable pair of pointed pliers. These snap rings must not be used again, discard them! Remove the limit stop rod (5) towards the front. The control valve must be out for this operation.

On hitches with two–piece limit stop rod, disconnect the rod at turn buckle (7) Illust. 19. Remove spring element and position actuator (2 and 3) from spool levers, as described under Illust. 14. Then remove position actuator from power arm (1) Illust. 17 and spring element from draft link plunger (4). To remove the draft link plunger, take out roll pin (7) and push the plunger out towards the rear.



Illust. 17

1 – Power arm
2 – Position actuator
3 – Spring element
4 – Draft link plunger
5 – Limit stop rod
6 – Stop disc
7 – Roll pin



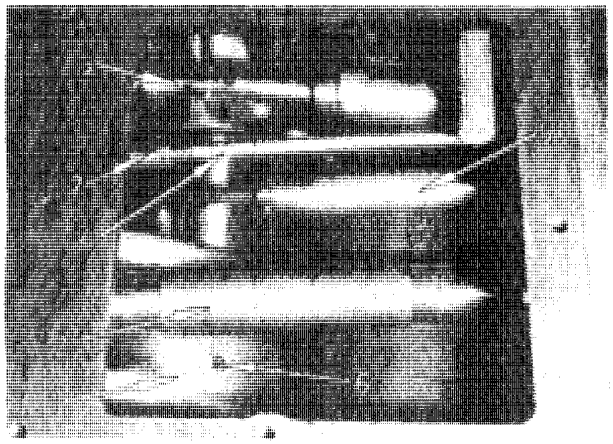
Illust. 18

1 – Draft link plunger
2 – Follow–up spring
3 – Spring cups

After removal of the draft link plunger, the follow–up spring (2) Illust. 18 and the two spring cups (3) are wedged in between the housing walls and are free to be removed.

Rockshaft Assembly

Loosen clamping bolts (8) Illust. 10 and remove rocker arms. Take out dog point set screws (9). Turn lift housing bottom side up and remove bottom cover.

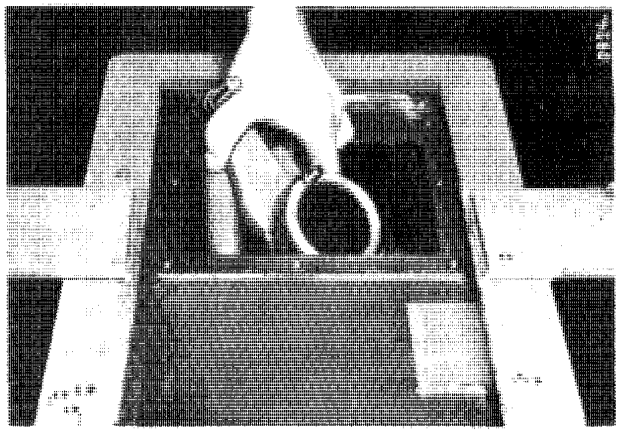


Illust. 19

1 – Power arm
2 – Ball–type connecting rod
3 – Draft link plunger
4 – Limit stop rod
5 – Position actuator
6 – Roll pin
7 – Turnbuckle

Drive locating roll pin (6) Illust. 19 into the rockshaft to free power arm. Now move the rockshaft to the right or left with a few light hammer blows until the bushing dislodges the oil seal, then drive the rockshaft in the opposite direction to remove the other oil seal. Be sure to discard old oil seals.

Note: Hitches of present design are equipped with spacer rings and O–rings instead of oil seals.

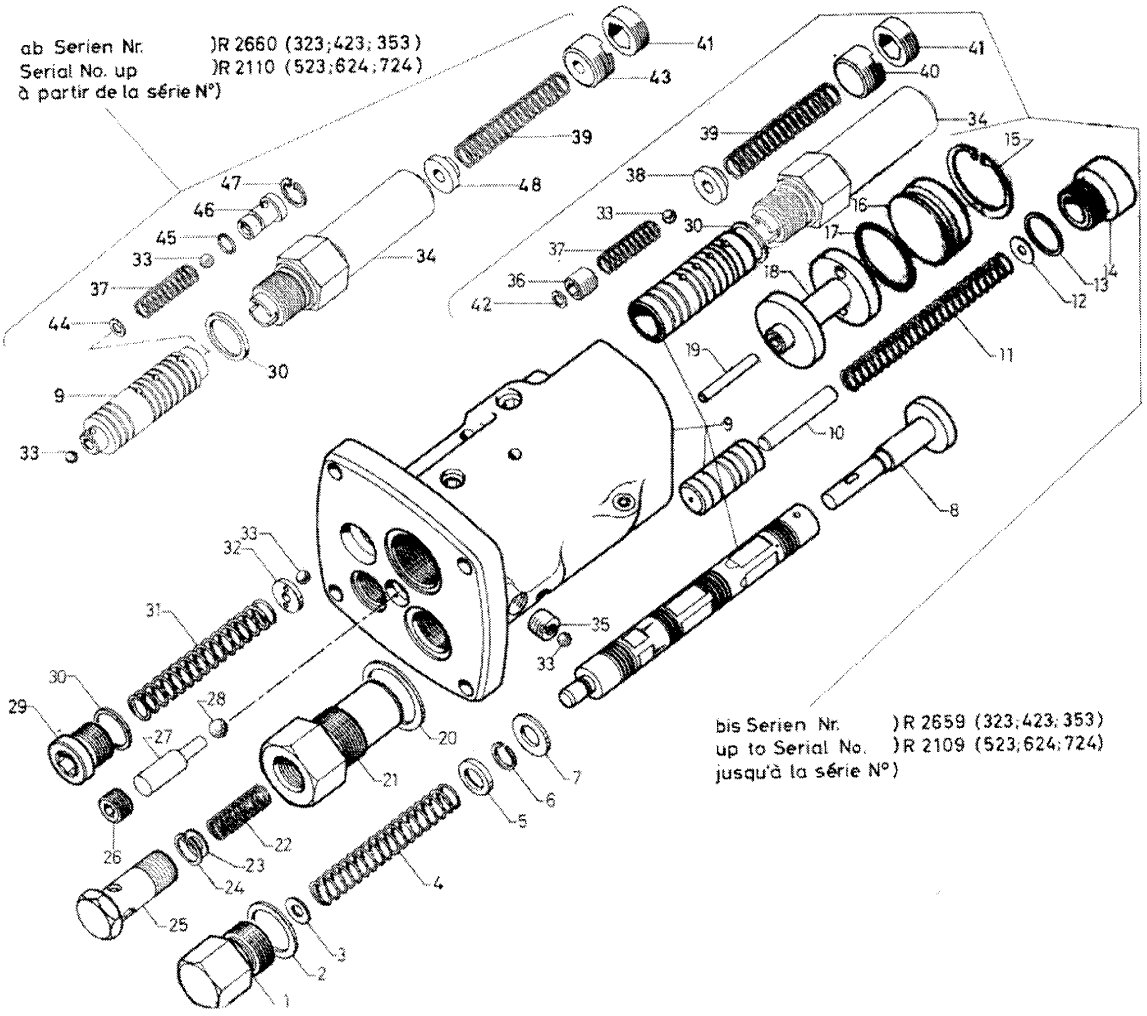


Illust. 20
Removal or installation of power arm

Remove power arm with connecting rod assembly, as shown in Illust. 20.

All precision made parts with highly finished surfaces, such as draft control valve, power cylinder, etc., should only be cleaned with carbon tetrachloride. As this solvent evaporates rapidly, there is no need, as a rule, for drying parts. If however, drying becomes necessary, compressed air should be used for this purpose. Never use rags for cleaning hydraulic components as these leave particles of lint hardly visible to the naked eye. These minute particles prevent valves from seating properly and are sure to cause trouble which is very difficult to locate.

Draft Control Valve



Illust. 21

All components keyed to reference 9 are not available separately for service. If one of these parts is damaged and must be replaced, a new control valve should be used.

As any trouble on the control valve is generally due to foreign matter in the oil, it is advisable to disassemble and clean all components thoroughly, checking to see if they are fit for reuse.

Note: When repairing or replacing the draft control valve, take care to select parts that correspond with the operating pressure of the system. For details see Parts Catalog.

Specifications

Values at operating pressure	140 – 150 kg/cm^2 = 1990 – 2130 PSI	160 – 170 kg/cm^2 = 2280 – 2420 PSI
Opening pressure of cut–out relief valve	140 – 150 kg/cm^2 = 1990 – 2130 PSI	160 – 170 kg/cm^2 = 2280 – 2420 PSI
Free length of spring (37) Illust. 21.	24.3 mm = .957"	23.2 mm = .913"
Test length	18.5 mm = .728"	18 mm = .708"
Test load	12 kg = 26.4 lbs	15 kg = 33 lbs
Opening pressure of additional relief valve (34)	160 – 170 kg/cm^2 = 2280 – 2420 PSI	180 – 190 kg/cm^2 = 2560 – 2700 PSI
Opening pressure of relief valve for auxiliary hydraulic system	160 – 170 kg/cm^2 = 2280 – 2420 PSI	180 – 190 kg/cm^2 = 2560 – 2700 PSI
Opening pressure of cylinder cushion valve	220 – 250 kg/cm^2 = 3130 – 3560 PSI	190 – 210 kg/cm^2 = 2700 – 3000 PSI
Spring for cushion valve (11) Illust. 42.		
Free length	56.5 mm = 2.22"	53 mm = 2.1"
Test length	40 mm = 1.57"	43 mm = 1.7"
Test load	81 kg = 178.6 lbs	58 kg = 127.9 lbs
Values at flow divider and cut-out relief valve version:	Illust. 6a	Illust. 6
Free length of spring (31)	70 mm = 2.75"	65 mm = 2.56"
Test length	43 mm = 1.7"	37 mm = 1.45"
Test load	1.55 kg = 3.4 lbs	1.55 kg = 3.4 lbs
Free length of flow divider spring (11)	105 mm = 4.13"	90 mm = 3.54"
Test length	54.5 mm = 2.15"	53.4 mm = 2.10"
Test load	12 kg = 26.45 lbs	12.8 kg = 28.2 lbs
Free length of valve spring (39)	55.2 mm = 2.17"	50 mm = 1.97"
Test length	40 mm = 1.57"	39 mm 1.53"
Test load	37.1 kg = 81.8 lbs	39.6 kg = 87.3 lbs
Free length of block valve spring (22)	25 mm = 1"	
Test length	15 mm = .59"	
Test load	3.5 kg = 7.7 lbs	

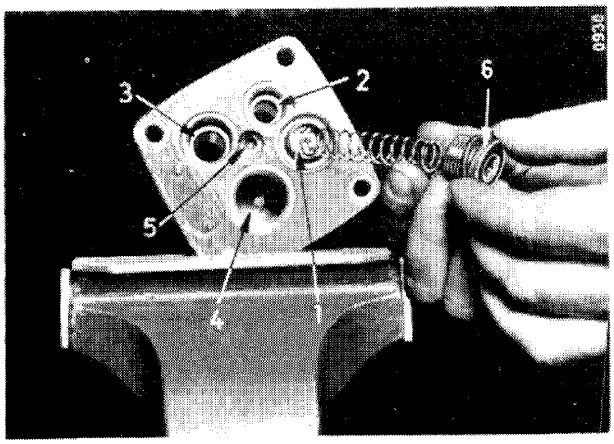
Free length of lowering valve spring (8) Illust. 42.	60 mm = 2.36"
Test length	48 mm = 1.9"
Test load	1.8 kg = 4.0 lbs
Running clearance of cut–out valve and flow divider piston in housing bore	.008 – .015 mm = .00032 – .00059"
Maximum permissible out–of–round and taper	.002 mm = .00008"
Running clearance of valve spool in housing bore	.004 – .012 mm = .00016 – .00048"
Maximum permissible out–of–round and taper	.002 mm = .00008"
Free length of valve spool spring (4)	143 – 147 mm = 5.6 – 5.8"
Test length	41 mm = 1.6"
Test load	4.16 kg = 9.2 lbs

Cut–out Relief Valve and Additional Relief Valve

The complete cut–out relief valve can be removed either towards the front with the control valve in place or towards the rear, after removing the control valve.

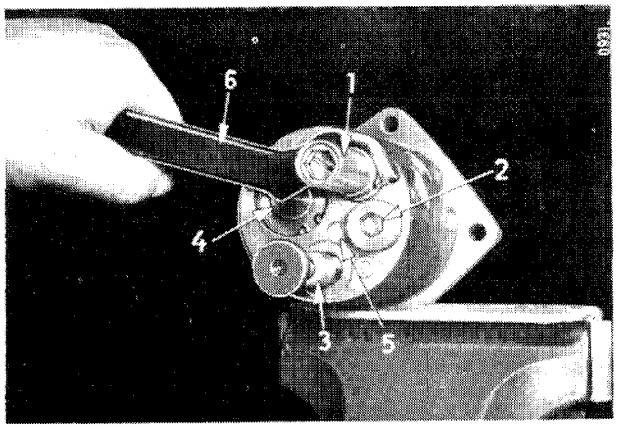
Remove plug (6) Illust. 22 with spring. Tilt the complete valve and shake out disc (32) and ball (33) Illust. 21. Bump the control valve housing lightly on a block of wood to remove valve (1) Illust. 22.

Note: With the control valve in place, these parts must be removed with a clean pair of tweezers.



Illust. 22

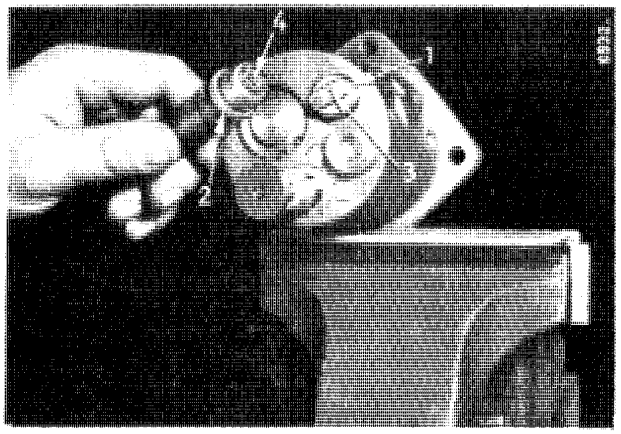
1 – Cut–out relief valve
2 – Inlet connection to flow divider
3 – Spool bore
4 – Bore for block valve
5 – Bore for non–return valve (28) Illust. 21
6 – Plug



Illust. 23

1 – Additional relief valve
2 – Plug (flow divider)
3 – Valve spool
4 – Cover with O–ring (pilot piston)
5 – Plug non–return valve
6 – Hook wrench (for early model valves only)

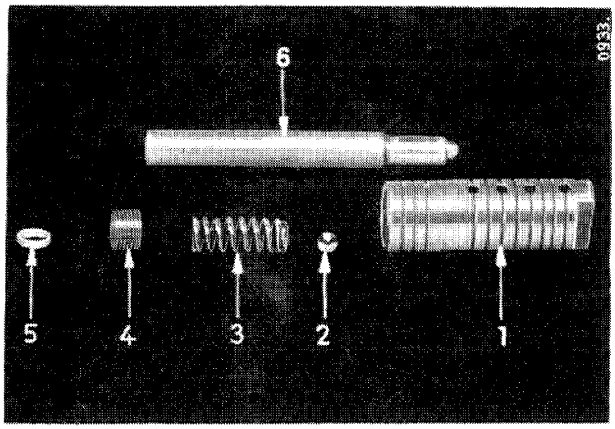
With the control valve removed, it is simpler to take out the additional relief valve (1) Illust. 23 first, using hook wrench (6) and then remove the cut–out relief valve from the rear. Clean the relief valve and components and carefully check for any possible flaws.



Illust. 24

1 – Cut–out relief valve
2 – Additional relief valve
3 – Inlet orifice
4 – Valve poppet

Valve piston (1) Illust. 24 must slide in the housing bore with a light drag. There must be no binding or tight spots anywhere. Orifice (3) and all internal passages must be completely clean. Carefully inspect the piston surfaces and the housing bore for signs of scoring or other damage. Replace the complete control valve if such damage is noted.

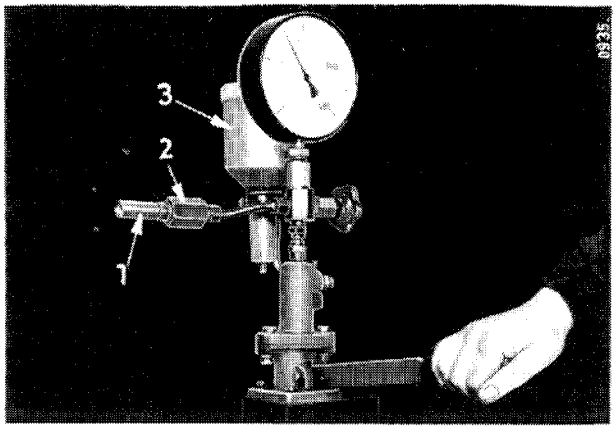


Illust. 25

1 – Cut–out valve piston
2 – Valve ball
3 – Spring
4 – Pressure setting plug
5 – Locking ring
6 – Special tool

Check valve spring (10) Illust. 28 against specifications and replace if signs of scoring or fatigue are noted. ***Note:*** Spring length is different between operating pressures (160–170 kg/cm^2 and 140–150 kg/cm^2). To remove this spring from the valve, take out the pressure setting plug (4) Illust. 25 with an Allen wrench. The locking ring (5) is forced out also.

Carefully inspect all parts. Valve ball (2) must seat in piston (1) without leakage. Locking ring (5) must be replaced with a new one whenever pressure setting plug (4) is removed.

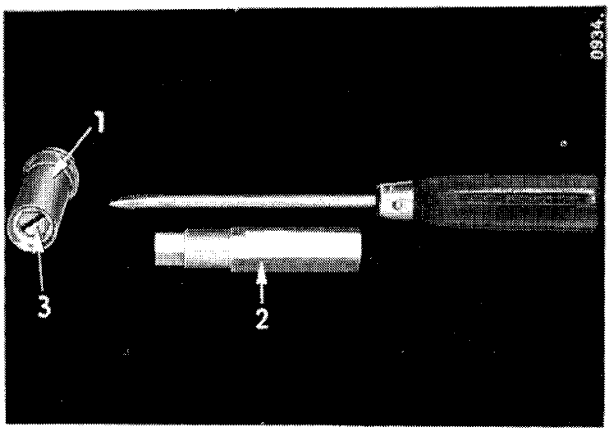


Illust. 26

1 – Additional relief valve
2 – Adapter (special tool)
3 – Oil reservoir for test pump

When reassembling, first place ball (2) on its seat followed by spring (3) with its tapered end toward the ball. Install pressure setting plug and tighten in such a way that two threads are visible above the plug. Final adjustment must be made later when the valve is installed in the system. Do not yet install locking ring (5) at this stage. This ring is only installed after final pressure setting on the tractor using special tool (6). This special tool must be used to spread the locking ring to ensure that ball (2) Illust. 28 can move freely in and out of the Allen screw, see also "Pressure Setting of Cut–out Relief Valve".

Check spring and pressure setting of additional relief valve (1) Illust. 26. The pressure is properly set at the factory and normally requires no adjustment. It is good practice, however, to check this pressure setting whenever the control valve is taken down for repair. A test pump, as shown in Illust. 26 is required for such a check. To raise the pressure setting, turn the slotted headless plug (3) Illust. 27 in.



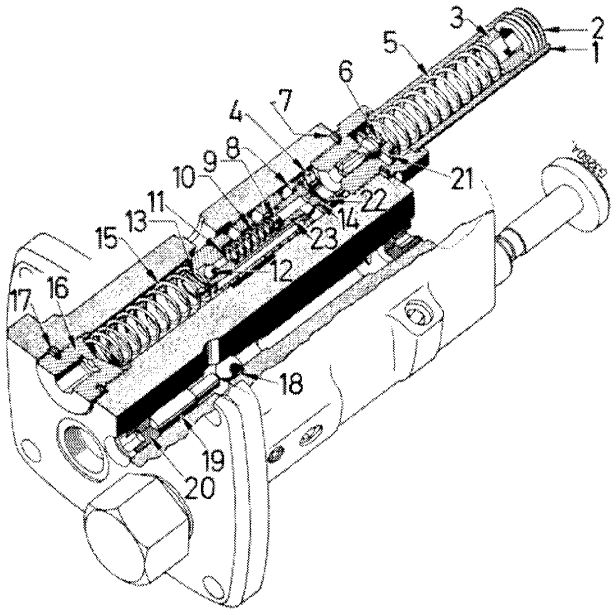
Illust. 27

1 – Additional relief valve
2 – Special tool (tubular)
3 – Slotted headless plug

To adjust pressure, loosen the lock nut behind the slotted plug, using special tool (2). Turn the headless plug (3) in or out until the pressure setting is correct. Then tighten the lock nut. Take care when tightening to hold the slotted plug with a screw driver so as not to change the pressure setting.

