

June 7, 1938.

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2,119,632

HYDRAULIC LIFT

Filed March 30, 1936

3 Sheets-Sheet 1

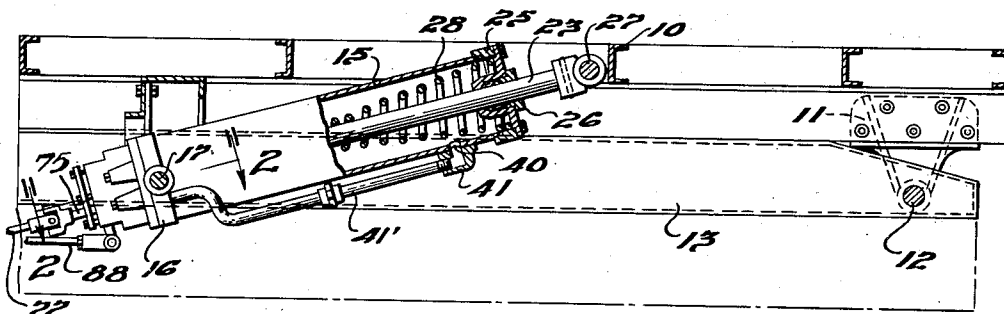


FIG. 1.

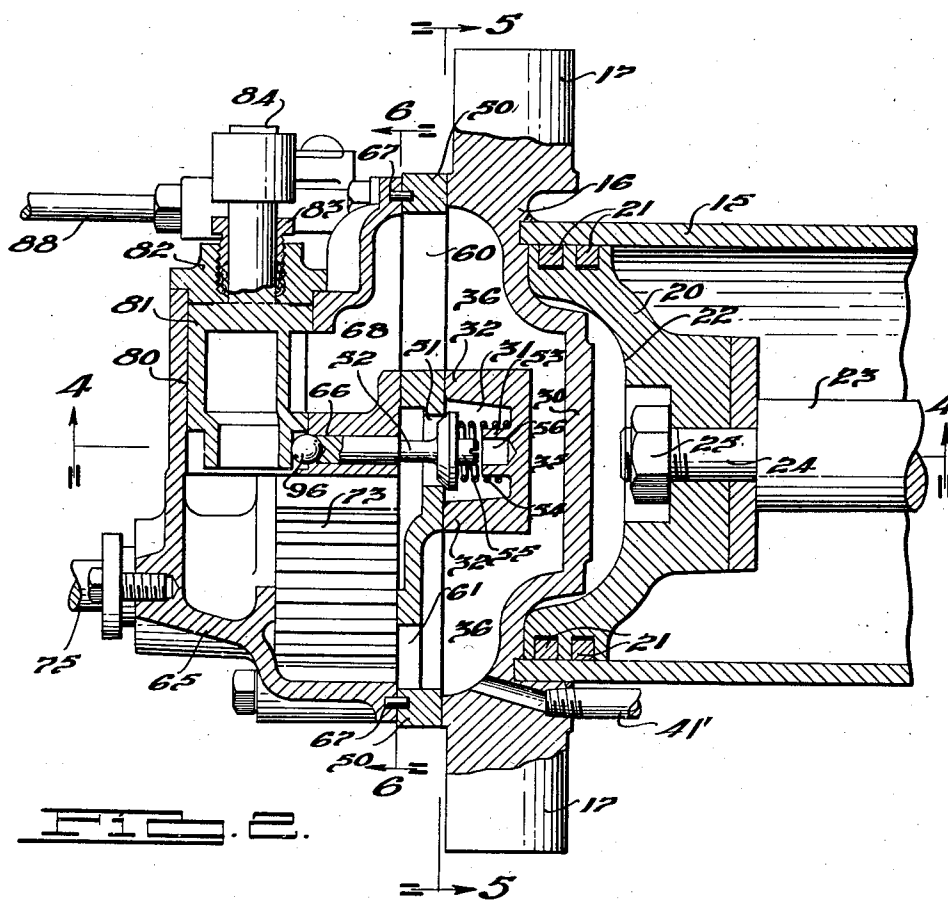


FIG. 2.

