

March 29, 1938.

E. B. MALOON

2,112,466

GRADER CONTROL MECHANISM

Filed Nov. 16, 1935

2 Sheets-Sheet 1

Fig. 1.

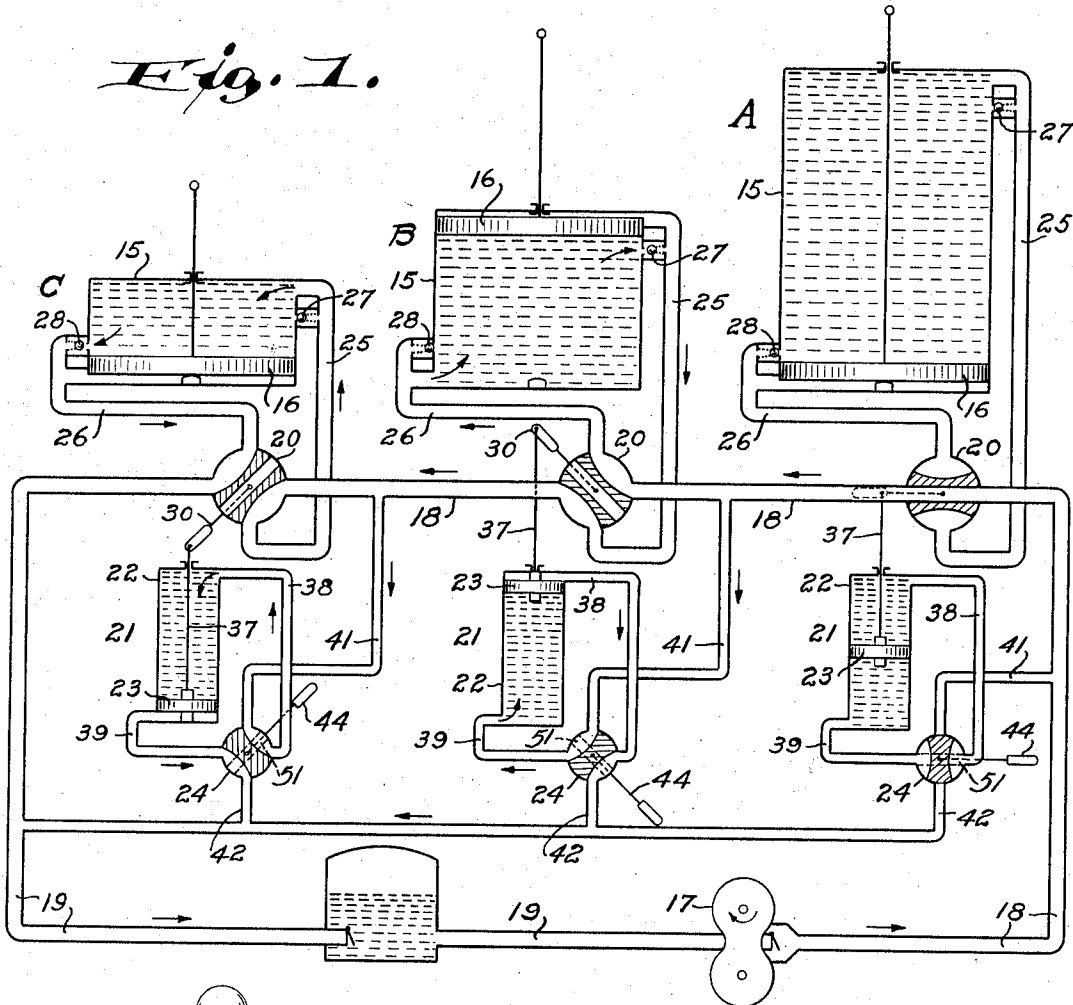


Fig. 2.