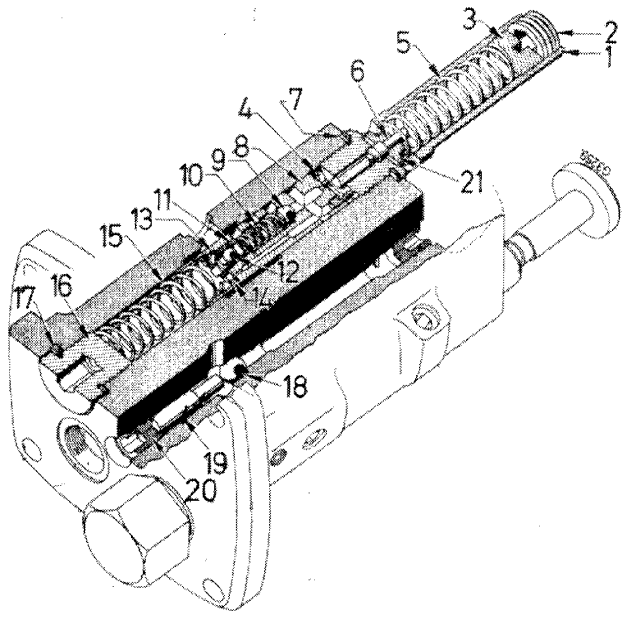
Should the first test reveal a marked deviation from the regular setting, say for example less than 150 kg/cm^2 = 2130 PSI, it is advisable to remove and check the valve spring against specifications. Replace with a new spring, if necessary. Also check the valve poppet for tight sealing.

A very slight deformation of the sealing face can be corrected by lapping the poppet into its seat. Then reassemble the valve and set the pressure. If the sealing face is badly damaged, the complete relief valve must be replaced.



Illust. 28
Cut–out relief valve and additional relief valve (present design)

1 – Valve sleeve
2 – Lock nut
3 – Slotted headless plug
4 – Bore
5 – Valve spring
6 – Valve poppet
7 – Packing ring
8 – Piston, cut–out relief valve
9 – Valve ball
10 – Valve spring
11 – Shims
12 – Valve ball
13 – Roll pin
14 – Sleeve
15 – Return spring
16 – Plug
17 – Packing ring
18 – Non–return valve ball
19 – Retainer pin
20 – Plug
21 – Pilot washer
22 – Circlip
23 – O–ring



Illust. 28a
Cut–out relief valve and additional relief valve (displaced design)

11 – Adjusting plug
13 – Locking ring
14 – Spring disc

Install cut–out relief valve and additional relief valve as shown in Illust. 28 or 28a.

CHECKING AND ADJUSTING CUT–OUT RELIEF VALVE

When taking pressure readings on units where additional control valves are mounted, it should be borne in mind that there are three relief valves which could affect the pressure reading:

a) The cut–out relief valve. Pressure will rise to "cut–out pressure" then suddenly drop to 8 – 9 kg/cm^2 = 115 – 130 PSI.

b + c Additional relief valve. If, on a loaded system, pressure does not rise above a certain level, as for example 100 kg/cm^2 = 1400 PSI, this might be due to a malfunction of the additional relief valve or, on the other hand, to a faulty relief valve in the additional control valve mounting block.

In order to distinguish between the two, first check pressure on the additional circuit. If this pressure is correct, check the draft control valve relief valve setting.

Note: If the opening pressure of the three relief valves is correct, the cause for insufficient operating pressure may be a faulty cylinder cushion valve.

Before performing checks, be sure the fluid level is correct and the filter is not restricted. The fluid should be at operating temperature 50° – 80°C = (120° to 180°F.) and the system should be cycled a sufficient number of times to eliminate all air from the system.

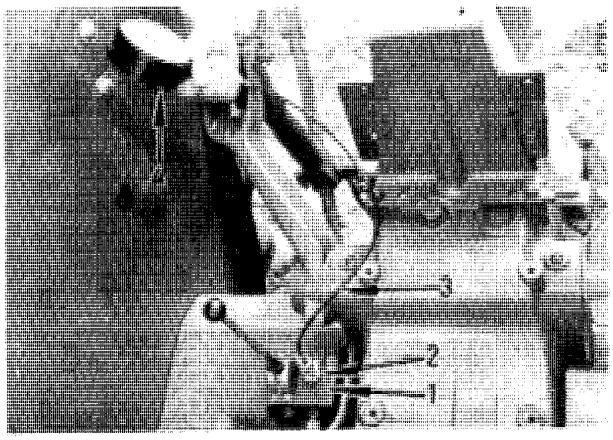
Depending on the hydraulic equipment used, checks can be made on the three following points:

1. on mounting block for additional control valves (Restrictor device not required)

2. on pressure oil filter (Restrictor device required)

3. on draft control valve (Restrictor device required)

Checks should be made on mounting block Illust. 29 whenever possible. If the tractor is not so equipped, check either on pressure filter or draft control valve, see Illust. 29a or 30 respectively.

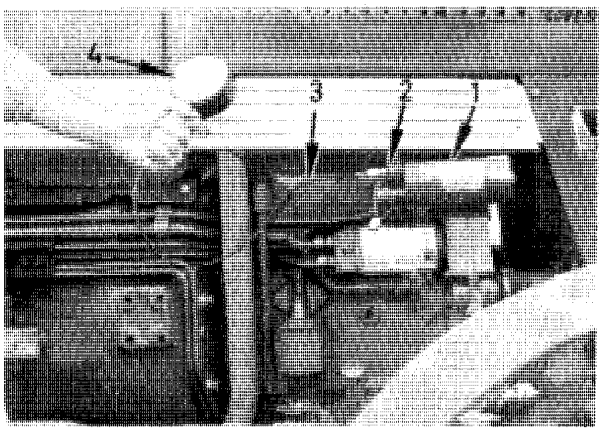


Illust. 29
Checking on mounting block

1 – Mounting block
2 – Test connector
3 – Pressure hose
4 – Gauge (0–250 kg/cm^2 = 3500 PSI)

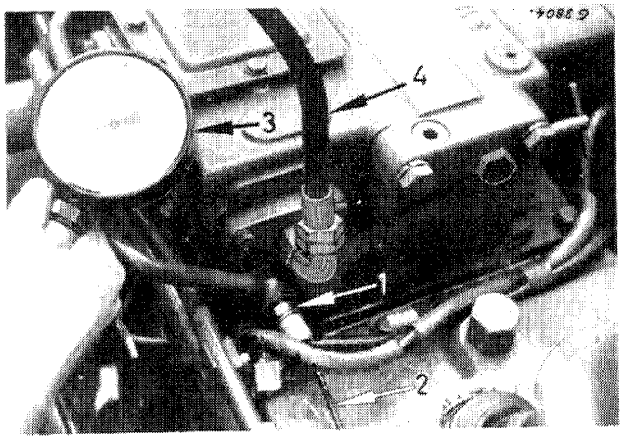
Remove plug and take out flow divider piston with spring. Connect pressure gauge as shown in Illust. 29.

Remove pressure line (7) Illust. 10 from control valve and close the port with a plug.



Illust. 29a
Checking on pressure oil filter

1 – Pressure oil filter
2 – Test connector
3 – Pressure hose
4 – Gauge (0–250 kg/cm^2 = 3500 PSI)



Illust. 30
Checking on draft control valve

1 – Test connector
2 – Pressure hose
3 – Gauge
4 – Restrictor device (special tool)

When checking on pressure oil filter Illust. 29a or on draft control valve Illust. 30, the restrictor device (4) Illust. 30 must be installed to obtain a gradual rise of system pressure.

Remove pressure line between control valve and cylinder head and fit the restrictor device as shown in Illust. 30.

Fit the restrictor union of the device (4) in place of the oil level gauge in the lift housing.

The pressure oil is now no longer flowing to the power cylinder but is re–routed to the reservoir through device (4).

Note: Without restrictor device a correct pressure checking is impossible.

Check the pressure setting as follows. The draft and position control levers should be down all the way. Make sure that the gear shift lever is in "neutral". Start the engine. Place the position lever in a lifting position and gradually increase engine speed while observing the pressure build–up on the gauge. Take the highest pressure reading before the cut–out valve cuts off the pressure. The setting is correct when system pressure rises to the specified values and then suddenly drops to 8–9 kg/cm^2 = 115 – 130 PSI. Repeat this test several times.

By this cut–out action the relief valve immobilizes the complete system, but leaves the valve spool in lifting position. To repeat the pressure test reading, it is

necessary to move the control lever towards "lowering", and then initiate the next lifting operation.

If the opening pressure deviates from the specified values, adjust the relief valve by adding or subtracting shims (11) Illust. 28 or by turning the adjusting plug (11) Illust. 28a.

When the pressure setting is correct punch the babbit locking rim (5) Illust. 25 into the threads, using special tool (6) to secure the adjustment.

Before checking pressure the second time allow the system to switch off for several times in order to vent the cushion chamber.

Non–Return Valve

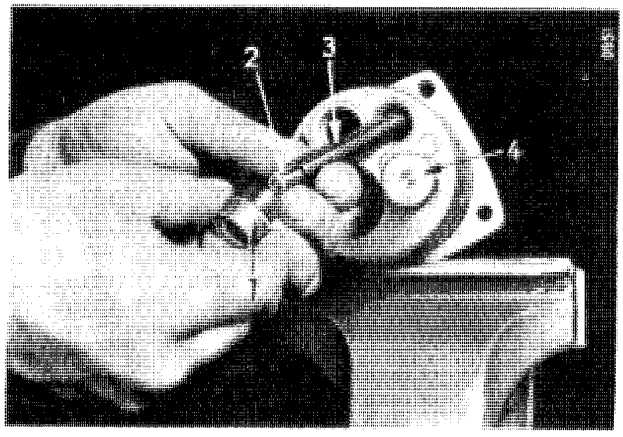
While lowering, the non–return valve (18) Illust. 28 becomes unseated, allowing the return oil to pass over the spool into the lift housing.

The non–return valve is not subject to any appreciable wear or change and any trouble that might develop will not originate here. When disassembling, therefore, it is good practice to leave the non–return valve in place.

Flow Divider

The flow divider has been changed, Illust. 32 and 33, see also Parts Catalog.

To disassemble the flow divider the control valve must be removed.

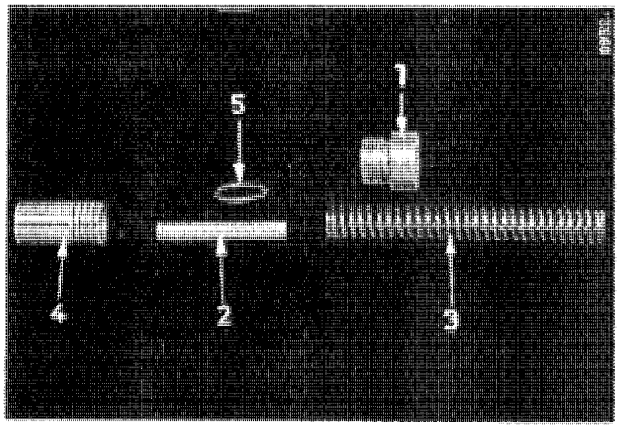


Illust. 31

1 – Plug
2 – Stabilizer pin
3 – Flow divider spring
4 – Valve spool tappet

Remove plug (1) Illust. 31 and take out packing ring, stabilizer pin (2) and spring (3). Use a pair of clean tweezers to remove the flow divider piston or push the piston out from the front, using a clean pencil.

Carefully inspect the flow divider piston (4) for signs of scoring, etc. The piston must slide in the housing bore without any "tight spots", check against specifications.



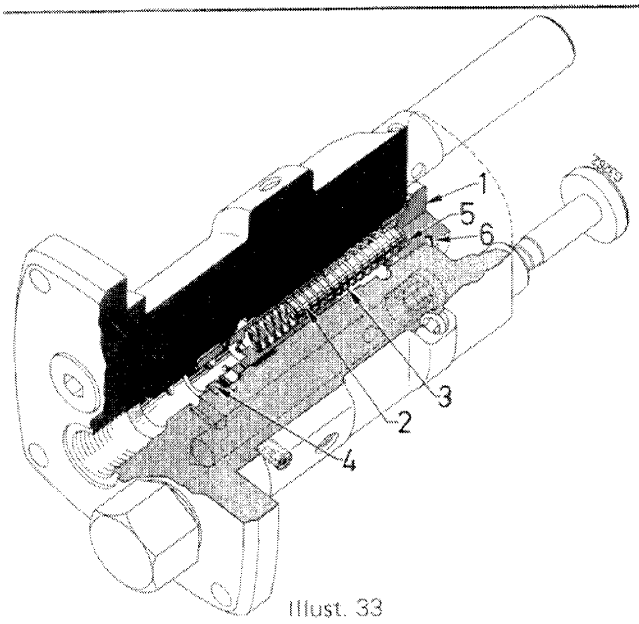
Illust. 32
Flow divider (displaced design)

1 – Plug
2 – Stabilizer pin
3 – Flow divider spring
4 – Flow divider piston
5 – Packing ring

If signs of erosion, seizure or scoring are noted, replace the complete control valve as the flow divider piston is not serviced separately. Some localized minor defects can be corrected by careful lapping with a mild lapping compound or a very fine grade of emery cloth, using oil to make it less harsh. This may not always be successful, depending on the degree of damage, the skill of the serviceman or the suitability of the lapping agent available. Check spring (3) against specifications.

Note: Spring length is different between present–and displaced design.

Reassemble parts in the order shown in Illust. 31 and 33.



Illust. 33
Flow divider (present design)

1 – Plug
2 – Stabilizer roll pin
3 – Flow divider spring
4 – Flow divider piston
5 – Spring washer
6 – Packing ring

The flow divider controls pilot stream pressure which must be checked whenever the flow divider has been disassembled.

Check pilot stream pressure on mounting block, Illust. 29 see also (11) Illust. 7a.

Piston and spring must remain in the mounting block.

On tractors without additional control valves, check on pressure oil filter (Illust. 29a) or on draft control valve (Illust. 30).

The pilot stream pressure must be:

7–8 kg/cm^2 = 100–115 PSI on mounting block Illust. 29
6–8 kg/cm^2 = 85–115 PSI on pressure oil filter, Illust. 29a
6–7 kg/cm^2 = 85–100 PSI on draft control valve Illust. 30.

Check pressure as follows:

Bring hydraulic oil temperature to + 40–60° C = 100–140°F. Connect a pressure gauge with a range of up to 200 PSI according to Illust. 29, 29a or 30.

Move both operating levers down all the way to lowering position.

Start the engine and accelerate to 1200 rpm. Observe the pressure gauge. Pilot stream pressure, as registered on the gauge must correspond with the pressures mentioned above.

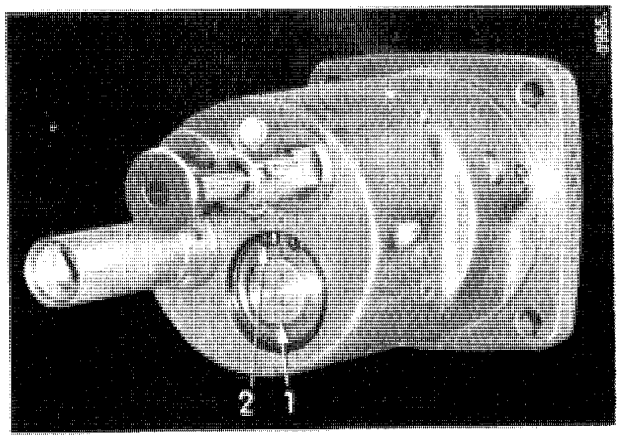
Note: With cold oil, this pressure may be slightly higher. Under no circumstances should pilot stream pressure be appreciably below this specification because the pilot stream would then not be strong enough to open the block valve for lowering. If necessary, use a new flow divider spring (3) Illust. 32.

Caution: Be sure when checking pilot stream pressure that both control levers (10 and 11) Illust. 10 are down all the way. Never move a lever up as long as the engine is running and the sensitive gauge is connected, as this would destroy the instrument.

Block Valve

Note: The pilot piston (3) Illust. 35 has been changed, Illust. 35 and 38 show the displaced -and present design, respectively.

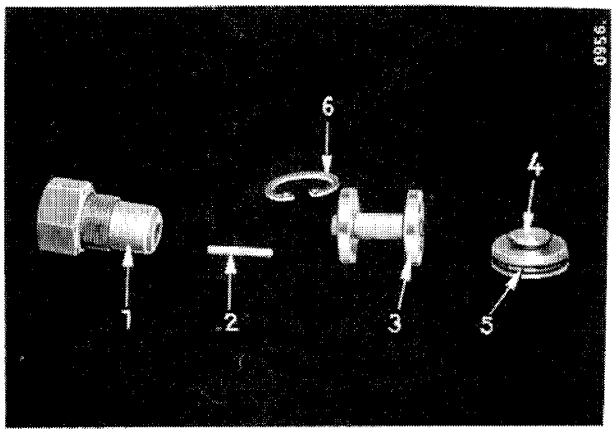
The block valve (1) Illust. 35 can be removed with the control valve in place. If removal of the pilot piston (3) or cover (4) should become necessary, the complete draft control valve must be removed.



Illust. 34

1 – Cover with O–ring
2 – Circlip

Take out circlip (2) Illust. 34, using a pair of needlepoint pliers. Remove cover (1) and take out pilot piston. Use a pair of tweezers to remove the thrust pin if necessary.

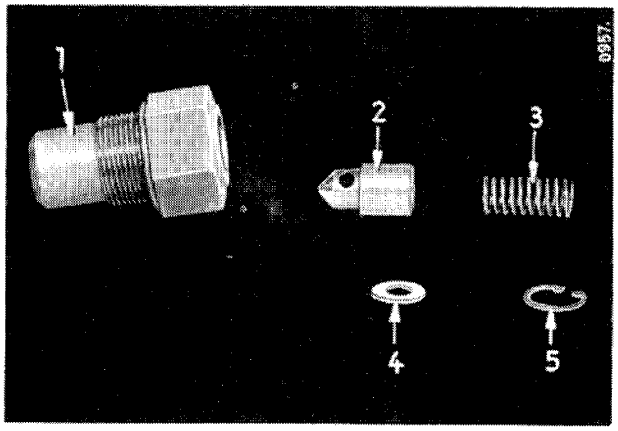


Illust. 35

1 – Block valve
2 – Thrust pin
3 – Pilot piston (displaced design)
4 – Cover
5 – O–ring
6 – Circlip

Clean parts shown in Illust. 35 and inspect for any possible damage or wear. It is not likely that the pilot piston (3) should show signs of wear. Nonetheless, it must be inspected to see if discs are still secure on the central stem. The O–ring (5) must be replaced as a rule.

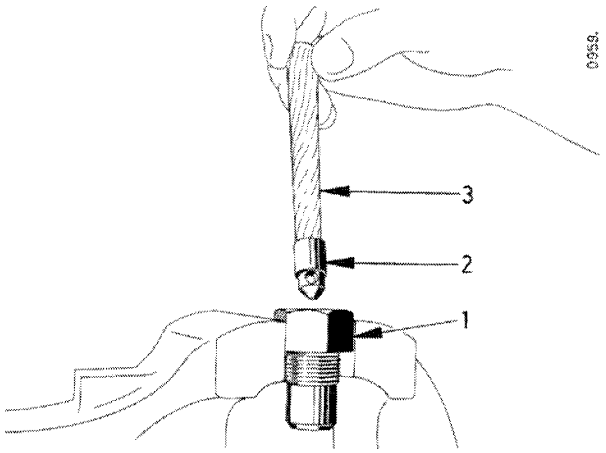
It is important that the block valve does not leak. Otherwise the implement would slowly drop to the ground when the engine is stopped. When the engine is running, a leaking block valve results in the implement being lowered imperceptibly and the system corrects the implement position from time to time resulting in a "hiccup" condition.



Illust. 36

1 – Block valve housing
2 – Valve poppet
3 – Valve spring
4 – Spring washer
5 – Circlip

To check the condition of block valve components, remove circlip (5) from block valve housing (1) and take out washer (4), spring (3) and poppet (2). Inspect the sealing face of poppet (2) and its counterpart in the housing (1). Minor defects can be corrected by lapping poppet (2) into its seat as shown in Illust. 37.



Illust. 37
Lapping block valve into its seat

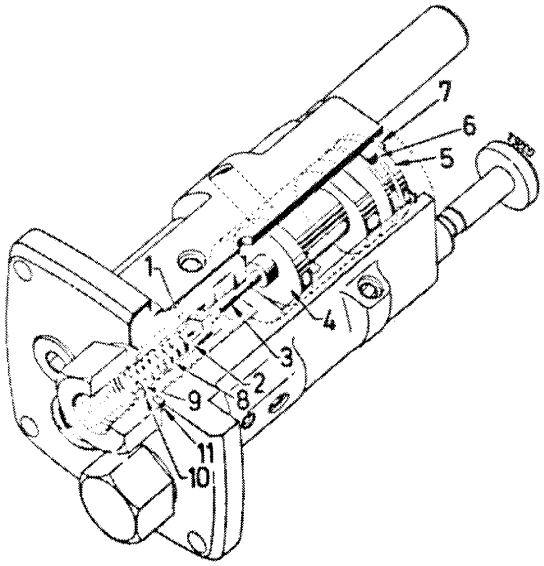
1 – Valve housing
2 – Valve poppet
3 – Wooden peg

If signs of hammering or other severe damage is noted, replace the complete block valve assembly. Housing (1) and poppet (2) are mated components and not available as individual service parts.

Check valve spring (3) Illust. 36 against specifications and replace with a new one if necessary.

Clean and reassemble all parts as shown in Illust. 38.

When installing pilot piston (4) and thrust pin (3), make sure to see that these slide freely in the housing. Take care not to overtighten block valve housing (1) as the poppet (2) might have the tendency to stick as a result. After reassembly, check the function of the block valve.