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3 Sheets-Sheet 2

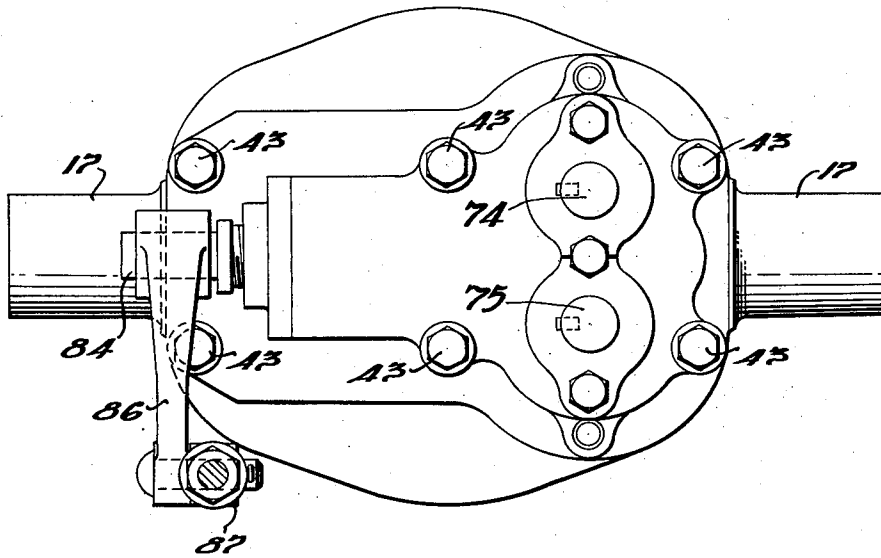


FIG. 3.

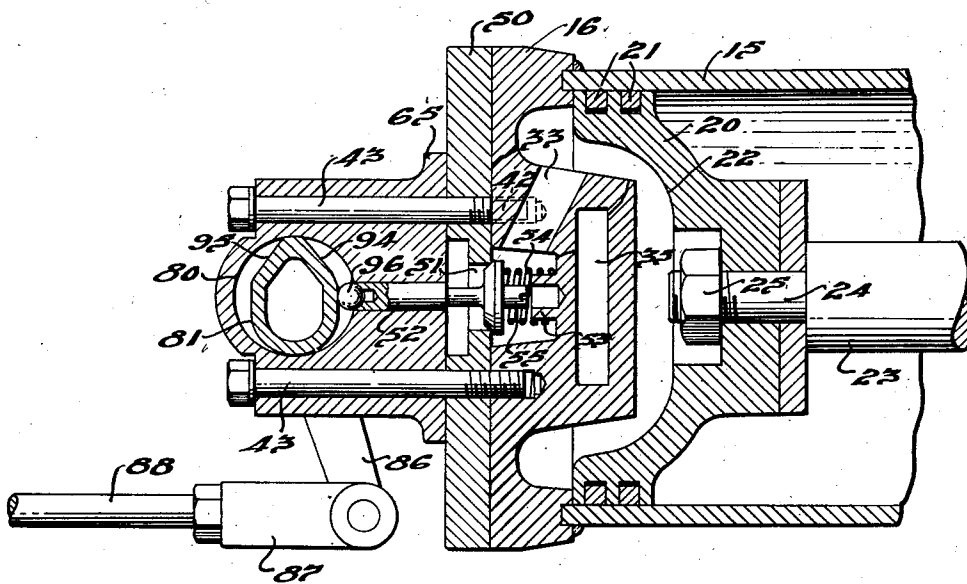


FIG. 4.

