

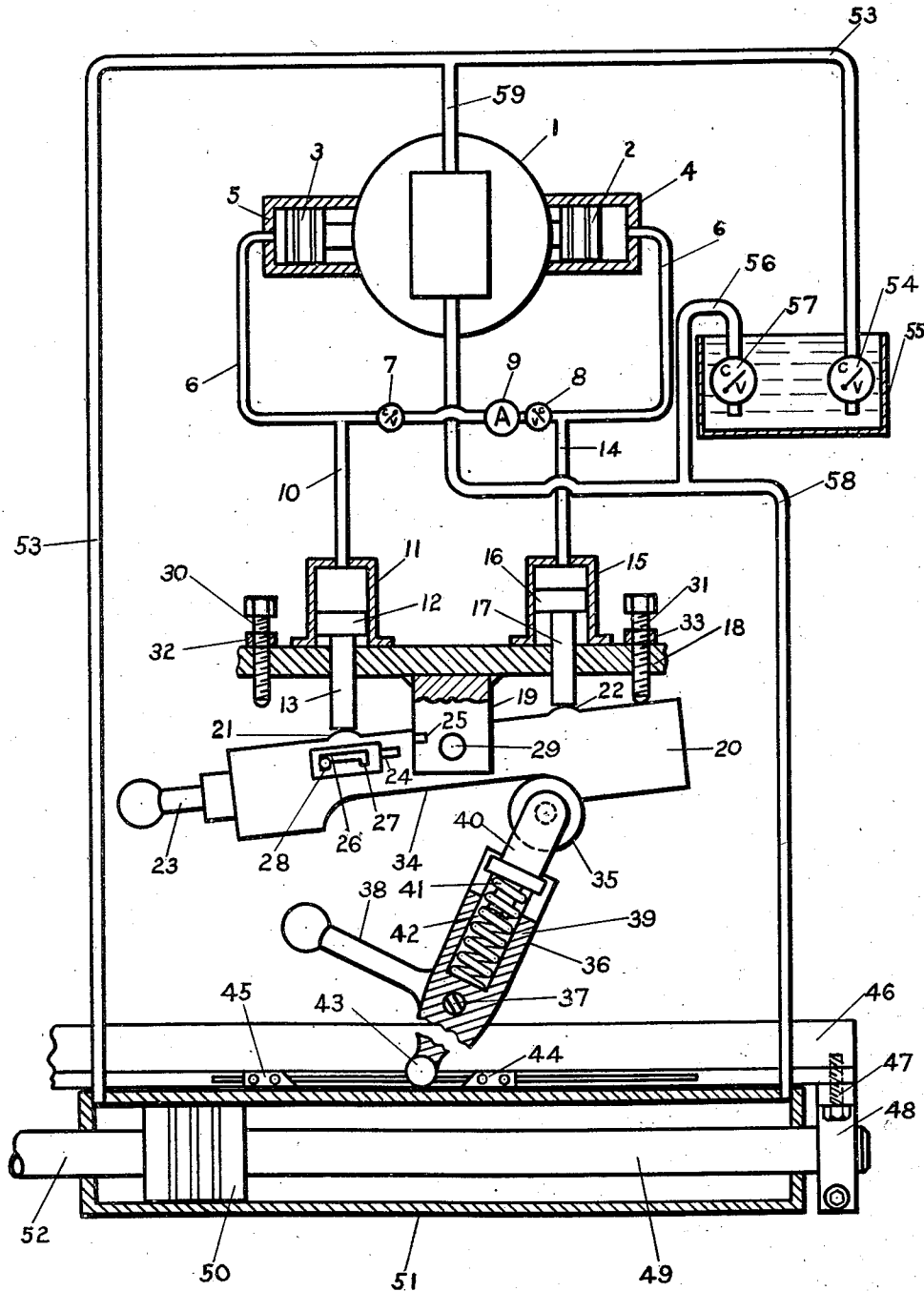
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CONTROL MECHANISM

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CONTROL MECHANISM

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This invention relates to control mechanism and, in particular, to means for use in connection with control mechanism, such as a reciprocable member, controlling the supply of operating fluid to fluid operable machinery. The invention is particularly adapted for the control of reversible pumps in closed hydraulic systems, but is by no means limited thereto.

It is an object of the invention to provide simplified control means adapted to be used in connection with hydraulic systems for controlling fluid operable machinery.

It is another object to provide a control mechanism for a reciprocable member adapted to control hydraulic machinery, which control mechanism is operable automatically by said machinery in a hydromechanical way.