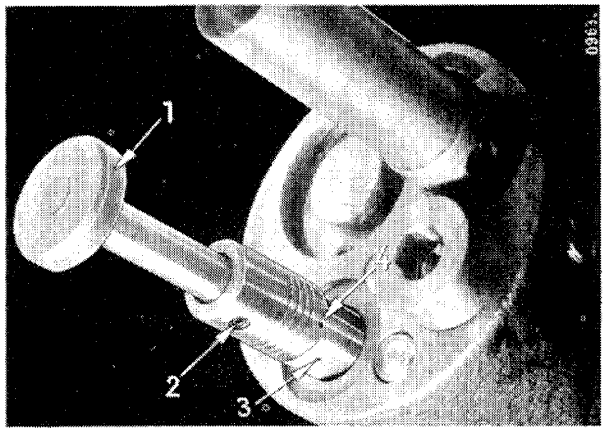


Illust. 38

1 – Block valve housing
2 – Valve poppet
3 – Thrust pin
4 – Pilot piston (present design)
5 – Cover with O–ring
6 – O–ring
7 – Circlip
8 – Block valve spring
9 – Spring washer
10 – Circlip
11 – Packing ring

Valve Spool, Auxiliary Change–Over, Restrictor Orifice

The valve spool has a running clearance of .004 to .012 mm = .00016 – .00048" in the housing. Out–of–round and taper must not exceed .002 mm = .00008". These dimensions are given to show that any repairs are not likely to meet with success. Therefore, do not attempt to lap or polish the valve spool in any way as this would entail a change in dimensions and cause trouble.



Illust. 39

1 – Tappet
2 – Double roll pin
3 – Filling orifice
4 – Relief ports

To ensure trouble–free operation, the valve spool must slide freely in the housing. Tappet (1) must also be free to move all the length of the lost–motion slot to ensure smooth operation of the auxiliary change–over, see also Illust. 41. Should the tappet stick, there is danger that the valve spool will not react positively and slide from one position to another but may stick in an intermediate position. If there are doubts as to the proper operation of the valve spool and auxiliary change–over, remove the spool and check as follows.

Remove plug (4) Illust. 40 and take out spring (3) and spring washer (2). Use a pair of needle–point pliers to remove the circlip, securing washer (1). Remove the washer and slide out the spool toward the rear.

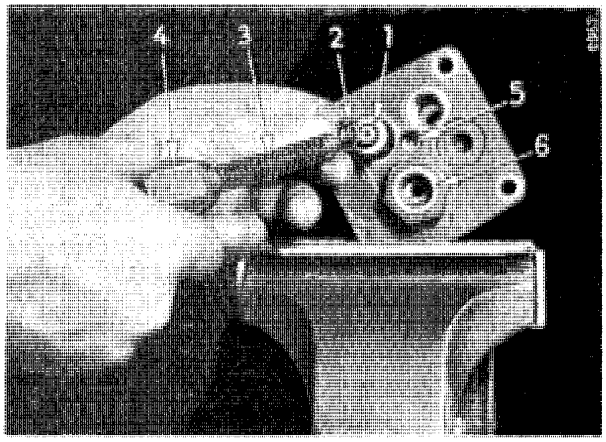
Inspect valve spool and its bore in the housing for signs of scoring, seizure or other damage. Install a new control valve if such damage is noted. Check to see if tappet (1) Illust. 39 moves freely all the length of the lost–motion slot.

If necessary, remove roll pin (2) and clean the respective parts. Lost–motion slot must be free from burrs. The roll pin must not contact the slot sides. Polish the tappet carefully in a rotary motion if necessary. Filling orifice (3) and relief ports (4) must be clear. Clean them with compressed air.

Check spool spring (3) Illust. 40 against specifications.

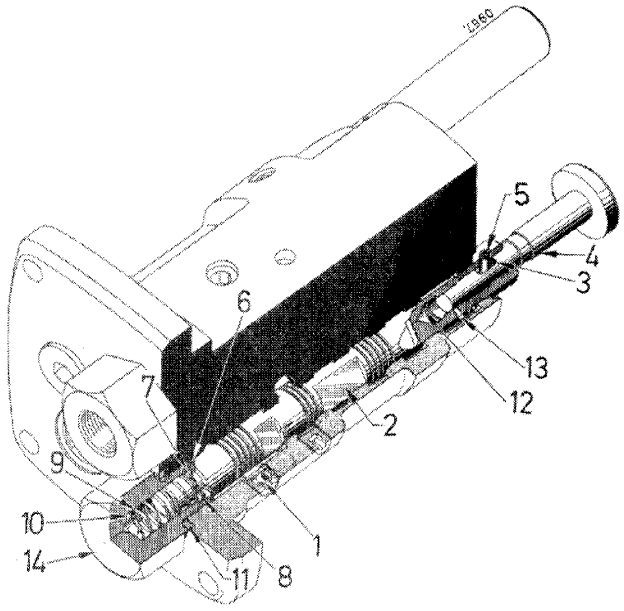
Restrictor orifice (1) Illust. 41 is not susceptible to wear but foreign matter in the oil may prevent it from functioning properly. Should this orifice become clogged, the draft control system would respond sluggish and slow. Remove the orifice union and clean with

compressed air. On reassembly clean all parts and dip them in hydraulic oil. Illust. 41 shows the correct relation of parts to each other. Make sure to assemble spring washers (8 and 10). Spring washer (8) fits with its recessed side over circlip (7). Do not over–tighten plug (14).



Illust. 40

1 – Stop washer
2 – Spring washer
3 – Spool spring
4 – Plug
5 – Non–return valve
6 – Block valve

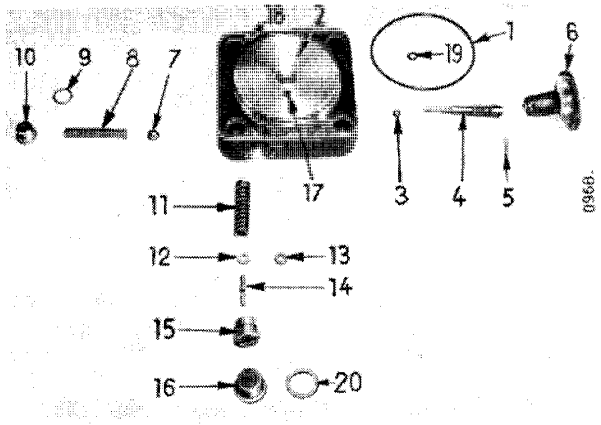


Illust. 41

1 – Restrictor orifice
2 – Valve spool
3 – Lost–motion slot
4 – Tappet
5 – Double roll pin
6 – Stop washer
7 – Circlip
8 – Spring washer
9 – Spool spring
10 – Spring washer
11 – Packing ring
12 – Filling orifice
13 – Relief ports
14 – Plug

Cylinder Head

The cylinder head serves as a cover for the power cylinder front end and accommodates the lowering control valve and cylinder cushion valve. The cylinder head is not subject to wear and, if handled with care, should give many years of trouble–free service. If the cylinder head must be removed and disassembled for some reason, refer to Illust. 16 for details.



Illust. 42
Cylinder head
(displaced design, for present design see Illust. 44).

1 – O–ring
2 – Cylinder head
3 – O–ring
4 – Spindle (lowering control)
5 – Roll pin
6 – Hand wheel
7 – Ball (lowering control)
8 – Spring
9 – Packing ring
10 – Plug
11 – Cylinder cushion valve spring
12 – Spring washer
13 – Shim .5 mm = .02"
14 – Valve poppet
15 – Valve seat
16 – Plug
17 – Pressure oil port
18 – Return oil port from cushion valve
19 – O–ring
20 – Packing ring

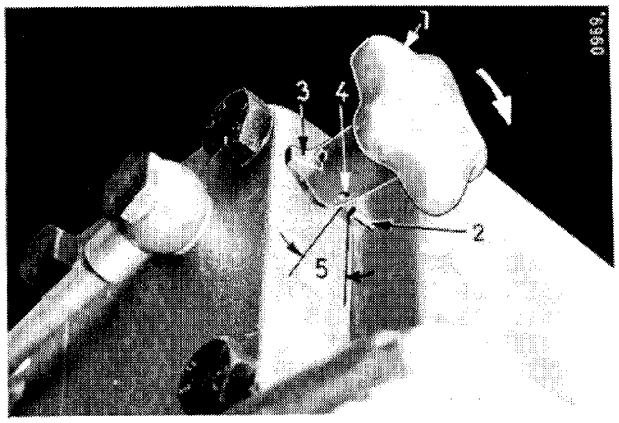
Lowering Control Valve

Lowering speed is controlled by means of the lowering control valve (4–8) Illust. 42 located inside the cylinder head. The lowering control valve is not prone to trouble

as a rule, except for an occasional leakage or valve spring failure. To remove these parts, take out plug (10). The spindle (4) can be removed from the other side. It is possible, when doing so, that the O–ring (3) remains in the cylinder head. Use a small wire hook to remove this O–ring through the pressure intake port.

Check all parts to see if they are fit for reuse. Spring (8) has a free length of 60 mm = 2.36". A test load of 1.8 kg = 3.97 lbs. compresses this spring to its test length of 48 mm = 1.89".

A plastic locking pellet (19) Illust. 44 is provided in the spindle to secure the adjustment. It is good practice to replace this pellet whenever the spindle is removed. The same applies to the O–ring. After cleaning and checking, reassemble all components, reversing the removal order. Be sure O–rings are not twisted. Screw in the spindle until approximately three to four threads are showing.



Illust. 43
The white arrow indicates opening direction

1 – Hand wheel
2 – Stop, roll pin
3 – Stop, hand wheel
4 – Roll pin, hand wheel mounting
5 – Approximately 15° to 30°

To adjust the lowering spindle, the system must be operable. Proceed as follows: (Displaced design with hand wheel)

Start the engine and lift rocker arms all the way. Put the system in lowering position and turn the spindle counterclockwise (in the opposite direction as indicated by the arrow Illust. 43) until the lowering process is stopped by the valve. Now fit the hand wheel on the spindle in such a way that the stop (3) points downward and nearly contacts roll pin (2). Secure hand wheel with roll pin (4), using the cross holes provided for a more precise adjustment.

(Present design with roll pin)

Install roll pin (6) Illust. 44.

Start the engine and lift rocker arms all the way. Put the system in lowering position and turn the spindle counterclockwise (in the opposite direction as indicated by the arrow Illust. 43) until the lowering process is stopped by the valve. Now install roll pin (5) Illust. 44 in such a way that it points downward and nearly contacts stop (2) Illust. 43 using the cross holes provided for a more precise adjustment.

Check the spindle adjustment as follows:

Turn the spindle until stop (3) Illust. 43 contacts stop (2) Illust. 43. No lowering must be possible in this position. To check this, put the system in lifting and lowering position with the position control lever. Now, turn spindle as indicated by the white arrow, approximately 15° to 30°. In this position, the system should start lowering. The further the spindle is turned the greater the lowering speed.

Cylinder Cushion Valve

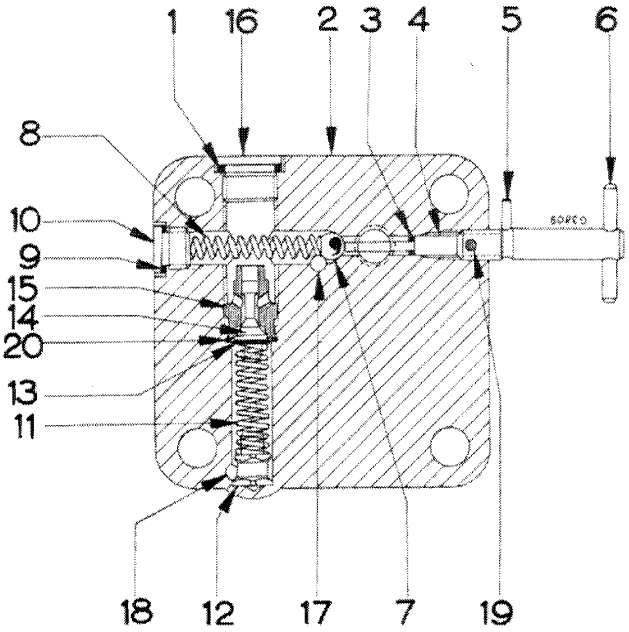
The purpose of the cylinder cushion valve is to protect the system in neutral position of the valve spool against shock loads when driving over a bumpy road with a bouncing implement. Valve (14) Illust. 44 will open briefly to cushion these shock loads in the power cylinder.

Test values of spring (11) at valve opening pressure:

	190-210kg/cm^2= 2700-3000PSI	220-250kg/cm^2= 3130-3560PSI
Free length		53 mm = 2.08"
Test length	43 mm = 1.69"	40.0 mm = 1.57"
Test load	58 kg = 127.8 lbs	81 kg = 178.6 lbs

The cylinder cushion valve is not susceptible to trouble. The main considerations are leak–proof seating and correct adjustment. If this valve leaks, remove all parts and replace valve poppet (14) and valve seat (15). If no service parts are at hand and the unit is required urgently, lapping may be tried as a temporary measure.

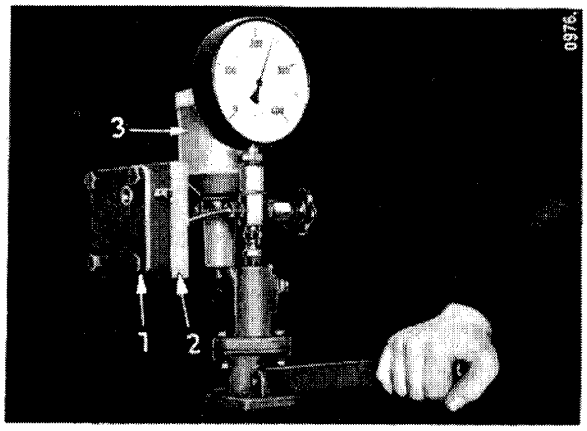
Reassemble all parts as shown in sectional view Illust. 44. Screw in valve seat (15) all the way to the stop. Opening pressure cannot be adjusted on this valve seat.



Illust. 44
Cylinder head (present design)

1 – Packing ring
5 – Roll pin
6 – Roll pin
12 – Spring seat
13 – Shim 0.5 or 1.0 mm = .02 or .04"
19 – Pellet
20 – Packing ring

The other reference numbers show the same components as in Illust. 42.



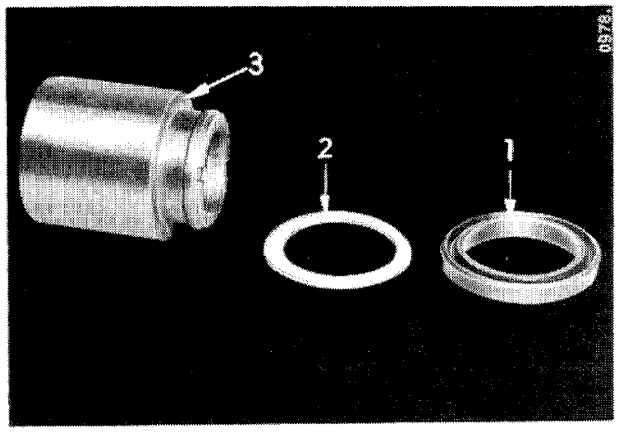
Illust. 45

1 – Cylinder head
2 – Adapter plate (special tool)
3 – Oil reservoir

To check the opening pressure, a test pump, as shown in Illust. 45 is necessary. Use the adapter plate (2) to seal the cylinder head. Open the lowering control valve to allow air to escape and close it as soon as oil begins to flow out. Should opening pressure be too low, install an additional shim (13), Illust. 44.

Power Cylinder and Piston

Oil, leaking past the piston seal or the O–rings in the power cylinder can be diagnosed by tendency of rocker arms to drop when the engine is shut down. When the engine is running, rocker arms are "jerked" up as the system corrects this imperceptible lowering.



Illust. 46

1 – Piston seal
2 – Back–up ring
3 – Shoulder of piston

Refer to Illust. 16 for details on removal of power cylinder and piston.

Slide the piston out of the cylinder and inspect both parts for signs of scoring and seizure.

Check piston seal (1) Illust. 46 and back–up ring (2) for wear and replace when in doubt. To fit a new back–up ring, heat it in hot oil of approximately 80°C = 175°F, to facilitate getting it over the piston collar without damage. The back–up ring must contact piston shoulder (3).

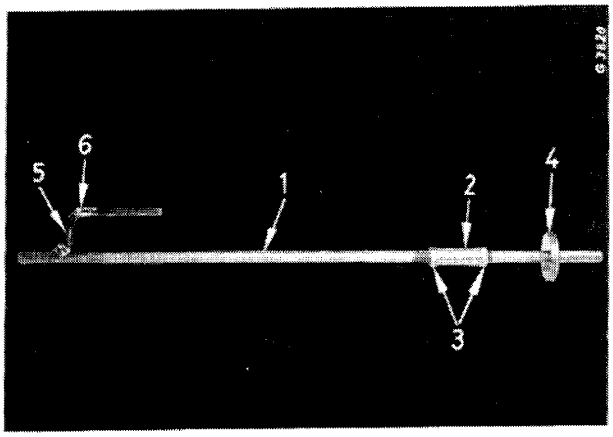
A spherical bearing insert is pressed into the recessed rear end of the piston (Early model pistons only.) This bearing insert is not replaceable and damage is not to be expected. Should replacement become necessary, a complete new piston must be used. O–rings should be replaced whenever the power cylinder is opened.

Draft Control Linkage

Components of the draft control linkage such as draft and position control levers, spool levers, spring element, draft link plunger and limit stop mechanism are not subject to any appreciable wear so that, under normal conditions, their life would exceed that of the tractor. However, it is possible after long service that the original setting has changed and readjustment becomes necessary. If making a new adjustment on the draft control linkage, closely inspect all parts for their condition and replace any defective part with a new one.

The limit stop rod has been changed.

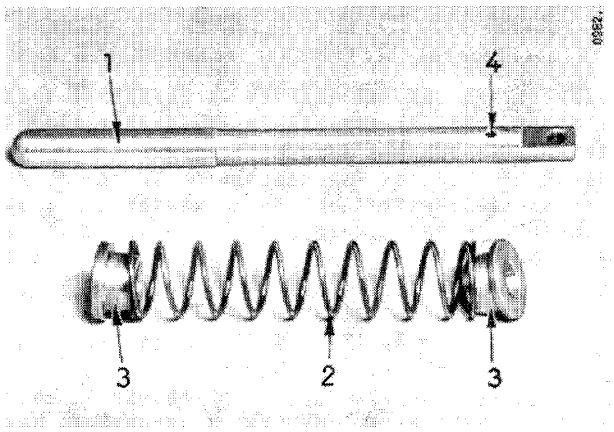
When repairing hitches equipped with the displaced design of limit stop rod, it is recommended to install the present adjustable design of limit stop rod Illust. 47. For adjustment see Illust. 63.



Illust. 47
Limit stop rod, present design

1 – Limit stop rod, front half
2 – Turnbuckle
3 – Lock nuts
4 – Limit stop rod, rear half with stop disc
5 – Pin, actuating spool
6 – Pin, actuating draft spool lever

Check the chromium–plated sealing face (1) Illust. 48 of draft link plunger for signs of scoring. If damage is noted, be sure to replace the seal in the housing and the draft link plunger. Check follow–up spring (2) against specifications. Free length is 129 mm = 5.08". A test load of 13.5 kg = 30 lbs compresses this spring to its test length of 70 mm = 2.75". When installing the draft link plunger, refer to instructions given below Illust. 56.

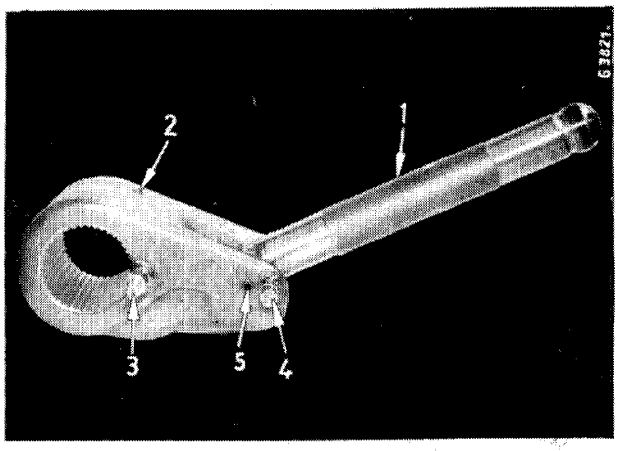


Illust. 48

1 – Polished sealing face
2 – Follow–up spring
3 – Spring cups
4 – Roll pin hole

Power Arm and Connecting Rod

To disassemble the connecting rod from the power arm, remove the roll pin (5) Illust. 49. The spherical bearing insert in the power arm is not repairable. If necessary replace the complete power arm.

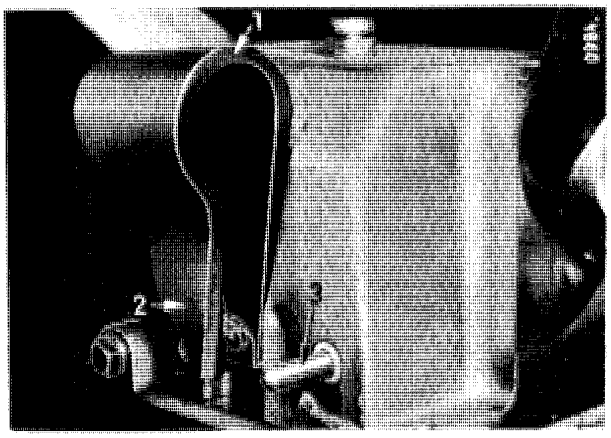


Illust. 49

1 – Connecting rod
2 – Locking hole
3 – Pin for position actuator
4 – Pin for limit stop mechanism
5 – Roll pin

Make sure that both actuator pins (3 and 4) Illust. 49 are in good condition. If cracks or signs of failure are noted, the complete power arm must be replaced. Do not attempt welding as this would cause distortion i. e. a slightly changed position of these pins resulting in functional disturbances or, in the case of the limit stop mechanism, severe damage.