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3 Sheets-Sheet 3

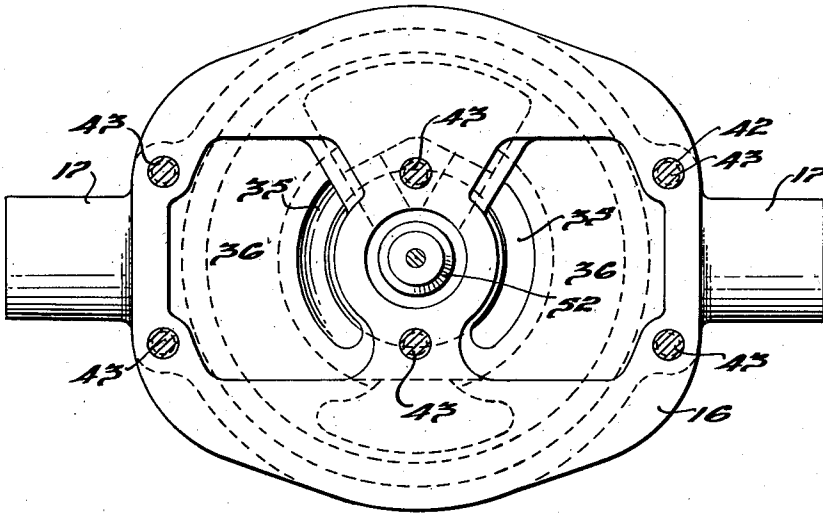


FIG. 5.

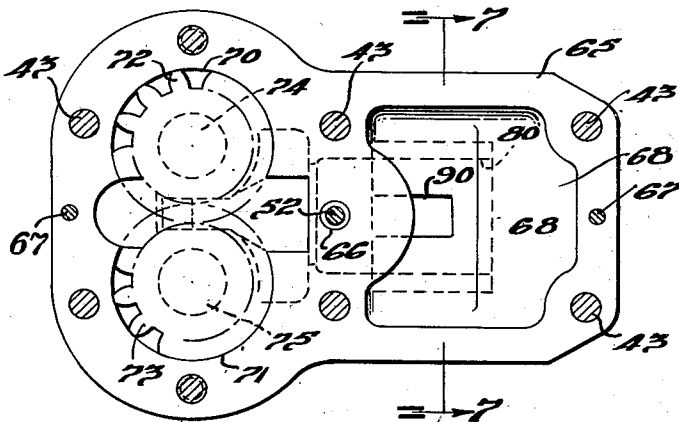


FIG. 6.

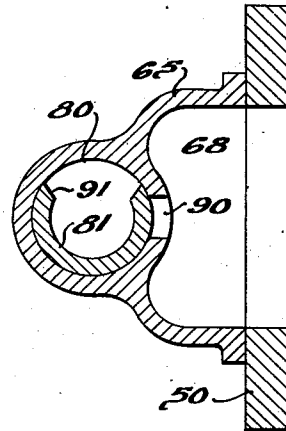


FIG. 7.

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2,119,632

HYDRAULIC LIFT

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Application March 30, 1936, Serial No. 71,598

9 Claims. (Cl. 60—52)

This invention relates generally to hydraulic lifts. More particularly it relates to a hydraulic lift mechanism adapted particularly for utilization in the actuation of pivotally mounted dump bodies for automotive trucks.

It is a general object of the present invention to provide a novel and improved type of hydraulic lift mechanism which is particularly simple in construction, effective in operation, and adaptable to many and various types of installation.

The present application contemplates a construction which includes a rotary pump adapted to be connected to and operated by a conventional rotary power take-off mechanism from the vehicle on which the particular hydraulic lift mechanism is mounted. Means are provided for simply adjusting the mechanism to operate on vehicles which have power take-off mechanisms on either the right or left-hand side thereof and, in addition, means are provided for adapting the improved lift mechanism to a power take-off which runs in either clockwise or counter-clockwise direction. The present invention contemplates the provision of a head structure embodying the pump and control mechanism which may be removably secured to the cylinder portion of the hydraulic lift and which may be connected in any one of a plurality of positions thereon in order to adjust the mechanism to cooperate with the particular type of power take-off mechanism with which the vehicle is equipped.

Still further, the present invention contemplates the provision of a hydraulic lift mechanism in which no auxiliary fluid reservoir is required and one in which the lifting cylinder is utilized for the purpose of storing surplus fluid, thus providing a completely closed system.

It is an object of the present invention to provide a hydraulic lift mechanism in which effective means are included for controlling the rate of lift and further means are provided for bypassing fluid when maximum lift is obtained in order to prevent the development of prohibitively high pressures within the lifting cylinder.

It is a still further object of the present invention to provide a hydraulic lift construction in which a poppet type of valve is utilized for the purpose of controlling communication between the interior of the lifting cylinder and the pump in order to effectively seal the same when a predetermined degree of lift is obtained.

