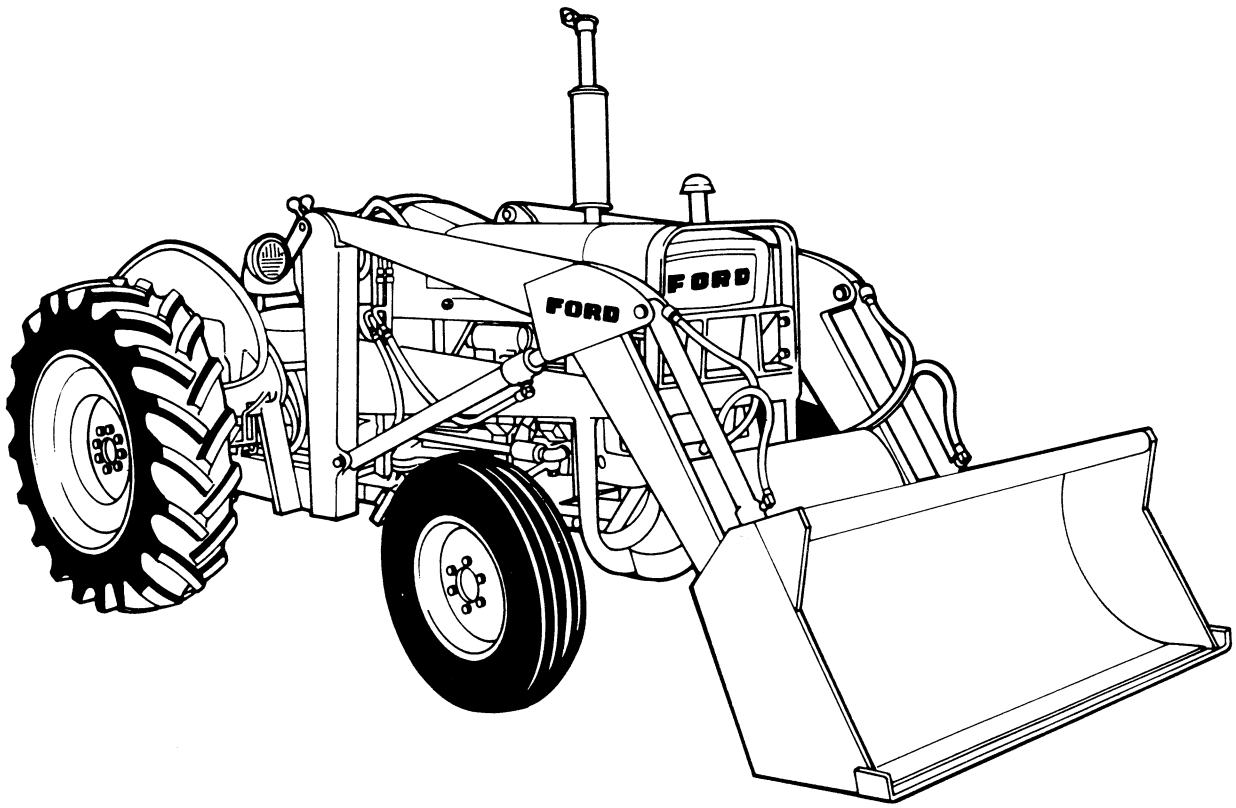
FORD

Service Manual

NEW HOLLAND

Loader
Series 727, 730, 735, and 740

40072740



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FOREWORD

THIS MANUAL CONTAINS SERVICE INFORMATION FOR THE FORD SERIES 727, 730, 735, AND 740 LOADERS. DETAILED INFORMATION IS PROVIDED ON DESCRIPTION AND OPERATION, TROUBLE SHOOTING, TESTS AND ADJUSTMENTS, COMPONENT OVERHAUL, LUBRICATION, AND SPECIFICATIONS. CONVERSION EQUIVALENTS OF THE SPECIFICATIONS USED IN THE TEXT ARE LISTED ON PAGES 114 AND 115.

INSTRUCTIONS FOR INSTALLING THE LOADERS, LOADER COMPONENTS, OR ATTACHING KITS ARE NOT COVERED IN THIS MANUAL. REFER TO THE APPROPRIATE OPERATOR'S AND ASSEMBLY MANUALS FOR DETAILED INFORMATION.

THE LOADERS ARE SIMILAR IN CONSTRUCTION AND OPERATION. HOWEVER, THERE ARE VARIANCES IN DIMENSIONS AND OTHER SPECIFICATIONS. PARTICULAR ATTENTION SHOULD BE GIVEN TO CORRECT LOADER SERIES IDENTIFICATION WHEN ORDERING PARTS OR WHEN SERVICING THE UNIT.

KEEP THIS MANUAL, ALONG WITH YOUR OTHER SERVICE LITERATURE, AVAILABLE FOR READY REFERENCE.

SERVICE DEPARTMENT
FORD TRACTOR DIVISION
FORD MOTOR COMPANY

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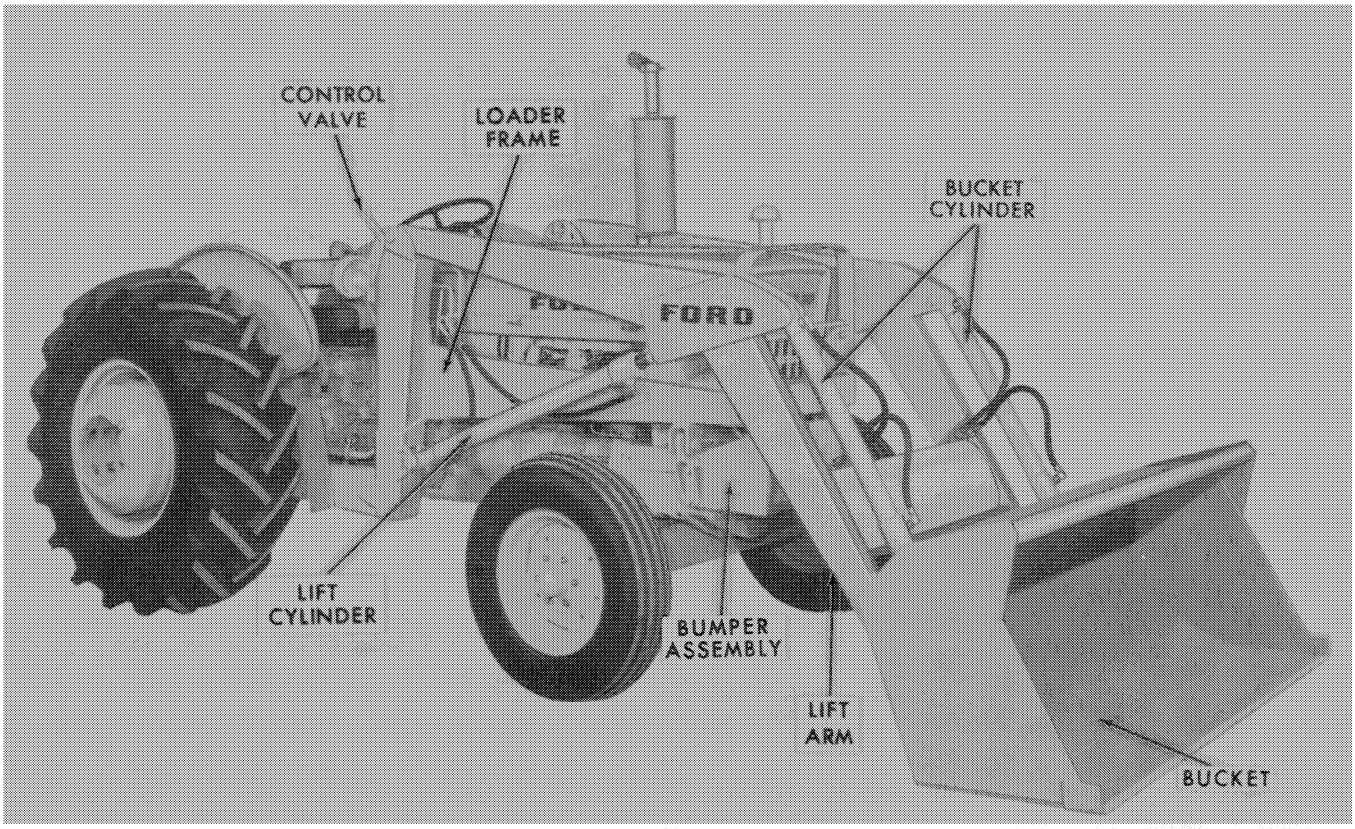

Figure 1
Loader Components

DESCRIPTION AND OPERATION

Each loader consists of a loader frame, lift arms, lift cylinders, bucket cylinders, control valve, hydraulic pump, and necessary hoses and tubes. The components of a basic loader are illustrated in Figure 1.

SERIES 727 LOADER

The Series 727 Loader is used with the Ford 4000 and Ford 5000 All Purpose Tractors. The loader uses the tractor hydraulic lift system. Loader control is accomplished by a double spool (plunger), tractor accessory, remote control valve. The two lift cylinders are single-acting displacement type and the one bucket cylinder is a double-acting type.

The tubing and hoses connecting the control valve to the cylinders are secured to the main frame. The loader frame is welded box-type construction and mounts at the tractor front support and at each rear axle housing. Separate attaching kits are used for the Ford 4000 and Ford 5000 Tractor installations.

SERIES 730 AND 735 LOADERS

The Series 730 and 735 Loaders are available as a non-self-leveling loader equipped with a unit-type control valve, or a self-leveling loader equipped with a stacked-type compensating control valve. These loaders are for industrial-type applications. Optional capacity front-mounted, crankshaft-driven hydraulic pumps power the loader. Loader control is accomplished by a control valve mounted on the right-hand post of the loader frame. The tubing and hoses connecting the control valve to the cylinders are secured to the mainframe.

On the self-leveling loaders, the loader control valve provides a bucket self-leveling feature utilizing pump hydraulic oil as its working force. As the loader lift arms are raised, the compensating section of the loader control valve adjusts the bucket to maintain approximately the original degree of bucket rollback.

In both types, the loader frame is welded box-type construction. Serviceable bushings (Series 735 only) are used in the loader lift arms and in the cylinders. A hydraulic filter, which has a safety bypass, is

incorporated in the bottom of the left-hand frame post to filter oil entering the pump inlet tube. Double-acting bucket cylinders are used and either single-acting (Series 730 only) or double-acting lift cylinders are available as detailed below.

Series 730 Loader

The loader frame attaches to the tractor front support and each rear axle housing. The various frames which may be encountered are as follows:

- Frame w/double-acting lift cylinders and unit-type control valve.
- Frame w/double-acting lift cylinders and float position unit-type control valve.
- Frame w/single-acting lift cylinders and unit-type control valve.
- Frame w/double-acting lift cylinders and float position stacked-type compensating control valve with or without selector valve.

Series 735 Loader

The loader frame attaches to each rear axle housing for all installations and to the front support on Serial 2130 and 4130, and Ford 4400 Tractors; and to the radiator cowling on Ford 3500 Tractors. The various frames which may be encountered are as follows:

- Frame for Ford 4400 Tractor with double-acting lift cylinders and float position unit-type control valve.
- Frame for Ford 3500 Tractor w/double-acting lift cylinders and float position unit-type control valve.
- Frame for Ford Series 2130 and 4130 Tractors w/double-acting lift cylinders and float position unit-type control valve.
- Frame for Ford 3500 Tractors w/double-acting lift cylinders and stacked-type compensating control valve with or without selector valve.
- Frame for Ford 4400 Tractors w/double-acting lift cylinders and stacked-type compensating control valve with or without selector valve.

Series 740 Loader

The Series 740 Loader is used only on the Ford 4500 Tractor, and will be found equipped with a two-section stacked-type control valve with float position, or a three-section stacked-type compensating control valve with float position with or without selector valve.

The Series 740 Loader compensating control valve is the same as on the Series 730 and 735 Self-Leveling Loaders in that the valve provides float position in the lift circuit and a bucket self-leveling feature utilizing pump hydraulic oil as its working force. As the loader lift arms are raised, the compensating section of the control valve adjusts the bucket to maintain approximately the original degree of bucket rollback.

The loader hydraulic pump, control valve, hydraulic filter, and hydraulic reservoir are supplied with the tractor. The tractor side rails (loader subframe) act as the oil reservoir along with a hydraulic package reservoir located in the tractor radiator shell. The crankshaft-driven vane-type pump is mounted in the tractor front support. Oil drawn from the hydraulic package reservoir passes through a replaceable suction screen. Loader control is accomplished by a two-plunger control valve with float position, incorporated as a part of the tractor hydraulic package and mounted on the post of the right side rail (loader subframe). A replaceable hydraulic filter which has a safety bypass, is included as a part of the tractor hydraulic package. The filter assembly is located in the reservoir tank and filters the oil returning from the control valve.

Double-acting lift and bucket cylinders with serviceable bushings are used. The lift arms, with serviceable bushings are of box-welded construction, and attached to the side rail posts.

DESCRIPTION AND OPERATION

PUMPS

SERIES 727 LOADER

The pump used for the Series 727 Loader is an integral part of the tractor hydraulic lift system. Servicing procedures for the pump are covered in the Tractor Repair Manual, SE 9205.

SERIES 730, 735, AND 740 LOADERS

The hydraulic pump for the Series 730, 735, and 740 Loaders is crankshaft-driven and is mounted either internally or externally on the tractor frame depending on the tractor model.

VANE PUMP

Figure 2 shows a cutaway of the hydraulic pump, showing the relative location of the parts assembled. Figure 3 is an exploded view identifying the component parts.

The rear cover acts as the high-pressure chamber for the oil forced out of the pump. A high-pressure line connects to the pump pressure port and subsequently to the control valve. The high-pressure port positioning varies on some tractor installations. Drilled holes in the casting serve as guides for the four through bolts.

The pressure plate is positioned between the cam ring and the rear cover. A compression spring holds the pressure plate in position. The pump shaft extends into the pressure plate and rotates in a bronze bushing. During operation the plate seals the rear end of the rotor and vanes. It channels both low-pressure and high-pressure oil within the pump, and it relieves the pressure trapped between the rotor and vanes during the high pressure discharge cycle.

