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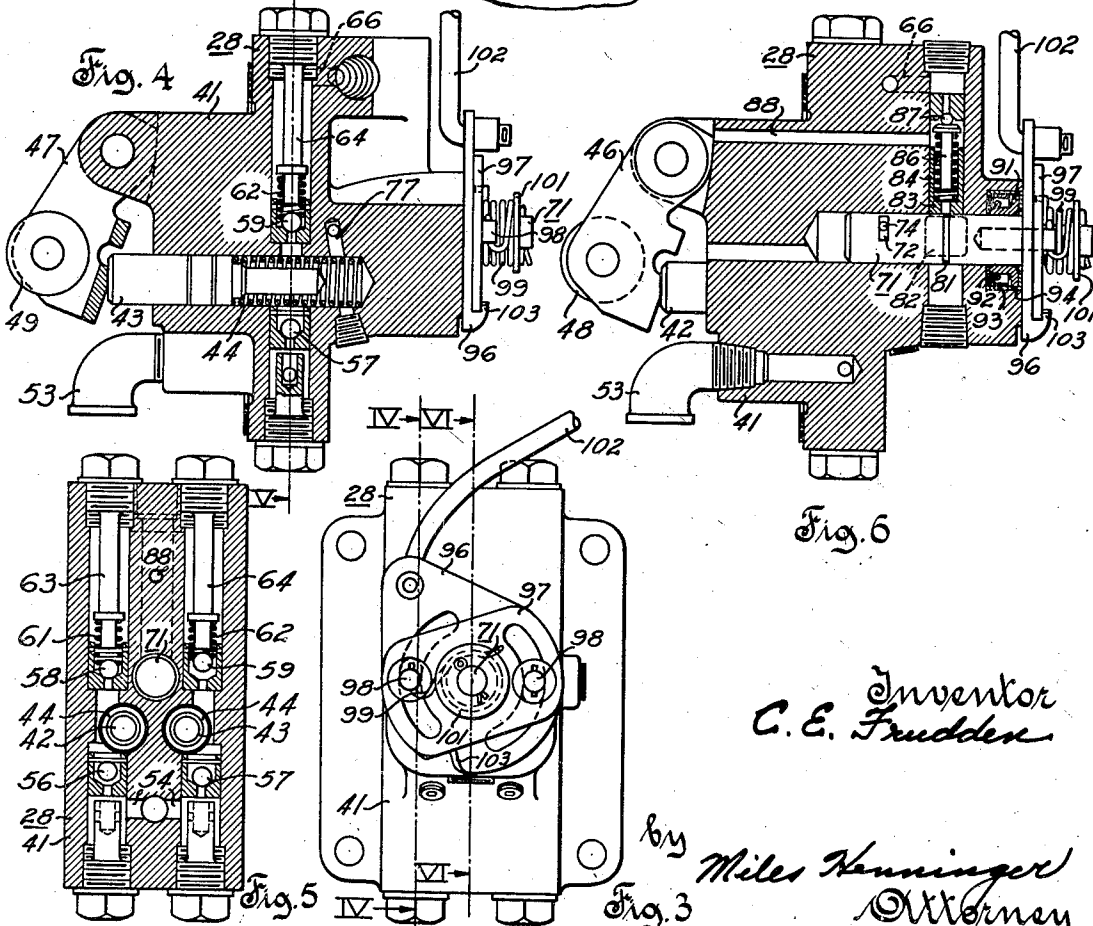
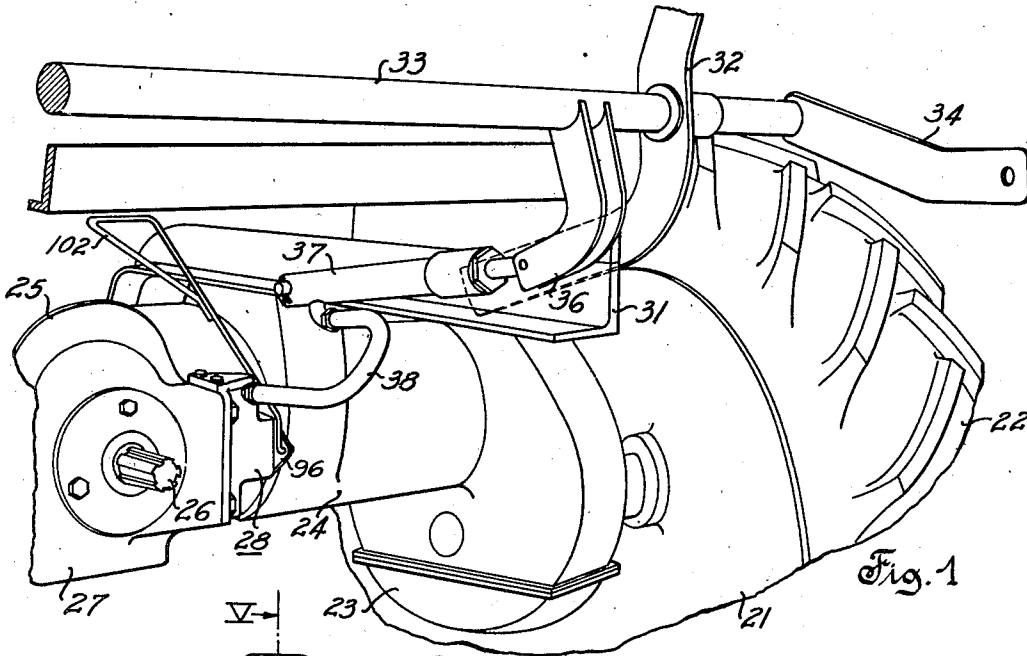
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2,332,629