Yet another object of the present invention consists in the provision of a rotary type of control valve which serves to regulate the rate at which fluid is by-passed around the pumping

mechanism and which rotary valve is provided with cam means for actuating the poppet valve which serves to control the passage of fluid into and out of the lifting cylinder.

Many other and further objects and advantages of the present invention will become clearly apparent from the following specification when considered in connection with the accompanying drawings forming a part thereof.

In the drawings:

Figure 1 is a fragmentary, side elevational view, with parts broken away, illustrating the improved hydraulic lift mechanism mounted for actuating a dump body of a truck;

Fig. 2 is an enlarged, sectional view, taken substantially on the line 2—2 of Fig. 1, illustrating in detail the internal construction of the improved cylinder head and control mechanism;

Fig. 3 is an end elevational view of the cylinder head, showing the same mounted upon the cylinder and the manner in which the same is secured thereto;

Fig. 4 is a longitudinal, sectional view, taken substantially on the line 4—4 of Fig. 2, illustrating in further detail the interior construction of the cylinder and the cylinder head, showing the valve controlling mechanism;

Fig. 5 is a transverse, sectional view, taken substantially on the line 5—5 of Fig. 2, illustrating in detail the construction and arrangement of the ports providing communication between the improved cylinder head and the cylinder;

Fig. 6 is a sectional view, taken substantially on the line 6—6 of Fig. 2, illustrating in detail the pump mechanism and the ports communicating therewith; and

Fig. 7 is a transverse, sectional view, taken substantially on the line 7—7 of Fig. 6, illustrating in detail the construction of the rotary control valve for by-passing fluid around the pump.

Upon referring more particularly to the accompanying drawings, it will be clear that the specific embodiment of the invention illustrated therein is merely illustrative of the generic inventive concept presented in this application, and that many modifications, substitutions and changes therefrom may be made without departing from the generic scope of the invention set forth in this application.

One form of the novel hydraulic lift mechanism disclosed in this application is illustrated in Fig. 1 as utilized for the purpose of actuating a dump body of an automotive truck. As is conventional in constructions of this general char-

acter, the dump body is supported upon a framework 10 which may be made up of a plurality of elements of channel section, as shown. This framework adjacent the rear end thereof is provided with suitable downwardly extending projections 11 which provide a pivotal connection with a transversely extending shaft 12 mounted in the main frame of the vehicle 13. It will be appreciated that this construction is substantially conventional and provides a pivotal mounting for the framework supporting the dump body with respect to the frame of the vehicle proper.

The improved hydraulic lift mechanism, hereinafter described in detail, is of substantially unitary construction and includes a cylinder 15 which is preferably permanently mounted in a cylinder head 16 described in detail below. The cylinder head 16 at each of its lateral sides is provided with coaxially disposed trunnions 17 which may be mounted in suitable bearings carried by the framework 13 of the vehicle. It will be appreciated that the pivotal mounting of this cylinder head permits a pivotal movement of the cylinder 15 as a whole about the axis of the trunnions 17 and, consequently, the cylinder will move about this axis as the dump body is tilted, as will hereinafter be more clearly seen.

Interiorly the cylinder 15 is provided with a piston 20 which may have the peripheral surface thereof circumferentially grooved to receive suitable piston rings 21 in order to effect a tight seal with the wall of the cylinder with which it cooperates. The piston 20 has a concave forward face 22, the purpose and function of which will hereinafter become more clear. A piston rod 23 is permanently and rigidly secured to the piston 20 by means of a suitable axially extending portion 24 which is externally threaded to receive a nut 25 which locks the piston 20 firmly in position on the end of the piston rod 23.

The opposite end of the cylinder 15 is closed by a suitable cap member 25 which is preferably permanently secured thereto and in its central portion is provided with a packing gland 26 of conventional construction which serves to receive and permit the passage of the piston rod 23. By reference to Fig. 1, it will be appreciated that the piston rod 23 extends outwardly from the cylinder and is pivotally connected by means of a suitable bearing 27 at its outer end to the framework 10 which supports the pivotally mounted dump body. Interiorly, the cylinder 15 is provided with a conical compression coil spring 28 which serves to cushion the outward movement of the piston in the cylinder and also serves to aid in returning the piston to normal position when fluid pressure within the forward portion of the cylinder is relieved, as hereinafter described in detail.