It is a further object of the invention to provide a control mechanism for a reciprocable member, with which the reciprocable control is shiftable selectively in one or the opposite direction by fluid columns which are adapted to be actuated in a purely mechanical way.

It is a still further object of the invention to provide a control mechanism, as set forth in the preceding paragraph, which is provided with means operable selectively for varying the stroke of the reciprocable member.

Still another object of the invention consists in the provision of a control mechanism for a reciprocable member controlling the supply of operating fluid to hydraulic machinery, in which means is associated with said machinery for automatically effecting hydraulic control of said reciprocable member.

These and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawing, which diagrammatically illustrates the present invention by way of example.

General arrangement

The control mechanism according to the present invention comprises substantially a reciprocable member having associated therewith fluid operable means for actuating the latter.

The fluid operable means is connected through a conduit system with a cylinder-piston-assembly, which conduit system is continuously filled with fluid, so that when said cylinder-piston-assembly is actuated in one direction, a fluid column moves the reciprocable member in a first direction, whereas actuation of said cylinder-piston-assembly in the opposite direction, will cause another

fluid column to impart upon said reciprocable member, movement in a second direction.

The cylinder-piston-assembly is operable in a purely mechanical way selectively either manually or automatically by a machine, and may be controlled by the reciprocable member.

According to further features of the invention, the stroke of the reciprocable member may be varied and, if desired, the reciprocable member may be held in an intermediate or neutral position for any desired length of time.

Structural arrangement

Referring now to the drawing in detail, the system shown therein substantially comprises a reversible variable delivery pump 1, which may be of any standard design, and includes a reciprocable flow-control member (not shown), the position of which controls the delivery of the pump. The flow-control member is operable in one direction by a plunger 2, whereas movement of the flow-control member in the opposite direction is adapted to be effected by the fluid operable plunger 3.

The fluid operable plungers 2 and 3 are respectively reciprocable in cylinders 4 and 5. The cylinders 4 and 5 have hydraulically connected thereto a conduit 6 with two check valves 7 and 8. The conduit 6 also comprises an accumulator 9.

The check valve 7 is so arranged that it allows fluid to flow from the accumulator 9 toward the cylinder 5, while preventing the flow of fluid in the opposite direction. The check valve 8 is adapted to allow flow of fluid from the accumulator 9 to the cylinder 4, while preventing flow of fluid in the reverse direction.

Branching off from the conduit 6, between the cylinder 5 and the check valve 7, is a conduit 10 leading to a cylinder 11. Reciprocably mounted in the cylinder 11 is a piston 12 having connected thereto a piston rod 13.

Similarly branching off from the conduit 6, between the cylinder 4 and the check valve 8, is a conduit 14 leading to a cylinder 15, in which is reciprocably mounted a piston 16 with a piston rod 17. The cylinder-piston-assemblies 11, 12 and 15, 16 are identical and of the same capacity. The fluid in the conduits 10, 14 and 6, as well as in the cylinders 4 and 5, is preferably held at a slight pressure according to the pressure of the fluid in the accumulator 9. In this way, a predetermined pressure condition will, at all times, be assured in the cylinders 4 and 5.

The cylinders 11 and 15 are mounted on a sup-

port 18, which has connected thereto an extension 19. Pivotaly connected to the extension 19 is a main control lever 20, having two cam portions 21 and 22 for respectively engaging and actuating the piston rods 13 and 17. The control lever 20 has also connected thereto a handle 23, allowing manual shifting operation of the control lever 20. The control lever 20 furthermore carries a reciprocable pin or latch 24, adapted to engage a correspondingly shaped recess 25 in the extension 19, when the lever 20 occupies a substantially horizontal position, so that the pistons 12 and 16 are on the same level. The pin or latch 24 is adapted to be shifted into one or the other direction by means of the handle 26 connected to the pin 24, and adapted to slightly rotate the pin 24, and to engage selectively either the slot 27 or the slot 28 for locking the pin 24 in its respective end position.

The shifting movement of the control lever 20 about the pivot 29 may be varied by means of abutment screws 30, 31, which are held in their adjusted position by means of locking nuts 32, 33. The control lever 20 is furthermore provided with a cut out portion 34, both ends of which are curved in correspondence with the curvature of a roller 35, carried by a reversing lever, generally designated 36. The lever 36, which is shiftable about a pivot 37, has connected thereto a handle 38 for actuating the lever 36.

