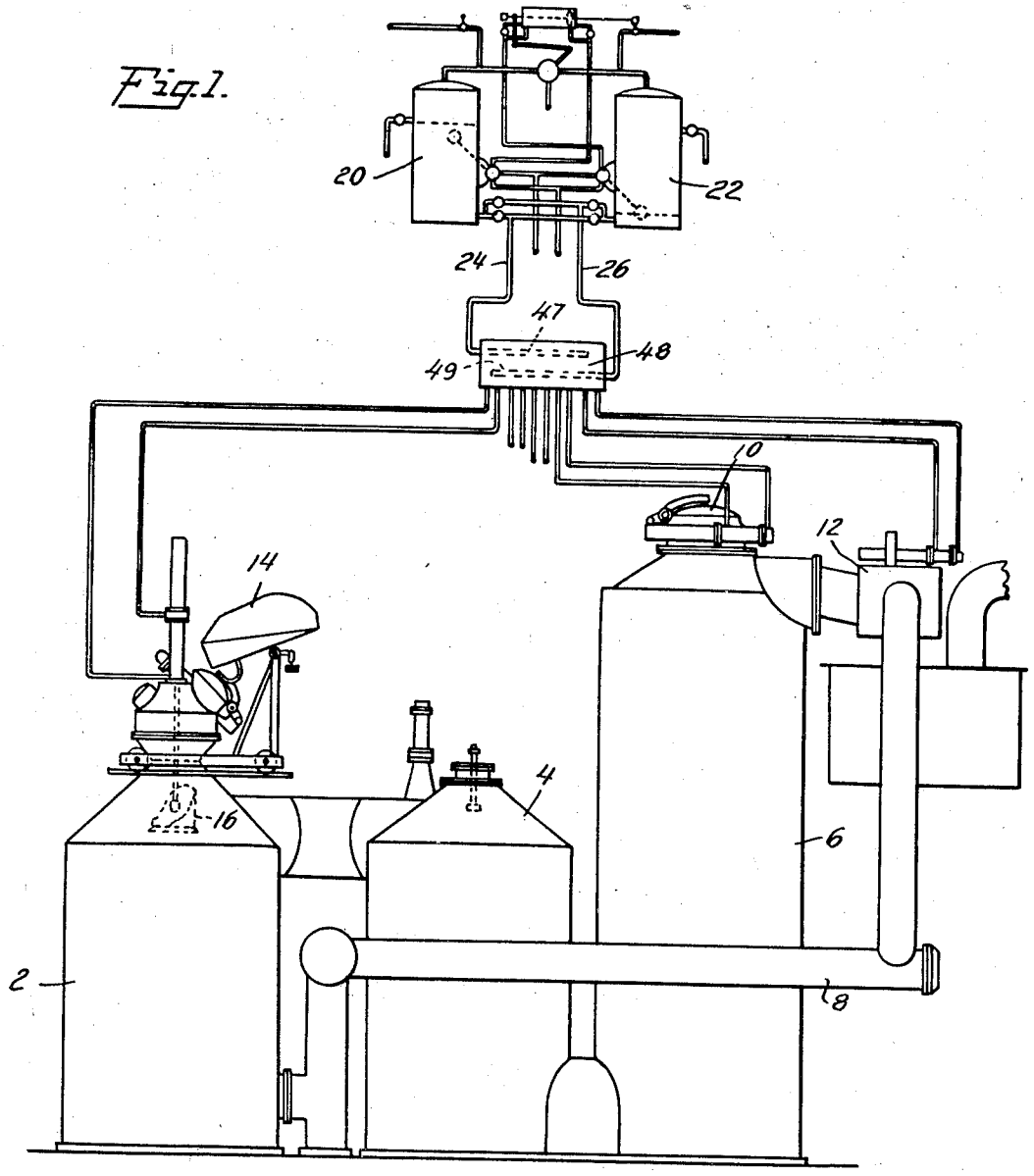
Jan. 31, 1939. R. L. ELLIS 2,145,540

HYDRAULIC SYSTEM

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Fig. 1.



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HYDRAULIC SYSTEM

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Fig. 2.