The cylinder head 16 is preferably formed from a single integral casting and provides a wall 30 which serves to substantially close the end of the cylinder 23. As is clearly seen by reference to Fig. 2, this wall 30 is located substantially inside of the cylinder 15 and fits into the hollow face 22 of the piston when the piston is disposed at the inner end of the cylinder. This casting 16 is formed to provide a recess in substantially the central portion thereof which serves to provide space for mounting a poppet valve, hereinafter described in detail. This space 31 is defined by a surrounding wall 32 which terminates in the plane of the face of the cylinder head 16.

As will be seen by reference to Fig. 4, a suitable bore or duct 33 provides communication be-

tween this space 31 and the interior of the cylinder 15. The parts above described are all integrally formed as a part of the casting 16 forming the cylinder head and it will be noted that the various parts are so constructed and arranged that a duct 35 is formed which provides communication between spaces 36 on opposite sides of the valve receiving structure 32.

The cylinder 15 is provided adjacent its outer end with an aperture 40 which permits the escape of fluid from within the cylinder into a fitting 41 and pipe 41' which connects with the space 36 in the cylinder head. The function and operation of the improved pumping head have been described in detail.

By reference to the drawings, it will be noted that the axial face of the cylinder head 16 is a smooth plane surface and lies in the same plane as the valve housing 31 in the central portion thereof. It will further be clear that the spaces 36 which provide parts for the feeding of fluid to and from the cylinder head, are symmetrically disposed in the cylinder head construction as a whole and, by reference to Fig. 5, it will be seen that a plurality of internally threaded apertured holes 42 are drilled in the cylinder head to receive bolts 43 for the securement of the improved pumping head in position and it will be appreciated that these holes are symmetrically disposed with respect to the cylinder head as a whole.

The improved pumping head includes a valve seat plate member 50 which has an outer configuration substantially the same as the axial face of the cylinder head 16 and has a smooth, plane surface adapted to mate therewith in sealing engagement. This valve seat plate is provided in its central portion with an opening 51 which is ground to provide a conical seat for a conventional type of poppet valve 52 mounted in the pump housing hereinafter described in detail. The recess 31 which is formed in the cylinder head construction described above, is provided with an annular projection 53 in the central portion thereof which serves to position a compression coil spring 54 bearing against the face of the valve 52 to maintain this valve normally in engagement with its valve seat. The valve 52 is provided with a cylindrical projection 55 thereon which cooperates with the cylindrical recess 56 formed by this annular projection 53 to provide a guide which serves to align the valve 52 with its seat.

The valve seat member 50 is provided with a relatively large aperture 60 which communicates with one of the spaces 36 in the cylinder head 16 and preferably registers therewith.

The surface of this plate which covers the space 36 on the opposite side of the cylinder head is cut away to provide a port 61 which communicates with the oil pump hereinafter described in detail and constitutes the inlet therefor, as will subsequently be more clearly seen. A housing 65, preferably formed from a single integral casting, is adapted to seat upon the exposed surface of the valve seat plate 50 and is provided with a plain face adapted to mate therewith to form a tight joint. Both the housing 65 and the valve seat plate 50 are retained in unitary relation with the cylinder head 16 by means of the six symmetrically disposed bolts 43 which are threadably received in the apertures 42 in the cylinder head.

The central portion of this housing 65 is provided with a cylindrical bore 66 adapted to receive the stem of the valve 52 and it will be appreciated that this bore is coaxially disposed with

the valve seat 51 in the valve seat plate 50. The valve seat plate 50 and housing 65 are retained in their predetermined relative positions by means of a plurality of pins 67 which seat in complementary recesses in the two members.

On one side of the central portion thereof, this pump housing structure is provided with a recess 68, the open face of which preferably registers with the opening 60 in the valve seat plate and consequently provides together therewith and with the space 36 a substantially open reservoir which communicates through the passageway 35 with the space 36 on the opposite side of the cylinder head.