PUMP FOR POWER LIFTED IMPLEMENTS

Filed Aug. 15, 1941

2 Sheets-Sheet 1



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Fig. 3 Attorney

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2 Sheets-Sheet 2

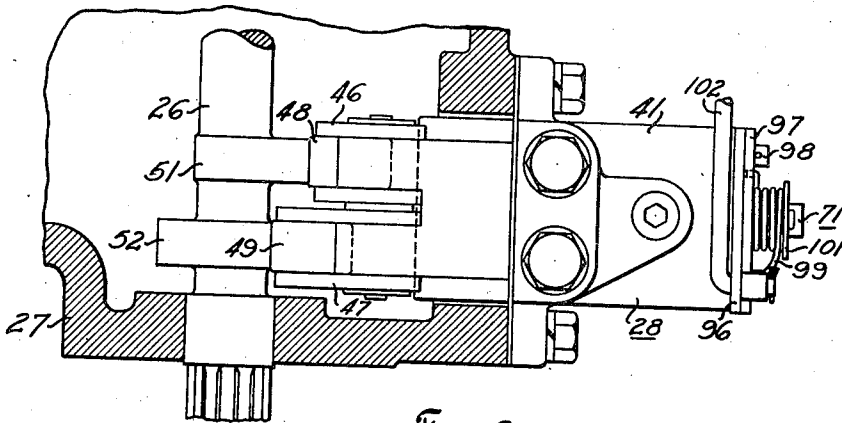


Fig. 2

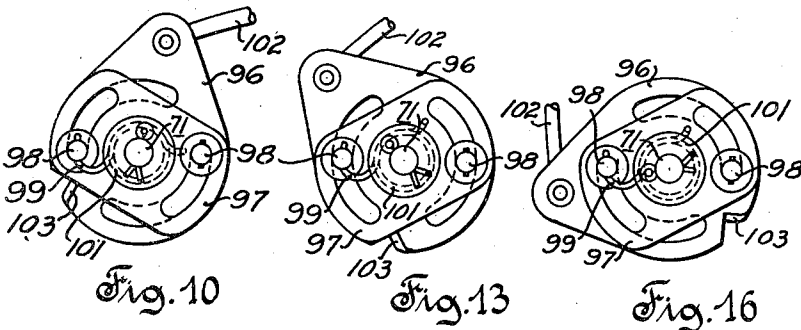


Fig. 10

Fig. 13

Fig. 16

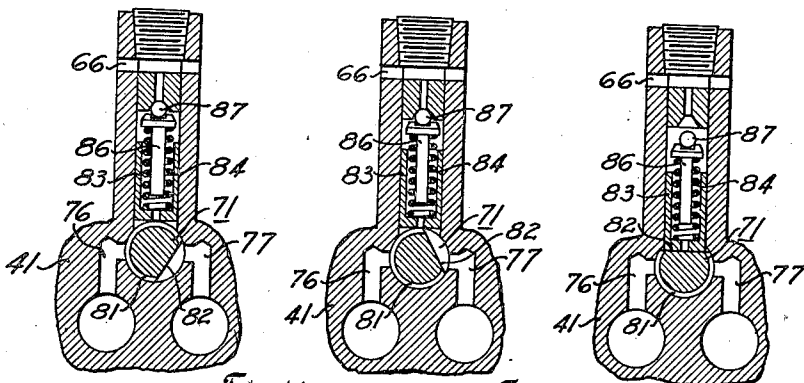


Fig. 11

Fig. 14

Fig. 17

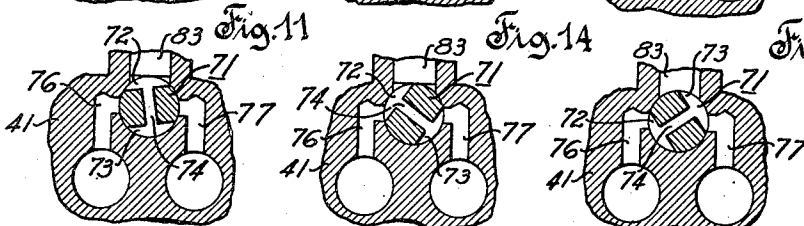


Fig. 12

Fig. 15

Fig. 18

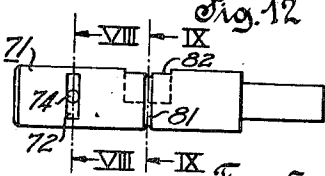


Fig. 7

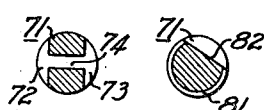


Fig. 8

Fig. 9

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UNITED STATES PATENT OFFICE

2,332,629

PUMP FOR POWER LIFTED IMPLEMENTS

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Application August 15, 1941, Serial No. 407,023

6 Claims. (Cl. 103—41)

This invention relates to improvements in power lifting means for devices which require frequent raising and lowering during their operation and particularly to a hydraulic power lift for implements and the like to be drawn by an automotive vehicle having an engine supplying power for operating the lift.

Internal combustion engine driven tractors for both farm and industrial uses are frequently provided with various implements which must be intermittently lifted and held away from the work and lowered into contact with the work. Such lifting and holding require the expenditure of sufficient energy to be manually impractical or undesirable, and it is therefore necessary to provide power driven means to secure the lifting action. The continuously operating engine of a tractor provides a suitable source of power if suitable means are devised to convert the power into lifting action and to avoid such power conversion during the periods when the lifting action is not desired. A pump can be readily driven from the engine shaft or a connection therewith and fluid pressure produced by the pump can be transmitted by way of a servomotor or ram to a crank acting on a shaft rocking in suitable supports and having the implements mounted thereon for the purpose of securing lifting of the implements whenever desired. Means must, however, be provided to avoid production and transmission of pressure to the servomotor when lifting is completed.

It is therefore an object of the present invention to provide a hydraulic lift for implements to be operated by an automotive vehicle in which a two cylinder reciprocating piston type pump is continuously operated from a constantly driven shaft of the vehicle and is provided with means permitting lifting, holding and lowering of the implements at the will of the operator.

Another object of the invention is to provide a hydraulic lift for implements to be operated by automotive vehicles in which a single control member operates both a relief valve and a bypass between the two cylinders of a piston pump.