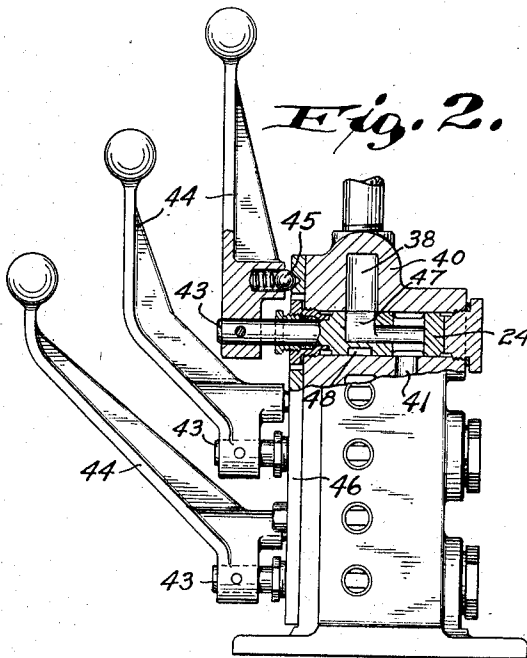


Fig. 3.

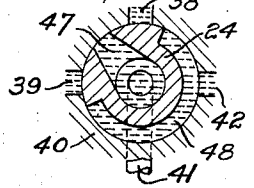


Fig. 5.

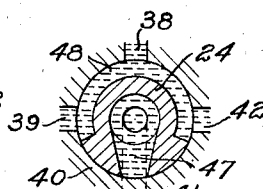
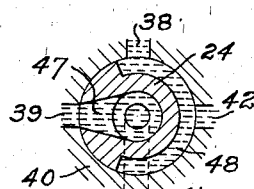
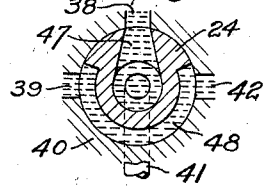


Fig. 4.

Fig. 6.

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2 Sheets-Sheet 2

Fig. 9.