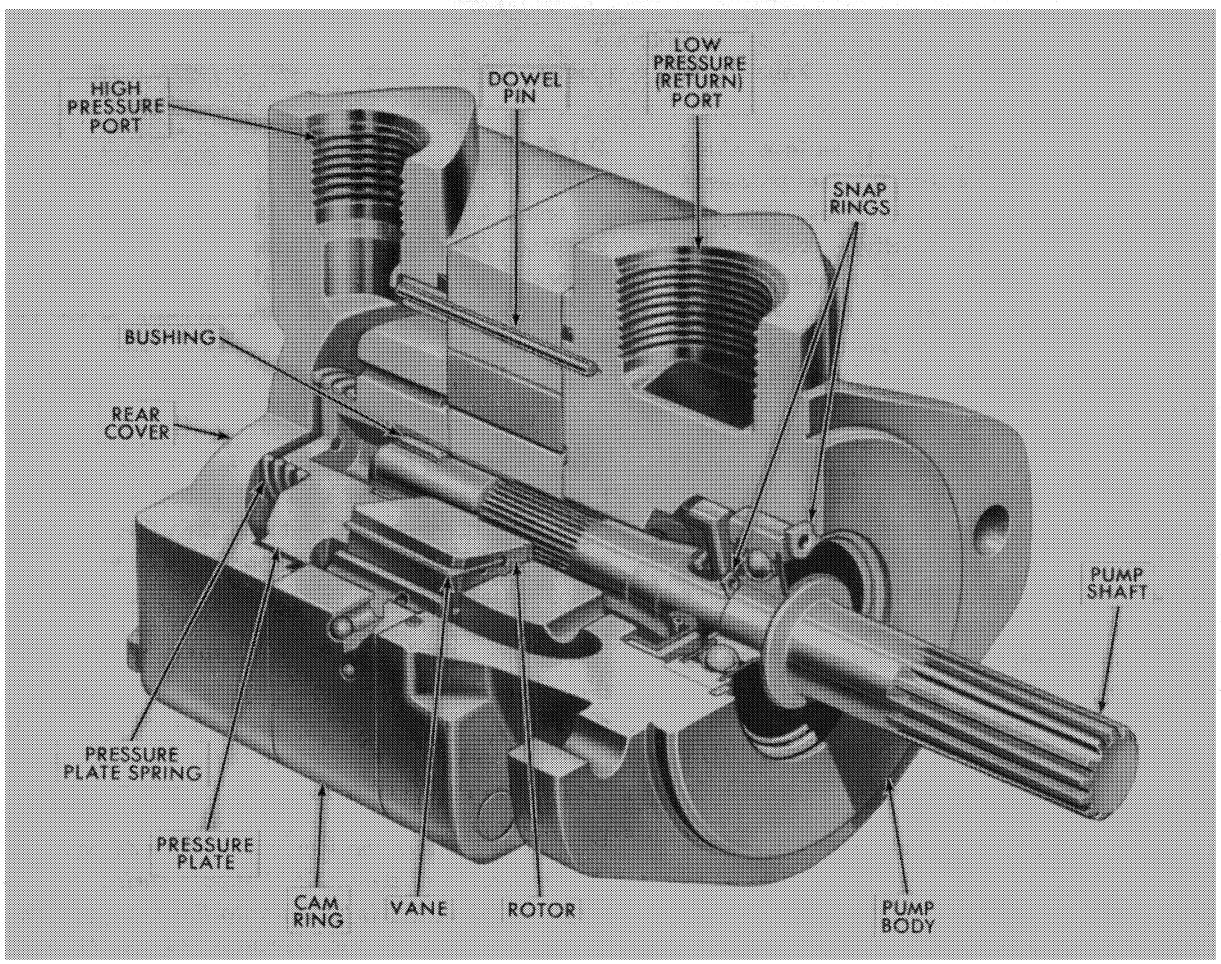

Figure 2
Vane-Type Hydraulic Pump

DESCRIPTION AND OPERATION

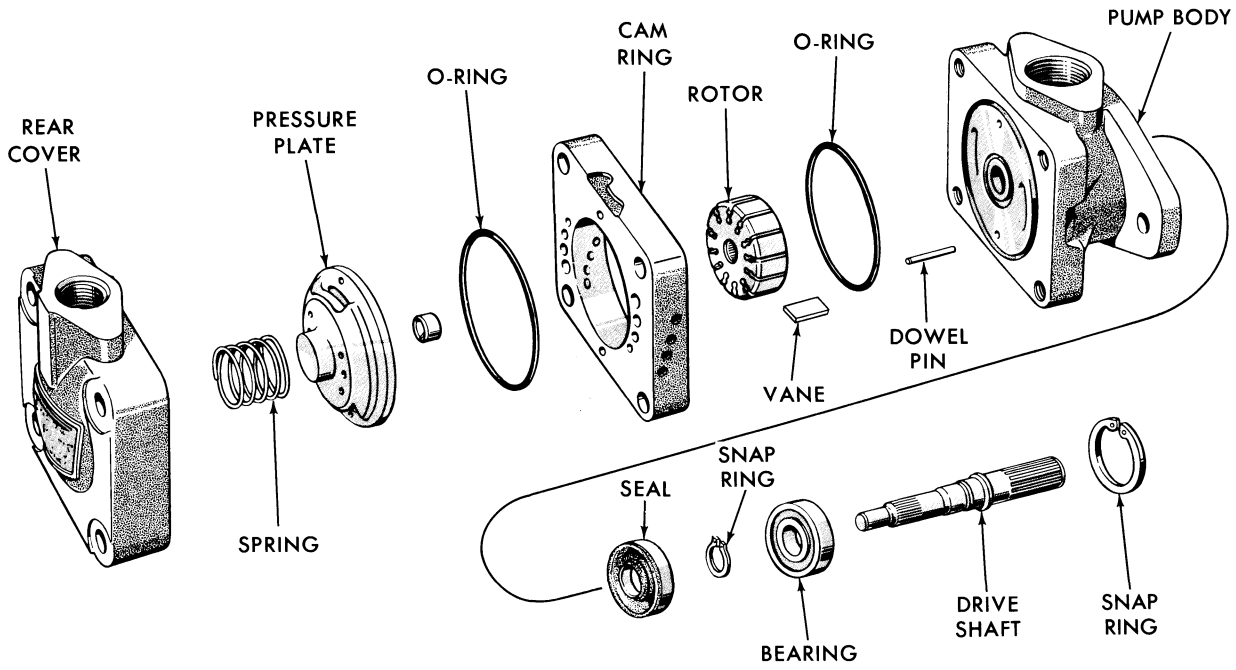

Figure 3
Vane Pump – Exploded View

The cam ring has an elliptical inner surface which the vanes follow in their movement. Internal passages in the cam ring furnish oil to the vanes. The cam casting is stamped with an identifying code (refer to page 10), and an arrow to aid in assembly for proper pump rotation. Two dowel pins located between the pressure plate and the pump body locate the cam ring and pressure plate in proper relationship to the pump body.

The rotor is splined on the pump drive shaft and carries the twelve vanes around the elliptical inner surface of the cam ring. The slots in which the vanes are located are machined to allow radial movement of the vanes. Bored passages in the rotor slots allow pressured oil to enter. This pressured oil aids in forcing the vanes against the inner surface of the cam ring, and provides lubrication for the vanes.

The two O-rings, Figure 3, seal each side of the cam ring, preventing oil leakage between the pump sections. The rear O-ring also seals against the outer diameter of the pressure plate, preventing high-pressure oil from bypassing back to the low-pressure side of the pump.

Oil Flow

Figure 4 illustrates two sectional views of the pumping cartridge describing the pumping cycle. Figure 5 shows the flow of oil through the pump body and to the rotor area, and subsequently to the pump outlet.

Oil enters the pump body at the low pressure port, Figure 5, and divides into two paths; one going to the right kidney-shaped port and the other to the left kidney-shaped port. These ports, or openings, are open to the vanes and to the five axially drilled passages in each side of the cam ring. Some oil enters the area of the vanes, while some passes through the cam ring into kidney-shaped ports in the pressure plate. Oil in the kidney-shaped ports of the pressure plate can also enter the area of the vanes.

NOTE: *Oil enters the vanes at both ends and in the center section to provide full supply during the short time available. Oil is forced into the pump by atmospheric pressure of approximately 14 psi (1 atmosphere). Mechanical action forces oil out of the pump through the outlet in the pressure plate.*

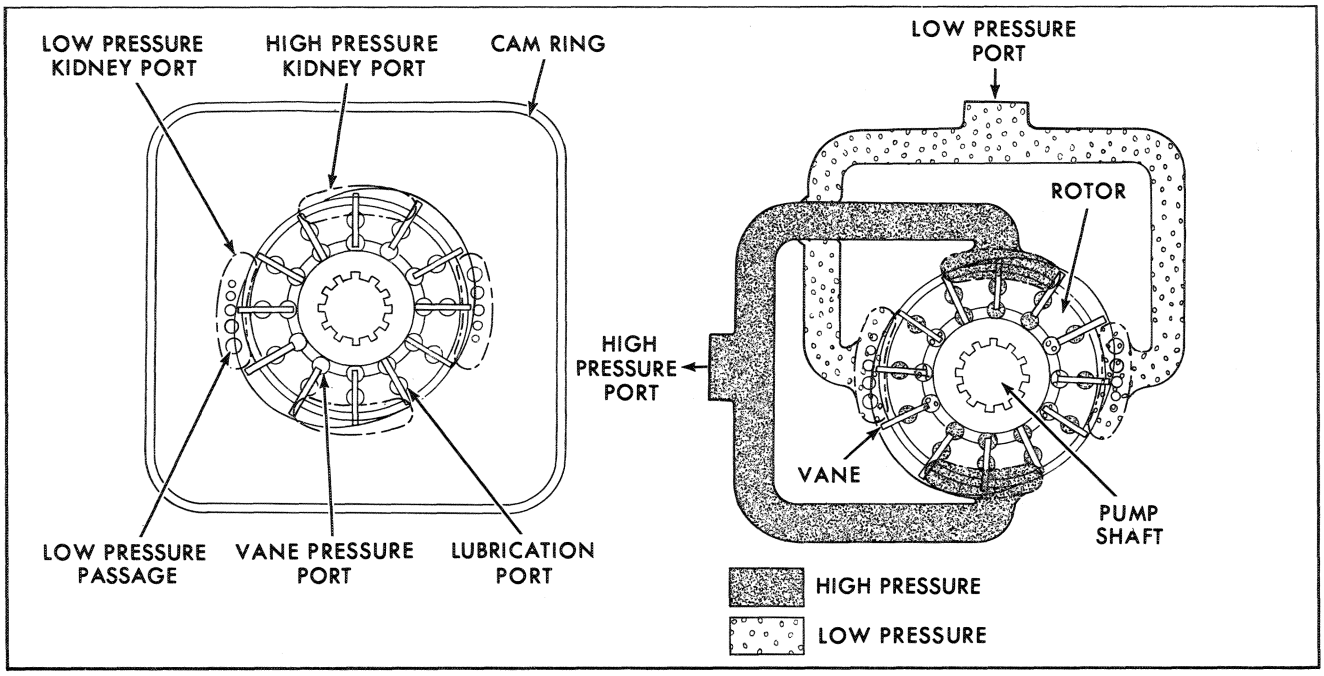

Figure 4
Pumping Cycle

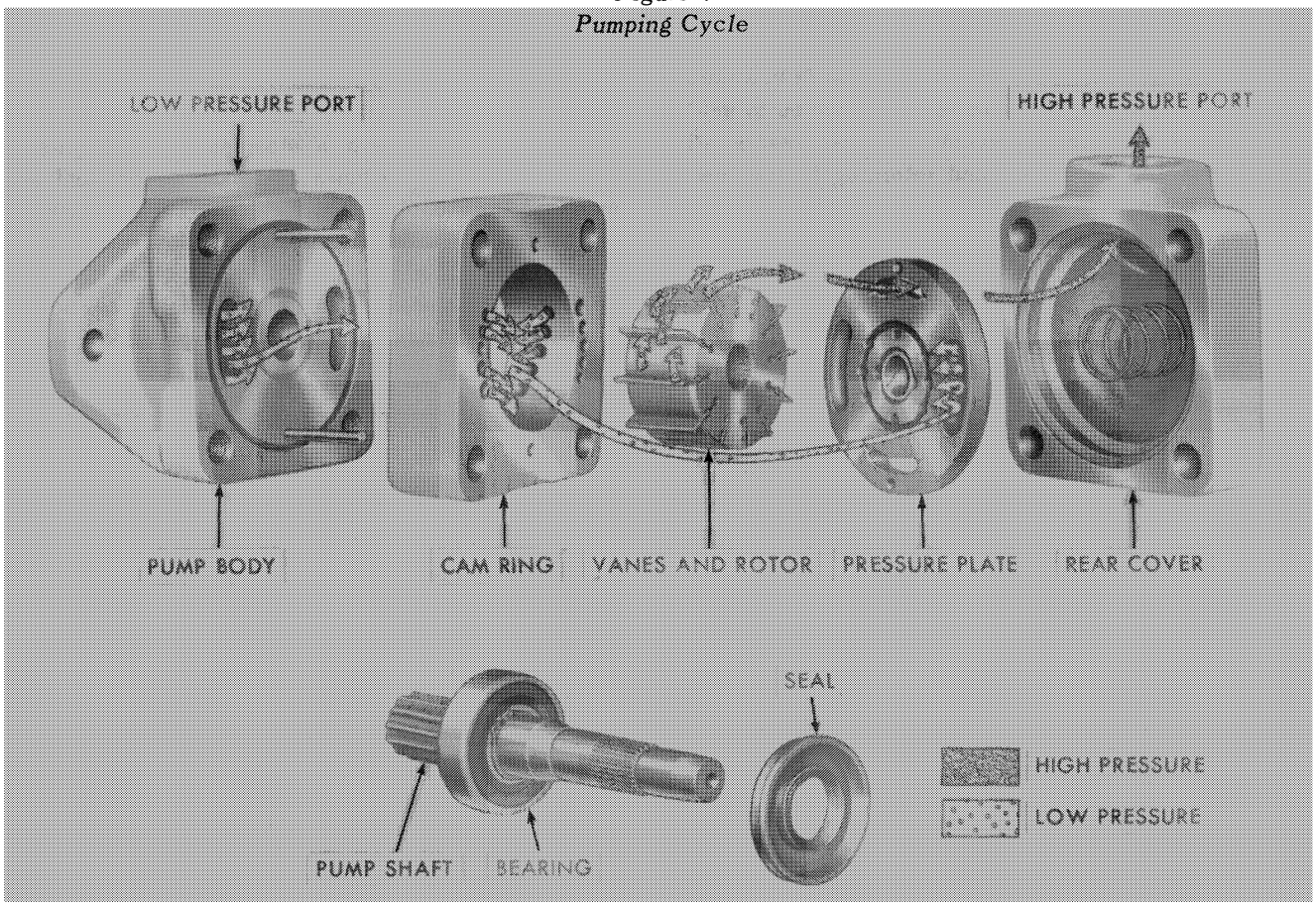

Figure 5
Pump Oil Flow

DESCRIPTION AND OPERATION

The two drilled passages in each vane slot in the rotor, Figure 5, are for lubrication and pressure seal. The inner passage supplies oil at pump pressure to the bottom edge of the vanes moving them outward during the intake cycle keeping them in contact with the cam ring. As wear occurs, oil pressure forces the vanes out of their slots to the cam ring surface and forces the rear pressure plate forward toward the vanes and rotor.

During the pressure cycle, the vanes are forced inward by the cam ring contour and the oil trapped below is forced to the bushing area for lubrication of the pump shaft. This oil then returns to the low-pressure side through the splines between the pump shaft and rotor.

Small notches, illustrated in Figure 5, at each end of the high-pressure ports in the pressure plate, serve to meter initial high-pressure oil out from between the vanes.

High-pressure oil in the rear cover, Figure 6, forces the pressure plate against the rotor and vanes to seal the side of the pump, preventing high-pressure oil from bypassing the vanes and returning to the low-pressure ports.