Bellcrank Spring

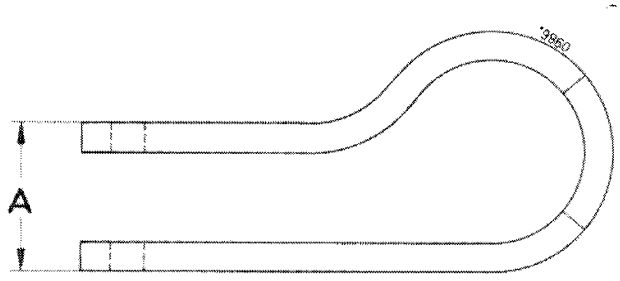


Illust. 50

1 – Bellcrank spring
2 – Rear leg of spring
3 – Draft link plunger

Signal forces from the upper link are taken up by the bellcrank spring (1) Illust. 50. This results in a definite movement of the spring's rear leg (2), which is in direct proportion to the strength of the signal. Draft link plunger (3) is following this motion and transmits the signal to the draft spool lever to initiate lifting and lowering operations.

Being of good quality spring steel, it is not expected that the spring will take a permanent set nor should it be necessary to replace a spring for fatigue reasons. When the spring is taken down for repairs, it is good practice to check dimension "A" Illust. 51. When deviations of 2 – 3 mm = .08 – .12" or more are noted, a new spring should be used. Inspect the two spring pins for signs of cracking or other damage. Replace these pins if damage is noted using the improved quality pins attached with bolts, nuts and belleville washers.



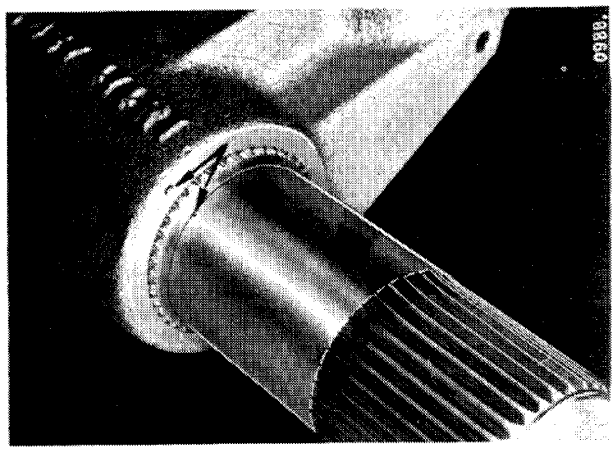
Illust. 51
A = 60 – 63 mm 2.36 – 2.48"

REASSEMBLY AND INSTALLATION

Broadly speaking, reassembly and installation is the reverse of the removal and disassembly procedure. All components must be checked, well cleaned, and reassembled in the order shown on the illustrations. Cleanliness is most important. Dip moving parts into hydraulic oil as they are reassembled.

Power Arm and Connecting Rod

Enter power arm and connecting rod assembly as a unit into the lift housing, see Illust. 20. Power arm, rockshaft and rocker arms are provided with corresponding markings to ensure their reassembly in the correct position to each other.



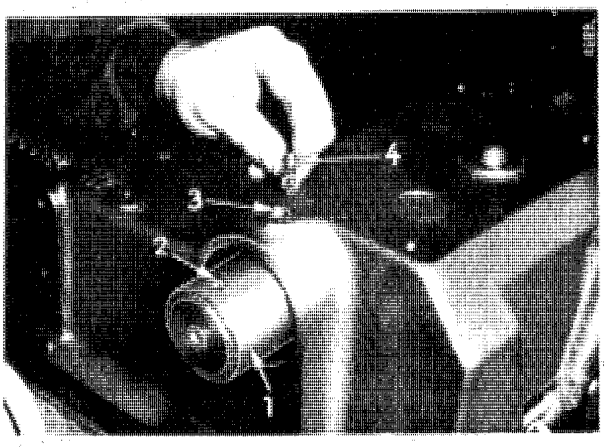
Illust. 52
Markings on power arm and rockshaft

Slide the power arm on the serrations of the rockshaft in such a way that markings, Illust. 52, are in line. This will also ensure correct alignment of locking hole for roll pin. Drive roll pin into this hole to secure the power arm on the rockshaft.

Assemble bushings (1) Illust. 53 in the lift housing, taking care to align holes (2 and 3). Insert and tighten dog–point set screws, using new packing rings. With bushings in place, install new O–rings with spacer rings.

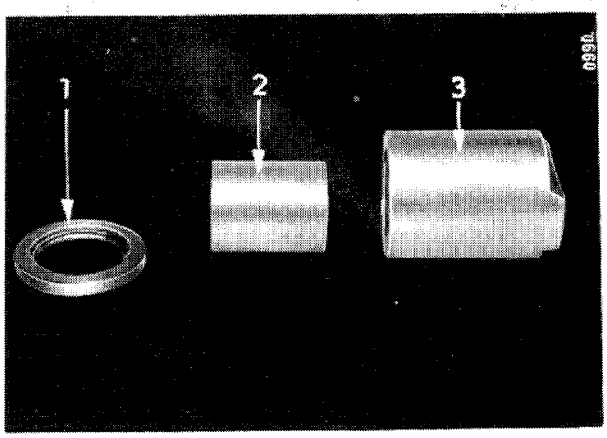
Note: Hitches of early production series have oil seals instead of O–rings and spacer rings.

When installing these oil seals observe the following:



Illust. 53

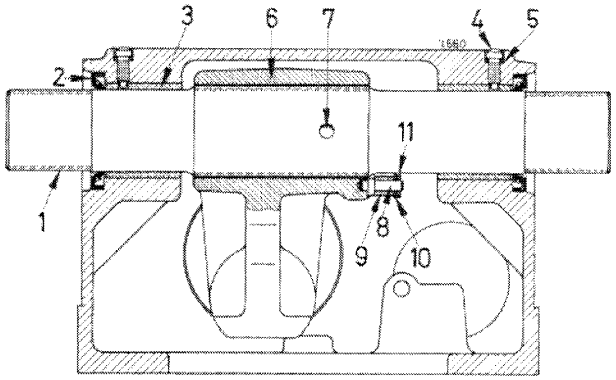
1 – Rockshaft bushing
2 – Locking hole
3 – Tapped bore
4 – Dog–point set screw



Illust. 54

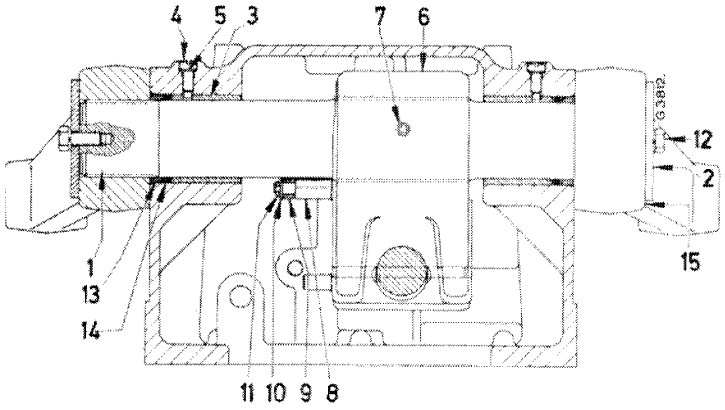
1 – Oil seal
(displaced design)
2 – Seal jumper
3 – Driver tool

The lip of the oil seal is towards the oil reservoir, i.e. the inside of the housing. To protect the oil seal, it is absolutely necessary to use seal jumper (2) Illust. 54. This seal jumper (2) and driver tool (3) are available as a service tool set.



Illust. 55
(displaced design shown)

1 – Rockshaft
2 – Oil seal
3 – Bushing
4 – Dog–point set screw
5 – Packing ring
6 – Power arm
7 – Locking roll pin
8 – Pin, position actuator
9 – Position actuator
10 – Washer
11 – Cotter pin



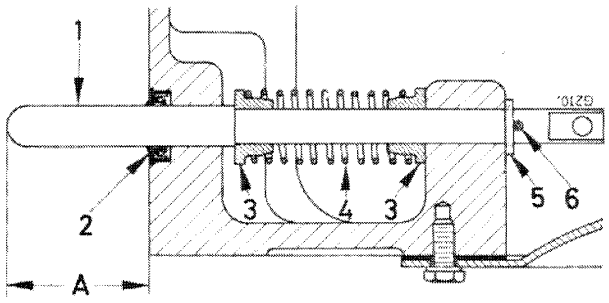
Illust. 55a
(present design shown)

1 – Rockshaft
2 – Washer
3 – Bushing
4 – Dog–point set screw
5 – Packing ring
6 – Power arm
7 – Locking roll pin
8 – Pin, position actuator
9 – Position actuator
10 – Washer
11 – Cotter pin
12 – Bolt
13 – Spacer ring
14 – O–ring
15 – Rocker arm

Illust. 55 and 55a give a sectional view of the rockshaft assembly. The shaft must be accurately centered in the housing.

Draft Link Plunger

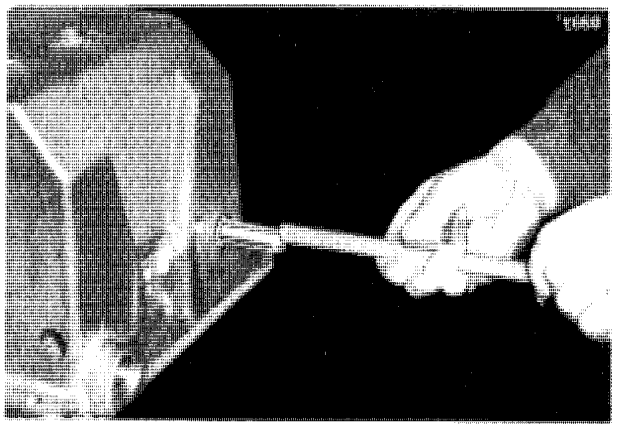
Assemble draft link plunger as shown in Illust. 56.



Illust. 56

A – 54 mm = 2.125" up to Serial Nr. N–5099
56 mm = 2.203" from Serial Nr. N–5100 and up
1 – Draft link plunger
2 – Oil seal
3 – Spring cups
4 – Follow–up spring
5 – Thrust washer
6 – Roll pin

First install the draft link plunger (1) then fit a new oil seal (2) so as not to damage the sealing lip. Use the special installing tool provided for this purpose. Be sure to fit ***only a new oil seal*** to avoid leakage. Take care to assemble thrust washer (5) and roll pin (6) properly. To do this, depress draft link plunger (1) against follow–up spring (4) into the housing.



Illust. 57

With the thrust washer contacting the housing boss, draft link plunger must protrude 56 mm (up to Serial No. N–5099 = 54 mm) see Illust. 56 (A) and 57. This dimension is taken from the end of the draft link plunger to the steel casing of the oil seal with the bellcrank removed. If this dimension exceeds 56 mm, add thrust washers (5) to reduce this dimension proportionately.

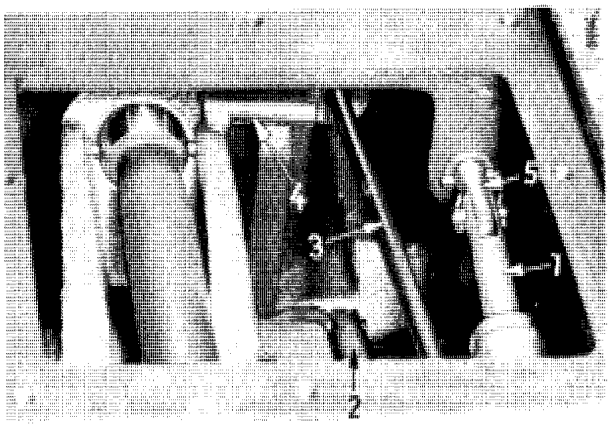
Important: When the spring element of the draft control is connected to the draft link plunger and the draft control lever is up all the way (lifting position), this dimension 56 mm must be rechecked. In this position, the spool is run in all the way in the valve housing. Check this and refer to Illust. 68 for details.

Control Linkage and Limit Stop Mechanism

Reassemble the internal linkage as shown in Illust. 68. All connections and adjustments require careful attention to ensure smooth operation of the draft control system.

Note: When installing the new two–piece limit stop rod Illust. 47, adjust this rod according to Illust. 63.

Control linkage and rocker arms must be installed prior to this adjustment.



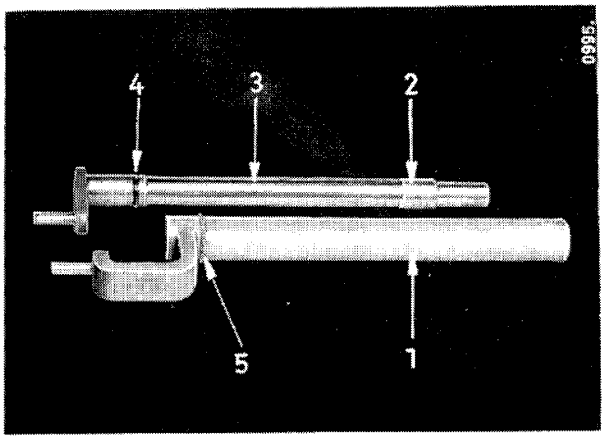
Illust. 58

1 – Spring element, draft control
2 – Position actuator
3 – Limit stop rod (displaced design)
4 – Actuator pin, limit stop
5 – Draft link plunger

Secure spring element (1) Illust. 58 and position actuator (2), using flat round hole washers and cotter pins. Flat round hole washers are used throughout except on the draft link plunger connection (5). Carefully spread cotter pins to prevent them from falling out. When installing the limit stop rod, be sure that the disc is behind the actuator pin (4). Secure the rod in place with cotter pin (6) Illust. 68. The expansion plug behind the limit stop rod must be oil–tight.

Position Lever Tube and Draft Lever Shaft

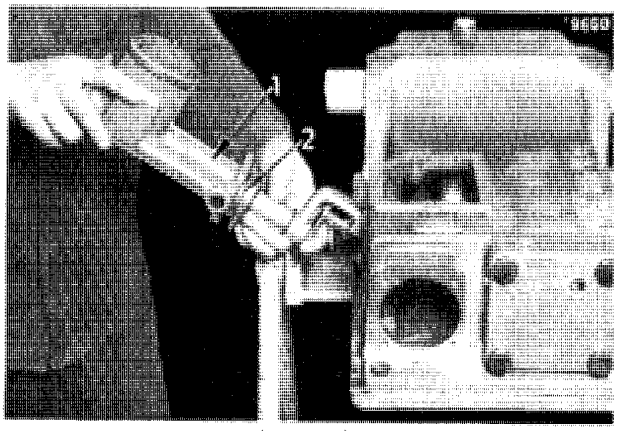
Clean tube and shaft (1 and 2) Illust. 59 and install them in bearing (1) Illust. 60 observing the following: Fit circlip (5) Illust. 59 and install a new O–ring (4) taking care that it is not twisted in its groove. Fill the whole length of the reduced shank (3) with chassis lubricant and insert the shaft into the tube. The tube requires no lubrication as it is surrounded by the return oil stream.



Illust. 59

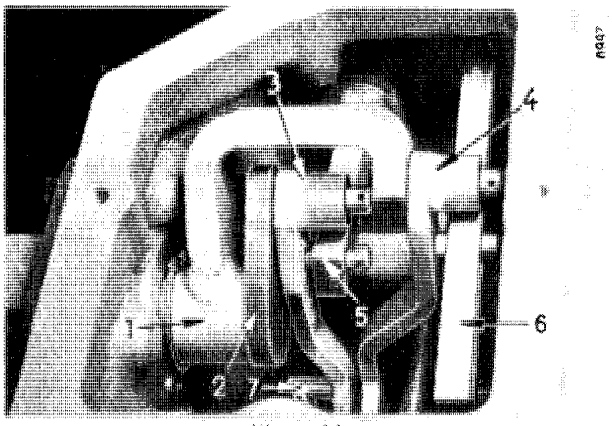
1 – Position lever tube
2 – Draft lever shaft
3 – Reduced shank (grease)
4 – O–ring
5 – Circlip

Insert both parts in bearing (1) Illust. 60 and install the assembly in the lift housing, using a new gasket (2). Before tightening up, place spool levers (3 and 4) Illust. 61 as well as spring element (5) and position actuator (6) on their respective pivot pins.



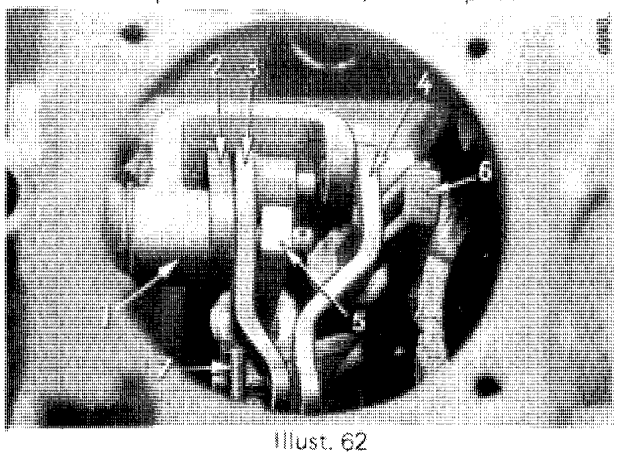
Illust. 60

1 – Bearing assembly
2 – Gasket



Illust. 61
Top view

1 – Position lever tube
2 – Draft lever shaft
3 – Draft spool lever
4 – Position spool lever
5 – Spring element, draft control
6 – Position actuator
7 – Pin, limit stop rod



Illust. 62
Front view

Reference numbers show the same components as in Illust. 61.

Correct assembly of the internal control linkage is shown in Illust. 61 and 62. On connection points (3, 5 and 6) flat round hole washers are used on both sides. Position spool lever (4) has only one washer at the cotter pin side. Take care to spread cotter pins fully. Be sure the upright limit stop pin (7) engages in front of the draft spool lever pin (3). See also Illust. 68.

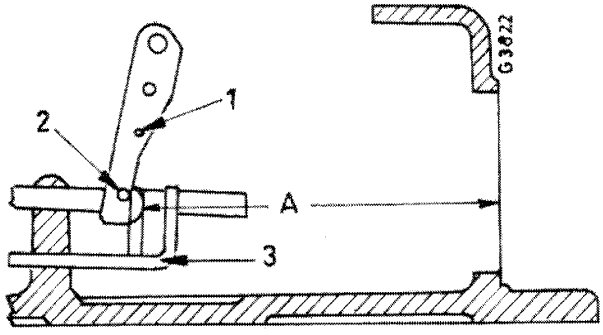
Install limit stop rod. After adjustment of control levers (Illust. 68 and 69) has been made, adjust the length of the limit stop rod as follows:

Lift up the rocker arms all the way and secure them in this position. Move the draft control lever all the way up.

Turn buckle (2) Illust. 47 in such a way that the distance (A) Illust. 63 between contact surface of lever (1) and housing front edge is obtained.

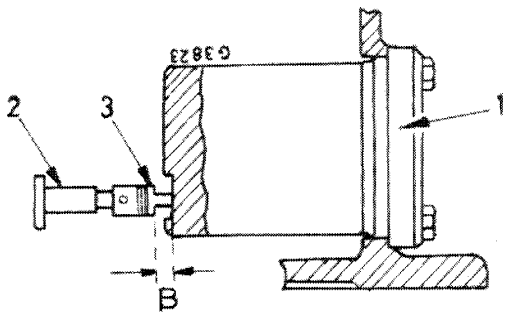
Tighten both lock nuts (3) Illust. 47. After installation of draft control valve, check the adjustment as follows:

With rocker arms and draft control lever in the position as described above, spool (2) Illust. 64 must be pulled out by the limit stop pin to obtain clearance (B).



Illust. 63
A = 167 – 169 mm = 6.57 – 6.65"

1 – Draft spool lever
2 – Pin
3 – Limit stop rod

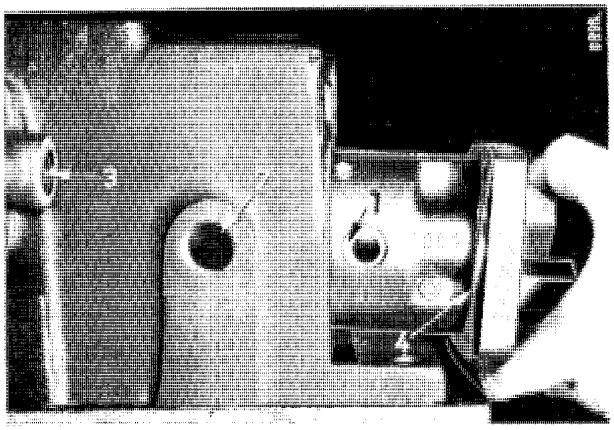


Illust. 64
B = 3 - 5 mm = .12 — .20"

1 — Control valve
2 — Valve spool
3 — Spool edge

Draft Control Valve

Install draft control valve, Illust. 65 using a new gasket (4). Be sure the spool tappet engages behind the limit stop rod.