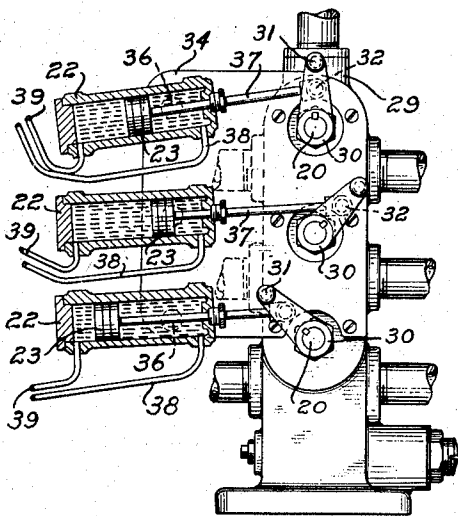
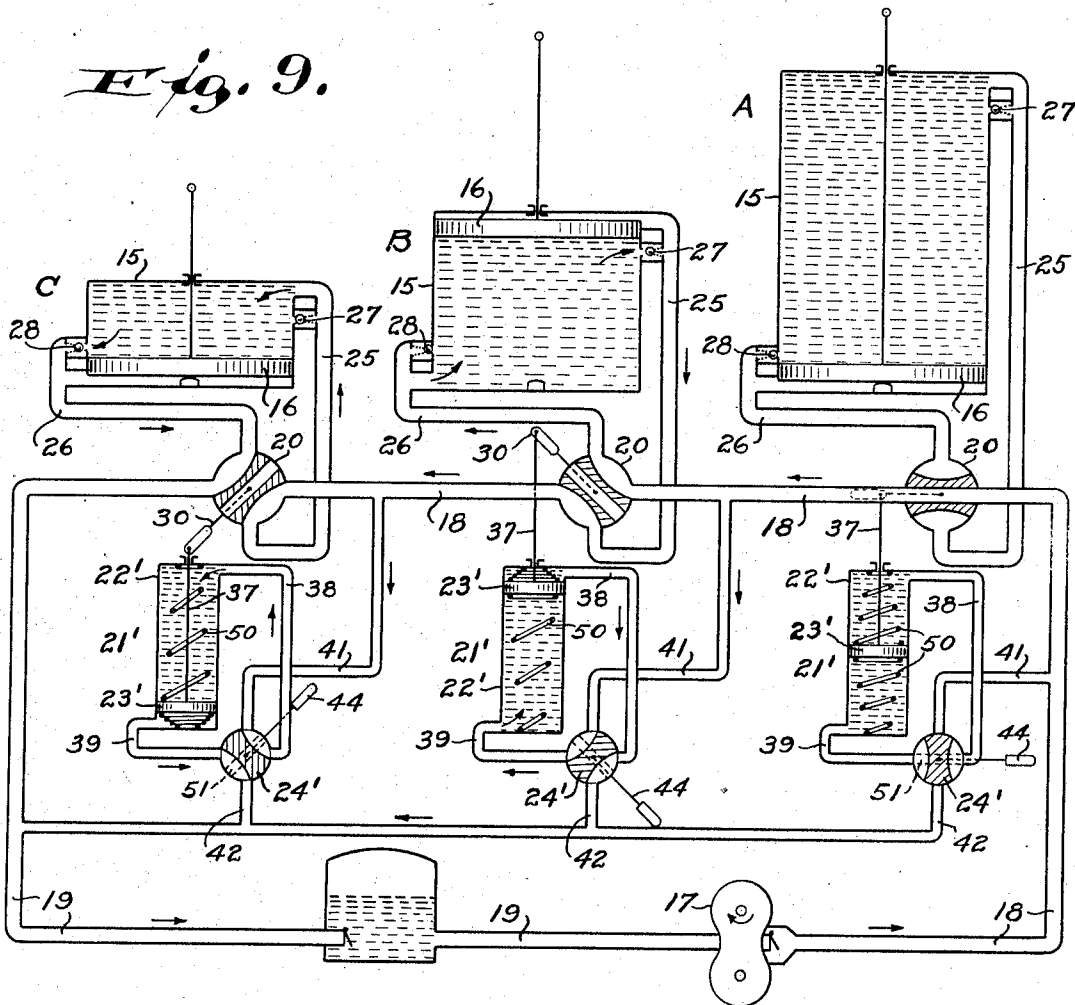


Fig. 7.

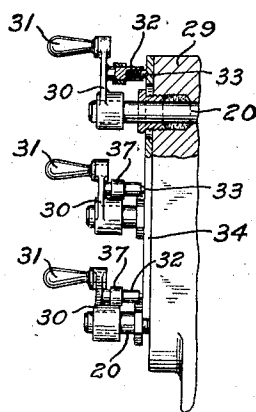


Fig. 8.

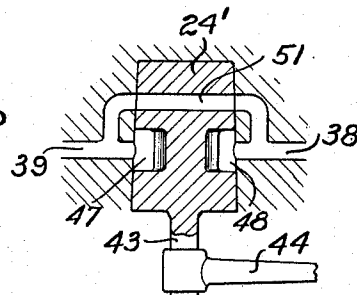


Fig. 10.

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2,112,466

GRADER CONTROL MECHANISM

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Application November 16, 1935, Serial No. 50,109

4 Claims. (Cl. 60—52)

My present invention relates in general to improvements in the art of controlling devices from a distant station, and relates more specifically to improvements in the construction and operation of control mechanism especially applicable to earth excavating and grading machines or systems.

Generally stated, an object of the present invention is the provision of improved control mechanism for fluid pressure actuated grader assemblages or the like, which will permit efficient operation of these assemblages from distant stations such as the driver's seat of a propelling vehicle.