One of the features of the hydraulic pump is that all loads are balanced by counteracting forces. The pumping cycle takes place through 180° of revolution,

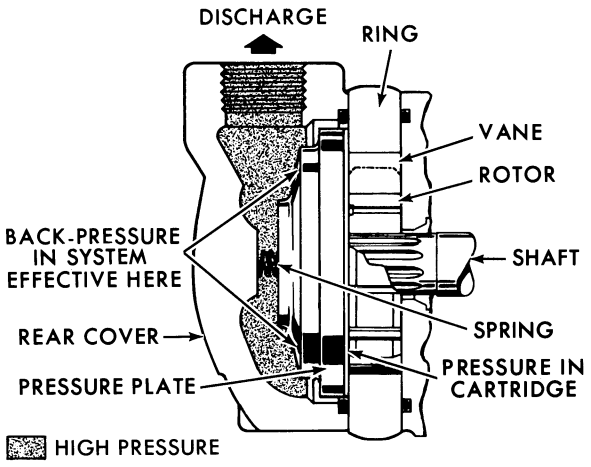

Figure 6
Rear Cover – Sectional View

thus the high-pressure oil is produced on opposite sides of the pump. This balancing of forces reduces the loads carried by the bearings. Through 360° of revolution, oil enters the vane area twice and leaves the pump area twice.

Pump Identification

The cam rings have a stamped code, Figure 7, which identifies the pump as to component and part number. This coding is for identification purposes only. It indicates the manufacturer's flow rating under "no-load" at 1200 rpm. The following chart indicates application, pump identifying codes, component numbers or part number, and rated capacities:

Loader Series	*Pump Code Number*	*Component or Part Number*	*Rated Capacity*	*System Pressure (165° F. ± 15° F.)*
730	9	19-415	11.3 gpm 11.1 gpm	2000 psi @ 1700 rpm 2200 psi @ 1700 rpm
730	12	19-414	15.8 gpm 15.5 gpm	1800 psi @ 1700 rpm 2200 psi @ 1700 rpm
735	12	19-414	15.8 gpm 15.5 gpm	1800 psi @ 1500 rpm 2200 psi @ 1500 rpm
735	13	19-413	17.8 gpm 17.5 gpm	1800 psi @ 1500 rpm 2200 psi @ 1500 rpm
740	17	C5NN-600-K	21.3 gpm 20.5 gpm	1600 psi @ 1700 rpm 2200 psi @ 1700 rpm

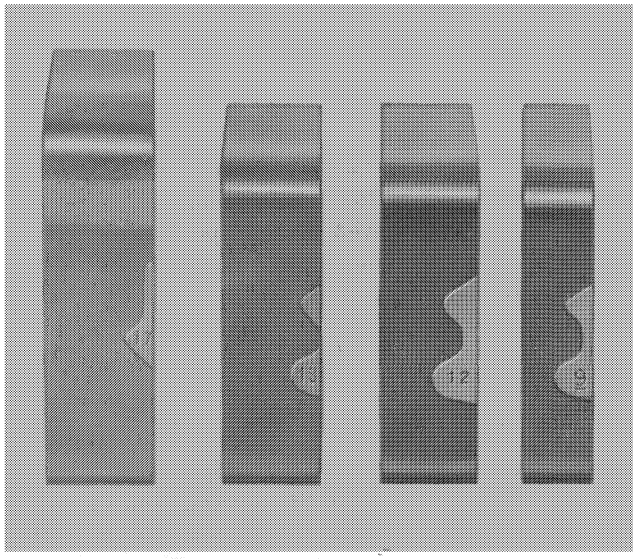

Figure 7
Pump Cam Ring Identification

GEAR PUMP

The gear-type hydraulic pump for the Series 730, 735, and 740 Loaders is crankshaft-driven and is mounted either internally or externally on the tractor frame depending on the tractor model.

Figure 8 is an exploded view identifying the component parts.

The gear-type pump is driven in a clockwise direction and delivers oil, taken from the reservoir, to the control valve. Oil enters the pump at the inlet port and is transported via the two gears to the pump outlet (pressure port). Pumping action takes place as the drive gear rotates the driven gear. As the gears unmesh, oil fills the spaces between the gear teeth and is carried to the outlet side of the pump. As the gears begin to mesh, the oil is forced from between the teeth, thus building pressure and forcing oil out through the outlet port.

A small amount of oil that is being transported by the gears during pumping action is allowed to pass by the gears to lubricate the pump. This lubricating oil passes along oil grooves in the bearings thus lubricating the gear shafts. The shaft cavities are connected by passages to insure adequate lubrication of the gear shafts.

As pressure builds within the system, it is transmitted back to the pump outlet, forcing the check balls off their seats. This action permits the pump lubricating oil to flow past the check valve, Figure 9, back to the gears which deliver it into the system. Thus, there is constant lubrication of the pump, and sufficient pressure is maintained to seat the seals within the pump.

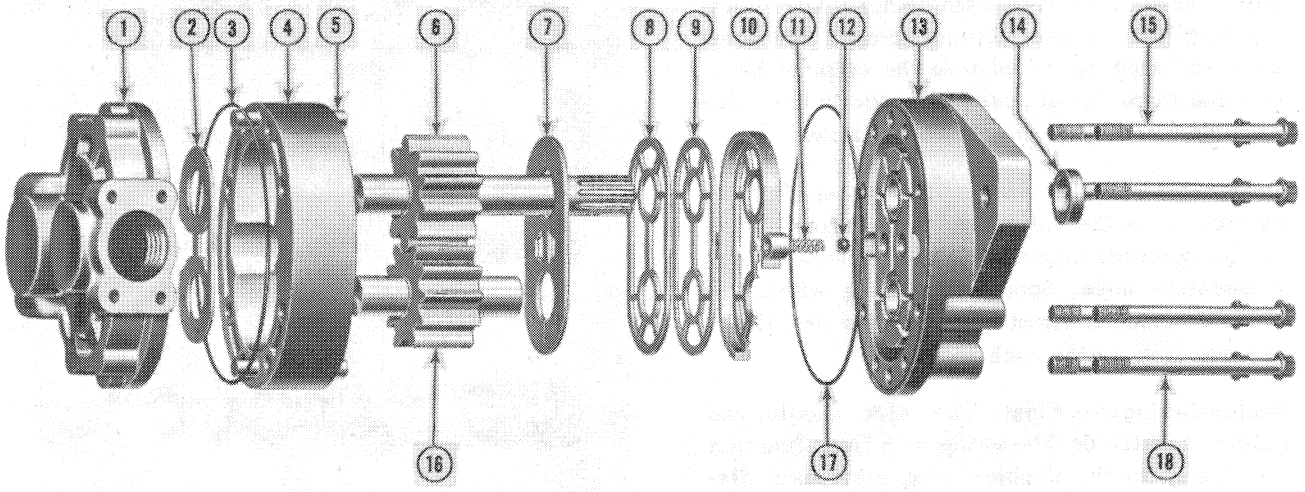

Figure 8
Gear Pump – Exploded View

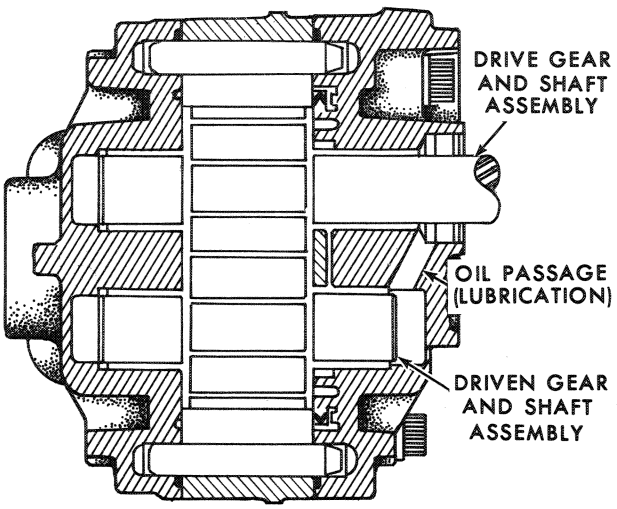

Figure 9
Gear Pump Lubrication

CONTROL VALVE

GENERAL INFORMATION

In discussing control valves, cylinders, and spools, reference is made to single-acting, double-acting, double-acting with float, and double-acting with float and compensating. The terminology used relates as follows:

- **Single-Acting:** Oil flows to the cylinder from the valve and spool through a single hose. Oil returning from the cylinder returns through the same hose and must be forced from the cylinder by an external force. Spool positioning within the valve passage determines direction of oil flow.

- **Double-Acting:** Oil travels to one end of the cylinder from the valve through one hose, while oil being forced from the cylinder returns through a separate hose. Spool positioning within the valve determines direction of oil flow and allows two-way flow within each hose.

- **Double-Acting with Float:** The valve, spools, and cylinders of the double-acting with float, function identically to the double-acting previously discussed. A modification has been made in the valve lift spool configuration for a detent mechanism which holds the spool open and permits oil to flow in either direction when an external force is applied.

- **Double-Acting with Float and Compensating:** The cylinders and float position function the same as above. Oil flow through an external check valve, located in the circuit between the rod end of the right-hand lift cylinder and the control valve, and through the compensating section of the control valve, determines the self-leveling of the bucket. The lift handle moves the lift spool and the comsating spool, whereas the bucket handle moves only the bucket spool.

SERIES 727 LOADER

The remote control valve for the Series 727 Loader is mounted on the tractor lift housing and operates from the tractor hydraulic lift system. Refer to the Remote Control Valve section of the Tractor Repair Manual, SE 9205, for detailed information for servicing the valve.

UNIT-TYPE CONTROL VALVE (SERIES 730 AND 735 LOADERS)

The non-self-leveling loader control valve for the Series 730 and 735 Loaders is of the unit valve type. For information pertaining to the compensating, three-section, stacked-type control valve, refer to

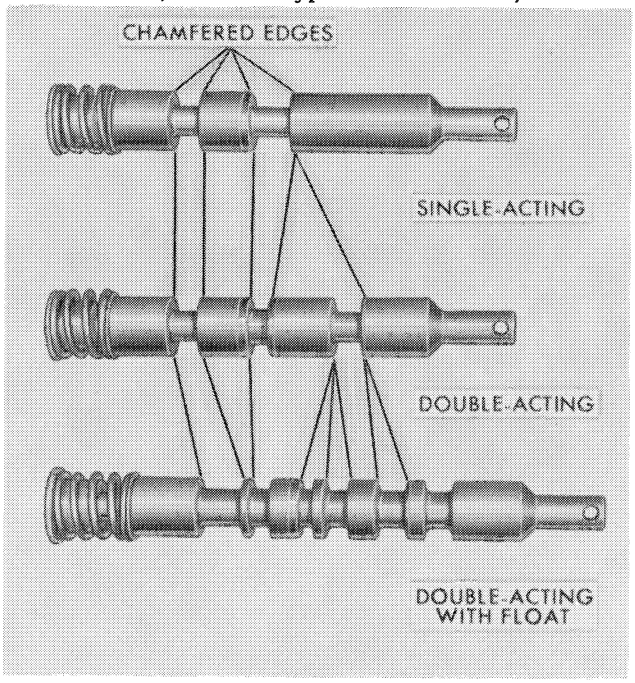

Figure 10
Unit-Type Control Valve Spools

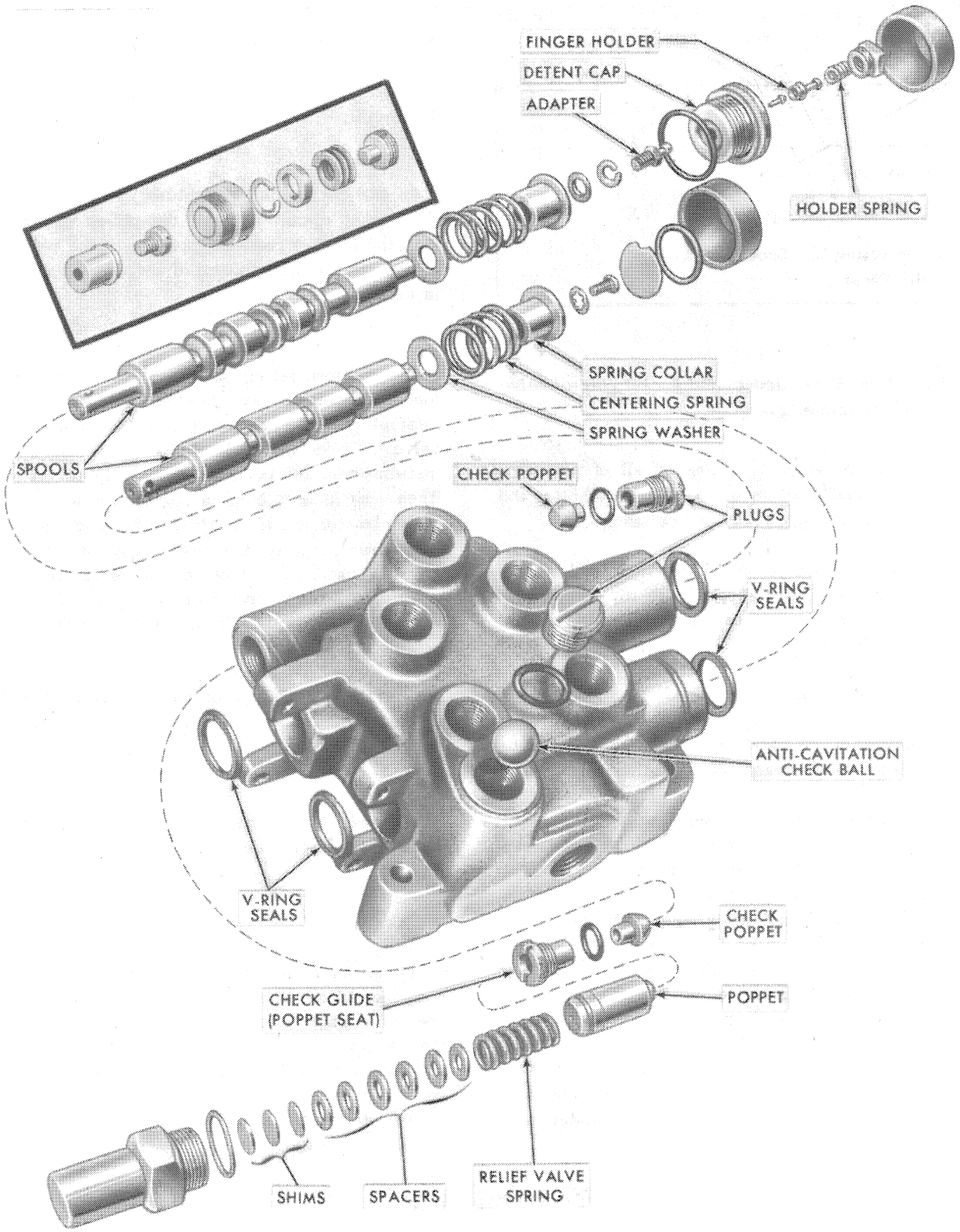

Figure 11
Unit-Type Control Valve with Float and Double-Acting Lift Spool

Page 26. The various valve arrangements for the unit-type valve are as follows:

	Series 730	*Series 735*
Single-Acting Lift Spool	X	
Double-Acting Lift Spool	X	
Double-Acting Lift Spool with Float	X	X

NOTE: *All bucket cylinders and bucket control valve spools are double acting.*

The cast iron valve body houses all of the valve components and acts as an attaching point for the high- and low-pressure tubes and cylinder hoses.