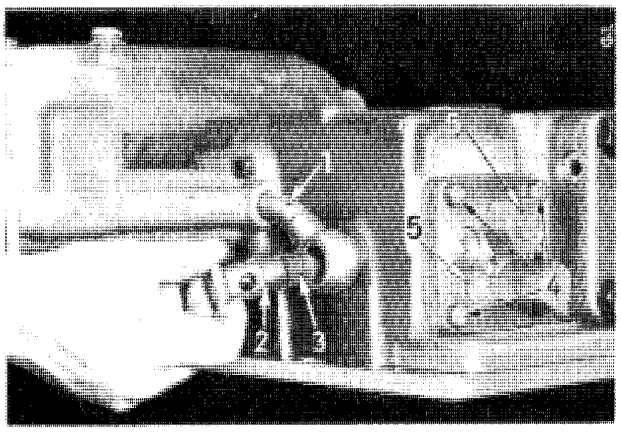


Illust. 65

1 — Recessed sealing face
2 — Return oil port
3 — O—ring
4 — Gasket

Take care to align recessed sealing face (1) with return port (2). Do not yet tighten up retainer bolts (4) Illust. 66.

On hitches with return oil filter fit return oil line (1) in bearing assembly, taking care not to twist the O—ring. Place packing rings on both sides of ring connection. Insert a new hose adapter (3) into female bolt (2) and carefully tighten the bolt, making sure that the hose adapter fits into the recess (1) Illust. 65. To check this, look through the top hand hole of the housing.



Illust. 66

1 — Return oil line
2 — Female bolt
3 — Hose adapter
4 — Retainer bolts
5 — Protection cap

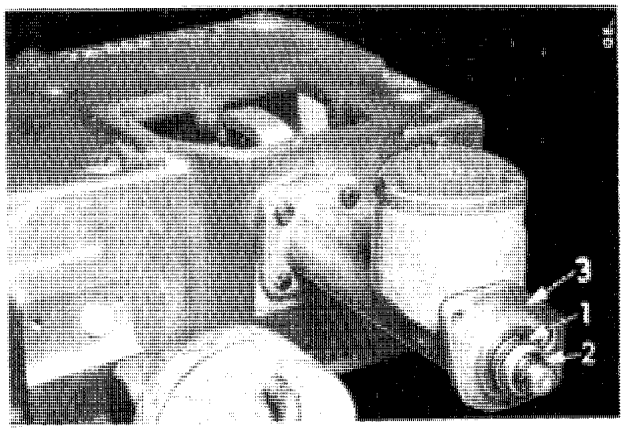
Important:

The housing adapter must fit properly into the recess. Only after making sure that the hose adapter is properly aligned, tighten up retainer bolts (4).

Note: Observe that the special contact washer is placed into the recess of the female bolt before the adapter is inserted. Be sure to fit this washer on all units even if they were not so equipped originally.

Operating Levers

With the internal linkage and the control valve properly fitted, install draft and position control levers and adjust as follows:



Illust. 67

1 — O—ring, position control tube
2 — O—ring, draft control shaft
3 — Mounting flange

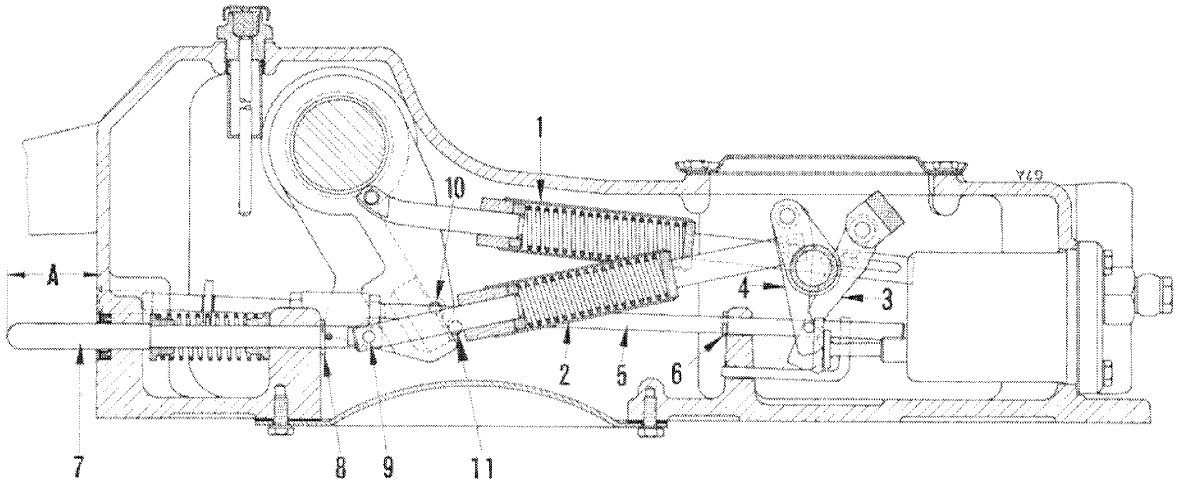
Note: On present production units, the O–ring (1) Illust. 67 is replaced by an oil seal (25) Illust. 69.

Use new O–rings and oil seals as a rule whenever these parts are disassembled. Take care when fitting O–rings (1 and 2) Illust. 67 that these are not twisted in their grooves. O–ring (2) serves as a dust seal only. Bolt the lever quadrant to flange (3) without tightening up.

Put position control lever (2) Illust. 69 on the tube in such a way that the ball points inward. Tighten clamping bolt lightly. Position draft control lever (4) on the shaft without tightening up. Now tighten the lever quadrant bolts and adjust operating levers as follows:

Put position lever (2) down all the way and draft control lever (4) all the way up. Turn draft control shaft in such a way that draft spool lever (4) Illust. 68 depresses valve spool tappet all the way to "Lifting with full Capacity". Hold the draft control shaft in this position and, with the draft control lever (4) Illust. 69 up all the way, tighten the clamping bolt.

Important: In this position of the draft control lever, the draft link plunger must protrude 56 mm (up to Serial No. N–5099 = 54 mm) out of the lift housing. Check this dimension.



Illust. 68

1 – Position actuator
2 – Spring element, draft control
3 – Position spool lever
4 – Draft spool lever
5 – Limit stop mechanism
6 – Cotter pin
7 – Draft link plunger
8 – Thrust washer
9 – Straight joint pin
10 – Roll pin securing connecting rod
11 – Actuator pin, limit stop
A – 56 mm (up to Serial No. 5099 = 54 mm

Illust. 68 shows internal linkage with draft control components properly adjusted. The draft control lever is in extreme lifting position. Draft link plunger protrudes 56 mm (up to Serial No. 5099 = 54 mm). Position control lever is in float position.

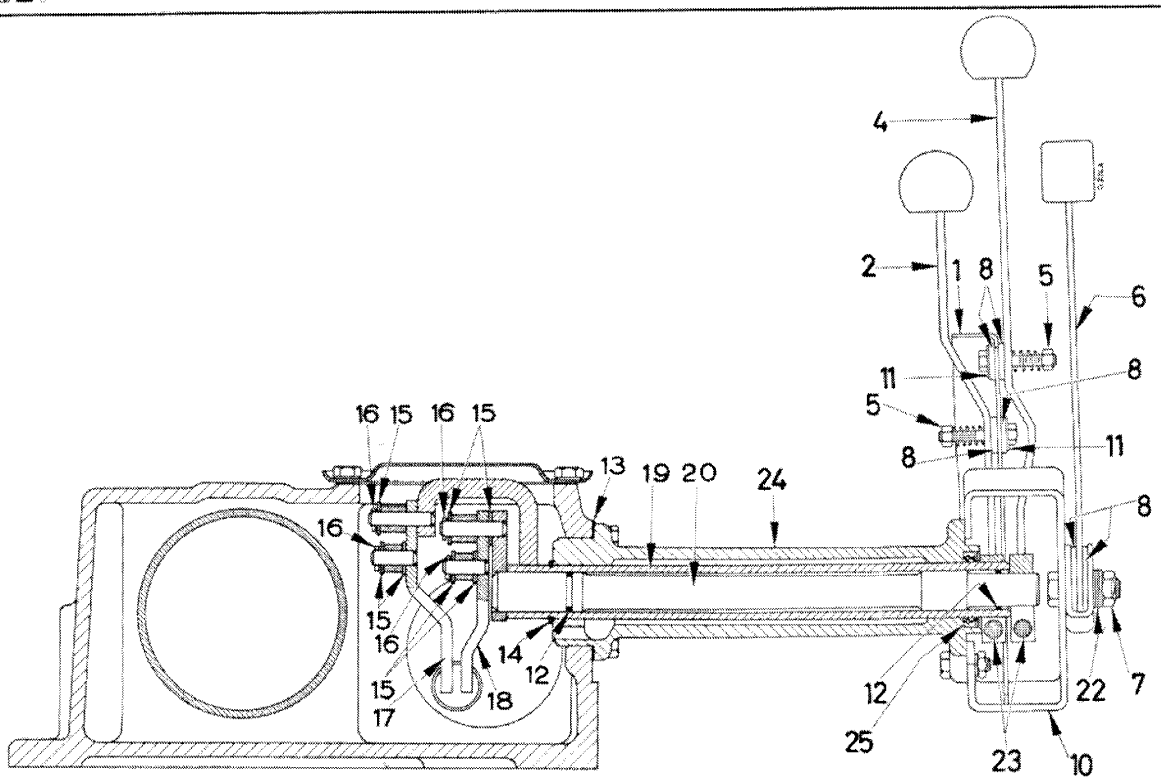
To adjust the position control lever (2), Illust. 69 it is necessary to load the system over a rocker arm, forcing the power arm forward all the way. Place the draft control lever down all the way beside the position lever. With both levers down, turn the position tube in such a way that the position spool lever (3) Illust. 68 just contacts the spool tappet without play. Now tighten up clamping bolt of the position control lever while holding the position spool lever in contact with the tappet.

Place thrust washers and springs on pins of levers (2 and 4) Illust. 69. Tighten castellated nuts (5) in such a way that a resistance of approximately 18 to 10 kg = 22 lbs is felt on the ball when shifting the lever. Insert and spread cotters in castellated nuts. Install marker lever (6) with bracket (10) and friction discs (8). Tighten castellated nut (7) until a force of approximately 20 kg = 45 lbs is reached to shift the marker lever. Secure castellated nut with cotter pin.

Note: Protect friction discs (8) from oil and grease. Insufficient resistance at the marker lever is an indication that friction discs have been contaminated with lubricant.

Fit return spring (9).

Illust. 69 shows a sectional view of the lever assembly. Check to make sure that no parts have been overlooked.

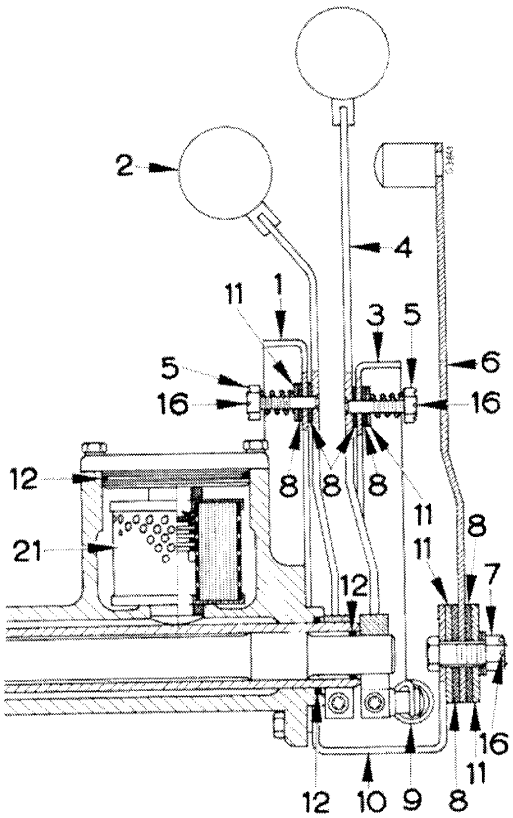


present design

Illust. 69

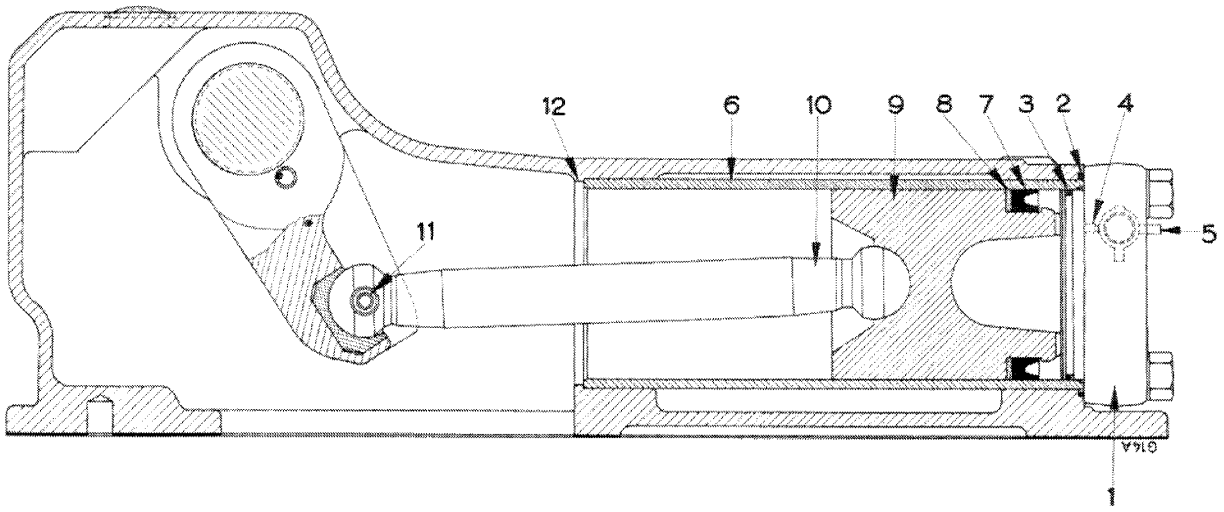
Controls

1 – Quadrant
2 – Position control lever
3 – Quadrant
4 – Draft control lever
5 – Castle nut
6 – Marker lever
7 – Castle nut
8 – Friction discs
9 – Return spring
10 – Marker lever bracket
11 – Thrust washer
12 – O–rings
13 – Gasket
14 – Circlip
15 – Flat round hole washers
16 – Cotter pins
17 – Position spool lever
18 – Draft spool lever
19 – Position control tube
20 – Draft control shaft
21 – Return oil filter
22 – Spring washer
23 – Clamping bolts
24 – Bearing
25 – Oil seal



displaced design

Power Cylinder and Cylinder Head



Illust. 70

1 – Cylinder head
2 – O–ring
3 – O–ring
4 – Stop, lowering control valve
5 – Roll pin
6 – Power cylinder
7 – Piston seal
8 – Back–up ring
9 – Piston
10 – Ball–type connecting rod
11 – Roll pin
12 – Power cylinder stop

Install the power cylinder as shown in Illust. 70 observing the following:

The cylinder (6) must rest against the stop (12). The larger chamfer is toward the front, on the cylinder head side. Install piston (9) with back–up ring (8) and piston seal (7) from the front. Fit O–rings (2 and 3). Install cylinder head, taking care not to damage or twist O–rings. Tighten cylinder head bolts (following a crosswise sequence. Fit connecting line (7) Illust. 10.

Rocker Arms

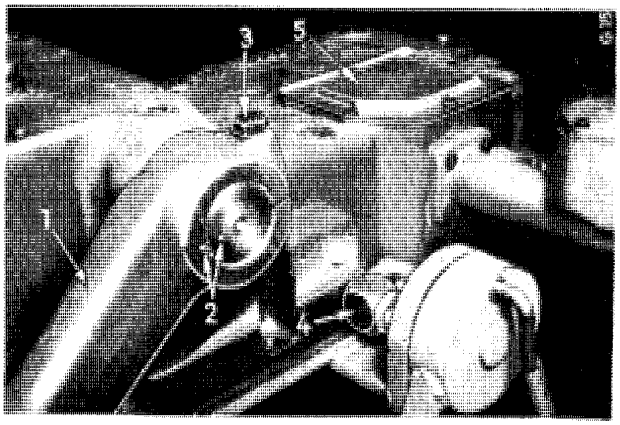
Rocker arms are the final step of the reassembly and installation procedure.

Rocker arms are identical and can be mounted right or left as desired. Take care to align index marks (2) Illust. 71.

Use new spring lock washers below clamping bolt heads (3) and tighten clamping bolts to secure rocker arms on the shaft.

Fit washers (14) Illust. 10a.

Be sure to use new gaskets for bottom and top hand hole covers (5).



Illust. 71

1 – Rocker arm
2 – Corresponding index marks
3 – Clamping bolt
4 – Suction screen connection
5 – Hand hole cover

Lift Housing and Oil Lines

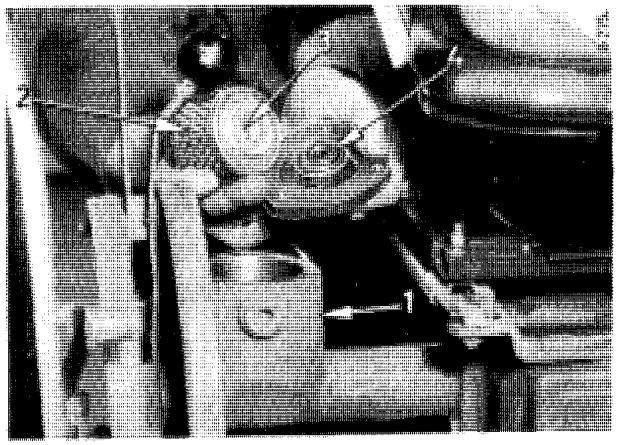
With a hoist carefully lower the lift housing onto the dowels of the main frame, using a new gasket. Tighten the flange bolts evenly. Take care that oil lines are installed without tension. Bend the lines slightly if necessary. Lines must be free from interference i.e. they must not chafe on the tractor or against each other.

Do not overtighten nut unions.

Check the condition of the suction strainer before installing it. Use a new strainer if the screen is damaged or indented by excessive suction.

Oil Filter

After each repair on the hydraulic system the element of return oil filter Illust. 72 or element of pressure oil filter must be replaced with a new one.



Illust. 72
Return oil filter

1 – Filter case
2 – Filter element
3 – Safety valve
4 – Pilot boss

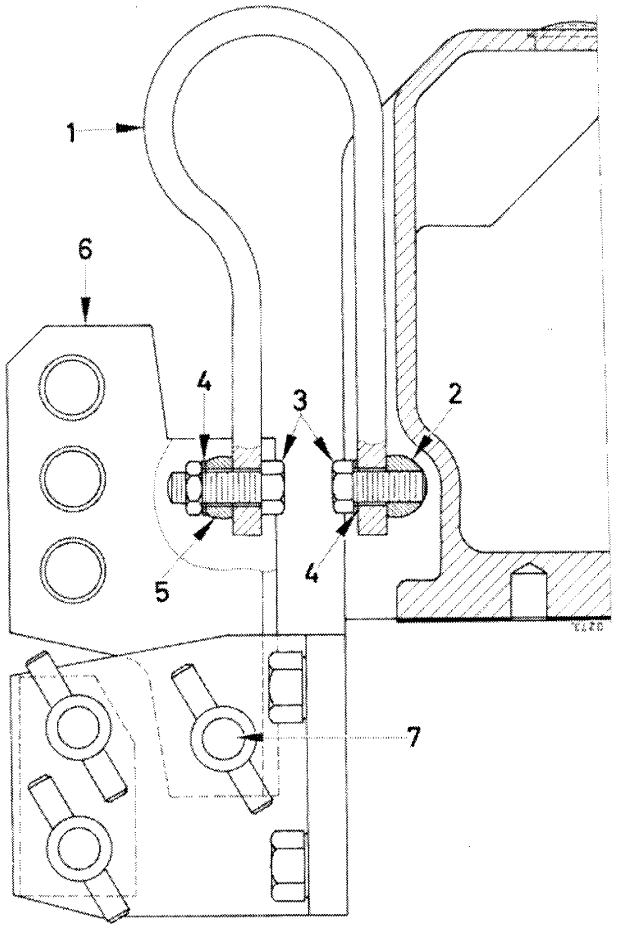
Take care, when installing the element (2) that safety valve (3) is towards the top.

The purpose of this safety valve is to open a by–pass, allowing the return oil to drain into the reservoir when the element is clogged.

When installing, first twist the insert onto the pilot boss (4) with a gentle screw–like motion, then install the assembly in filter case (1) using a new O–ring for the cover, see also Illust. 69. Fill the system with hydraulic fluid to the proper level. Replace pressure oil filter element according to Operator's Manual.

Bellcrank Spring

Install bellcrank spring as shown in Illust. 73.