In my prior application Serial No. 43,812, filed October 7, 1935, and now abandoned, is shown and described a new control system for fluid pressure actuated grader mechanisms of the type having a main dirt carrying bowl and front and rear aprons cooperable with the bowl to confine the material therein and to eject the material therefrom, at the will of the operator. The main bowl may be raised or lowered, and the aprons may be moved back or forth, by means of independently operable hydraulic jacks the operation of which is controllable by an oil circulating system including a pump and a control valve for effecting delivery of liquid to and from each of the jacks. This hydraulic circulating system is carried by and forms a part of the grading machine which is ordinarily hitched to a tractor or other propelling vehicle, and in order to reduce the number of attendants to a minimum, it is desirable to provide remote control means operable directly by the driver of the tractor, for manipulating the adjustable grader elements. My prior application above referred to, discloses a type of remote control comprising hydraulic motion transmitting devices for imparting movement from levers near the operator's station, to the control valves for the hydraulic jacks on the grading machine; and while such hydraulic transmission devices are satisfactory in principle of operation, they may be difficult to manipulate and sluggish in operation when applied to larger and relatively powerful equipment.

It is therefore a more specific object of the present invention to provide an improved hydraulically actuated control system for apparatus of the above described type, wherein the same source of power which actuates the jacks, may also be utilized to transmit motion from the remote station to the jack control valves.

Another specific object of the invention is the provision of a simple, compact and positively

acting remote control for one or more hydraulic jacks or the like, which can be disposed at any desired distance from the controlled mechanisms without affecting the effectiveness of the controlling devices.

A further specific object of the invention is to provide a new and useful grader control system especially applicable to large and powerful units, and which will insure quick and positive response by the adjustable elements of the assemblage to manipulation of the controlling levers.

Still another specific object of the invention is the provision of an improved control for hydraulic power systems comprising a series of hydraulically actuated jacks or the like, whereby any one or more of the power units may be independently or simultaneously actuated from a distant station as well as from a point nearer the individual units.

These and other objects and advantages of the present improvements will be apparent from the following detailed description, and some of the novel features of hydraulic control systems shown but not specifically claimed herein, form the subject of my copending application Serial No. 43,812, filed October 7, 1935.

A clear conception of several embodiments of the present invention, and of the mode of constructing and of manipulating grader control mechanisms built in accordance therewith, may be had by referring to the drawings accompanying and forming a part of this specification wherein like reference characters designate the same or similar parts in the various views.

Fig. 1 is a diagram showing a typical hydraulic jack and control system, having one type of improved hydraulically actuated remote control associated therewith;

Fig. 2 is an enlarged part sectional side view of the remote control valve assemblage;

Fig. 3 is a further enlarged transverse section through one of the remote control valves, showing the same in jack holding or neutral position;

Fig. 4 is a similar view of the same valve, showing the same in jack elevating position;

Fig. 5 is another similar view of the valve, showing the same in jack lowering position;

Fig. 6 is a further similar view of the valve, showing the same in position to permit actuation of the jack control valve by hand instead of hydraulically;

Fig. 7 is a part sectional side elevation of the main jack control valve assembly showing the remote control cylinders associated therewith;

Fig. 8 is a partial front elevation of the main jack control valve assemblage;

Fig. 9 is another diagram showing a hydraulic jack and control system, having a modified type of the improved hydraulically actuated remote control associated therewith; and

Fig. 10 is an enlarged section through one of the remote control valves of Fig. 9.

Although the improvements have been shown and described herein as being specifically applied to a hydraulic remote control for a jack actuated scraper assembly of a particular type, it is not intended to thereby unnecessarily restrict the scope, since some of the improved features of remote hydraulic control may be more generally applicable. The term "hydraulic" as used herein, applies to any liquid including water, oil or any anti-freezing solution such as is ordinarily utilized in motor cooling systems.