Mounting bolts attach the control valve body to the loader frame. Valves equipped with the float spool and detent mechanisms have a longer extension at the lift spool bore.

Valve spools are constructed of high carbon, ground, polished and chrome-plated steel. Three types of spools are used in these valves. Refer to Figure 10 for spool identification and configuration.

The centering spring, washer, and spring collar, Figure 11, are attached to the end of the spool and function to return the spool to the neutral position when the valve handles are released. On spools equipped with the float mechanism, the spring end contains an adapter, detent cap, control valve finger, finger holder, and spring holder. The detent mechanism is a spool locking device which must be manually released to permit the spool and valve to return to the neutral position. Each valve spool is selectively fitted to its respective spool bore. Because of this selective fitting, the spools are ***not*** interchangeable. If the spools are damaged, the valve and spool must be serviced as an assembly.

The adapter, Figure 11, threads into the end of the spool. Spring fingers, located in the cap, grip the knot on the end of the adapter. This mechanism overrides the centering spring to hold the spool in the "float" position.

Check valves are located in the valve body and function to prevent the cylinder oil from leaving the cylinder when the valve is opened, until sufficient pressure is developed to overcome the pressure in the circuit.

An anti-cavitation (anti-voiding) valve functions in the bucket circuit between the piston end cylinder port and the low pressure passage of the valve. The check valve is constructed of industrial nylon to aid in long life.

The system relief valve serves to protect the loader components from damage caused by excessive internal pressure. Oil supply to the loader control valve is from the hydraulic pump. In loader only installations, oil is supplied directly to the valve. When a backhoe is used in conjunction with a loader on the tractor, oil is supplied to the backhoe control valve and then to the loader control valve. The loader control valve receives all of the pumped oil circulated through the backhoe main control valve while the backhoe spools are in the neutral position.

Both the loader control valve and backhoe main control valve incorporate system relief valves as integral parts of the units.

NOTE: *The loader control valve system relief is set at a lower relief pressure than the backhoe system relief.*

The loader relief valve acts to protect the loader components from excessive pressure while the backhoe main control valve system relief acts to protect the backhoe components. Thus, the loader control valve, when used in combination with a backhoe control valve, is linked in series with the backhoe main control valve by means of a "series" or power-beyond plug.

The system relief valve is adjustable to increase or decrease system pressure. Shims are used to increase or decrease spring compression which in turn determines system pressure.

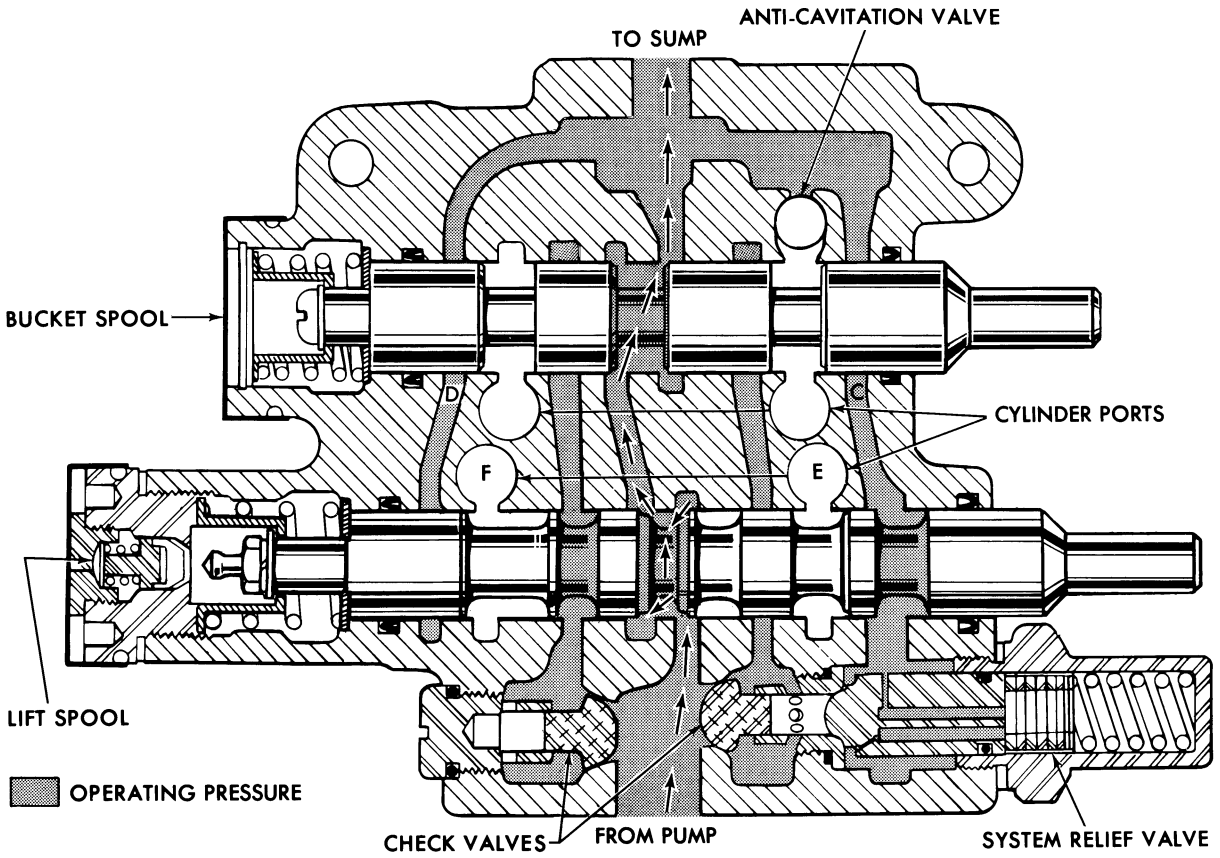

Figure 12
Unit-Type Control Valve – Neutral

General Oil Flow

Figure 12 illustrates a sectional view of the control valve. Oil flow through the valve open center with the spools in neutral, circulates freely to the reservoir. Oil in the cylinders is trapped because of the closing of the passages by the control valve spools.

Pumped oil enters the valve at the inlet and flows through the open center, past the spools to the outlet, as shown.

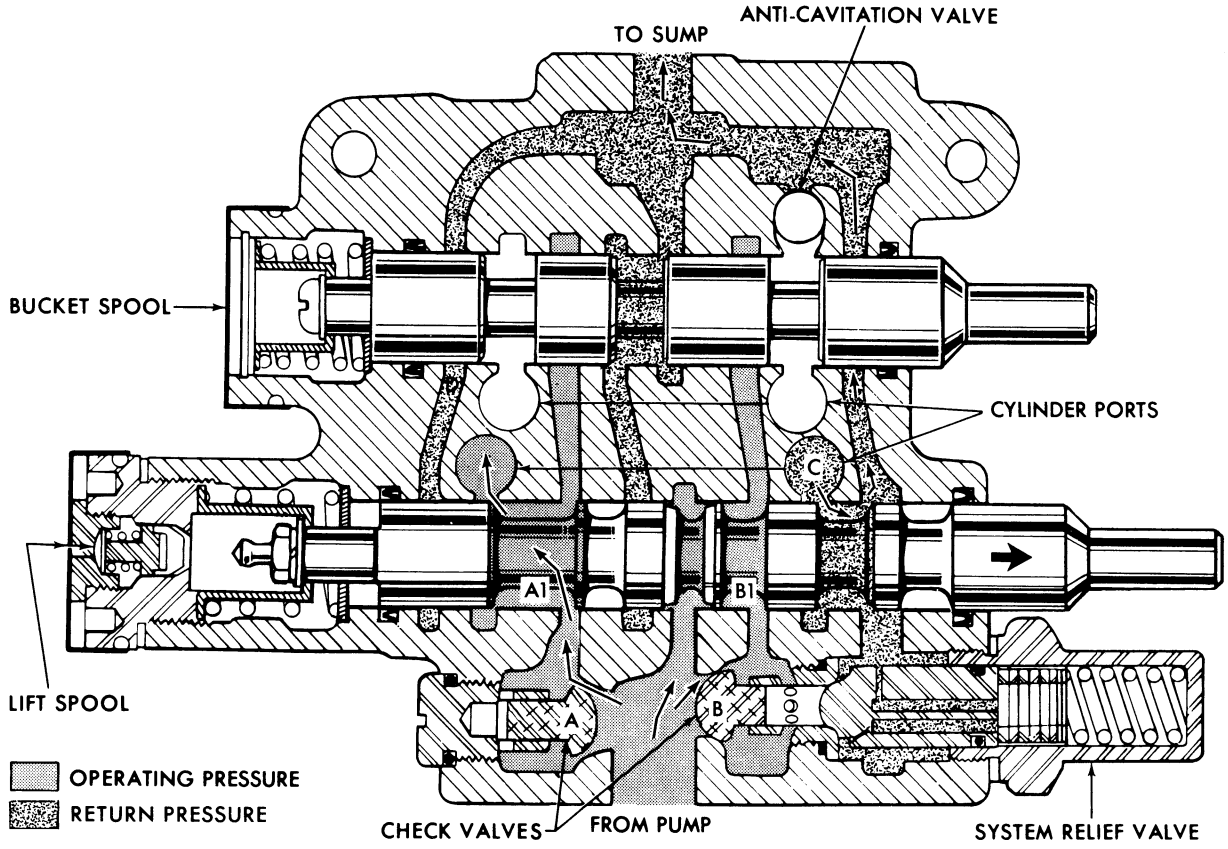

Figure 13
Unit-Type Control Valve – Lift Spool Raising

Lift Spool – Raising

Figure 13 illustrates oil flow through the unit valve with the lift spool moved to direct oil to the piston end of the lift cylinder. Oil entering the valve at the inlet port is blocked by the positioning of the spool land, causing a pressure increase. As pressure builds, check valves (A) and (B) unseat to allow pressured oil to enter passage (a_1) and (b_1). Oil travels past the spool land in passage (b_1) and to the cylinder hose port. Return oil from the cylinder is dumped into the low pressure passages (C) and flows to the loader reservoir.

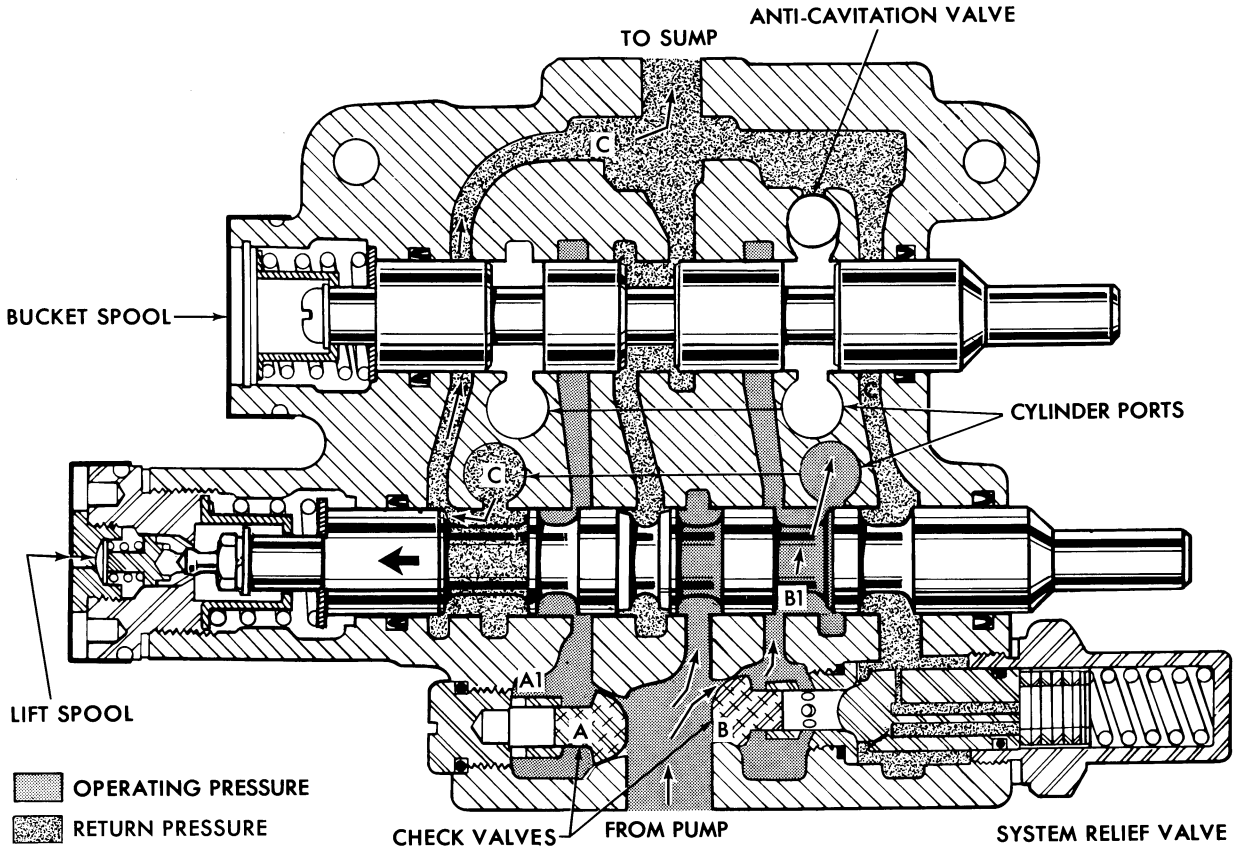

Figure 14
Unit-Type Control Valve – Lift Spool Lowering

Lift Spool – Lowering

Figure 14 illustrates oil flow through the control valve with the lift spool moved to direct oil to the rod end of the lift cylinder. Oil entering the valve at the inlet port is blocked by the positioning of the spool land, causing a pressure increase. As pressure builds, check valves (A) and (B) unseat to allow pressured oil to enter passages (a_1) and (b_1). Oil travels past the spool land in passage (b_1) and to the cylinder hose port. Return oil from the cylinder is dumped into the low pressure passages (C) and flows to the loader reservoir.

Bucket Spools – Raising and Lowering

Oil flow during right and left positioning of the bucket spools for control of bucket movement is basically the same as that during movement of the lift spool previously discussed. The anti-cavitation feature is discussed below.

Anti-Cavitation (Anti-Voiding) Valve Operation

The anti-cavitation (anti-voiding) valve is located between the bucket cylinder piston end port and the low pressure or sump passage, Figure 15. During the dumping procedure, particularly with the bucket fully loaded, oil can be forced out of the rod end of the cylinder faster than the pump can supply oil to the piston end of the cylinder. A void (air bubble) will be formed in the piston end of the cylinder if there is lack of oil supply. To supplement pump oil, the oil leaving the rod end flows to the piston end through the anti-cavitation valve instead of returning to sump.