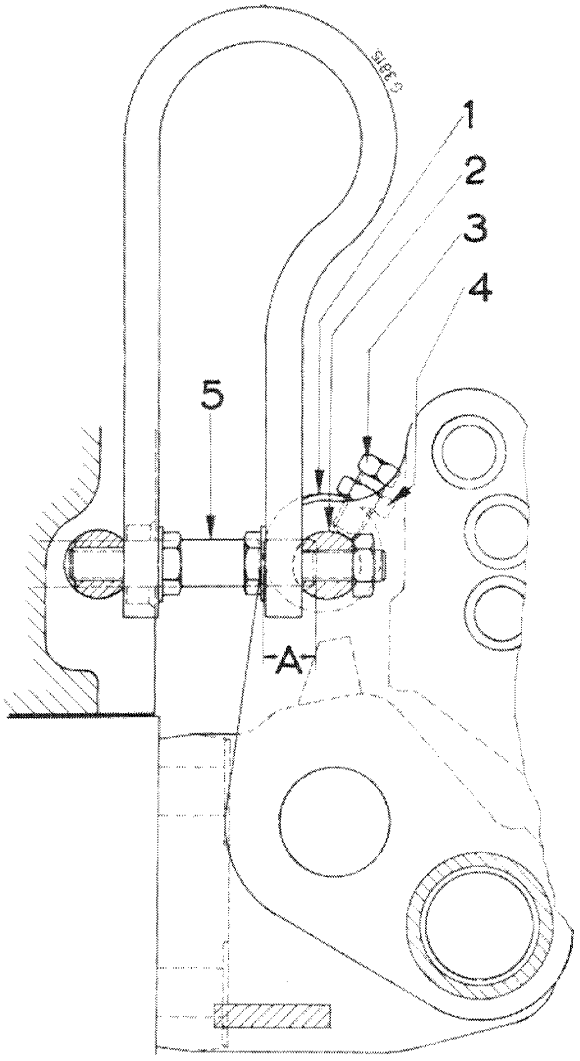


Illust. 73

1 – Bellcrank spring
2 – Mounting pin
3 – Bolts
4 – Belleville washers
5 – Contact pin
6 – Bellcrank
7 – Pivot pin

Check pins (2 and 5) for cracks and fissures. Be sure, when servicing the spring assembly, to use only the improved quality pins, which are attached with bolts (3), belleville washers (4) and nuts.

Bellcrank Pin Adjustment on Tractors equipped with Adjustable Trailer Hitch



Illust. 74
A = 18 mm = .7"

1 – Adjusting cam
2 – Bellcrank pin
3 – Set screw
4 – Lock nut
5 – Draft link plunger

Adjust as follows:

Run draft link plunger (5) Illust. 74 out all the way. From this maximum extended position press plunger into the housing 18 mm = .7" (A).

Bring cam (1) into positive contact with draft link plunger (5) and lock with set screw (3).

FINAL INSPECTION

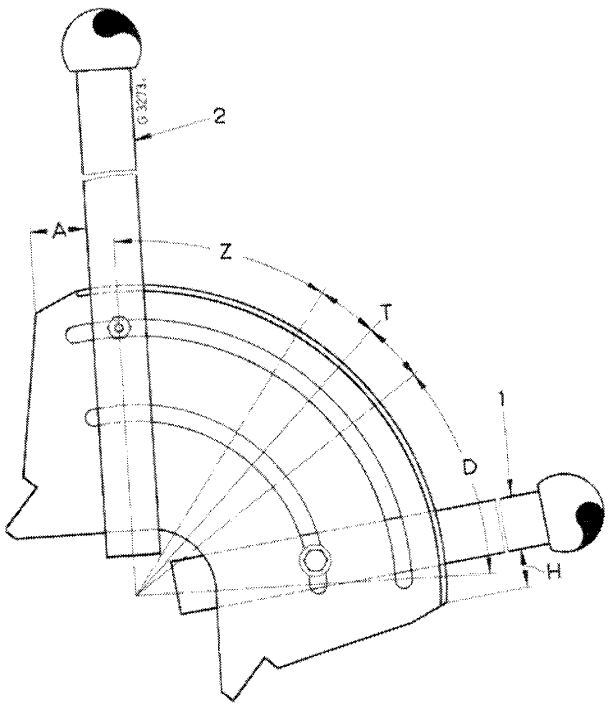
After the unit has been reassembled properly, and filled with hydraulic fluid, vent the system and make a final inspection as follows:

Start the engine. Immediately after starting, operate the hydrostatic power steering. Let the engine idle for three minutes at 1200 rpm. Operate the hydraulic draft system and remote control, completing a few cycles of lifting and lowering. Check to see that all parts are working freely and that there is no interference with stationary tractor parts. Stop the engine and allow the oil to settle. The hydraulic fluid must now be free from air bubbles. Repeat the venting procedure, if necessary.

Check the oil level and top up to the upper mark of the dip stick.

Observe strict cleanliness! Great care must be taken on filling or adding oil to the system, to prevent water, dirt or any foreign matter from entering the lift housing. Inspect all seals, line connections etc. for evidence of leakage.

Check adjustment of operating levers and limit stop mechanism.



Illust. 75

1 – Position control lever
2 – Draft control lever
D – Pressure range 45°
Z – Tension range 45°
T – Dead position
(possible deviation 10° to both sides)
H – Float position 10–15 mm = .39 – .59"
A – Lifting range 10 – 15 mm = .39 – .59"

To check adjustment of position control lever, move both control levers (1 and 2) Illust. 75 all the way down to float position. The bellcrank pin or the adjusting cam must not contact the draft link plunger. Pull position control lever (1) over range (H), the system must now begin to lift.

If necessary readjust position control lever on its shaft.

The dead point of draft control lever must be within the range (T), to check this, pull lever up until the draft link plunger just contacts the bellcrank pin without play. The position of draft control lever must now be within range (T).

To check lifting range (A), move control lever (1) all the way down. Pull lever (2) up to range (A). The system must now lift to maximum height.

Check function of draft control valve spool. At a draft link plunger way of 1–2 mm = .039 – .078" in or out, the system must change over from neutral to either lifting or lowering respectively.

Check setting of lowering control valve spindle.

Check cut–out and pilot stream pressures.

Load the coupling balls of lower links with approx. 1500 kg = 3300 lbs and check lifting speed. Operate the system at full engine speed, completing three to four cycles of lifting and lowering.

With a fluid temperatur of 50 – 60° C = 120 – 140° F the lifting stroke should last no longer than 2.8 seconds to indicate that the unit is in good working order.

With the loaded rocker arms half–way up, stop the engine and mark rocker arm position. Check, after five minutes, if the rocker arm position has changed.

Lower the system and remove the load. Manually operate the rocker arm assembly over its full stroke to ensure free float.

Correct any possible faults, misadjustments etc. revealed by these checks as you go along. For the adjustment of the three–point linkage refer to the Operators's Manual of the tractor.

Hydraulic Pump

The tractor can be equipped either with a single stage–or tandem type pump of "Bosch" or "Plessey" manufacture. Service Manual "Hydrostatic Power Steering" No. 1 090 585 covers specifications and servicing of the tandem type pump.

Descriptions below are for the single stage pump.

There are no differences of any significance between these pumps as regards size, capacity or method of servicing.

The following illustrations show the "Plessey Pump".

The gear–type pump (4) Illust. 76 is bolted to the crankcase front plate. The drive gear (7) is in mesh with the camshaft gear of the engine.

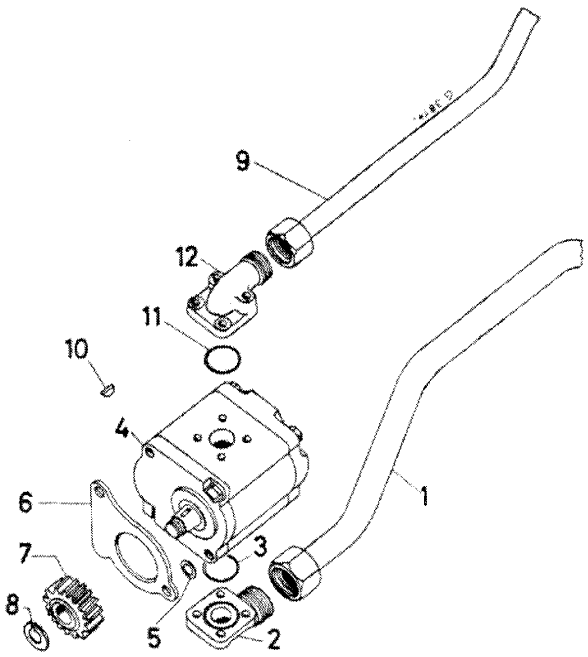
Speed ratio engine–pump 1:1.65. Idle capacity of a new pump at 1900 rpm engine speed is 25–25.6 l/min = 6.6 – 6.7 US gpm.

The following data has been prepared to enable checking pump capacity on a test bench.

Pump is designed for:

Max. permissible rpm 4100
Max. permissible pressure 185 kg/cm^2 = 2600 PSI

Idle capacity at 3000 rpm of pump = 24–24.5 l/min = 6.34 – 6.47 US gpm.



Illust. 76
Pump with connections

1 – Suction line	7 – Drive gear
2 – Flange	8 – Washer
3 – O–ring	9 – Pressure line
4 – Pump	10 – Key
5 – Washer	11 – O–ring
6 – Gasket	12 – Flange

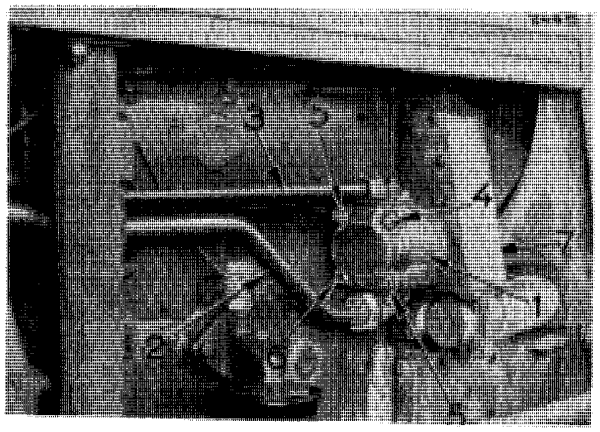
Reduced pump capacity when operating against a pressure of 185 kg/cm^2 = 2600 PSI = 22–23 l/min = 5.8 – 6.1 gpm. Replace the pump if capacity is less than 18 l/min = 4.75 gpm at 3000 rpm.

Because of the close tolerances involved, pump repairs are not considered an economical proposition. If pump capacity is low, oil tends to heat up excessively.

The discoloration due to heat is a sure sign of low pump efficiency. Therefore, if this discoloration or flaking off of paint is noted, the pump must be replaced without delay.

Important: If a pump is replaced the hydraulic fluid must also be changed.

Pump repairs are restricted to replacement of seals and gaskets. For a pump service package see Parts Catalog.



Illust. 77

1 – Gear–type pump
2 – Suction line
3 – Pressure line
4 – Stud nut
5 – Pump housing bolts
6 – Mounting bolt
7 – Mounting bolt nut

Drain hydraulic fluid. Remove pressure and suction lines (3 and 2) Illust. 77. Remove stud nut (4) and mounting bolt (6). Unmesh the drive gear and take the pump unit out of its recess.

Remove drive gear nut and washer (8) Illust. 76 and take off the drive gear (7) using a suitable puller. Check this gear for wear, cracks, scoring, chipping, etc. Should damage of this nature be noted, it is advisable to check the camshaft gear of the engine also. Refer to the respective service manual for engines.

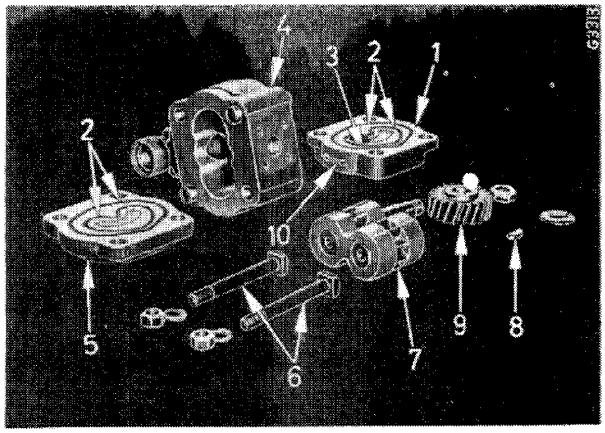
Disassemble the pump only as far as is necessary to replace seals, see Illust. 78.

Housing components (1, 4 and 5) are kept in alignment by dowel roll pins. To open the housing, apply a suitable mallet after removing the bolts.

Pump cartridge (7) is a thumb push fit in the housing. Do not use force to remove the cartridge.

Clean all parts in a suitable solvent and dry with compressed air, do not use rags!

Dip moving parts in clean hydraulic oil on reassembly.



Illust. 78

1 – Housing cover DE
2 – O–rings
3 – Oil seal
4 – Pump housing
5 – Housing cover rear end
6 – Housing bolts
7 – Pump cartridge
8 – Woodruff key
9 – Drive gear
10 – Directional arrow

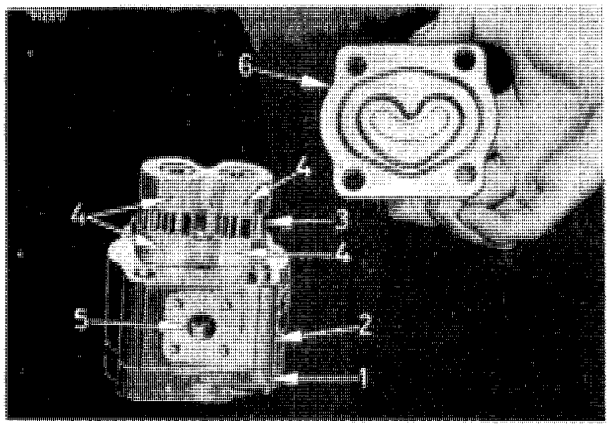
Replace covers (1 and 6) Illust. 79 using new O–rings (2) and oil seal (3) Illust. 78.

Press the oil seal all the way into the cover recess and secure in place with a circlip. Make sure when replacing cover (1), that directional arrow (10) points to the pressure side of housing (2) Illust. 79.

Enter pump cartridge (3) as illustrated, making sure that pressure side (4) is in line with ports (5).

Replace cover (6) and gradually tighten housing nuts to a final torque of 4.5 – 5 mkg = 33 – 36 ft lbs.

When fitting the pump drive gear (7) Illust. 76 on the tapered shaft, use a new woodruff key (10). Install lock washer and tighten the shaft nut to 10 to 12 mkg = 72 to 87 ft lbs. Secure the nut with lock washer (8). Insert the pump drive gear and mesh with the camshaft gear using a new gasket (6). Tighten stud nut (4) Illust. 77 and mounting bolt (6) to a final torque of 4.5 to 5 mkg.



Illust. 79

1 – Housing cover DE
2 – Pump housing
3 – Pump cartridge
4 – Pressure side, indicated by flat surfaces
5 – Pressure port
6 – Pump cover, rear end

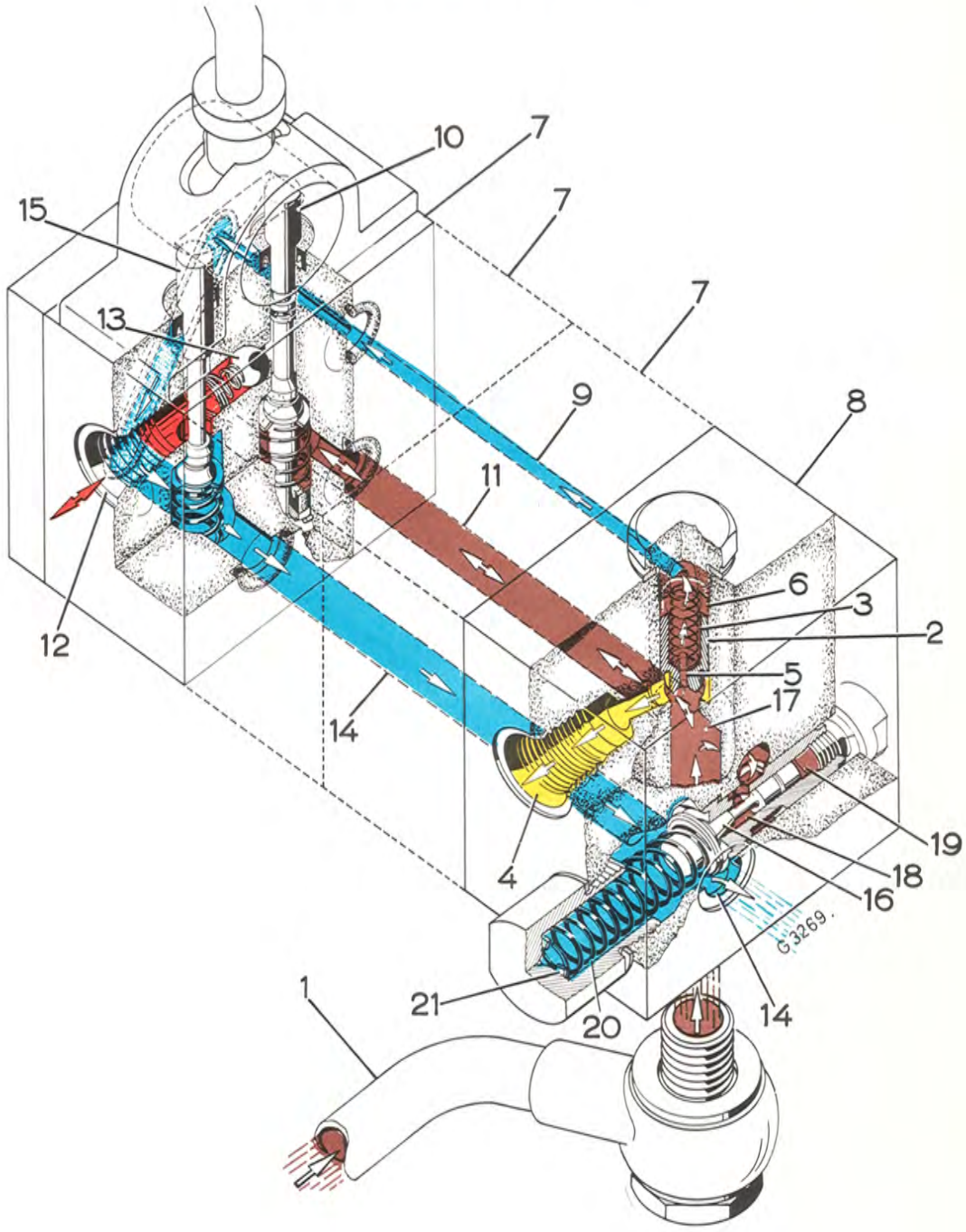
= 33 to 36 ft lbs. alternating from nut (4) to nut (7) several times. Nut (7) of mounting bolt (6) can be reached between radiator and water channel.

Note: Stud nut (4), mounting bolt (6) and its nut (7) are secured by belleville washers. Place a belleville washer each below the nuts of the mounting bolt, the stud and the bolt head, taking care that the small diameter contacts the bolt head or the nut.

Before connecting the oil lines, be sure to fill some hydraulic fluid into the pump to ensure initial lubrication. The oil circulating through the pump also takes care of its lubrication. With the pump in place, the engine should therefore, not be started unless the system is properly filled with hydraulic fluid.

Fill up hydraulic fluid and vent the system as described under "Final Inspection". After a trial run allow the system to cool down and draw up the pump mounting bolt and stud nut (4 and 6) Illust. 77 to the specified torque.

ADDITIONAL CONTROL VALVES



Illust. 80

= Operating pressure

= Return oil

= Pilot stream pressure, additional control valves (8 – 9 kg/cm^2 = 115 – 130 PSI)

= Pilot stream pressure, draft control valve (6 – 7 kg/cm^2 = 85 to 100 PSI)

1 – Pressure oil line from pump
2 – Flow divider piston
3 – Spring
4 – Outlet port to draft control valve
5 – Orifice
6 – Oil chamber behind divider piston
7 – Control valve
8 – Mounting block
9 – Restricted passage
10 – Valve stem, lifting
11 – Pressure passage
12 – Outlet to power cylinder
13 – Non–return valve
14 – Return passage
15 – Valve stem, lowering
16 – Relief valve
17 – Oil chamber
18 – Oil chamber
19 – Oil cushion
20 – Relief valve spring
21 – Shims

General

Certain additional equipment such as front loaders, power mowers, etc. operated by remote hydraulic control, necessitate the use of additional control valves as shown in Illust. 80. Up to four control valves (7) can be mounted in series on a mounting block (8), using an end plate to close the ports on the outside. Control valves can be factory mounted on special order. Repairs on these valves are restricted to replacement of seals and gaskets. If trouble develops which cannot be rectified, replace the defective valve unit with a new valve available through the usual service parts channels. The operating principle is now briefly explained to help in finding the cause of any trouble that might develop.

Neutral

Illust. 80 shows the additional control valve assembly in neutral. The pressure oil from the pump enters the mounting block (8) from the bottom at line (1), forcing flow divider piston (2) up against spring (3). When the pressure build–up has reached 8 – 9 kg/cm^2 = 115 – 130 PSI (brown), the flow divider piston (2) is forced up from its seat clearing outlet port (4) to draft control valve and partly restricting passage (9) until pressure at (17) and (6) is nearly the same passage (9). This pilot stream is necessary for operating the flow divider piston (2). In neutral, this pilot stream is displaced through passage (9) and return passage (14) into the reservoir. When operating the draft control valve, pressure will build up in line (1), below flow divider piston (2) and in outlet port (4), depending on the load acting on the draft control system. The flow divider piston will again take up a restrictive position, nearly equalizing pressure at (17 and 6).

Lifting

To lift with a remote control cylinder, valve stem (10) must be depressed. By this action, the pilot stream return flow passage (9) is blocked, while the outlet port (12) is opened. Blocking passage (9) results in a pressure build–up in chamber (6) until a hydraulic balance is achieved between (6) and (17). At this point, spring (3) reasserts itself pushing down flow divider piston (2) to close outlet port (4). The complete pump capacity is now displaced through passage (11) and outlet port (12) to the additional remote control cylinder. Non–return valve (13) is opened by the pressure oil flow. The lifting operation is ended when valve stem (10) is free to move downwards, closing passage (11) and opening pilot stream return passage (9). Non–return valve (13) becomes re–seated, preventing return flow from the remote control cylinder.