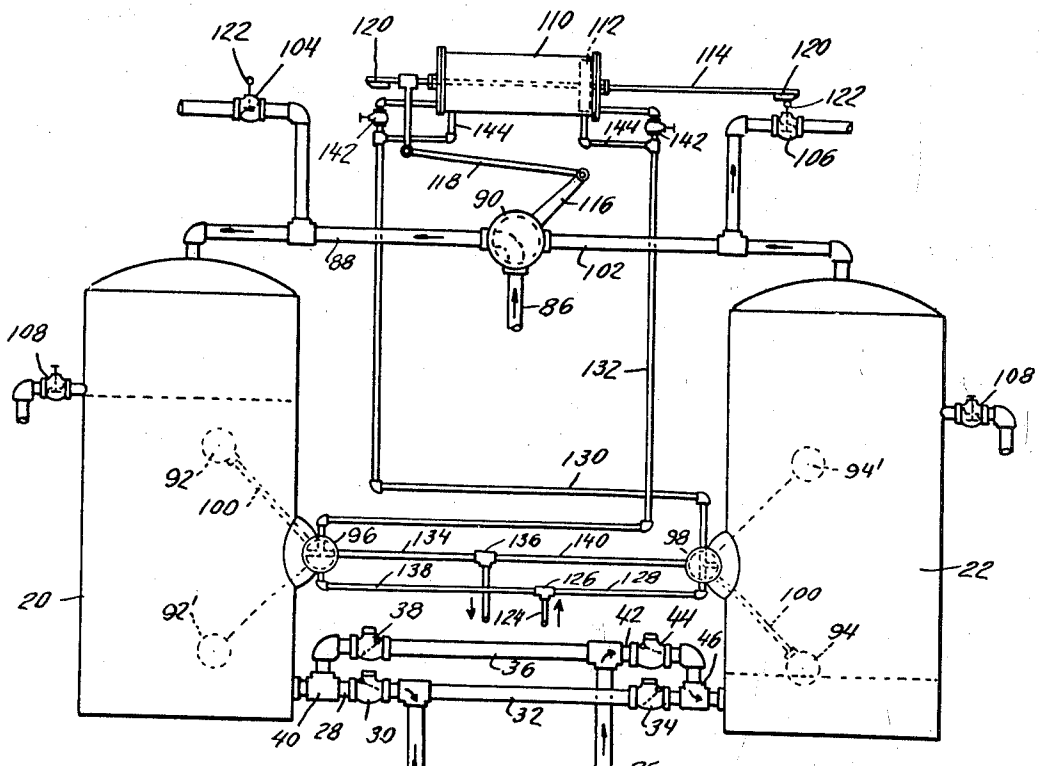
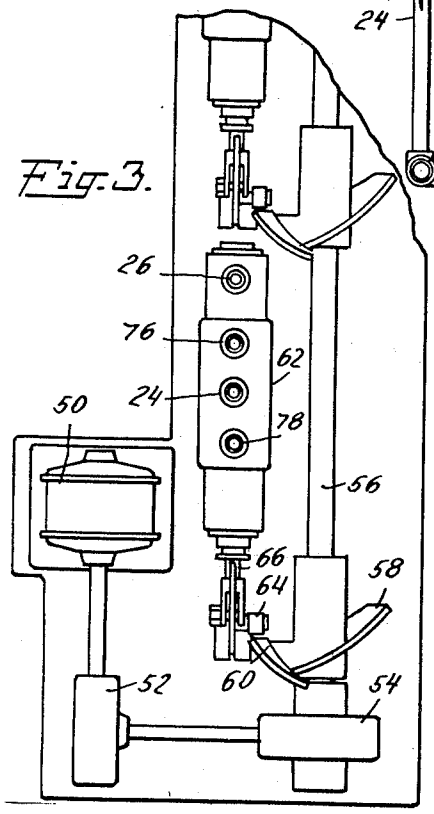


Fig. 3.