Another object of the invention is to provide a hydraulic lift for implements to be operated by an automotive vehicle in which a single control member operates both a relief valve and a bypass between two cylinders of a piston pump and has positive end positions for lifting and lowering of the implement and an impositive midposition for holding the implement in the lifted position.

Another object of the invention is to provide a hydraulic lift for implements to be operated by

automotive vehicles in which a single control member operating both a relief valve and a bypass between two cylinders of a piston pump must be manually brought to the position for lifting the implement but is automatically returned to the position for holding the implement in raised position.

Objects and advantages other than those above set forth will be apparent from the following description when read in connection with the accompanying drawings, in which:

Fig. 1 is a fragmentary view of approximately the right half of the rear end of an internal combustion engine driven tractor having an implement supporting and rocking shaft mounted thereon and showing the mounting of the pump on a power take-off shaft housing of the tractor and the connection of a hydraulic ram with the rock shaft for the implement;

Fig. 2 is a plan view of a two cylinder reciprocating pump with the upper portion of the power take-off casing removed to show the manner in which the pump is mounted on the casing and is driven from the power take-off shaft of the tractor;

Fig. 3 is an elevational view taken looking at the end of the pump exterior of the power take-off casing and illustrating a portion of the means for controlling the application of pressure from the pump to the ram;

Fig. 4 is a vertical sectional view taken longitudinally through the pump adjacent one cylinder of the two cylinder reciprocating pump, on the plane of the line IV—IV of Fig. 3, to show the structure and the manner of driving the pump pistons and to show the location and arrangement of valves controlling the intake and the discharge from the cylinders;

Fig. 5 is a vertical sectional view taken on the plane of the line V—V of Fig. 4 transversely to the two cylinders of the pump to show the location of the several cylinders, of the intake to the cylinders, of the sets of valves for the several cylinders and to indicate the location of the shaft for controlling the application of pressure from the pump to the ram;

Fig. 6 is a vertical sectional view taken longitudinally of the pump and on the plane of the line VI—VI of Fig. 3 to show the structure and location of the relief valve controlling flow through a discharge passage, the location of the shaft for controlling the relief valve and the means for operating the shaft;

Fig. 7 is a side elevation of the shaft for controlling the application of pressure from the

pump to the ram and for assisting in operating the relief valve for controlling the discharge of pressure from the ram;

Fig. 8 is a transverse sectional view of the control shaft taken on the line VIII—VIII of Fig. 7;

Fig. 9 is a transverse sectional view of the control shaft taken on the line IX—IX of Fig. 7;

Figs. 10, 11 and 12 are somewhat diagrammatic views of the control shaft operating means and the relief valve and the control shaft in section to show the positions of the several parts when the implement is to be lifted;

Figs. 13, 14 and 15 are somewhat diagrammatic views of the control shaft operating means and the relief valve and the control shaft in section to show the positions of the several parts when the implement is to be held in the lifted position; and

Figs. 16, 17 and 18 are somewhat diagrammatic views of the control shaft operating means and the relief valve and the control shaft in section to show the position of the several parts when the implement is to be lowered down to the work surface.

Referring to the drawings by characters of reference, numeral 21 designates the right rear wheel of a tractor having a pneumatic tire 22 mounted thereon. The wheel is driven by way of the usual gear drive enclosed in a housing 23 and power is transmitted from the usual engine by way of a rear axle enclosed in the housing 24. A power take-off shaft 26 is driven from the transmission unit 25 and extends from the housing 27 mounted on the transmission unit 25 and having an aperture to be closed by a pump 28 extending into the housing 27 and to be driven from the power take-off shaft 26. The numeral 31 indicates one of the frame members of a tractor on which is mounted the bracket 32 for rotatably receiving a shaft 33 bearing a crank 34 to which any desired implement may be connected. A pair of cranks 36 is connected with the shaft 33 and is connected at the free ends thereof with the movable portion or piston of a servomotor or ram 37 having its cylinder pivotally mounted on the frame member 31. Pressure is applied from the pump 28 to the ram 37 and is discharged from the ram to the pump by way of a flexible tube 38. It will be understood that the ram comprises only a cylinder closed at one end and a piston movable in the cylinder and extending therefrom through a seal at the other end of the cylinder.