Lowering

For lowering, valve stem (15) is depressed, opening the return passage (14). The remote control cylinder, being under load from the implement, will displace the oil, draining it into the reservoir through passage (14).

Flow divider piston (2) remains up in its "neutral" position permitting the pump capacity to be displaced through outlet port (4) to the draft control valve. Lowering operation is ended when the remote cylinder is at the end of its stroke or when the lowering valve stem (15) is allowed to go up, closing return flow passage (14). Non–return valve (13) remains on its seat. If lowering operation was interrupted by valve stem (15), the implement will be locked in the position it was in when the return was cut off.

Relief Valve

The additional remote control circuit is protected while lifting by a relief valve (16). Chambers (17 and 18) are connected by a small passage so that pressure build–up at (17) is equal to pressure at (18). The oil squeezes past the valve guide piston into chamber (19), resulting in a slightly delayed relief valve action. If the pressure limit is exceeded, valve (16) is forced off its seat against spring (20) by the pressure oil in chamber (19). Oil from chamber (18) can now drain into return passage (14).

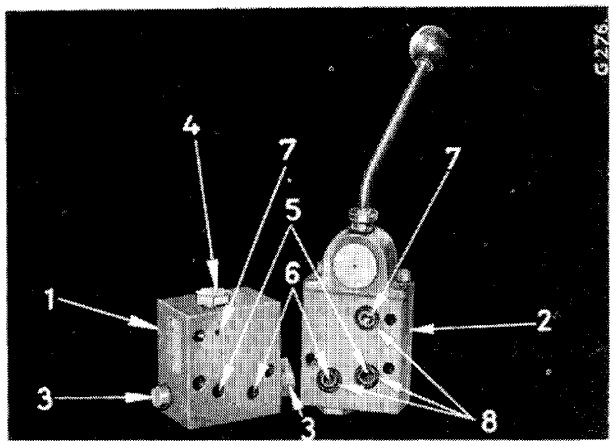
Shims (21) are provided behind relief valve spring (20) to allow for a pressure setting.

Note: Should this relief valve not function properly, i.e., if the valve leaks or opens too early, the draft control system may be affected, resulting in loss of lifting power.

Removal and Disassembly

Wash the tractor on the right hand side.

Disassemble oil lines taking care to tape them up so that no dust can enter. The complete control valve assembly can now be removed by taking out the two bottom mounting bolts.



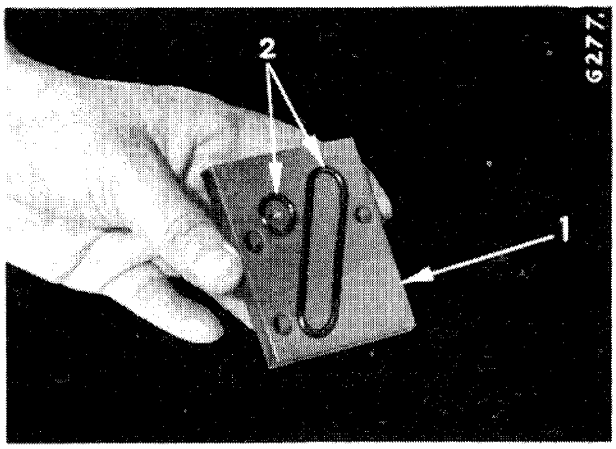
Illust. 81

1 – Mounting block
2 – Additional control valve
3 – Plugs (relief valve)
4 – Plug (flow divider)
5 – Feed passage (lifting)
6 – Return passage (lowering)
7 – Pilot stream passage (see also 9 Illust. 80)
8 – O–rings

The upper bolt secures the control valve assembly to the mounting block. Remove this bolt and take off individual control valves. Replace O–rings (8) Illust. 81 and (2) Illust. 82 whenever the unit is disassembled. The same applies to the O–ring for the mounting block return oil pipe.

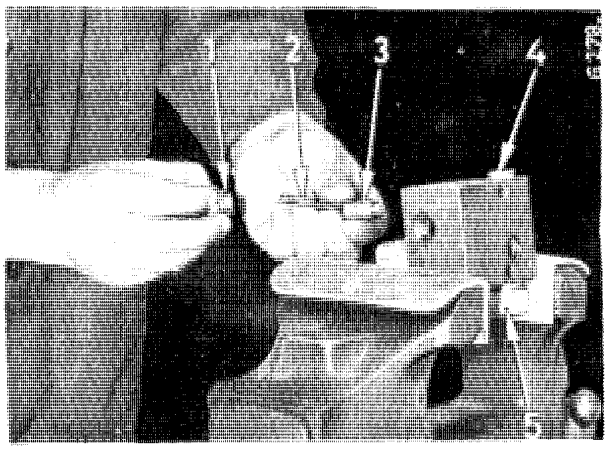
Remove relief valve assembly and flow divider from the mounting block, Illust. 83.

Note: On control valves of present production series there are two plates (5 and 6) Illust. 98 instead of end plate (1) Illust. 82.



Illust. 82

1 – End plate
2 – O–rings



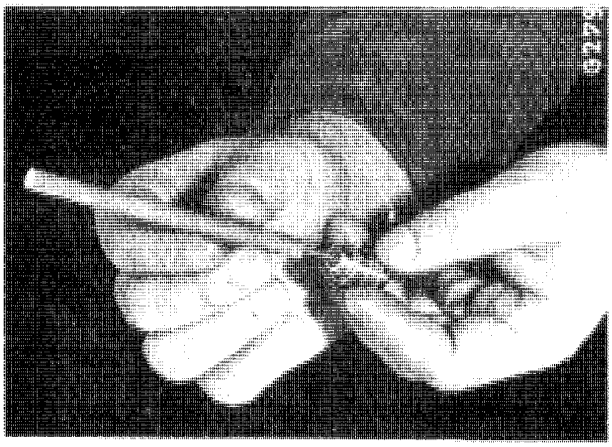
Illust. 83

1 – Plug
2 – Flow divider spring
3 – Flow divider piston
4 – Relief valve plug, rear
5 – Spring plug, front

To remove the flow divider unit, take out plug (1) Illust. 83 with packing ring and spring (2). Tap the mounting block on a clean piece of wood or use a clean pair of tweezers to remove the flow divider piston.

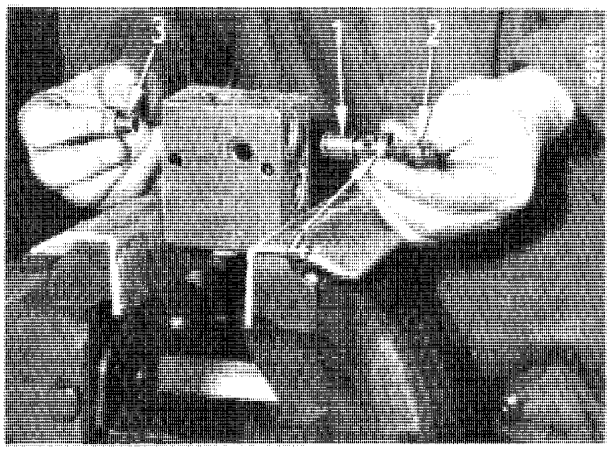
To remove the relief valve, take out plug (5). Remove valve spring, shim and packing ring. Shake the mounting block assembly to remove valve poppet (3) Illust. 85. To remove the valve housing (2), take out plug (4) Illust. 83

Clean all parts in solvent. Blow passages in the mounting block dry with compressed air. Check to see if the central orifice of the flow divider is clogged.



Illust. 84
Cleaning the flow divider orifice

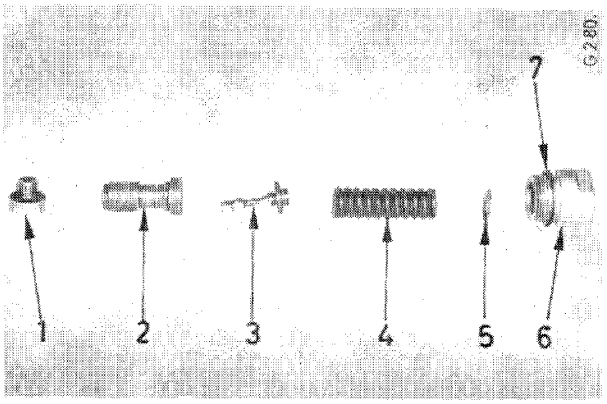
Clean the orifice with a suitable needle, as shown in Illust. 84. Also clean the pilot stream passage (7) Illust. 81 in the mounting block, using a needle. Check the flow divider piston to see if it moves freely in the housing. If necessary clean the piston by removing minor localized damage with a mild lapping compound. Be careful to remove all remnants of this compound before installing the flow divider piston.



Illust. 86
Tighten plug (3) to 2.5 – 3 mkg = 18 – 22 ft lbs

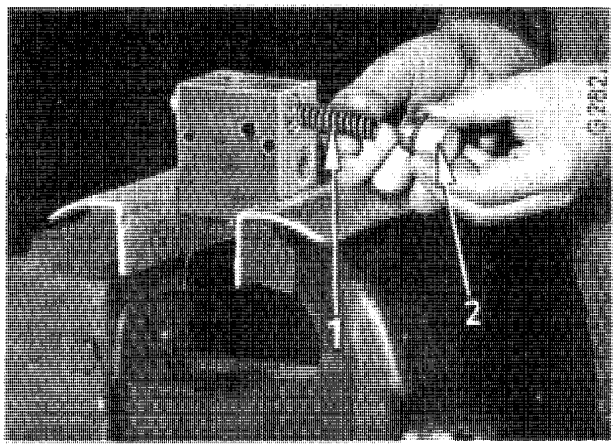
Inspect the sealing face and seat of poppet (3) and valve housing (2). If damage is noted on these parts, the complete mounting block unit should be replaced. To reassemble the relief valve, first install valve housing (1) and poppet (2), Illust 86. Be sure to use a packing ring on plug (3) and on housing shoulder (4).

Note: When ordering service parts take care to select parts that correspond with the operating pressure of the system. For details see parts catalog.



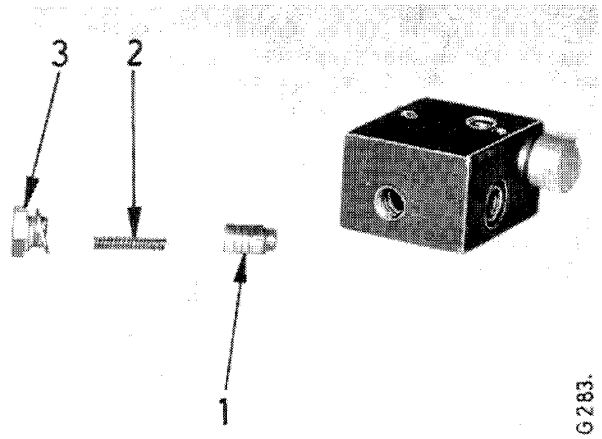
Illust. 85

1 – Relief valve plug, rear
2 – Relief valve housing
3 – Valve poppet
4 – Valve spring
5 – Shim
6 – Spring plug, front
7 – Packing ring



Illust. 87

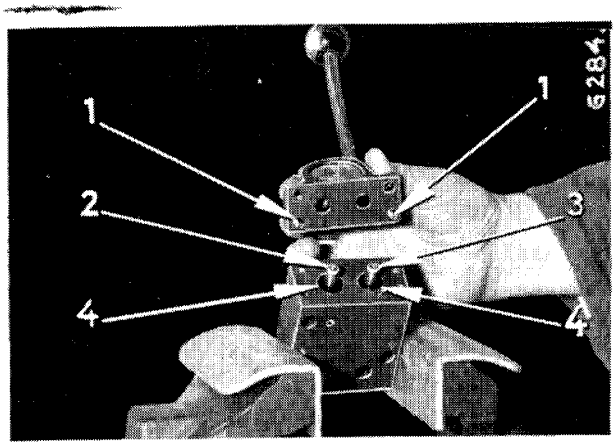
Install relief valve spring (1) Illust. 87. Be sure to use the shim found on disassembly in the recess of plug (2). Install this plug, using a new packing ring and tighten to 5 – 7 mkg = 36 – 50 ft lbs.



Illust. 88

Install flow divider piston (1) Illust. 88 with spring (2) using the washer found on disassembly. Install a new packing ring on plug (3) and tighten to 4–7 mkg = 30 – 50 ft lbs.

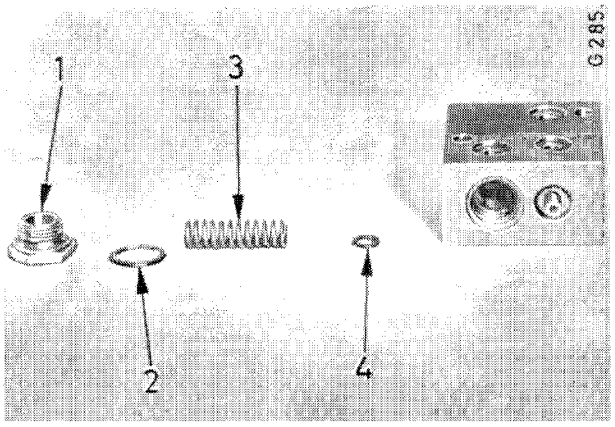
To disassemble the control valve, proceed as follows:



Illust. 89

1 – Roll pins
2 – Valve stem (lifting)
3 – Valve stem (lowering)
4 – Stem seals

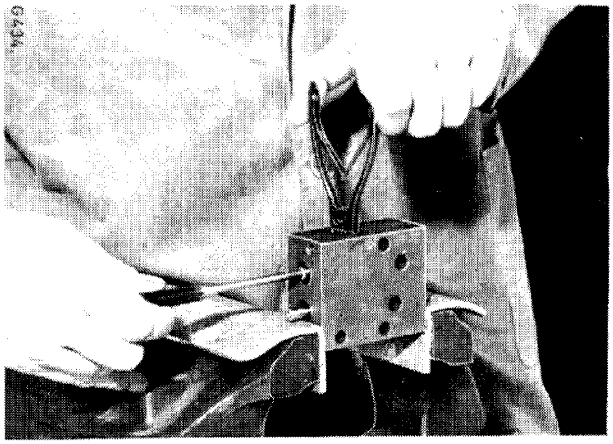
Remove "Allen" screws, securing lever head and lift off the assembly Illust. 89. Remove washers from stem seals (4). To remove valve stem (3), take out bottom plug with packing ring, spring and spring washer, Illust. 90.



Illust. 90

1 – Plug (bottom), torque load 4–5 mkg = 30–35 ft lbs
2 – Packing ring
3 – Valve spring
4 – Spring washer

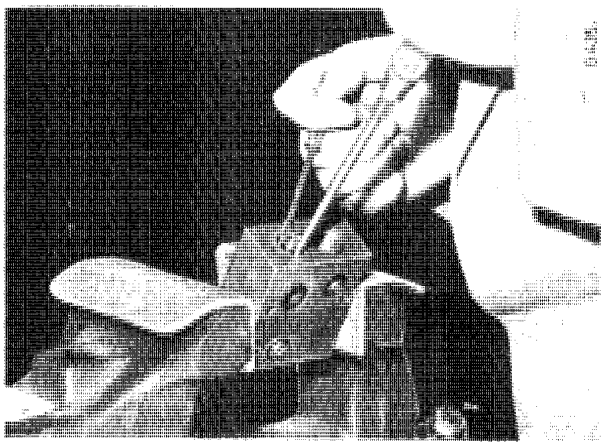
Then push out the valve stem towards the bottom while depressing the non–return valve spring with a suitable tool (tweezers or pliers, etc.), see Illust. 91.



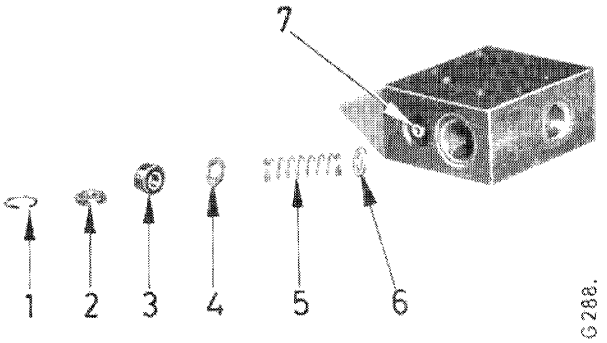
Illust. 91

Removal of the other valve stem (12) Illust. 96 necessitates removal of the bottom snap ring (16).

To do this, depress the spring washer with a suitable tool, then depress the snap ring center making both legs stand out see Illust. 92. After removing the snap ring, the spring will lift out the stem seal and the respective washers. Be careful to keep the spring under control to avoid injuries.



Illust. 92



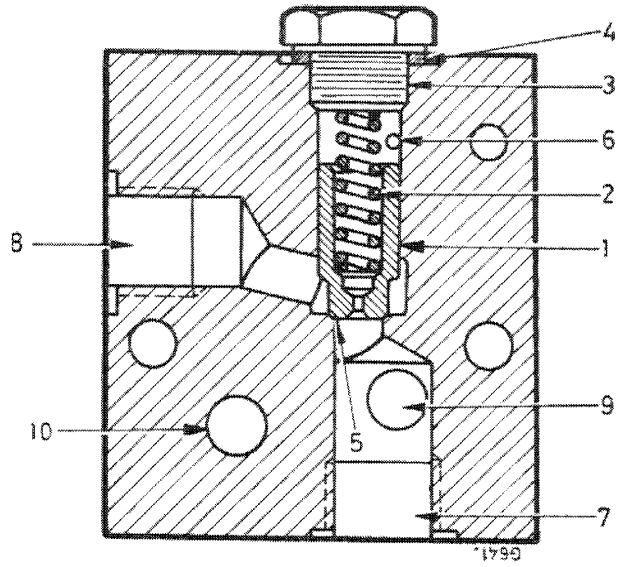
Illust. 93

1 — Snap ring
2 — Stepped washer
3 — Stem seal
4 — Spring washer (with oil passage)
5 — Valve spring
6 — Spring washer
7 — Valve stem (lifting)

Use a clean punch to push the valve stem (7) Illust. 93 out of the housing (there is a light drag due to the O—ring, see also (11) Illust. 96). Remove stem seals (4) Illust. 89.

Clean all components in solvent. Blow passages in the housing dry with compressed air. Carefully inspect all parts and use a new valve if defects are noted. If all parts are in order, reassemble the valve unit ***using new seals, O—rings and gasket throughout.***

Special seal and gasket packages are available for this purpose.



Illust. 94

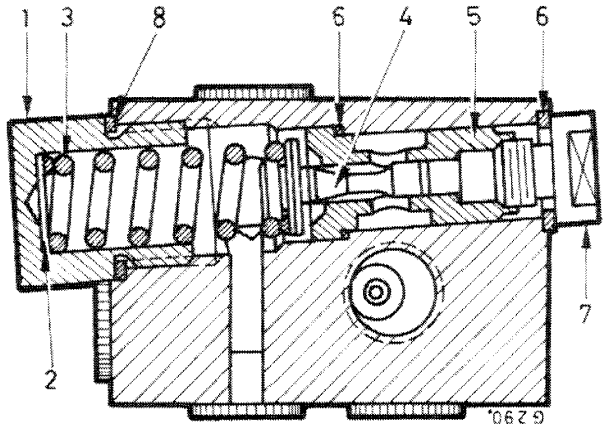
1 — Flow divider piston
2 — Flow divider spring
3 — Plug
4 — Packing ring (16 x 22 mm)
5 — Flow divider seat
6 — Pilot stream passage
7 — Inlet port from pump
8 — Outlet port to draft control valve
9 — Feed passage (lifting), additional control valve
10 — Return passage to reservoir

Note: Seal washers (10) Illust. 96 included in the service package differ in their inner dia. viz 8.05 — 8.10 mm = .316 — .318" and 8.25 — 8.30 mm = .324 — .326". This is necessary because of the tolerances in valve stem dia.

When fitting the seal washers take care that there is no more than 0.1 mm clearance between washer and valve stem.