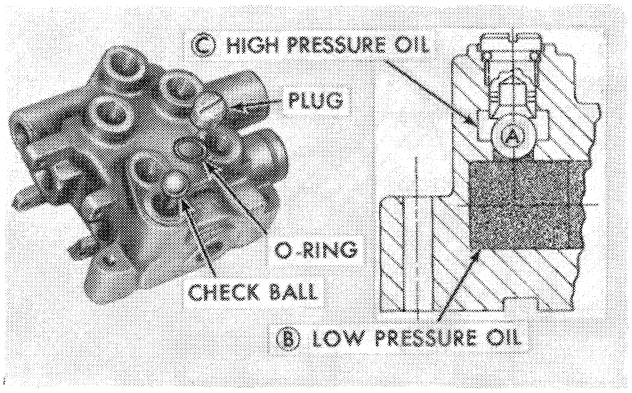

Figure 15
Anti-Cavitation Valve

In operation, the valve functions when oil leaving the rod end exceeds the pumped oil supply. The low-pressure oil (B), Figure 15, in the reservoir passage pushes the check ball (A) off its seat; the oil then enters the cylinder port (C), supplementing the pump oil going to the piston end of the cylinder. When pump oil supply is sufficient to build pressure, the check ball (A), is forced back to its seat and held by the high-pressure oil (C).

Float Operation

When the lift spool, Figure 16, is moved completely left, the detent mechanism engages to hold the spool in this position. With the spool in this position, oil is permitted to flow freely between the rod end and the piston end of the lift cylinders as illustrated. The pump oil also flows directly through the open center (as if in neutral). Oil will be forced from either end of the cylinder as external forces are applied. The bucket will rest on the ground and the loader lift arms will float or follow the ground contour. There will be no down pressure or lifting pressure.

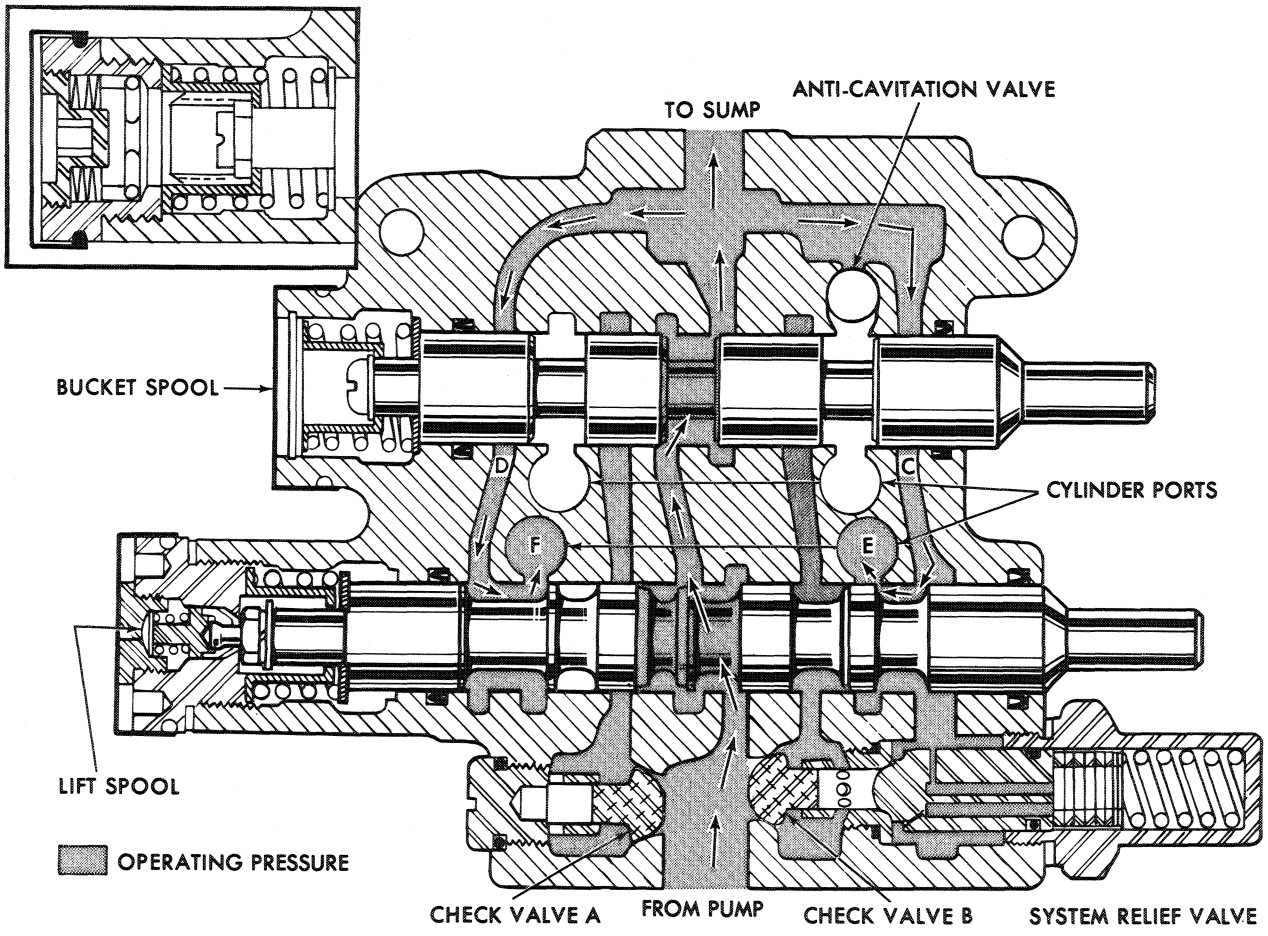

Figure 16
Unit-Type Control Valve – Float Position

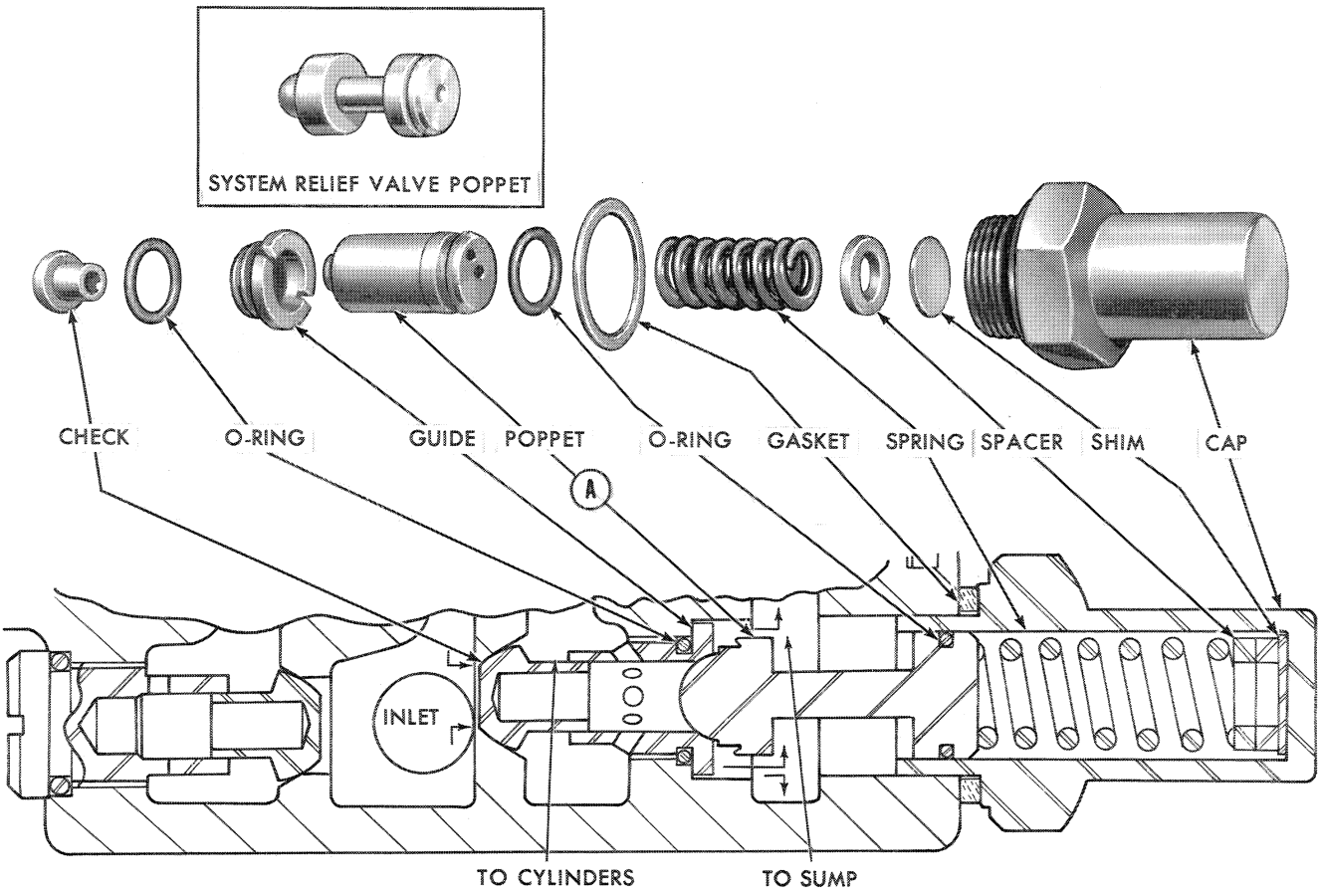

Figure 17
Unit-Type Control Valve – System Relief

Oil travels through passages (C) or (D) from either port (E) or (F), depending on whether a raising or lowering condition is encountered. Oil being forced out, or displaced from the cylinder end, circulates to the other cylinder end through the internal low-pressure passage in the valve.

System Relief Valve Operation

The system relief valve, Figure 17, is located between the high-pressure passage and the low-pressure passage.

NOTE: *There are two designs of the system relief valve poppet in production. See Insert, Figure 17.*

When a spool is moved, oil is directed to one end of the cylinder. If the cylinder stalls, is restricted, or reaches the end of its stroke, oil pressure builds in the system. To protect against this pressure increase, the relief valve opens and allows high-pressure oil to return to sump.

The valve is the direct operating type valve, in that oil forces the valve from its seat, enters the low-pressure passage, and goes to sump. System pressure is adjusted by adding or removing shims from behind the compression spring.

In operation, oil entering the inlet port normally is maintained below the pressure required to unseat the relief valve poppet (A), Figure 17. When system pressure exceeds the setting of the relief valve (see "Specifications", page 108), the poppet moves to allow oil to flow into the inner area of the relief valve which connects to the sump passage. As system pressure decreases, the spring force causes the poppet to seat. All pumped oil, within pressure specification limits, then enters the internal passages of the control valve and is directed to a cylinder or to sump.

Cylinder Check Valve Operation

Check valves (A) and (B), Figure 16, are located in both high pressure passages of the control valve. When a hydraulic cylinder is under load and a valve spool is moved to actuate the cylinder, there would be a momentary tendency for oil to flow in the opposite direction. The check valves keep the circuits closed until there is sufficient flow and pressure to overcome the load on the cylinders.

Flow Restrictor Valve Operation (Series 730 Loaders)

A flow restrictor valve, Figure 18, is installed between the bucket cylinder rod end hose and the control valve on Series 730 Loaders. The purpose of this valve is to restrict oil flow returning to the control valve during the bucket dumping cycle. A heavily loaded bucket will force unrestricted oil from the rod end of the bucket cylinder faster than the oil can enter the piston end. Normally, the anti-cavitation valve will supply oil to supplement the volume difference between the rod end and the piston end of the cylinders; however, with a small volume pump, the required oil cannot be supplied as rapidly as needed. Therefore, the restrictor valve is used to slow the flow in one direction only. This reduces the possibility of voiding in the cylinders.

The standard restrictor provided with the loader has an 11/64-inch orifice. This size orifice will restrict the oil sufficiently for the normal operating conditions. When the oil flows in the opposite direction, the sliding sleeve moves and permits unrestricted flow.

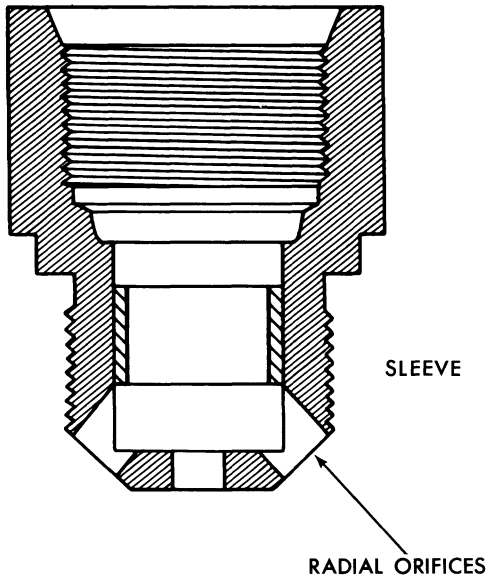

Figure 18
Flow Restrictor Valve

TWO-SECTION STACKED-TYPE CONTROL VALVE

The non-self-leveling loader control valve for the Series 740 Loaders used on Ford 4500 Tractors is a stacked-type valve assembly composed of two valve sections and two end covers, Figure 19. Each valve section and end cover is serviced separately.

The left-hand end cover houses the system relief valve and provides the inlet and outlet oil ports for the valve assembly. The valve sections contain the spools, check valves, and anti-cavitation valve. Each valve section contains internal passages through which the oil travels in going to and coming from the cylinder. Hose ports are incorporated in the valve sections and serve as valve attaching points for the cylinder hoses. The valve sections and end covers are held together by three through bolts and are sealed through the use of O-rings at each oil passage.

The right-hand cover seals against the bucket valve section and acts to direct oil to the outlet port of the control valve. Internal passages connect to the reservoir passages and the open-center pumped oil passage.

The spools are of high carbon, chrome-plated and polished steel. Each spool is selectively fitted to the section spool bore. Because of this selective fitting, the spools and sections are not interchangeable or serviced individually.

The spool in the lift section differs slightly from the bucket spool because of the float feature in the lift circuit. An additional land and groove in the float spool allows additional oil flow. The detent mechanism on the float spool end serves to hold the spool in position when float is desired. Each spool end contains a centering spring which functions to return the spool to the neutral position on release of the lever handle.