The lever 36 comprises a cylindrical portion 39 which is slotted at its upper end for guiding a support 40 for the roller 35. The support 40 is engaged by one end of a spring 41 located in a recess 42, while the other end of the spring 41 rests on the bottom of the recess 42. The arrangement is such that the spring 41 continuously urges the roller 35 into engagement with the cut out portion 34 of the lever 20, but is adapted to yield when the lever 20 is shifted in a corresponding direction, for instance, in connection with the drawing in clockwise direction.

The lower end of the reversing lever 36 has an extension 43, which is adapted to be engaged and actuated in one or the other direction by the dogs 44 and 45 respectively, which dogs are adjustably mounted on and carried by a table 46. The table 46 is connected, in any convenient manner, for instance by means of a screw 47 and a collar 48, with one end of a piston rod 49, the other end of which is connected to a piston 50. The piston 50 is reciprocally mounted in a cylinder 51 through which extends a piston rod 52, which is preferably of the same diameter as the piston rod 49, and is also connected to the piston 50.

The left hand end of the cylinder 51 is connected to a conduit 53 comprising a check valve 54 and leading to a fluid reservoir or tank 55. The tank 55 furthermore communicates with a conduit 56 comprising a check valve 57, and leading to a conduit 58. One end of the conduit 58 communicates with the right hand end of the cylinder 51, whereas the other end of the conduit 58 leads to one side of the pump 1, the other side of which communicates through conduit 59 with the conduit 53.

Operation

It may be assumed that the piston 50 occupies the position shown in the drawing, whereas the control lever 20 is in horizontal position, at which the pin or latch 24 engages the recess 25, while the roller 35 engages the right hand end of the cut out portion 34. It may furthermore be as-

sumed that, at the horizontal position of the lever 20, the plungers 2 and 3 occupy an intermediate position, at which they are equally spaced from the adjacent outer ends of the respective cylinders 4 and 5.

If it is now desired to carry out a working cycle, the operator first unlocks the latch 24 by moving the handle 26 out of the slot 27 and into the slot 28. Thereupon, the operator, by actuating the handle 23, shifts the control lever 20 in anti-clockwise direction. As a result thereof, the spring 41 expands and causes the roller 35 to support the anti-clockwise shifting movement of the control lever 20. The operator may immediately thereafter release the handle 23, while the roller 35 will complete the shifting operation of the handle 20 until the latter is stopped by engagement of its right hand end with the abutment screw 31.

Due to the above described operation of the lever 20 in anti-clockwise direction, the cam portion 22 has moved the piston rod 17 and thereby also the piston 16 upwardly. The fluid expelled from the cylinder 15 during this upward movement of the piston 16, passes through conduits 14 and 6 into the cylinder 4 where it acts upon the piston 2 and causes the latter to move toward the left, and also moving the flow-control member toward the left for shifting the pump 1 into full stroke position in one direction. Due to the leftward movement of the piston 2, and the flow-control member pertaining to the pump, the piston 3 likewise moves toward the left, and the fluid expelled from the cylinder 5 passes through conduits 6 and 10 into the cylinder 11. This results in a downward movement of the piston 12 by the same distance as the distance at which the piston 16 has moved upwardly.

It will be appreciated that the check valves 7 and 8 prevent fluid from flowing from the cylinders 15 and 5 respectively through these check valves to the accumulator 9. If, due to leakage, fluid should escape from any of the cylinders or conduits connected thereto, the escaped fluid will be made up by the pressure fluid from the accumulator 9 through check valves 7 and 8.

All parts are now occupying the position shown in the drawing, and pressure fluid from the pump 1 now flows through conduit 53 into the left hand end of the cylinder 51, thereby moving the piston 50 toward the right. Fluid expelled during this movement of the piston 50 from the right hand end of the cylinder 51 flows through conduit 58 to the now suction side of the pump 1.

Since it was assumed that the diameters of the piston rods 49 and 52 are substantially equal, the quantity of fluid admitted to the right hand side of the piston 50 at any time during the right hand movement thereof, will equal the quantity of fluid expelled by the piston 50 from the right hand end of the cylinder 51. If, however, a greater quantity of fluid had to be supplied by the pump 1 to the left side of the piston 50 than is expelled from the right hand end of the cylinder 51, additional fluid would be conveyed from the tank 55 through the check valve 51 and conduit 56 to the now suction side of the pump 1.