Referring specifically to Figs. 1 to 8 inclusive of the drawings, the hydraulic grader control and actuating system shown purely by way of illustration, comprises in general three independent liquid actuated jacks A, B, C each having a cylinder 15 and a piston 16 movable therein; a liquid circulating pump 17 having a discharge or outlet pipe 18 for delivering liquid to the jacks and a return or inlet pipe 19 for receiving the liquid from the jacks; a main control valve 20 associated with each of the jacks A, B, C for effecting delivery of liquid to and from the cylinders 15; an auxiliary hydraulic servo-motor 21 for actuating each valve 20, and each having a cylinder 22 and a piston 23 movable therein; and a remote control valve 24 associated with each servo-motor 21 for effecting delivery of liquid from the pumping system to and from the cylinder 22 thereof. The pistons 16 of the jacks A, B, C have rods which are associated directly with the scraper elements which the respective jacks are adapted to adjust, the jack A being cooperable with the digging and carrying bowl, while the jack B is cooperable with the rear unloading apron, and the jack C is cooperable with the front loading and dirt confining apron, as clearly described in my copending application hereinabove referred to.

The hydraulic jacks A, B, C are of well known construction, each having an upper passage or port 25 and a lower passage or port 26 communicating with its main control valve 20; and upper and lower automatic by-pass valves 27, 28 respectively associated with the ports 25, 26, these valves functioning to permit free flow of liquid directly through the cylinders 15 when the pistons 16 have been moved into either extreme position and are subjected to liquid pressure. The main control valves 20 are preferably located relatively near their respective jacks and upon the scraper or grader, and these valves 20 are shown diagrammatically in Fig. 1, but may be of the type shown in my copending application, housed within a common casing 29 as shown in Figs. 7 and 8. Each of the jack control valves 20 has an actuating lever 30 provided with a manipulating handle 31, and also provided with a lateral pin or projection 32 carrying a latch ball 33 which is cooperable with a plate 34 secured to the casing 29. The valves 20 are thus independently manually operable by an attendant located upon the grader unit, who may grasp the desired handle 31 of one or more of these valves and effect either individual or simultaneous operation of the jacks A, B, C.

The present improved remote control mechanism comprising the servo-motors 21 and the

control valves 24, is shown diagrammatically in Fig. 1, and more in detail in Figs. 2 to 8 inclusive. The cylinders 22 of the servo-motors 21 are swingably supported upon the plate 34 by pivots 36, and the rods 37 of the servo-motor pistons 23 are connected to the adjacent projections 32 of the main valve actuating levers 30. Each servo-motor cylinder 22 has a port 38 communicating with one displacement chamber, and a similar port 39 communicating with the other displacement chamber, and these ports communicate through flexible conduits with the corresponding control valves 20 all of which may be mounted in a compact common casing 40 as shown in Fig. 2. The valves 20 may be of the special rotary type shown in Figs. 2 to 6 inclusive, and each valve has a pressure passage or port 41 communicating with the pump outlet pipe 18, and a return passage or port 42 communicating with the pump suction pipe 19, as shown in Fig. 1. While the diagram of Fig. 1 shows individual pressure ports 41, this port may be common to all of the valves, and the ports 41, 42 in the casing 40 are preferably connected to the pump outlet and return pipes 18, 19 by means of flexible conduits.

The servo-motor control valves 24 which are housed within the casing 40, have stems 43 to which actuating levers 44 are attached, and these levers 44 carry latch balls 45 which are cooperable with positioning notches formed in a plate 46 as shown in Fig. 2, in order to indicate when the levers have reached the desired position of adjustment or setting. The servo-motor control mechanism may be positioned as a unit, upon the scraper propelling tractor or similar vehicle other than the scraper itself, and the formation of the levers 44 is such that these may be conveniently either independently or simultaneously manipulated by the operator. As previously indicated, the valves 24 may be constructed as shown in Figs. 2 to 6 inclusive, and each of these valves has a passage 47 which constantly communicates with the pressure pipe 18 through the port 41, and another passage 48 which constantly communicates with the suction pipe 19 through the port 42. When one of the valves 24 has been positioned as illustrated in Fig. 3, the passages 47, 48 and hence the ports 41, 42 are cut-off from communicating with the corresponding servo-motor cylinder 22 through the ports 38, 39, and the piston 23 is then locked in position since no liquid can escape from either of the displacement chambers of the servo-motor 21. If the valve 24 is shifted to the position shown in Fig. 4, liquid under pressure will enter the lower displacement chamber of the servo-motor cylinder 22 from the passage 47 through the port 39, and other liquid will be free to escape from the upper displacement chamber through the port 38, passage 48 and suction pipe 42; thus causing the piston 23 of the servo-motor 21 to move the corresponding main jack control valve 20 and thereby effecting lifting movement of the jack B as shown at the center of Fig. 1. If a valve 24 is set as shown in Fig. 5, liquid from the pressure source will enter the upper displacement chamber of the corresponding servo-motor cylinder 22 from the passage 47 through the port 38, and the liquid from the lower displacement chamber will escape through the port 39, passage 48 and pipe 42; thereby causing the servo-motor piston 23 to move the corresponding main jack control valve 20 and thus effecting lowering movement of the jack C as indicated at the left in Fig. 1. When the valve 24 is positioned as shown in Fig. 6, the pressure