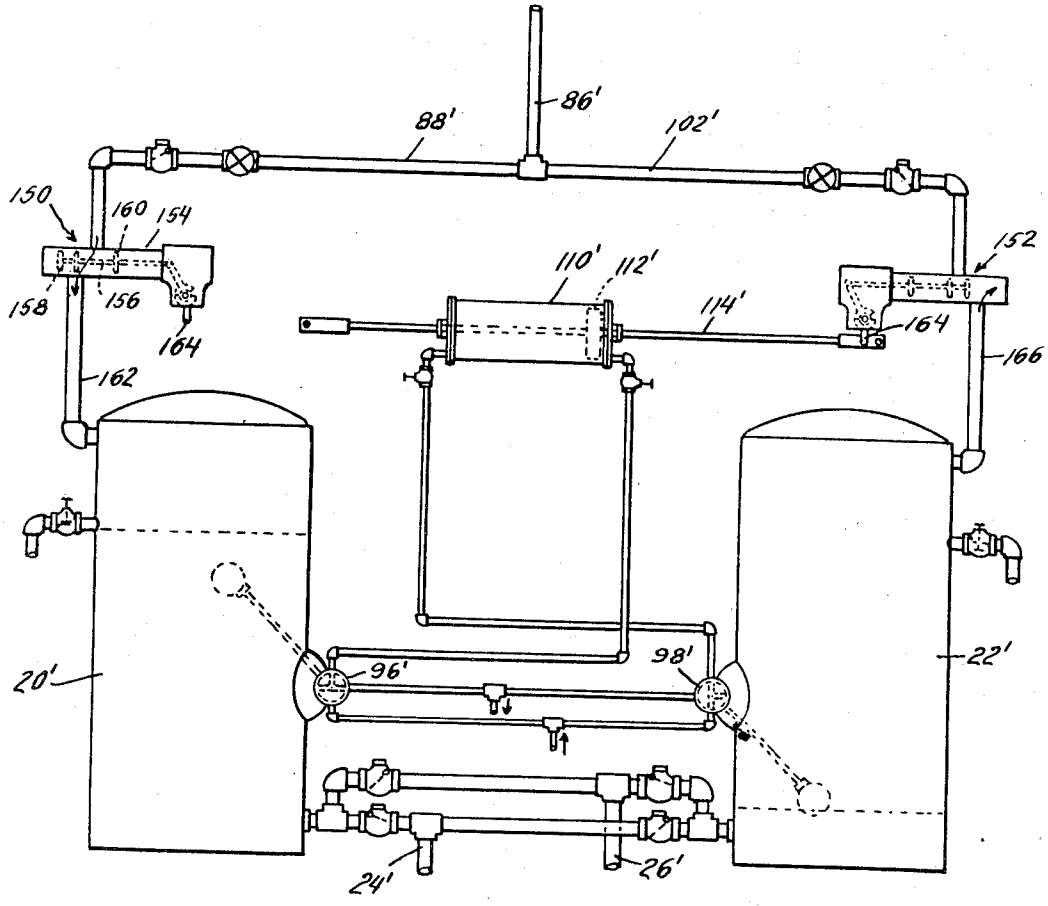
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Fig. 4.



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UNITED STATES PATENT OFFICE

2,145,540

HYDRAULIC SYSTEM

Robert L. Ellis, Miami Beach, Fla.

Application December 16, 1931, Serial No. 581,343

14 Claims. (Cl. 60—51)

My invention relates to apparatus for supplying liquid under pressure to hydraulic operating mechanism and particularly to apparatus adapted for use in combination with gas producing apparatus to actuate hydraulic operating mechanism for one or a plurality of devices employed therein, such as the valves for admitting steam to the apparatus, valves for purging the steam and oil lines, devices for introducing and spreading fuel, etc.

Heretofore the valves used in gas producing apparatus have been operated manually or by pressure liquid supplied by a pump operating continuously and provided with a by-pass and a surge tank to apply liquid under pressure to hydraulically operated mechanism for the valves. Manual operation is difficult and is not dependable and the use of pumps and surge tanks results in a continued loss of air from the surge tank, resulting in uneven pressure. Moreover, systems including pumps and associated mechanism are expensive to install and due to the many moving parts, such systems require excessive costs for maintenance and repair.

In accordance with my invention hydraulic apparatus is provided in which water or other liquid is passed back and forth repeatedly through the hydraulic operating mechanism while continuously maintaining a supply of liquid under pressure. The apparatus of this invention involves a minimum of moving parts and is of simple and rugged construction. It is therefore inexpensive to construct and maintain.

Among the objects of my invention are to provide a new and improved system for supplying liquid under pressure to hydraulic operating mechanism, to reduce the cost of installation, operation and maintenance of hydraulic apparatus and to provide automatic means operative in a continuous and dependable manner to operate hydraulic mechanism such as that employed for operating the valves and other mechanism in gas making apparatus.