A pair of axially disposed intersecting cylindrical bores are provided in the pump housing structure on the opposite side thereof from the side on which the recess 68 is located, and these bores 70 and 71 serve to house intermeshing gears 72 and 73, respectively, which together constitute a pump for feeding oil to the cylinder in the manner hereinafter described in detail. The gears 72 and 73 are preferably keyed to shafts 74 and 75, respectively, which shafts extend through suitable glands to the exterior of the housing and each is provided with means for attaching a shaft 77 from a suitable power take-off such as is conventionally provided in vehicles of this kind.

Inasmuch as, in conventional constructions of this character, power take-off drives are generally not reversible, it will be apparent that the pump may be driven in the desired direction by connecting the power take-off shaft 77 to whichever of the shafts 74 or 75 is desired, thus producing the desired direction of rotation for this gear pump.

The outer surface of the valve seat plate 50 is deformed to provide a port communicating with the aperture 51 which, as has been described above, is closed by means of the poppet valve 52, and it will be seen that this port communicates with the outlet side of the gear pump. As has been explained above, the valve seat plate 50 is provided with an aperture 61 which serves to admit fluid from the space 36 to the inlet side of the gear pump.

The pump housing structure as a whole is provided with a transversely extending bore 80 of substantial size, which provides communication between the recess 68 and the outlet side of the gear pump. It will be clearly seen by reference to Fig. 2 that this transverse bore 80 extends past the path and intersects the cylindrical bore 66 which serves to receive the stem of the valve 52. A hollow rotary valve element 81 of cylindrical configuration is mounted in this bore 80 and the outer end of the bore is preferably closed by means of a suitable annular cap member 82 which, in the axial central portion thereof, is provided with a packing gland 83, through which passes the actuating shaft 84 of the valve 81. A suitable crank arm 86 is secured to this actuating shaft 84 and to the outer end of the crank arm is pivotally secured a fitting 87 which serves to provide means for connecting a forwardly extending actuating rod 88 which may be manipulated in any convenient manner from the driver's compartment of the vehicle with which the apparatus is associated.

The cylindrical bore 80 has a suitable aperture 90 in the wall thereof which provides communication with the recess 68. The valve element 81 is hollow, as has been described above, and is open at its inner axial end. The wall of this valve element 81 is provided with an aperture 91

which, by rotation of the valve element, may be brought into registry with the opening 90 in the wall of the cylindrical bore 80, consequently providing communication between the recess 68 through the apertures 90 and 91 and the hollow interior of the valve with the outlet side of the pump.

The portion of this rotary valve element 80 which lies adjacent the end of the valve 52 is of reduced diameter and is preformed on its exterior surface to provide a symmetrical structure having cam faces 94 and 95 on the opposite sides thereof. Due to the fact that the main portion of the valve element 81 is of cylindrical configuration and closely fits within the bore 80, it will be appreciated that as the valve element is rotated, it will always rotate around a predetermined axis. The inner end of the stem of the valve 52 is preferably recessed to provide a concave surface adapted to seat a ball 96 which is adapted to be engaged by the cam surface of the rotary valve element 81.

From the foregoing, it will be apparent that, with substantially minor changes, the hydraulic lift mechanism described herein is fairly easily converted to be utilized with a vehicle which has the power take-off mechanism on either the right or left-hand side thereof and the construction of the device is such that it is immaterial whether the power take-off mechanism runs in clockwise or counter-clockwise direction, inasmuch as the power take-off mechanism can be connected to either one or the other of the shafts of the gear pump, as may be desired, in order that the gear pump will always be operated in the same direction. Further, it is believed clear from the foregoing that relatively simple means are provided for connecting the control rod to the device irrespective of whether it is arranged for a right or left-hand power take-off.