supply pipe 18, port 41 and passage 47 are shut off, and both of the displacement chambers of the corresponding servo-motor 21 are connected directly to each other and to the suction port 42 by the valve passage 48, thereby making the piston 23 freely shiftable in either direction by the corresponding valve lever 30. Each of the servo-motor control valves 24 may therefore be manipulated independently of the others, to either raise, lower, or lock the corresponding jack A, B, C from the remote operator's station, or to release the corresponding jack control valve 20 for manual operation by its actuating lever 30.

In the control system of Figs. 1 to 8 inclusive, it is necessary in order to return the piston 23 of each servo-motor 21 to mid-position as shown at the right in Fig. 1, to shift the corresponding control valve 24 from either extreme position, slightly beyond neutral or mid-position, and to quickly set the lever 44 in neutral position when the piston 23 reaches mid-position. Such extra movement of the levers 44 may be eliminated with a modified servo-motor assemblage such as shown in Figs. 9 and 10, wherein the modification is confined to the servo-motors and the control valves therefor, and does not in any manner affect the rest of the system. In the modified system, the servo-motors 21' have pistons 23' movable within cylinders 22', these pistons being biased or urged toward mid-position by means of coiled springs 50 coacting with the opposite faces thereof. The servo-motor control valves 24' which may be similar to the valves 24, are each provided with an additional port 51 as shown schematically in Figs. 9 and 10, and this port 51 is adapted to automatically establish direct communication between the ports 38, 39 whenever the valve 24 is in neutral or mid-position. With such assemblage, the servo-motor piston 23 will automatically assume mid-position whenever the control valve 24' is returned from either extreme to neutral position, and the jack control valves 20 will likewise be returned to neutral position by the servo-motors 21'.

The operation of the hydraulic jack systems shown in Figs. 1 and 9, is identical, and during normal operation of either of these systems, the remote control levers 44 may be manipulated to either independently or simultaneously raise or lower the jacks A, B, C. When a lever 44 is in mid- or neutral position as shown at the right of Fig. 1, the corresponding servo-motor piston 23 is in mid-position and holds the corresponding main valve actuating lever 30 in neutral position, thereby causing the liquid flowing through the pipe 18 to by-pass the jack A, and also causing the valve 20 to maintain the piston 16 of the jack A in any position of prior adjustment. If the lever 44 of one of the control valves 24 is moved to the position indicated at the center of Fig. 1, liquid under pressure will flow through the ports 41, 39 and will raise the corresponding servo-motor piston 23. This movement of the piston 23 is transmitted through the piston rod 37 to the actuating lever 30 of the corresponding valve 20, thus shifting this valve to admit liquid under pressure from the pipe 18 through the port 26 to the cylinder 15 of the jack B. The piston 16 of this jack will then rise until it reaches its extreme upper position, whereupon liquid will flow through the cylinder 15, past the by-pass valves 27 and through the port 25, and will be delivered to the pipe 18 beyond the valve 20. This operation will continue until the piston 16 is again lowered to cut off the communication past the valve 27. If the