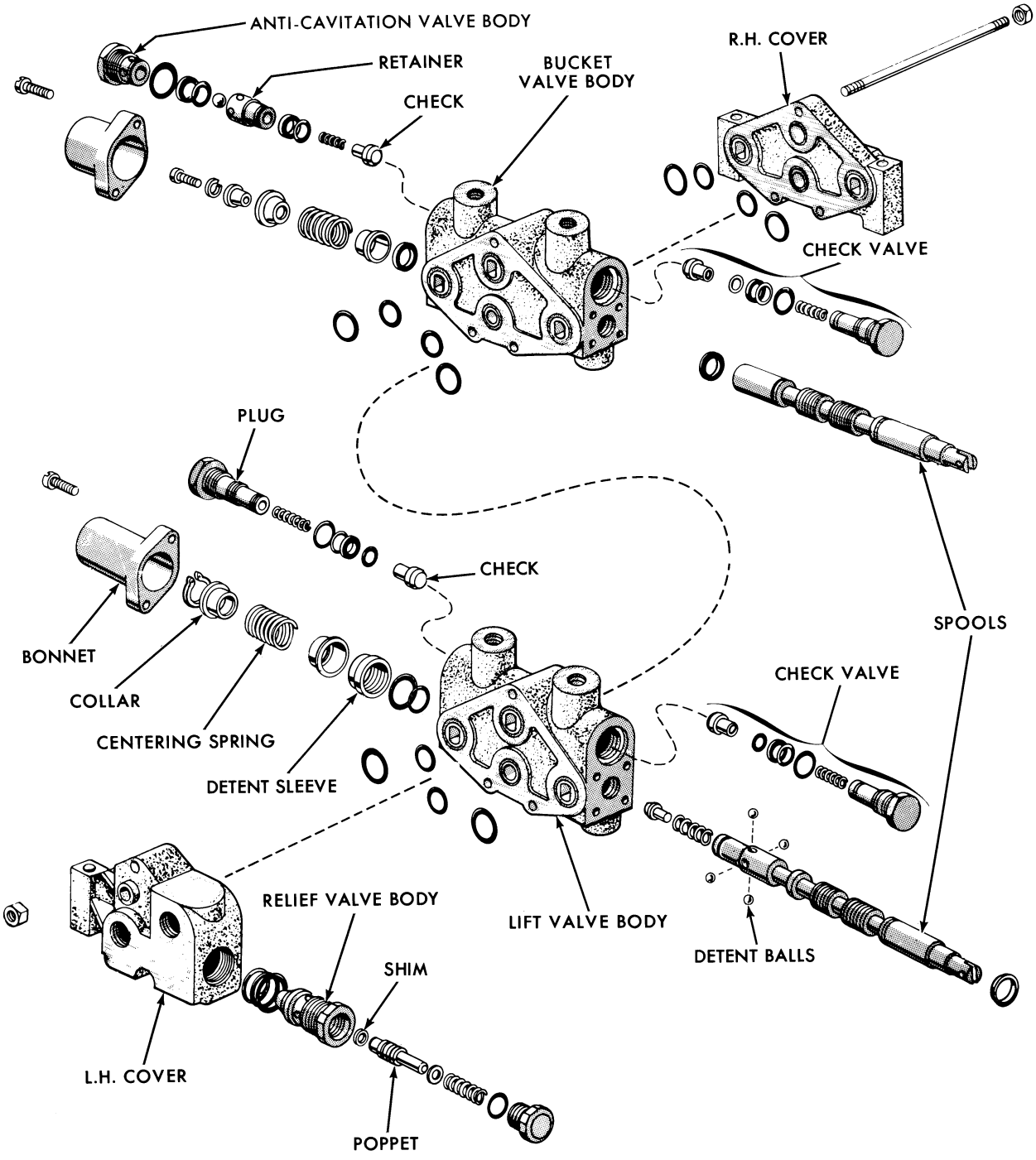

Figure 19
Stacked-Type – Two-Section Control Valve

Check valves are located between each spool and cylinder port. A combination check valve and anti-cavitation valve functions in the bucket section between the piston end cylinder port and the low-pressure passage of the valve. The check valve plugs are sealed against the valve body by O-rings. Internal sealing of the valves is accomplished by O-rings installed on the valve plug.

The system relief valve located in the left-hand end cover serves to protect the loader components from damage caused by excessive internal pressures. Oil supply to the valve is from the hydraulic pump. In the case of a loader only installation, oil is supplied directly to the valve. When a backhoe is used in conjunction with a loader on the tractor, oil is supplied to the backhoe control valve and then to the loader control valve. The loader control valve receives all of the pumped oil circulated through the main control valve with the backhoe spools in the neutral position. System pressure is maintained by the use of a power-beyond plug or series plug in the backhoe valve.

Both the loader control valve and the backhoe main control valve incorporate system relief valves as integral parts of the units. ***The loader valve system relief is set at a lower psi relief pressure than the backhoe system relief.*** As such, the loader relief valve acts to protect the loader components from excessive pressure while the main control valve system relief acts to protect the backhoe components. Thus, the loader control valve, when used in combination with a backhoe control valve, is linked in series with the main backhoe control valve.

The system relief valve is adjustable to increase or decrease system pressure. Shims are used to increase or decrease spring compression which in turn determines system pressure.

General Oil Flows

Figure 20 illustrates the stacked-type, two-section control valve assembly, showing the two valve sections and the two end covers. Also shown is the direction of oil flow through the valve when the spools are in the neutral position. Note that the valve sections contain four similar openings, and that the right-hand cover and left-hand cover contain three openings.

Oil flow through the valve, with the control valve spools in neutral, circulates freely to the reservoir. The oil in the cylinders is trapped because of the closing of the passages by the control valve spools.

Cylinder Check Valve Operation

Check valves are located in both ports of the bucket and lift sections of the control valve. The check valves function to hold the lift arms and the bucket in position at initial spool movement.

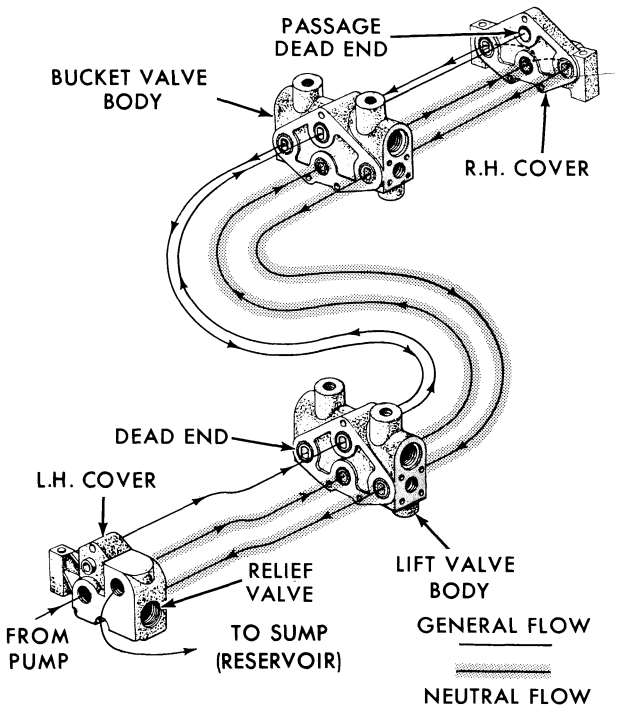

Figure 20
Stacked-Type Control Valve – Neutral

In operation, the check valve, Figure 21, is retained on its seat by spring force. At initial spool movement the natural tendency is for the oil, which is under external pressure, to seek passage at an area of lesser pressure. If the cylinder end passage is filled, the oil would then attempt to flow past the opened spool. This oil is held at the check valve until the pumped oil overcomes the force holding the check valve on its seat. As the pressure increases, the pressured oil unseats the check valve and pressured oil flows to the cylinder.

Lift Spool – Raising

Figure 21 illustrates oil flow through the lift section to the cylinder hose ports, with the spool moved inward, causing the lift arms to raise. Oil enters the inlet port of the lift section at (A). The spool lands block the oil from flowing through the valve section. All pumped oil is directed through drilled passages to passage (C) where it is blocked at the end plate. This causes an oil pressure buildup in passage (C). As the pressure increases, check valves (1) and (2) are unseated to allow pressured oil to enter passage (1a) and (2a). Oil is blocked at passage (1a) by the spool land. Pressured oil flows by the check valve

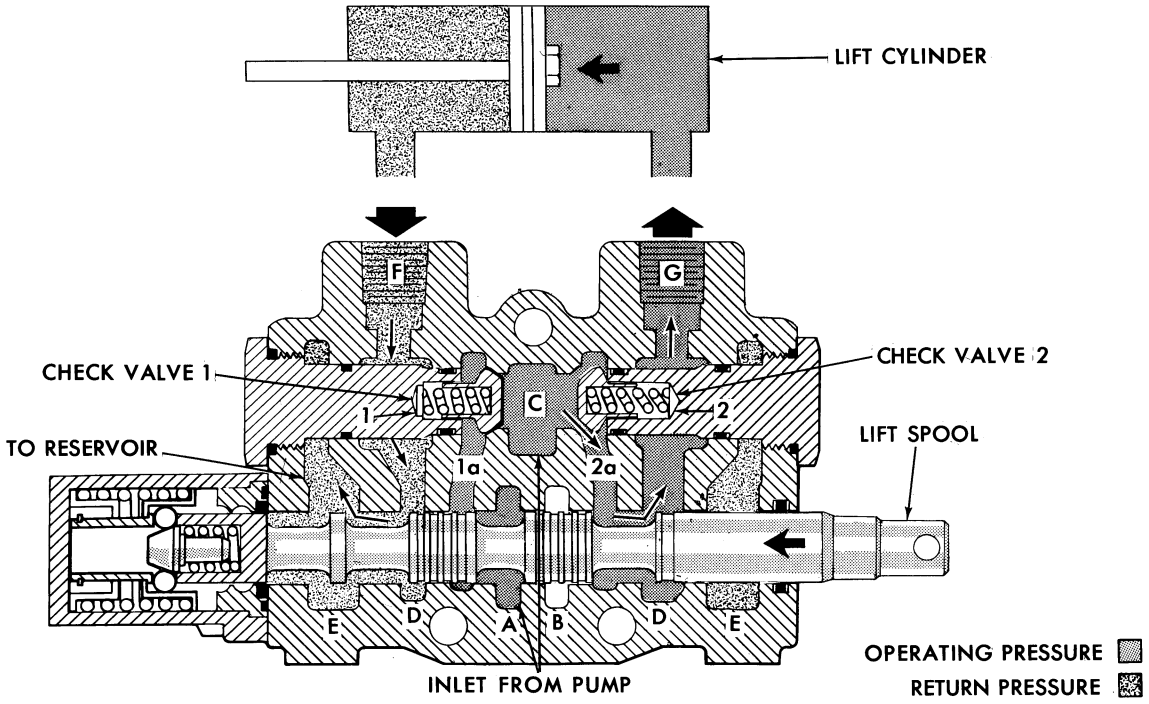

Figure 21
Stacked-Type Control Valve – Lift Spool Raising

(2), through passage (2a), around the spool, and to the hose port (G). From there it flows to the hose ports of the lift cylinders.

Oil forced out of the cylinders, by the action of the piston, enters the control valve at port (F) and travels to the reservoir through passage (E).

Lift Spool – Lowering

Figure 22 illustrates oil flow through the lift section to the cylinder hose ports, with the spool moved to the right, causing the lift arms to lower. Oil enters the inlet port of the lift section at (A). The spool lands block the oil from flowing through the valve section. All pumped oil is directed through drilled passages to passage (C) where it is blocked at the end plate. This causes an oil pressure buildup in passage (C). As the pressure increases, check valves (1) and (2) are unseated to allow pressured oil to enter passages (1a) and (2a). Oil is blocked at passage (2a) by the spool land. Pressured oil flows by the check valve (1), through passage (1a), around the spool, and to the hose port (F). From there it flows to the hose ports of the lift cylinders.

Oil forced out of the cylinders, by the action of the piston, enters the control valve at port (G), and travels to the reservoir through passage (E).

Bucket Spool – Raising and Lowering

Oil flow during right and left positioning of the bucket spool for control of bucket movement is basically the same as that during movement of the lift section spools previously discussed. The anti-cavitation check valve feature is explained as outlined on page 25.

Float Operation

Incorporated at the end of the lift spool is a locking device that when properly positioned, holds the spool in the full right or float position. With the spool in this position, oil is permitted to flow freely between the rod and piston end of the lift cylinders as illustrated in Figure 23. As the working surface varies, the loader lift arms "float" with the ground contour.

As the lift arms move, oil travels through passage (E) to either port (F) or (G), depending on whether raising or lowering conditions are encountered. Oil being forced out or displaced from the cylinder end circulates to the other cylinder end through the passage in the right-hand end plate.

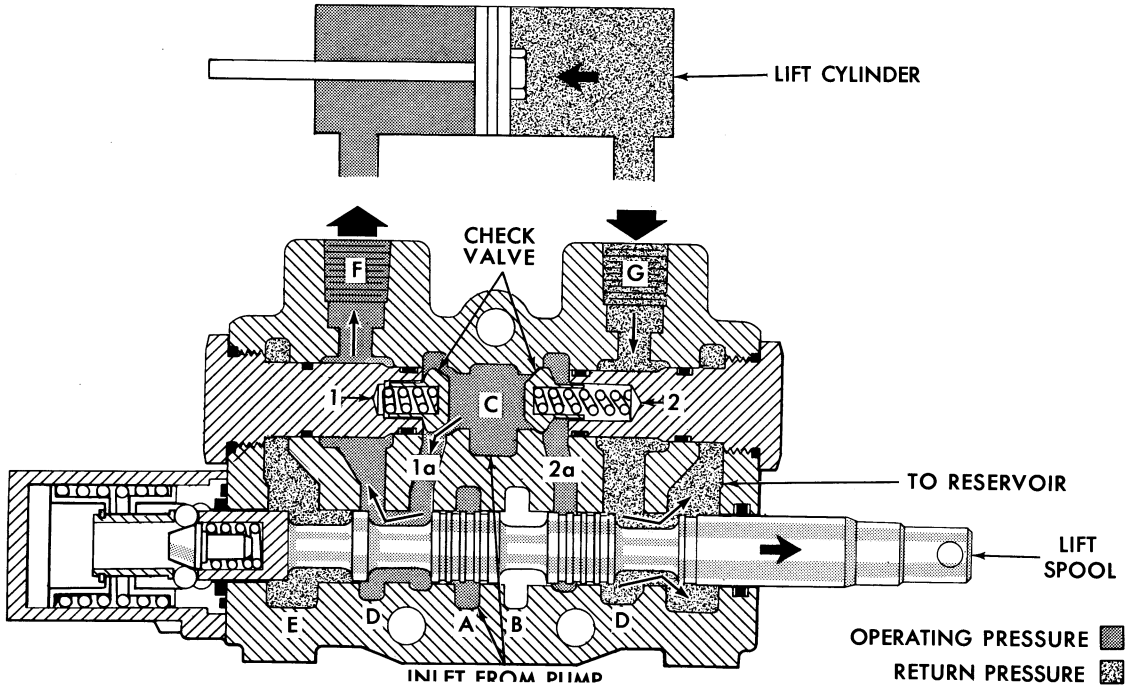

Figure 22
Stacked-Type Control Valve – Lift Spool Lowering

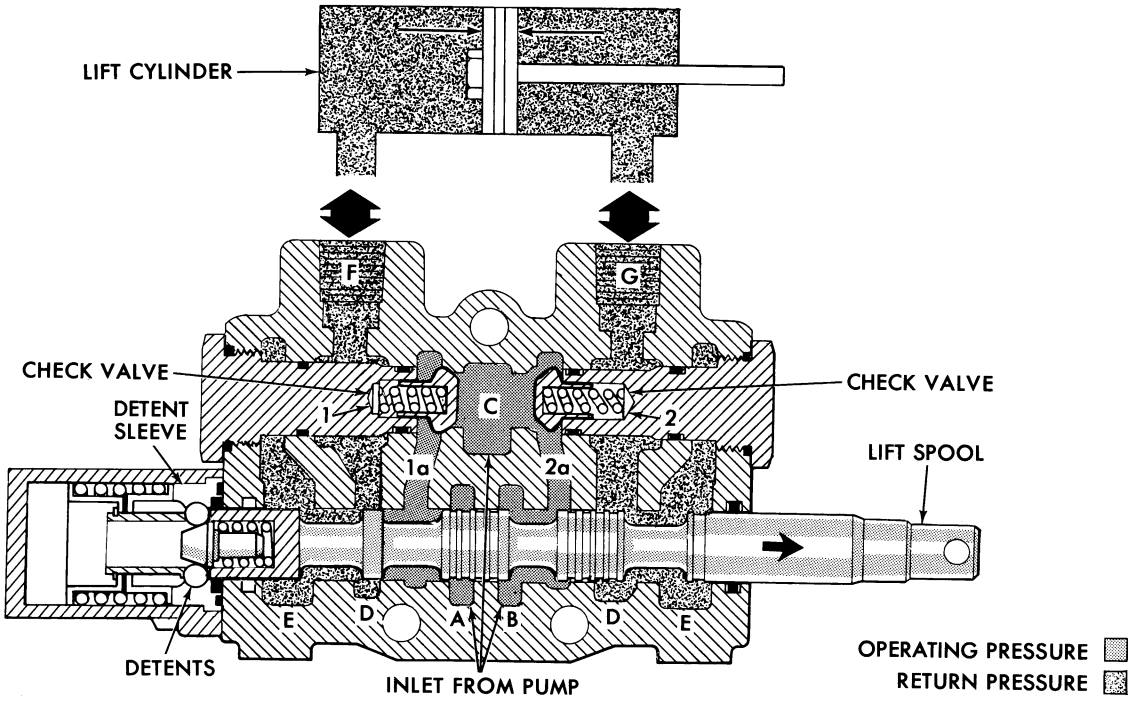

Figure 23
Stacked-Type Control Valve – Float Position

Pumped oil is blocked at passage (A). This blocking of oil unseats check valves (1) and (2). Oil flowing through passage (2a) to passage (B) travels to the reservoir or sump passage. As cylinder requirements vary, some pumped oil may enter the cylinder from the reservoir passage. The pumped oil, in addition to the oil being forced out of the cylinder, then provides a constant supply for the cylinder ends.