The operation of the apparatus is substantially as follows. After the device has been completely assembled, as is illustrated in Fig. 1, the entire system is filled with oil. When the dump body is in normal position upon the chassis of the vehicle, it will be appreciated that the piston 20 is seated in the inner end of the cylinder. The operating rod 88, by means of suitable control mechanism in the cab of the vehicle, is moved forward and starts bringing the aperture 91 in the hollow valve into registry with the port 90. The power take-off mechanism is now engaged, which starts rotation of the gears 72 and 73 of the gear pump, which gears will draw oil in through the inlet port 61 and force this oil into the outlet side of the pump where this oil will pass through the axial end of the hollow valve element 81 out through the ports 91 and 90 into the reservoir or recess 68. From this point, the oil may pass into the space 36 through the duct 35 and back through the intake port 61 of the pump. It will be appreciated that when the control mechanism is in this position, the rotary valve element 81 serves to by-pass the oil around the pump and, consequently, will not effect any lifting action of the dump body and will not feed any oil into the cylinder thereof.

When it is desired to elevate the dump body, the control rod 88 is pushed rearwardly to gradually close the port 90. As this port 90 is closed, it will be apparent that the fluid will gradually be cut off from its by-pass around the pump and consequently the pump will build up substantial pressure at the outlet side thereof, which pressure will be exerted on the under-side of the

poppet valve 52, thus opening this valve. The opening of the valve 52, as a result of this increased pressure, will permit the flow of oil into the space 31, thence through the port 33, into the cylinder 15 on the inside of the piston 20. As this pressure increases, it will be sufficiently great to force the piston 20 outward in the cylinder 15, consequently effecting a tilting of the dump body framework 10. The cam surfaces 94 and 95 are preferably so constructed and arranged that considerable rotation of the valve element 81 may take place without causing a positive actuating engagement of these cam surfaces with the ball 96. However, it will be appreciated that when the valve element 81 is rotated in a clockwise direction, as viewed in Fig. 4, the cam face 94 of the valve element 81 will engage the ball 96 and serve to raise the valve 52 off its feet. As will hereinafter be more clearly apparent, the rotary valve element 81 may be rotated to an extent which will bring the opening 91 thereof into partial registry with the opening 90 prior to any effective engagement of the cam surface 94 with the ball 96.

The conduit 41', described above, communicates with a suitable port in the cylinder head, providing communication between this conduit and the space 36 in the cylinder head. Thus, it will be seen that at all times constant communication is maintained between the space 36 and the interior of the cylinder on the outer side of the piston 20. This portion of the system therefore constitutes a reservoir for the fluid which is not actually in use in the device.

Due to the symmetrical disposition of the bolts 43 and the symmetrical disposition of the holes in the valve plate member and through the pump housing through which these bolts pass, it will be appreciated that in the event the power take-off on the particular vehicle with which the hydraulic lift of the present invention is used, is located on either of the sides of the vehicle, the pump may be assembled to operate in cooperation therewith. In case this is desired, it will be appreciated that the bolts 43 may be all removed and the pump housing and valve housing swung through 180 degrees and again be bolted in position upon the cylinder head. Such a reorganization of parts will position the shafts 74 and 75 which serve to provide means for driving the gear pump on the opposite side of the vehicle from that in which they are shown in the embodiment of the invention illustrated in the drawings.

When the pump housing head is swung through 180 degrees, it is necessary to disconnect the crank arm 86 from the shaft 84 to which it is secured, and reconnect it in a new position diametrically opposite to that in which it originally was positioned. The movement of this crank arm will cause it to assume a position when the pump head is reversed substantially the same as it occupied when the pump head was in its original position, except that it will be disposed upon the opposite side of the device.

It will be appreciated that if the port 91 is not completely closed, a certain amount of the oil will be by-passed around the pump and consequently the amount of oil pumped through the opening 51 and into the cylinder 15 may be accurately controlled and, consequently, the lift of the dump body may be as gradual as is desired. It will be appreciated that the piston 20 will move outward in the cylinder until the inner face of the piston passes the port 40, at which time it will