When the piston 50 approaches the end of its rightward stroke, the dog 45 engages the extension 43 so as to shift the reversing lever 36 about the pivot 37 in anti-clockwise direction. This causes the roller 35 to move toward the left hand end of the cut out portion 34, thereby shifting

the control lever 20 in clockwise direction. As a result thereof, the cam portion 21 moves the piston rod 13 and, thereby, the piston 12 upwardly. This upward movement causes fluid to be expelled from the cylinder 11 into the cylinder 5, where, acting upon the plunger 3, it moves the latter and, thereby, the flow-control member pertaining to the pump 1, toward the right. In this way the pump 1 has been shifted into full stroke reverse position, so that the conduit 58 becomes the pressure side and the conduit 59 becomes the suction side.

Rightward movement of the plunger 3 causes the plunger 2 likewise to move toward the right, with the result that fluid is expelled from cylinder 4 in the same quantity as was expelled into the cylinder 5. The fluid expelled from the cylinder 4 passes through conduits 6 and 14 into the cylinder 15, where it acts upon the piston 20 and moves the latter downwardly until the piston rod 17 is stopped by engagement with the cam portion 22.

The shifting movement of the control lever 20 in clockwise direction is halted by engagement of the left hand portion of the lever 20 with the abutment screw 30.

Pressure fluid from the pump 1 now flows through conduit 58 toward the right hand end of the cylinder 51 where it acts upon the piston 50 and moves the latter toward the left. Fluid expelled from the left hand end of the cylinder 51, during this left hand movement of the cylinder 50, flows through conduits 53 and 59 toward the suction side of the pump 1.

If the diameter of the piston rod 52 equals the diameter of the piston rod 49, the quantity of fluid conveyed through conduit 58 to the cylinder 51 equals the quantity of fluid expelled from the left hand end of the cylinder 51. If more fluid is to be conveyed toward the right hand end of the cylinder 51 than is expelled from the left hand end of the cylinder 51, additional fluid passes from the tank 55 through check valve 54 and conduit 53 to the conduit 58.

When the piston 50 approaches the end of its leftward movement, the dog 44 engages the extension 43 so as to shift the reverse lever 36 in clockwise direction, in a manner similar to that described above in connection with the shifting movement of the lever 38 in anti-clockwise direction. The pump 1 will then again be reversed and a new rightward stroke of the piston 50 will be started.

If the operator wishes to stop the piston 50 at any desired point, he has merely manually to shift the lever 20 into substantially horizontal position by actuating the handle 23 accordingly. If this movement of the lever 20 were, for instance, initiated when the lever 20 occupies the position shown in the drawing, it will be clear that the piston 12 moves upwardly to a certain extent, while the piston 16 moves downwardly to the same extent. In other words, both pistons will halt when their upper surface is at the same level.

The upward movement of the piston 12 will cause fluid to flow from the cylinder 11 into the cylinder 5 and shift the plunger 3 and, thereby, the flow-control member pertaining to the pump 1 into its neutral or intermediate position, at which the pump delivers practically no fluid, nor takes any fluid out of the cylinder 51. Consequently, the piston 50 is hydraulically blocked and, therefore, comes to a stop.

If the shifting movement of the lever 20 into

its horizontal position were effected while the right hand end of the lever 20 is in its lower position, fluid expelled, due to the upward movement of the piston 16, would shift the plunger 2 and thereby the flow-control member of the pump 1, from its right hand position toward a neutral position, so that the pump 1 would likewise be in neutral or no delivery position. The piston 50 would, therefore, also be halted.

It will be obvious that the shifting movement of the pump 1 to neutral position for halting the piston 50, may be effected at any point of travel of the piston 50 in either direction.

If it is desired to vary the stroke of the plungers 2 and 3, and thereby vary the delivery of the pump 1, it is merely necessary to effect a corresponding adjustment of the abutment screws 30 and 31. It will be obvious that, if desired, the adjustment of the screws 30 and 31 may be so effected that the movement of the plungers 2 and 3 to one side may be larger than the movement thereof to the other side, thereby causing the piston 50 to move in one direction faster than in the opposite direction.

It will be understood that I desire to comprehend within my invention such modifications as come within the scope of the claims.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In combination, a reciprocable member, fluid operable means associated with said member for selectively shifting the same in one or the opposite direction, cylinder-piston means for exerting hydraulic pressure on said fluid operable means for reciprocating the same, supporting means, an actuating element pivotally connected to said supporting means and movable selectively in clockwise or anti-clockwise direction for actuating said cylinder-piston means, adjustable abutment means for limiting the angular movement of said actuating element, and a yieldable member continuously urged into engagement with said actuating element and operable selectively to bring about shifting movement of said element in clockwise or anti-clockwise direction.