Anti-Cavitation (Anti-Voiding) Valve Operation

The anti-cavitation (anti-voiding) valve is located between the bucket cylinder piston end port and the low pressure or sump port, Figure 24. During the dumping procedure, particularly with the bucket fully loaded, oil can be forced out of the rod end of the cylinder faster than the pump can supply oil to the piston end of the cylinder. A void (air bubble) will be formed in the piston end of the cylinder if there is insufficient oil to supplement pump oil. The oil leaving the rod end is channeled to the piston end through the anti-cavitation valve.

In operation, the valve functions when oil required to fill the piston end exceeds the pumped oil supply. The low pressure oil in passage (E) pushes the anti-cavitation valve check ball off its seat and enters the cylinder port (F), supplementing the pumped oil going to the piston end of the cylinder. When pumped oil supply is sufficient to increase the pressure, the anti-cavitation valve check ball is forced back to its seat and held by the high-pressure oil in passage (F).

System Relief Valve Operation

The system relief valve, Figure 25, is located between the high-pressure passage and the low-pressure passage. When a spool is moved, oil is directed to one end of the cylinders. If the cylinders stall, are restricted, or reach the limits of their travel, oil pressure builds in the system. To protect against the pressure increase, the valve opens and allows high-pressure oil to return to sump.

The valve is the direct operating type in that oil forces the valve from its seat, enters the valve area, and goes to sump. System pressure is adjusted by adding or removing shims from between the compression spring and the valve poppet.

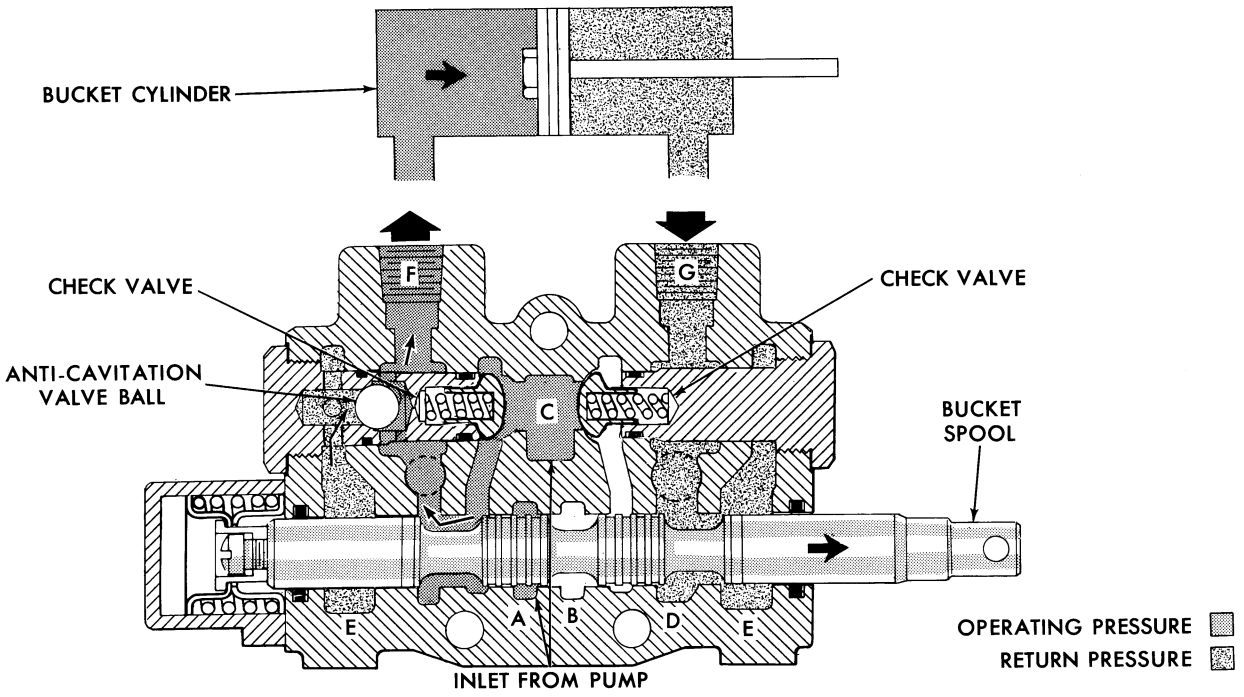

Figure 24
Anti-Cavitation Valve

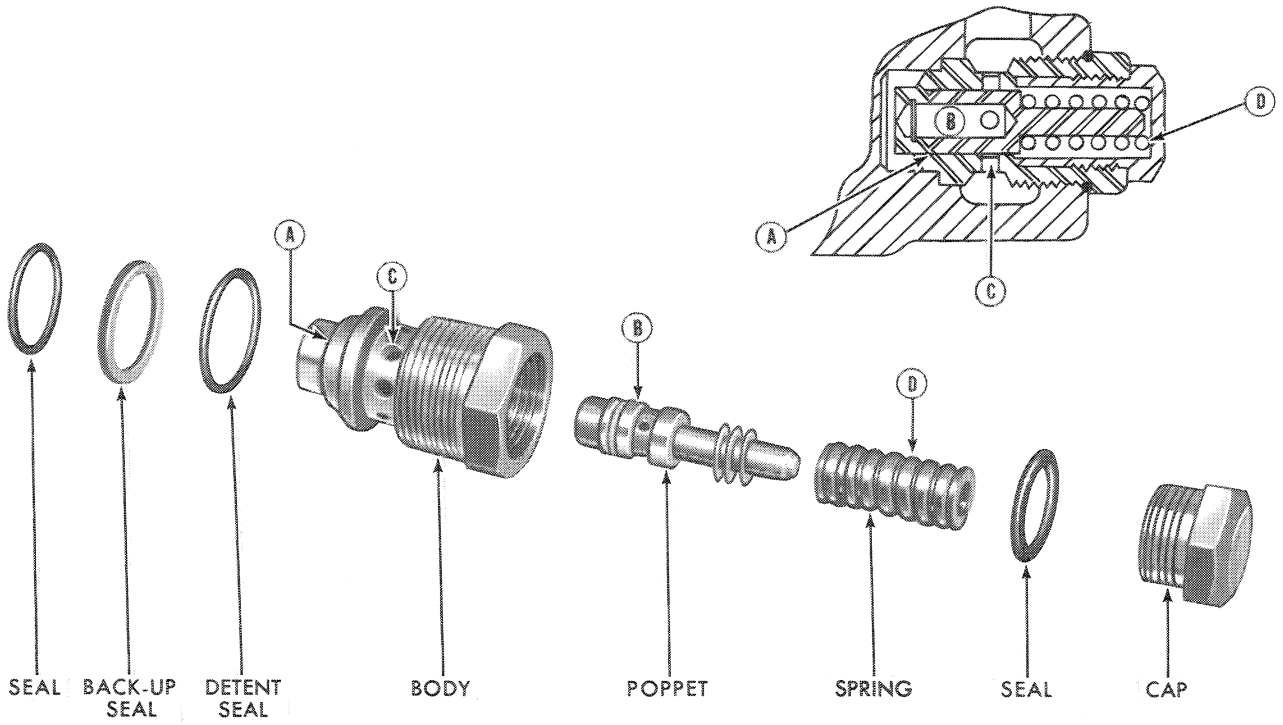

Figure 25
Stacked-Type Control Valve – System Relief

In operation, oil entering the inlet port (A) is below the pressure required to unseat the relief valve poppet (B), Figure 25. When system pressure exceeds the setting of the relief valve (see "Specifications", page 108), the poppet moves off its seat to allow oil to flow into the internal area of the valve and out the radially drilled holes (C) in the relief valve body, which connect to the sump passage. As system pressure decreases, the spring force causes the poppet to seat.

THREE-SECTION STACKED-TYPE CONTROL VALVE

The self-leveling loader control valve, Figure 26, is a three-section, stacked-type valve assembly composed of three valve sections and two end covers. The valve sections are identified as the lift, bucket, and compensating sections. The compensating section provides the self-leveling feature utilizing pump hydraulic oil as its working force. As the loader lift arms are raised, the compensating section of the valve adjusts the bucket to maintain approximately the original degree of bucket rollback.

Two handles are used on the control valve. The lift handle moves the lift spool and the compensating spool together, and the bucket handle moves only the bucket spool.

The self-leveling loader control valve used with the Series 730, 735, and 740 Loaders, are basically the same. There is, however, a difference in the system relief valve pressure settings. On Series 730 and 735 Loaders, the relief valve is set at 2200 psi; while on Series 740 Loaders, the relief valve is set at 1900 psi. The relief valve assemblies for the three series loaders are interchangeable when adjusted for the correct pressure.

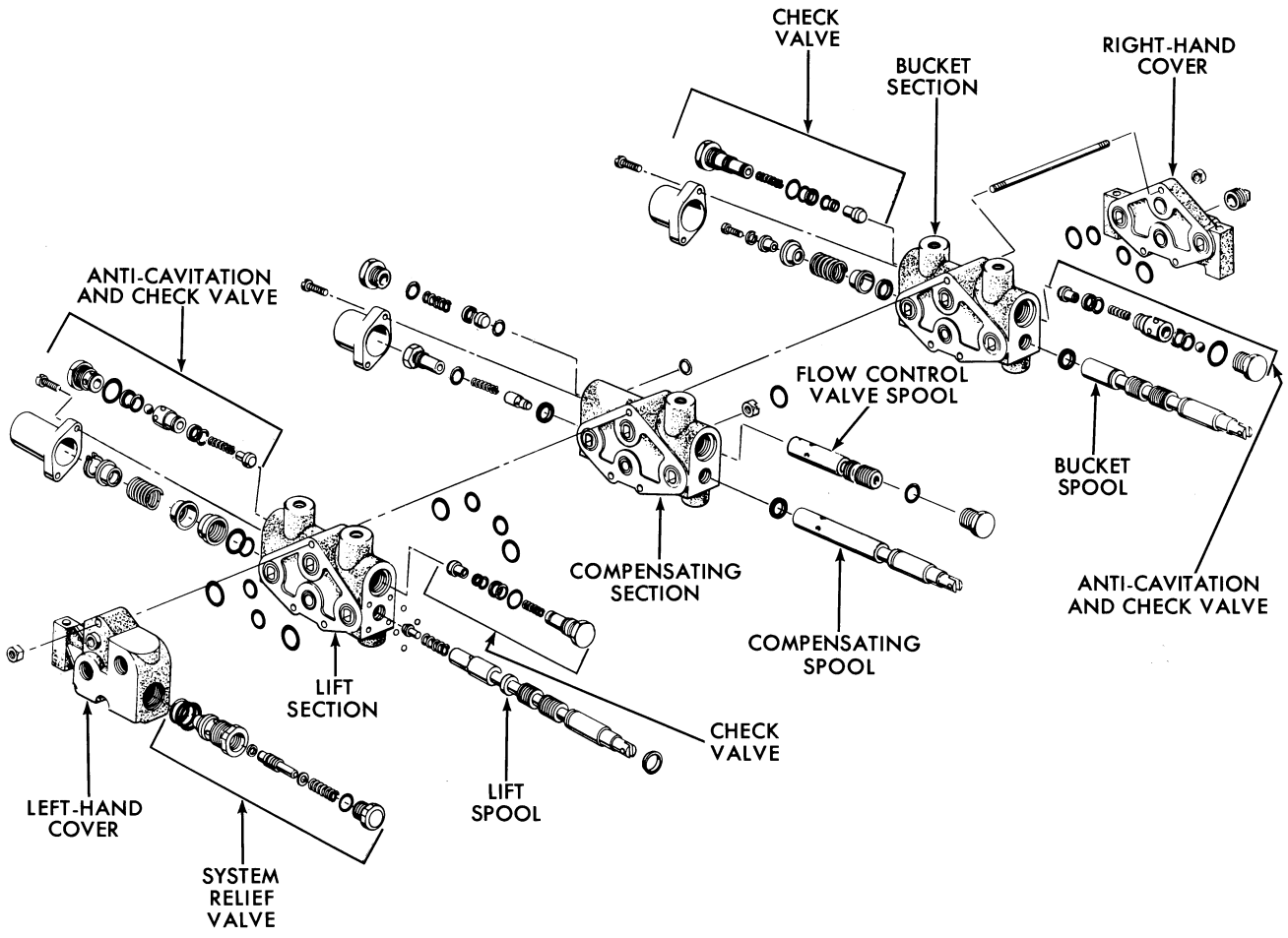

Figure 26
Self-Leveling Loader Control Valve – Exploded View

Oil from the hydraulic pump enters the valve and is directed through the valve sections to the lift or bucket cylinders, depending on the spool movement. The valve body contains separate sections for the lift and bucket circuits which function independently of each other. Each line leaving the valve body branches at the cylinder end to supply oil to both cylinders in the circuit.

Control Valve Components

The self-leveling loader control valve consists of the following major components. See Figures 26 and 27.

- Left-hand cover
- Lift valve body and spool
- Compensating valve body and spool
- Bucket valve body and spool
- Right-hand cover
- System relief valve
- Anti-cavitation valve
- Check valves

Left-Hand Cover: The left-hand cover provides the inlet and outlet oil ports for the valve assembly. This section directs pump oil into the open center passage of the valve assembly, and directs low-pressure oil back to sump. The system relief valve is located in this valve section.