lever 44 is thrown to the position shown at the left of Fig. 1, liquid under pressure is admitted from the pipe 41 through the port 38 to the displacement chamber above the servo-motor piston 23, and this piston will be lowered to thereby cause the piston rod 37 to swing the valve actuating lever 30 and its valve 20 to such position that the liquid under pressure is admitted above the piston 16 of the jack C. When the piston 16 has reached its extreme lower position, liquid under pressure continues to flow through the cylinder 15 past the by-pass valve 28 and through the port 26, to the return pipe 19. It will thus be apparent that the jacks A, B, C may be independently or simultaneously actuated in either direction, without in any manner interfering with the operation of the others, and without disturbing the continued circulation of liquid by the pump 17 through the pipes 18, 19. The servo-motors 21, 21', and the actuating valves 24, 24' thereof, are operable as hereinabove specifically described, and the servo-motor control valves may be disposed at any desired distance from the main control valves 20, while the servo-motors are preferably disposed directly adjacent to the latter. The operation of the servo-motors 21, 21' is effected by the same liquid under pressure which actuates the jacks A, B, C, thereby insuring positive power operation of the servo-motors. The several valves 20 may however be manually operated by adjusting the servo-motor control valves 24, 24' to the position indicated in Fig. 6, whereupon the servo-motor pistons 23, 23' are freely movable within their confining cylinders 22, 22'.

From the foregoing description it will be apparent that the present invention provides an improved hydraulic system for a multiplicity of hydraulic jacks or the like, which is extremely simple in its assemblage, and which is moreover highly efficient and rapid in operation. By utilizing the same source of power for actuating the servo-motors, as is used for operating the jacks, rapid and positive actuation is assured, and a single pump may be utilized for the entire system. The improvement is applicable to any desired number of jacks or other hydraulic units, and is especially adapted for remote control of such units. The invention has proven especially useful in connection with the control of the elements of road scrapers or the like, especially of the type shown and described in my prior application hereinabove referred to, and after the system has once been properly installed, its continued successful operation is assured.

It should be understood that it is not desired to limit the present invention to the exact details of construction and to the precise mode of operation herein shown and described, for various modifications within the scope of the claims may occur to persons skilled in the art.

I claim:—

1. In combination, a source of liquid supply, a hydraulic jack, a main valve for controlling delivery of liquid from said source to said jack, a servo-motor having a piston movable by liquid from said source to operate said main valve, manually operable means for actuating said main valve, and means for establishing direct communication between the displacement chambers on opposite sides of said servo-motor piston to permit manual actuation of said main valve without obstruction from said servo-motor.

2. In combination, means forming a conduit, a pump for constantly circulating liquid under

pressure through said conduit, a hydraulic jack, a main valve for controlling the circulation of liquid from said conduit through said jack, means for effecting direct manual actuation of said main valve, a servo-motor having a piston movable by liquid under pressure from said conduit to actuate said main valve, and means for establishing direct communication between the displacement chambers on opposite sides of said servo-motor piston while cutting off communication with said conduit to permit direct manual actuation of said main valve without obstruction from said servo-motor.

3. In combination, a source of liquid supply, a hydraulic device operable by liquid from said source, a main valve for controlling delivery of liquid from said source to said device, means for effecting direct manual actuation of said main valve, a servo-motor having a piston movable by liquid under pressure from said source to actuate said main valve, and an auxiliary valve operable to cut off communication between said source and

said servo-motor while establishing direct communication between the displacement chambers on opposite sides of said piston to permit direct manual actuation of said main valve without obstruction from said servo-motor.

4. In combination, means forming a conduit, a pump for constantly circulating liquid under pressure through said conduit, a hydraulic device operable by liquid from said conduit, a main valve for controlling the circulation of liquid from said conduit through said device, means for effecting direct manual actuation of said main valve, a servo-motor having a piston movable by liquid under pressure from said conduit to actuate said main valve, and an auxiliary valve operable to cut off communication between said conduit and said servo-motor while establishing direct communication between the displacement chambers on opposite sides of said piston to permit direct manual actuation of said main valve without obstruction from said servo-motor.

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