The pump 28 has a body 41 in which are drilled a pair of holes serving as cylinders in which pistons 42 and 43 are reciprocable. The pistons are under the action of springs, as at 44, compressed between the end of the cylinder and a shoulder on the piston 43 to force the pistons out of the cylinder into contact with cam follower arms 46 and 47 pivotally mounted on the pump body 41. Each of the cam follower arms 46 and 47 is provided with rollers as at 48 and 49 for contact (see Fig. 2) with the surface of cams 51 and 52 mounted on the take-off shaft 26 within the housing 27. As the shaft 26 rotates, cams 51 and 52 oscillate cam followers 46 and 47 back and forth and alternately push the pistons 42 and 43 into the cylinder following each outward movement of the pistons under the action of the springs 44. Each outward movement of the pistons produces a partial vacuum in the inlet pipe 53 and inlet passage 54 to draw oil into the cylinder from the housing 27. The oil lifts the

inlet ball valves 56 and 57 and fills the portion of the cylinder containing the springs 44. The next rotation of the shaft 26 and cams 51 and 52 alternately drives pistons 42 and 43 into the cylinders against the compression of springs 44 and ejects oil from the cylinders past the discharge valves 58 and 59. Discharge valves 58 and 59 are opened by the discharge pressure from the cylinders against the action of compression springs 61 and 62 severally mounted on supports 63 and 64 threaded into the valve body 41. Oil under pressure (up to 3500 pounds per square inch pressure) is then forced through the passage about the spring supports into a passage 65 through the pump body 41 and through the tube 38 and below the piston of the ram to force the ram piston outwardly and rock the shaft 33 as above stated. It will be noted that cams 51 and 52 are so designed that the cylinder volumes exactly balance each other at all times so that oil may be passed from one cylinder to the other without producing pressure when such action is desirable. The power take-off shaft is driven only through a single set of gears, thus preventing shock to the tractor engine as a result of the fluctuating load of the pump acting through the additive back-lash of several trains of gears.

Another hole is drilled in the pump body 41 to receive a shaft 71 which (as shown in Figs. 7, 8 and 9) has grooves 72 and 73 milled in opposite sides of the shaft and the grooves are joined by a bore 74. Grooves 72, 73 and bore 74 are so located that the grooves may be brought into registry with passages 76, 77 from the pump cylinders (see Figs. 4, 11, 12, 14, 15, 17 and 18). When such registry is obtained, the pressure producing stroke of one piston occurs while the other piston is producing a vacuum. Oil is then merely forced through the registering passages from one cylinder to the other without producing any material pressure, without discharging from the pump and without opening of the suction valves to admit more oil. Shaft 71 also has a groove 81 and a flat surface 82 milled therein outwardly from the bore 74 to provide a drain and a seat respectively for a thimble 83 fitting into a bore joining the pump discharge passage 66 and the hole for the shaft 71. The thimble receives a spring 84 supporting a plunger 86 on which is held a ball 87 for seating in the bore. Ball 87 controls the discharge of oil through a passage 88 to the exterior of the pump body 41 when it is necessary to vent pressure discharged by the pump in excess of the spring resistance pressure and when the implement is to be lowered which requires that the oil in the ram be discharged.