2. In combination, a reciprocable member, fluid operable means associated with said member for selectively shifting the same in one or the opposite direction, cylinder-piston means for exerting hydraulic pressure on said fluid operable means for reciprocating the same, supporting means, an actuating element pivotally connected to said supporting means and movable selectively in clockwise or anti-clockwise direction for actuating said cylinder-piston means, and a yieldable member continuously urged into engagement with said actuating element and operable selectively to bring about shifting movement of said element in clockwise or anti-clockwise direction.

3. In combination, a first reciprocable member, fluid operable means associated with said member for selectively shifting the same in one or the opposite direction, cylinder-piston means for exerting hydraulic pressure on said fluid operable means for reciprocating the same, supporting means, an actuating element pivotally connected to said supporting means and movable selectively in clockwise or anti-clockwise direction for actuating said cylinder-piston means, a yieldable member continuously urged into engagement with said actuating element and operable selectively to bring about shifting movement of said element in clockwise or anti-clockwise direction, and a second reciprocable member operable auto-

matically in response to a predetermined travel thereof to effect actuating movement of said yieldable member.

4. In combination, a first reciprocable member, fluid operable means associated with said member for actuating the same, said fluid operable means having a first and a second effective area, a first cylinder, first conduit means interconnecting said first cylinder and said first area, a first plunger reciprocable in said first cylinder, a second cylinder, second conduit means separated from said first conduit means and hydraulically interconnecting said second cylinder and said second area, a second plunger reciprocable in said second cylinder, a pressure fluid source for filling said conduit means with fluid and maintaining the same at a slight predetermined pressure, supporting means, an actuating member pivotally connected to said supporting means for actuating said plungers, said actuating means being provided with a cam area, lever means including a yieldable member continuously urged into engagement with said cam area and shiftable selectively in a first or second direction to actuate said actuating member in opposite directions, and a second reciprocable member operable in response to a predetermined travel thereof alternately to shift said lever means in said first or said second direction.

5. In combination, a reciprocable member, fluid operable means associated with said member and provided with two oppositely effective areas, two fluid operable plungers, separate conduit means respectively interconnecting said plungers with said areas, means for filling said conduit means and maintaining the same filled with fluid, pivoted actuating means movable for selectively actuating one or the other plunger, said actuating means being provided with a cam area, lever means movable in opposite directions for actuating said actuating means and spring pressed means carried by said lever means for yieldably engaging said cam area for substantially instantaneously actuating said actuating means in response to a predetermined movement of said lever means.

6. In combination, a reciprocable member, fluid operable means associated with said member for actuating the same, two separate fluid columns, plunger means operable to shift said columns selectively into one or the opposite direction for imposing a corresponding movement on said fluid operable means, pivoted control means for actuating said plunger means, yieldable means for engaging and actuating said control means and pivoted lever means for supporting

and moving said yieldable means, said lever means and said yieldable means carried thereby cooperating to cause said control means to be substantially instantaneously actuated in either direction.

7. In combination, a fluid pump having a reciprocable flow control member associated therewith, a reciprocable ram connected with said pump to be driven in both directions thereby, fluid operable means associated with said flow control member for selectively shifting the same in one or in opposite directions, cylinder-piston means for exerting hydraulic pressure on said fluid operable means for reciprocating said member thereby to vary said pump delivery and the reciprocation of said ram, a pivoted actuating element movable selectively in a clockwise or anti-clockwise direction for actuating said cylinder-piston means, adjustable abutment means for limiting the angular movement of said actuating element thereby to limit the movement of said flow control member and thereby the delivery of said pump and the speed of said ram, a yieldable member continuously urged into engagement with said actuating element and operable selectively to bring about shifting movement of said element in both directions, and means associated with said reciprocable ram for shifting said actuating element at predetermined points in the travel of said ram in both directions.

8. In combination, a fluid pump having a reciprocable flow control member associated therewith, a reciprocable ram connected with said pump to be driven in both directions thereby, fluid operable means associated with said flow control member for selectively shifting the same in one or in opposite directions, cylinder-piston means for exerting hydraulic pressure on said fluid operable means for reciprocating said member thereby to vary said pump delivery and the reciprocation of said ram, a pivoted actuating element movable selectively in a clockwise or anti-clockwise direction for actuating said cylinder-piston means, adjustable abutment means for limiting the angular movement of said actuating element thereby to limit the movement of said flow control member and thereby the delivery of said pump and the speed of said ram, a yieldable member continuously urged into engagement with said actuating element and operable selectively to bring about shifting movement of said element in both directions, and adjustable means associated with said ram for shifting said actuating element at predetermined points in the travel of said ram in both directions.

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