Lift and Bucket Valve Body Sections: The lift and bucket valve body sections, Figure 28, contain internal passages through which the oil travels in going to and coming from the cylinders. Hose ports are incorporated to serve as valve attaching points for the cylinder hoses. These sections contain the lift spool, bucket spool, check valves, and anti-cavitation valves.

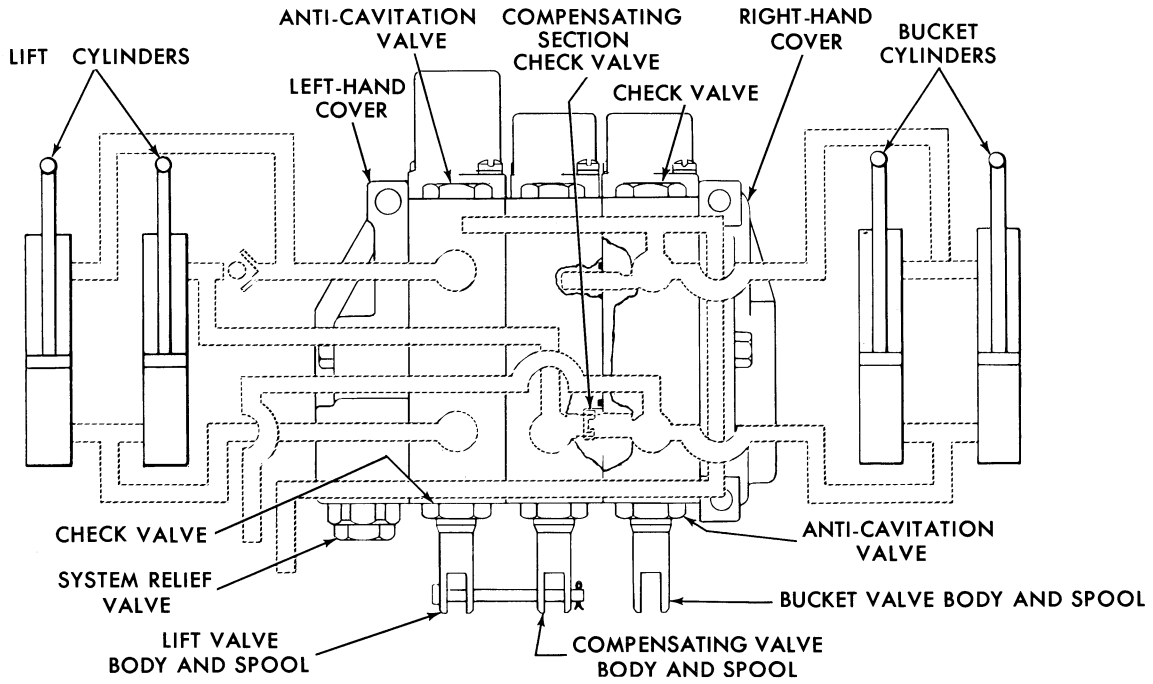

Figure 27
Self-Leveling Loader Control Valve – Nomenclature

The lift and bucket spools are of high carbon, chrome-plated and polished steel. The spools are selectively fitted to the section spool bore. Because of this selective fitting, the spools are not interchangeable with other spools. The spool in the lift section has an additional land and groove not contained in the other section spools. This allows the spool to have additional oil travel. The detent mechanism on the lift spool end serves to hold the spool in position when "float" is desired. The spool end contains a centering spring which functions to return the spool to the neutral position upon release of the control lever handle. Oil flow through these sections controls the movement of their respective cylinders.

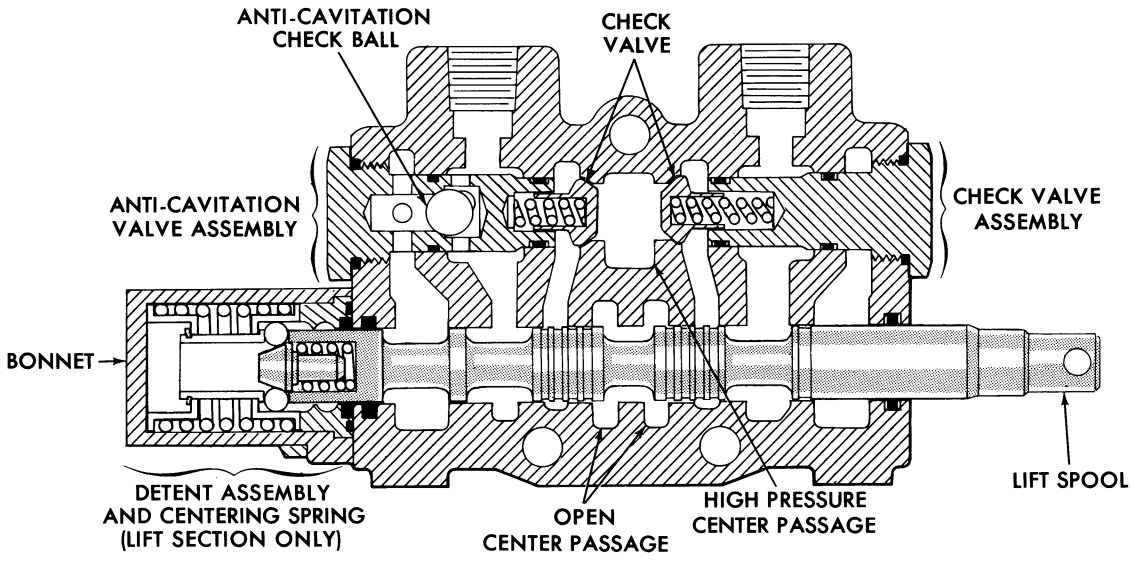

Figure 28
Self-Leveling Loader Control Valve – Lift Section

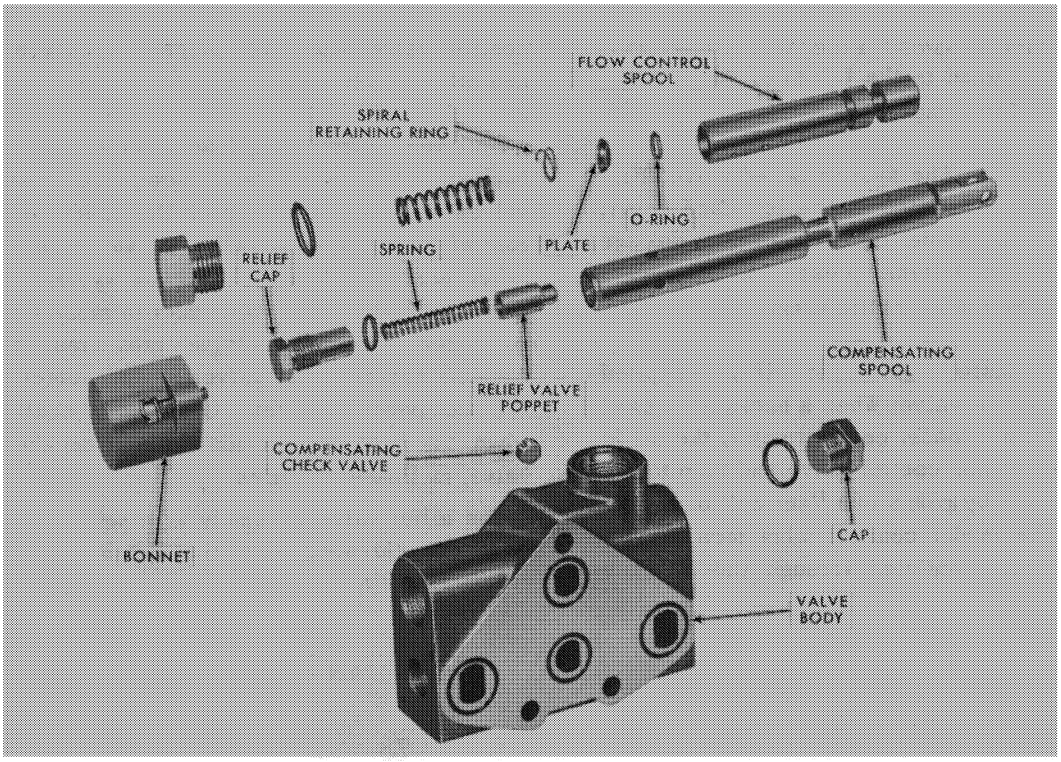

Figure 29
Compensating Section – Exploded View

Compensating Valve Body Section and Spool: The compensating valve body section, Figure 28, controls the self-leveling of the bucket, and houses the compensating spool, a relief valve, a flow control valve, and a check valve. The valve body acts as the attaching point for the one lift cylinder hose and directs return oil from the rod end of the right-hand lift cylinder during the lift cycle to the bucket circuit to extend the bucket cylinders.

The compensating spool is of high carbon, chrome-plated and polished steel, and is selectively fitted to the spool bore. The spool has only one groove which directs the oil from the one cylinder port. It also has a centrally drilled passage and three lateral passages for oil flow within the spool. The spool also contains a relief valve.

The compensating spool relief valve is located in the centrally drilled passage in the spool, and is a direct operating non-adjustable valve set at 200 psi. The valve does not require shims or external adjustment. The spring is of the correct length to give the desired pressure setting. For additional information on the compensating valve relief valve operation, refer to page 38.

The flow control valve consists of the spool, O-ring, plate, spiral snap ring, and spring. The O-ring and plate seal the open end of the spool while the spiral snap ring holds the two parts in place. The spring holds the spool in the closed position until the spool is actuated by hydraulic pressure.

The only function of the flow control valve is to direct low pressure oil returning from the rod end of the bucket cylinders back to sump. The valve maintains a back pressure in the system of 35 to 55 psi. For additional information on the operation of the flow control valve, refer to page 37.

The check valve in the compensating section is a flat button-type valve. Its seat is a machined surface within the compensating valve body. Oil is free to pass from the compensating section to the bucket section by moving the valve off its seat, passing around the valve, and entering the bucket section of the control valve. The valve will seat when pressure is directed to it from the bucket section of the control valve.

Right-Hand Cover: The right-hand cover, Figures 26 and 30, acts as a collection point for low-pressure oil returning from the cylinders and also as the end

of the open-center passage. From this cover, low-pressure oil is returned to the left-hand cover which in turn channels it to sump.

System Relief Valve: The system relief valve, Figures 26 and 27, incorporated in the left-hand cover, serves to protect the loader components from damage caused by excessive internal pressures. Oil supply to the valve is from the hydraulic pump.

In loader-only installations, the oil is supplied directly to the control valve. When a backhoe is used in conjunction with a loader on the tractor, the oil is supplied to the backhoe control valve and then to the loader control valve by means of a "series" or power-beyond plug. The loader control valve receives all of the pumped oil circulated through the backhoe control valve when the backhoe spools are in the neutral position.

Both the self-leveling loader control valve and the backhoe main control valve incorporate system relief valves as integral parts of the units. ***The loader control valve system relief is set at a lower psi relief pressure than the backhoe system relief.*** As such, the loader relief valve acts to protect the loader components from excessive pressures, while the backhoe system relief valve acts to protect the backhoe components. Thus, the loader control valve, when used in conjunction with a backhoe control valve, is linked in series.

The relief valve assembly is a self-contained unit which is threaded into the left-hand cover. The poppet is a direct operating relief valve.

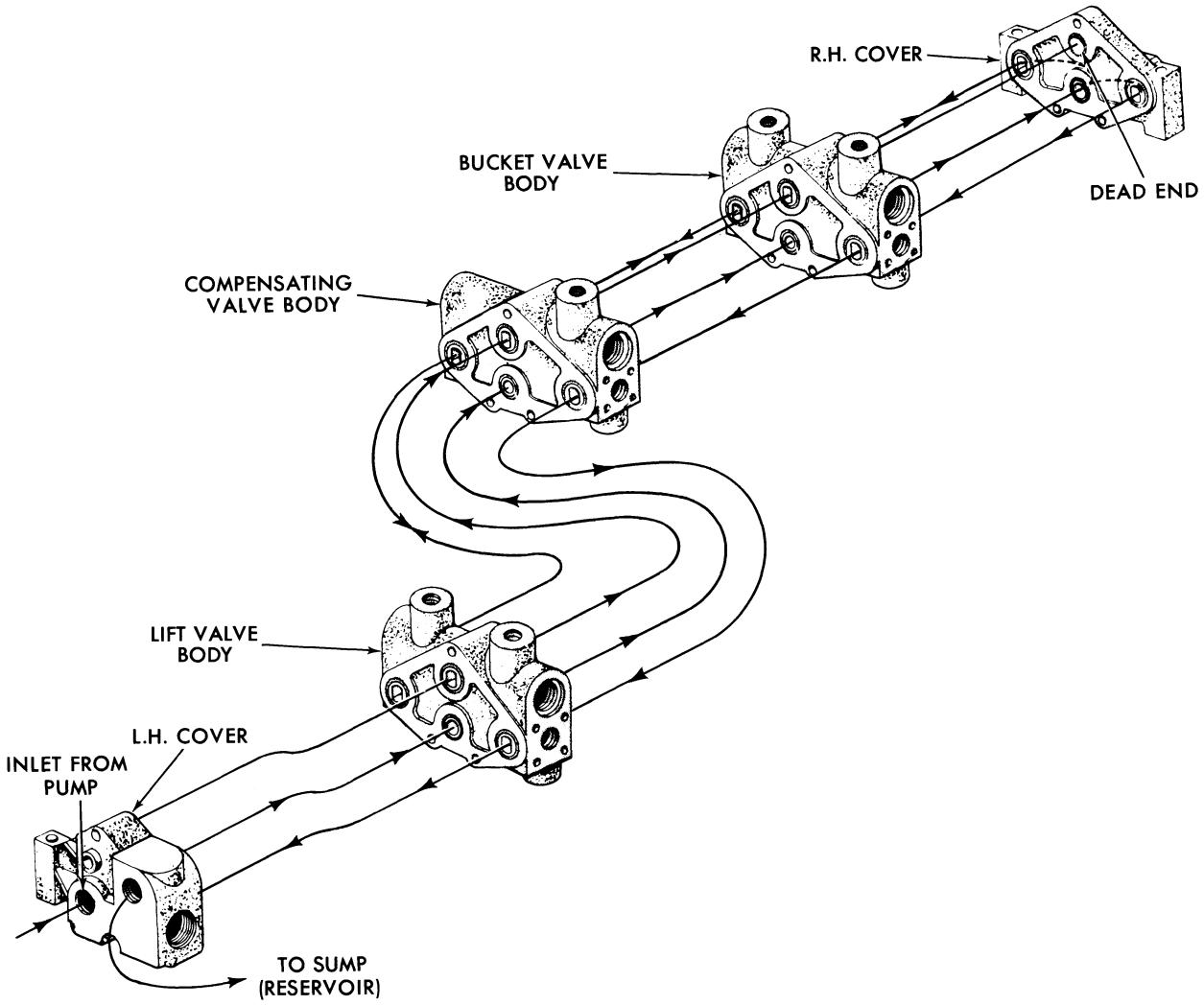

Figure 30
Compensating Control Valve – Oil Flow