The end of control shaft 71 extends from the pump body 41 and is sealed therein by a flexible seal ring 91 held at one end on the shaft by a spring clip 92 and held away from the shaft at the other end by telescopic flanged casings 93 and 94. The extending end of the control shaft has fixedly mounted thereon a plate 95 and a plate 97 loosely mounted thereon. Plates 96 and 97 are both slotted on the same arc and their movement is limited to a relatively small arc by studs 98 extending through the slots and threaded into the body 41 of the pump. Plate 97 is frictionally held against the plate 96 by a spring 99 connected at one end to one of the studs 98 and connected at the other end with the plate 97. The spring is prevented from slipping off the end of the shaft by a washer 101 pinned on the outer end of the shaft. Plate 96 is provided with a suitable handle 102 extending adjacent the seat of

the tractor and has formed thereon a projection 103 engaging with the plate 97 when the plate is moved beyond a predetermined amount.

The operation and control of the power lift device will be more clearly understood by reference to Figs. 10 to 18, inclusive. Figs. 10, 11 and 12 show the position of the parts when the implement is to be lifted. Fig. 10 shows the positions into which the plate 96 is pulled by the operator to secure the delivery of pressure from the pump to the ram and therefore secure the lifting of the implement. Projection 103 from plate 96 first engages the edge of the plate 97 and causes rotation thereof until the opposite ends of the slots in both plates engage the studs 98 at one end of the arc of plate rotation. During movement of the plate 97, spring 99 is tensioned and the operator must hold the plates in the positions shown against the spring tension as long as the lifting action is to continue. The above rotation of plates 96 and 97 and of control shaft 71 is without effect on the relief ball valve 87 because thimble 83 thereof merely rides on the periphery of shaft 71 as shown in Fig. 11. Grooves 72, 73 on control shaft 71 are turned to bring the bore 74 out of registry with the passages 76 and 77. Continued reciprocation of the pump pistons 42 and 43 therefore forces oil under pressure through the discharge passage 66 and tube 38 into ram 37. The ram plunger is then forced outwardly, thus rotating the rock shaft 33 until the implement connected therewith is lifted to its highest point. If the operator inadvertently continues to hold the control shaft 71 in the position shown, further pumping action producing oil pressure will only force the relief ball valve 87 off its seat against the action of its spring to vent the excess oil pressure back to the casing 27 by way of the passage 88.

If the implement is to be held in the lifted position, the operator releases the handle 102. Tension on the spring 99 then rotates plates 96 and 97 into the midposition shown in Fig. 13, that is, the plates are moved until the studs 98 are at the midpoint in the slots of plate 96 and at the end of the slots of plate 97. Shaft 71 then moves into the position shown in Fig. 14 in which the ball valve 87 is still held in its seated position capable of releasing excess pressure but retaining the pressure already produced in the pump discharge passage 66, the tube 38 and the cylinder of the ram 37. The forward end of the shaft 71 has been moved into the position shown in Fig. 15 to bring the grooves 72, 73 and the bore 74 into registry with the pump by-pass passages 76 and 77. Continued operation of the pump therefore merely forces oil at low pressure backward and forward through the by-pass due to the coincident suction and discharge strokes of the pump pistons in the several cylinders. No further pressure therefore is produced by the pump but the pressure already produced is retained and holds the implement in the lifted position.

When the implement is to be lowered from the lifted position, the handle 102 is pushed to rotate plate 96 into the position shown in Fig. 16 in which studs 98 again act as stops but the plate 96 has now moved so that the ends of the slots opposite those engaged in Fig. 10, are now engaged. The studs therefore determine the two end positions of the plates and the shaft and positively position the parts for lifting and lowering of the implement. Shaft 71 is moved to the position shown in Fig. 17 in which the shaft flat 82 allows thimble 83 to move downwardly into

position resting fully on the flat which relieves the compression of the spring 84 and the ball plunger 86, and ball 87 move downwardly to open the connection between the pump discharge passage 66 and the venting discharge passage 88. The oil therefore flows through the orifice formerly closed by the relief ball valve 87 and discharges such oil back to take-off housing 27. Pressure in the tube 38 and the ram 37 is therefore released and the weight of the implement brings the implement back to the work surface. It will be noted that the relief valve is opened by relieving a spring pressure on the ball rather than by acting against the high pressure fluid in the ram cylinder. Therefore, only a very small effort is required to secure opening of the relief valve. The forward end of the shaft 71 has been brought to the position shown in Fig. 18 in which the grooves 72, 73 and the bore 74 are still in registry with the by-passes 76, 77 from the pump cylinders, and oil merely flows back and forth between the cylinders as above stated, upon continued operation of the pump, without building up pressure and hence without in any way affecting operation of the ram while the implement is to be retained in its lowered position.