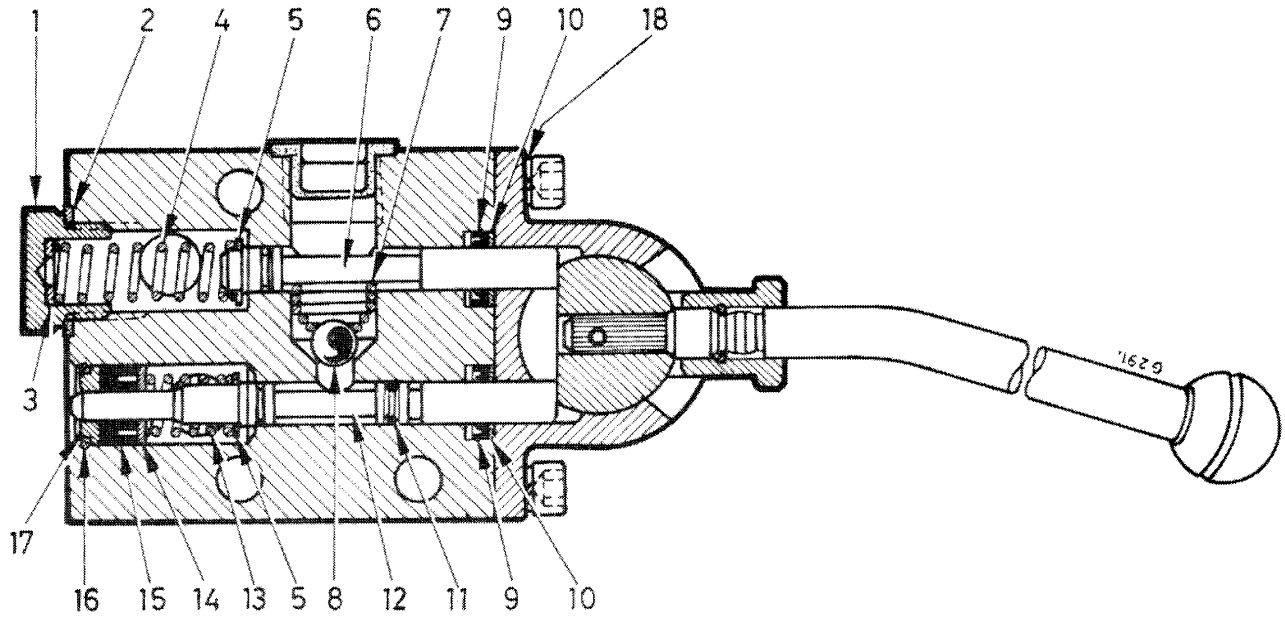
Reassembly is essentially the reverse of the disassembly procedure. The following Illust. 94 to 96 show the correct relation of components for reassembly.

Note: When installing valve stem (12) Illust. 96 be sure to depress O—ring (11) through the cross bore of non—return valve (8) with a suitable tool to avoid damage.



Illust. 95

1 – Spring plug (torque 5 – 7 mkg = 35 – 50 ft lbs)
2 – Shim
3 – Relief valve spring
4 – Valve poppet
5 – Valve housing
6 – Packing rings 14 x 18 mm (Part. No. 933 610 R1)
7 – Plug (torque 2.5 – 3 mkg = 18 – 22 ft lbs)
8 – Packing ring 22 x 27 mm



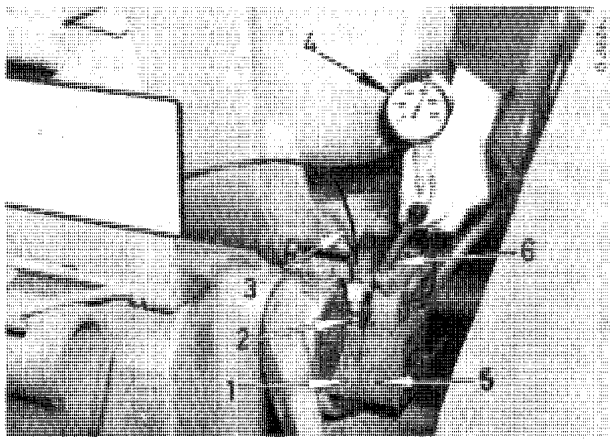
Illust. 96

1 – Plug
2 – Packing ring
3 – Spring washer (lower)
4 – Valve spring
5 – Spring washer (upper)
6 – Valve stem (lowering)
7 – Tapered spring
8 – Non–return valve ball
9 – Stem seal
10 – Washer
11 – O–ring
12 – Valve stem (lifting)
13 – Valve spring
14 – Spring washer (with oil passage)
15 – Stem seal, bottom
16 – Snap ring
17 – Stepped washer
18 – Spring lock washers

Reassemble the complete control valve unit with mounting block to the lift housing, taking care that O–ring (13) Illust 98 and return oil pipe (8) are in place. The outlet spout of return oil pipe (8) must show to the bottom and slightly to the rear. Tighten mounting bolts by steps to a final torque of 2.5 mkg = 18 ft lbs. Replace all oil lines. Fill and vent the system. Start the engine and check control valve action. Check for any possible leakage.

Check relief valve Illust. 95 as follows.
Connect pressure gauge as shown in Illust. 97. Flow divider piston (1) Illust. 94 and spring (2) must remain in the mounting block.

Start the engine and accelerate to 1500 rpm. Oil temperature should be 40–60° C (100 – 140° F). Place lever (6) Illust. 97 in lifting position. Observe pressure build–up on the gauge.

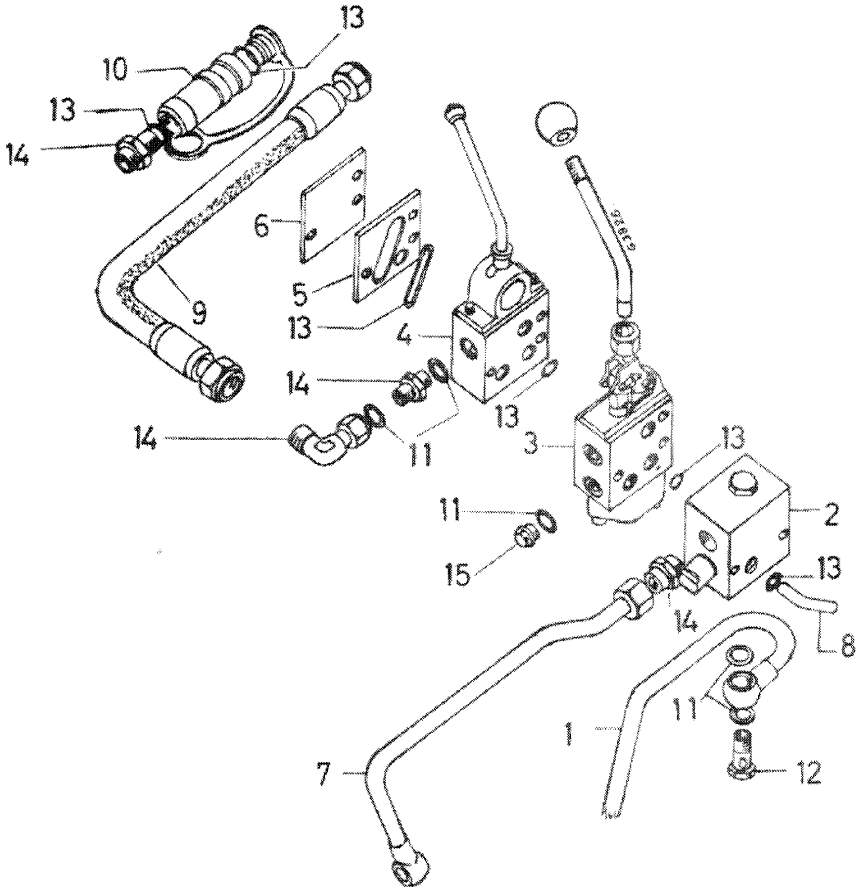


Illust. 97

1 – Mounting block
2 – Test connector
3 – Pressure hose
4 – Gauge (0–250 kg/cm^2 = 3500 PSI)
5 – Control valve
6 – Control valve lever

If the opening pressure deviates from the specified values, adjust the relief valve by adding or removing shims (2) Illust. 95.

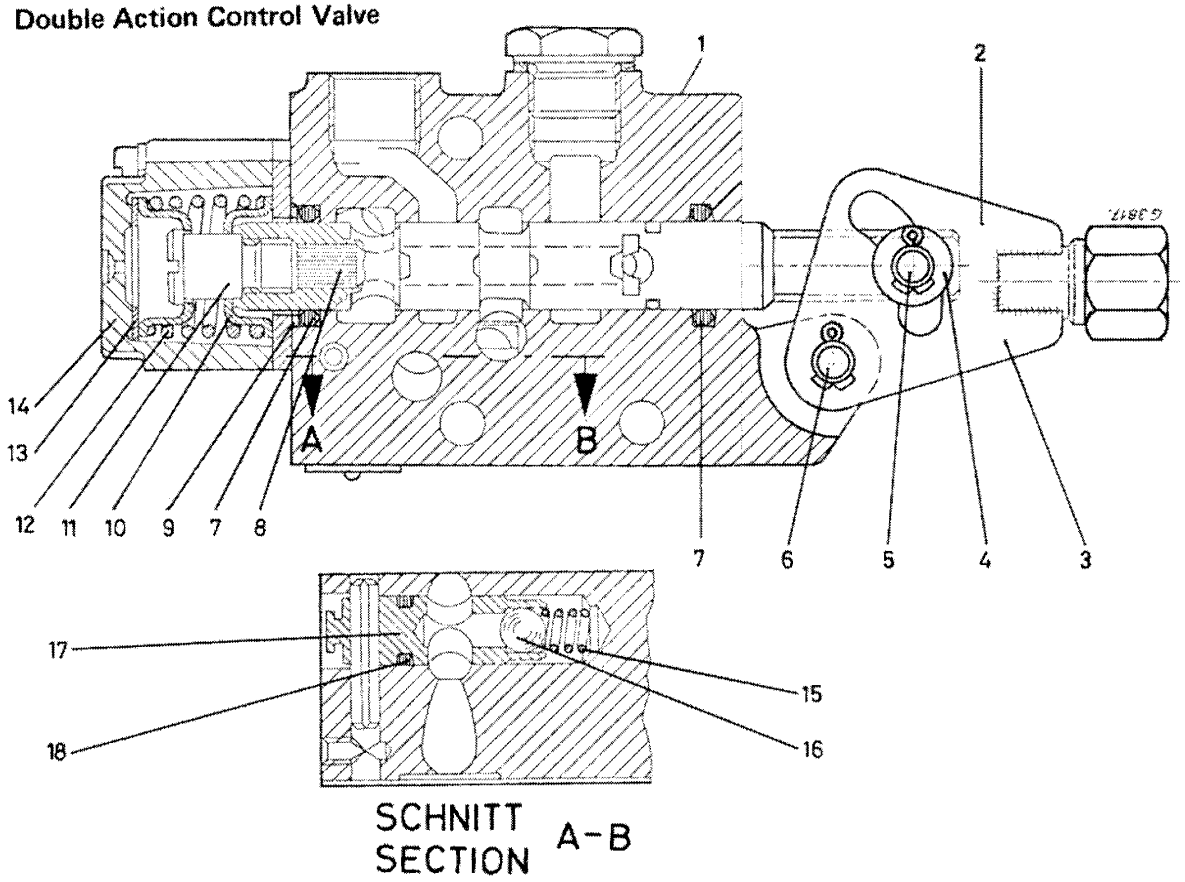
To check for proper flow divider action, put the draft control valve and one additional control valve into lifting position at the same time. If the flow divider is in order, the draft control system must not respond. Should the draft control system lift slightly, it indicates that the flow divider in the mounting block is either stuck or leaky.



Illust. 98
Additional control valves and connections

1 – Line from pump
2 – Mounting block
3 – Control valve, double acting
4 – Control valve, single acting
5 – Intermediate plate
6 – End plate
7 – Line to draft control valve
8 – Return pipe
9 – Hose, control valve to break–away coupling
10 – Break–away coupling
11 – Packing ring
12 – Hollow screw
13 – O–ring
14 – Adapter
15 – Plug

Double Action Control Valve



Illust. 99

1 — Control valve
2 — Shifting head
3 — Lever
4 — Washer
5 — Bolt
6 — Bolt
7 — Packing ring
8 — Plug
9 — Washer
10 — Spring retainer
11 — Stripper bolt
12 — Centering spring
13 — Washer
14 — Cup
15 — Spring
16 — Ball
17 — Poppet
18 — Seal ring

Control valve Illust. 99 is used when operating power cylinders of the double acting type, e.g. front loaders with power dump cylinder.

The control valve is bolted to the mounting block in the same way as the single control valve.

Components with reference numbers are service parts. When oil leakage past the spool in neutral position exceeds specified limits, use a new control valve.

TROUBLE SHOOTING

One of the most common complaints regarding any hydraulic system is "too hot". This is a very misleading and confusing statement.

How hot *is* hot?

The maximum ***desirable*** hydraulic fluid operating temperature in this draft control system is 80° – 90° C = 180 – 195° F. However, the hydraulic fluid, "O" rings and seals are tested at or above 100°C = 220°F for 100 hours or longer. At the end of this test, "O" rings and seals are still good, and the fluid has not been harmed.

Therefore, ***short*** periods of operation at 95°C = 200°F will not be harmful to "O" rings, seals, or hydraulic fluid. However, the fluid loses much of its lubricating property at higher temperatures, so bearings and gears could be damaged. ***Temperatures higher than 95°C = 200°F indicate a malfunction. Find the cause!***

A temperature of 80° – 90° C = 180° – 195° F will never harm any part of the system in any length of time.

The fact that some part of the hydraulic system is too hot for bare hands is ***not*** a sign of harmful heat. Temperatures of 50° – 60°C = 120° – 140°F are too hot for comfort on bare hands. ***Take the temperature of the system,*** using an accurate thermometer.

Important Note

Before investigating any service problem on the hydraulic system, the following must be checked:

1. Fluid level.
2. Condition of filters.
3. Efficiency of the hydraulic pump.
4. External leakage.
5. Age, condition, and type of fluid.
6. Air in the system or traveling with the fluid.

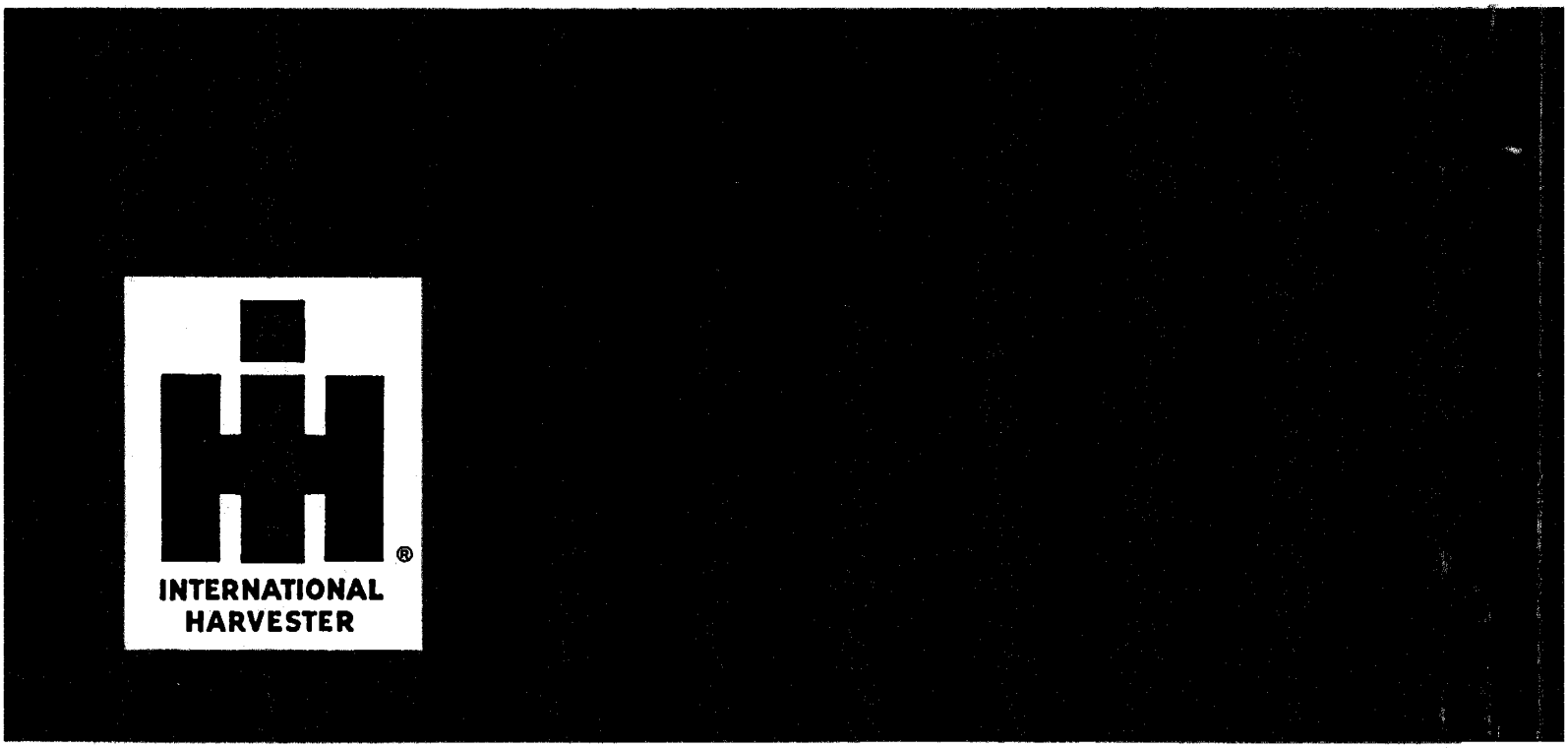
TROUBLE SHOOTING CHART

The Trouble Shooting Chart below keys a lot of trouble symptoms to their probable cause, to assist the memory of the experienced serviceman. To the novice in this field, or to service personnel which has less experience with this particular draft control dystem, this chart will not always be sufficient. It will then be necessary to study the principle of operation and functional details by referring to the recpective sections of this manual.

Problem	Probable Cause	Remedy
System is too hot	Excessive load	Move operating levers down all the way. Allow system to cool down. Reduce load
	Air in the system	Check oil level and connections of suction line. Vent the system
	Water in the system	Drain the system and fill up with new oil
	Valve spool or cut–out relief valve sticking	Clean or replace defective parts with new ones
	Cut–out pressure to high or additional relief valve opening pressure too low	Check pressure setting and readjust
	Internal leakage (control valve and power cylinder)	Check and replace defective parts
	Pump badly worn (due to foreign matter in the oil)	Replace pump and change hydraulic fluid. Clean or replace filters
Insufficient lifting power	Oil level too low	Top up to correct level
	Poor pump efficiency	Replace pump
	Suction screen clogged	Remove and clean the screen
	Excessive load	Reduce load
	Additional relief valve opens too early (whirling sound)	Check relief valve spring. Readjust
	Cut–out–valve opens too early Flow divider sticking (foreign matter)	Check and readjust Remove and clean
System remains at 8–9 kg/cm^2 = 115–130 PSI and does not lift	Cut–out relief valve sticks in open position	Clean, and if badly damaged, replace the control valve
	Fatigue of return spring (29) Illust. 6 or spring broken. Ball (35) Illust. 6 does not seat properly (foreign matter)	Replace spring Remove and clean

Problem	Probable Cause	Remedy
System will not lower	External obstruction of implement or linkage	Remove obstruction
	Lowering control valve closed	Turn hand wheel clockwise
	Pilot stream pressure in control valve too low (this pressure must be 6–7 kg/cm^2 = 85–100 PSI)	Add shims below flow divider spring until pressure is correct. Use a new spring if necessary
	Valve spool sticking	Disassemble and clean. If badly damaged, use a new control valve
	Block valve does not open. Block valve piston stuck or damaged	Replace or repair defective parts
System does not maintain its position and corrects repeatedly position of rocker arms (hiccups)	Leaking block valve	Grind valve into its seat or replace the block valve
	Cylinder cushion valve leaky	Replace
	External leakage on line (3) Illust. 11	Replace packing rings and tighten up
	O–rings or piston seal in cylinder damaged or brittle	Use new parts
System noisy	Oil level too low	Top up
	Air in the system	Check oil level and connections of suction line. Vent the system
	Suction screen clogged	Remove and clean
	Rocker arms interfering with tractor parts	Check to make sure that rocker arms and lower links with mounted implement are free to move over the complete stroke
	Restriction by foreign matter	Clean the system. Use new oil
	Oil lines vibrate	Check connections and pipe clamps. Tighten up
	Pump worn or defective	Replace pump. (Check also timing gear train of engine)
	Cut–out relief valve does not open so that pump operates against high pressure of additional relief valve. (This is probably adjusted too low)	Remove control valve. Disassemble and clean components. Readjust relief valve settings. Replace complete control valve if necessary
System lowers too fast with lowering control valve closed or too slow with lowering control valve open.	Position of hand wheel on spindle incorrect	Remove hand wheel and readjust on spindle.
Plow does not go deep enough or system does not lift high enough.	Operating levers not correctly positioned on shaft or tube	Check and readjust operating levers

Problem	Probable Cause	Remedy
Draft control does not respond	Draft link plunger spring or spring of element broken or weak	Check by moving draft link plunger 1–2 mm. This should bring the system from neutral to lifting or to lowering. Replace defective parts with new ones
	Plow not suitable for draft control operation	Adapt plow by changing hitch points or use a new plow
	Draft control lever between pressure and tension range see (D) and (Z) Illust. 1	Adapt plow by changing hitch points or use a new plow
Additional remote control power cylinders do not lift (front loaders, mowers, etc.)	Flow divider (2) Illust. 50 stuck in top position or spring (3) broken	Remove and clean flow divider piston. If badly damaged, use a new mounting block
Front loader gradually lowers by its own weight	Non–return valve (13) Illust. 80 or valve stem (15) leaky	Replace additional control valve
	Piston seals of power cylinders defective or brittle	Install new seals
Insufficient lifting power on remote control cylinders	Relief valve (16) Illust. 80 in mounting block adjusted too low	Check pressure setting. If necessary, add shims (21) Illust. 76. 1 mm shim changes the setting by 10 kg/cm^2 = 140 PSI
Remote control cylinders lift up to the end of the stroke although the additional control valve is returned to neutral	Valve stem (10) Illust. 80 stuck in open position	Replace the additional control valve
Oil leakage on valve stems (10) and (15) Illust. 80)	Stem seals defective	Install new stem seals. If valve stems are damaged, use a new control valve



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