be appreciated that oil pumped into the cylinder may pass through the port 40 back through the conduit 41' into the space 36 adjacent the inlet side of the pump, and, consequently, oil will be continually circulated through the cylinder without causing any further outward movement of the piston. When maximum outward movement of the piston has thus been obtained, completely raising the pivoted frame of the dump body to the desired dumping position, the operating rod 88 may then be again pulled forwardly to by-pass fluid around the pump through the rotary valve 81 and port 90. It will be apparent that poppet valve 52 will prevent the oil which has been pumped into the cylinder from returning back into the outlet side of the pump and, consequently, the dump body will be retained at the maximum elevated position. The power take-off mechanism now may or may not be disconnected, as is desired, and when it is desired to lower the dump body to its original position, the push rod operating rod 88 pulled forwardly to a position such that the cam surface 94 of the rotary valve element will engage the ball 96 which, as has been explained above, is seated against the lower end of the stem of the valve 52. This engagement of this cam surface with this ball will serve to raise the valve 52 from its seat and permit a bleeding of fluid from the interior of the cylinder and consequently permit a gradual restoration of the dump body frame to its original position. Due to the gradual slope of the cam surface 94, it may be appreciated that this bleeding of fluid from the interior of the cylinder may be as gradual as is desired and may be discontinued any time in order that the dump body frame will be lowered as gradually or as rapidly as the operator sees fit.

From the above described construction, it will be clearly apparent that, as the dump body is raised, it may be conveniently stopped at any point during its upward path and it will be retained in exactly the desired predetermined position due to the tight seal effected by the poppet valve 52. It will be appreciated that the construction described herein provides one in which a particularly effective and tight seal between the cylinder and the pump is obtained by use of the poppet valve 52, consequently precluding the bleeding of oil from the interior of the cylinder except at times when such is desired.

It will be appreciated that the specific embodiment of the invention herein illustrated and described is merely illustrative of the generic inventive concept presented in this application, and that many other and further modifications thereof, falling within the scope of the invention as defined in the subjoined claims, will be apparent to those skilled in the art.

What is claimed is:

1. A pumping head for hydraulic lifts including a pump, a poppet valve for controlling communication between said pump and a hydraulic cylinder, a rotary control valve for by-passing fluid around said pump and means on said rotary control valve for unseating said poppet valve when said control valve is opened.
2. A pumping head for hydraulic lifts including a pump, a poppet valve for controlling communication between said pump and a hydraulic cylinder, a rotary control valve for by-passing fluid around said pump and a cam associated with said rotary control valve for unseating said poppet valve when said control valve is opened.
3. A pumping head for hydraulic lifts including

a pump, a poppet valve for controlling communication between said pump and a hydraulic cylinder, a rotary control valve for by-passing fluid around said pump and an integrally formed cam surfaced projection on said rotary valve serving to open said poppet valve when said control valve is opened.

4. A pumping head for hydraulic lifts including a pump, a poppet valve for controlling communication between said pump and a hydraulic cylinder, a rotary valve for by-passing fluid around said pump and means on said last mentioned valve for actuating said first mentioned valve when said last mentioned valve is opened.

5. In a hydraulic lift construction a cylinder and a cylinder head, a pumping head secured thereto, a plate secured in position between said pumping head and cylinder head, a valve seat in said plate, a valve cooperating with said seat and means in both said pumping head and cylinder head for guiding movement of said valve.

6. In a hydraulic lift construction, a cylinder and cylinder head, a pumping head secured thereto, a plate secured in position between said pumping head and said cylinder head, a valve seat in said plate, a valve cooperating with said seat, means in said pumping head for guiding said valve and means in said pumping head for actuating said valve.

7. In a hydraulic lift construction, a cylinder and cylinder head, a pumping head secured thereto, a plate secured in position between said pumping head and said cylinder head, a valve seat in said plate, a valve cooperating with said seat, means in said pumping head for guiding said valve, and means including a rotary cam for actuating said valve.

8. In a hydraulic lift construction, a cylinder, a cylinder head, a plate secured to said cylinder head, a pump housing secured to said plate, said plate having a port therein serving to establish communication between said pump housing and cylinder head, a valve for closing said port and means in both said cylinder head and pump housing for guiding said valve during movement thereof.

9. In a hydraulic lift construction, a cylinder, a cylinder head, a plate secured to said cylinder head, said plate having ports therein, a pump housing secured to said plate serving to supply fluid to said cylinder head through the ports in said plate, said cylinder head, plate, and pump housing being secured together to provide a unitary structure and integrally formed trunnions extending co-axially from opposite sides of said cylinder head serving to mount said assembly for pivotal movement as a unit.

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