It will be seen from the above description, that the present structure provides a positive pressure producing pump having two pistons operated from cams on a power take-off shaft with a single control member operating both a relief valve and opening or closing a bypass between the cylinders. The pump can therefore be constantly operated to produce the high pressure required without any danger of building up excess pressure and without interference with the pressure operated lifting device at any time. The control member is movable into three positions of which the end positions are positively fixed by stops and in which the midposition is determined only by spring tension which automatically returns the control member from the lifting end position to the holding midposition. Such lifting position is the only position in which inadvertent retention of the control member can produce overpressure which is vented by the relief valve.

Although but one embodiment of the present invention has been illustrated and described, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

It is claimed and desired to secure by Letters Patent:

1. A high pressure pump comprising a plurality of cylinders, a piston for each of said cylinders, a discharge passage for fluid from each of said cylinders, a bypass passage interconnecting said cylinders, means for controlling flow of fluid through said bypass passage, a relief valve controlling pumped fluid, and means controlling both said flow controlling means and said relief valve.

2. A pump comprising a plurality of cylinders, pistons for each of said cylinders, a discharge passage from each of said cylinders, a bypass passage interconnecting said cylinders, means intersecting said bypass and having a passage therethrough movable into and out of registry with said bypass to control flow of fluid therethrough, a relief valve controlling pumped fluid, and means controlling both said flow control means and said relief valve.

3. A pump comprising a plurality of cylinders, pistons for each of said cylinders, a discharge passage for conducting fluid from said cylinders, a bypass passage interconnecting said cylinders, a control member controlling flow of fluid through said bypass, a relief valve controlling opening of said discharge passage, said control member also controlling opening of said relief valve, and means for selectively actuating said control member to positions for closing both said bypass and said relief valve, for opening said bypass only, and for opening both said bypass and said relief valve.

4. A pump comprising a body having a plurality of cylinders, pistons in said cylinders, a discharge passage for conducting fluid from said cylinders, a bypass passage interconnecting said cylinders, a control member extending from exteriorly of said pump body into said bypass for controlling flow of fluid therethrough, a relief valve controlling opening of said discharge passage, said control member also controlling opening of said relief valve, a plurality of plates mounted on the exterior end of said control member and having pairs of superposed arcuate slots therethrough, and studs extending through the slots to severally fix the positions of said control member respectively for closing both said bypass and said relief valve and for opening both said bypass and said relief valve.

5. A pump comprising a body having a plurality of cylinders, pistons in said cylinders, discharge passages for conducting fluid from said

cylinders, a bypass passage interconnecting said cylinders, a control member extending from exteriorly of said pump body into said bypass for controlling flow of fluid therethrough, a relief valve controlling opening of said discharge passage, said control member also controlling opening of said relief valve, a plurality of plates mounted on the exterior end of said control member, and a spring interconnecting said plates to fix the position of said control member for opening only of said bypass.

6. A pump comprising a body having a plurality of cylinders, pistons in said cylinders, discharge passages for conducting fluid from said cylinders, a bypass passage interconnecting said cylinders, a control member extending from exteriorly of said pump body into said bypass for controlling flow of fluid therethrough, a relief valve controlling opening of said discharge passage, said control member also controlling opening of said relief valve, a plurality of plates mounted on the exterior end of said control member and having pairs of superposed arcuate slots therethrough, studs extending through the slots to severally fix the positions of said control member respectively for closing and for opening both said bypass and said relief valve, and a spring interconnecting said plates to automatically fix the position of said control member for opening only of said bypass upon release of the plates from the position where both said bypass and said relief valve are closed.

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