These and other objects and features of my invention will appear from the following description thereof in which reference is made to the accompanying figures of the drawings illustrating preferred embodiments of my invention.

In the drawings—

Fig. 1 is a diagrammatic illustration of my invention as applied to a water gas set of the back-run type.

Fig. 2 is an enlarged view of a portion of the apparatus illustrated in Fig. 1.

Fig. 3 illustrates details of construction of mechanism used for controlling the passage of liquid under pressure to specific valves in predetermined timed relation, and

Fig. 4 illustrates a modification of a portion of the apparatus illustrated in Fig. 2.

In the preferred embodiments illustrated in the drawings, my invention is shown as employed in combination with gas making apparatus and the present description will be confined to the embodiments of the invention illustrated. It will be understood, however, that the novel features and improvements of my invention are susceptible of use in combination with other types of apparatus, machines and operating mechanism wherein liquid under pressure is employed. Hence the scope of the invention is not confined to the embodiment thereof herein described.

In the form of the invention illustrated in Figs. 1 to 3 inclusive, gas making apparatus of the back-run water gas type is shown comprising a generator 2, carburetor 4, superheater 6, and back-run pipe 8 which may be of any suitable construction. Operation of the water gas set involves numerous moving parts actuated by hydraulic cylinder mechanism, as for example a stack valve 10, back-run valve 12 and charging machine 14 including spreader 16, etc. Each of said elements may be operated hydraulically by means of operating mechanism 18 of any suitable type.

In order to supply liquid under pressure to the various hydraulic operating mechanisms, I provide two tanks 20 and 22, each adapted to contain a body of liquid under pressure, from which the liquid is discharged to a pressure line 24 and to which liquid discharged from the operating mechanism is passed through a drain line 26 and returned to the other tank. The tanks 20 and 22 may be of any suitable construction and preferably are each of sufficient capacity to supply pressure liquid to operate the hydraulic mechanism of a large gas plant for a period of hours, and in the case of a small gas plant each tank may be of a capacity sufficient to supply all of the pressure liquid required for operation over a period of a day or more.

In order that liquid may be supplied continuously under pressure to the pressure line 24, I provide suitable check valves in the pressure line and drain line to permit liquid under pressure to pass from whichever tank is under pressure to the operating mechanism and thence to the drain line and back to the other tank. As shown in Fig. 2, the pressure line 24 is connected to the tank 20 through the pipe 28 hav-

ing an outwardly opening check valve 30 therein, and to the tank 22 through a pipe 32 having an outwardly opening check valve 34 therein. The drain line 26 is connected to the tank 20 through the pipe 36 and inwardly opening check valve 38 to the T 40 in pipe 28. Similarly the drain line 26 is connected to the tank 22 through the pipe 42 and inwardly opening check valve 44 to the T 46 in the pipe 32. The check valves 30, 34, 38 and 44 are movable under pressure to allow liquid to pass from whichever tank is under pressure to the pressure line 24 and to allow liquid to return through drain line 26 to pass to whichever tank is under no pressure. In this way a continuous flow of liquid under pressure to the pressure line 24 is assured irrespective of which tank is supplying the liquid.

The sequence and timed relation of the hydraulic operating mechanism for the various valves and elements of the gas making apparatus is controlled by a device commonly referred to as a "control nest", such as that illustrated in part in Figs. 2 and 3. The control nest indicated at 48 in Fig. 1 is connected with each of the hydraulic operating mechanisms to which liquid under pressure is to be supplied. However, for simplicity of illustration only one hydraulic operating mechanism 18 and only one control nest valve have been shown in the detailed portion of the control nest illustrated in Figs. 2 and 3. A pressure header 47 is connected to pressure line 24 to supply liquid under pressure to each of the valves of the control nest and a drain header 49 is connected to the drain line 26 to receive liquid discharged from the various hydraulically operated mechanisms through the control nest valves.

The control nest is provided with a motor 50 operating through gears 52 and 54 to rotate the shaft 56 at a constant speed. Cams 58 and 60 secured to the shaft 56 are provided for actuating the valve 62 by engaging the roller 64 secured to the valve stem 66. Only one set of cams and one valve are fully shown in Figs. 2 and 3, but it will be understood that as many sets of cams and valves are provided as are necessary for operating the various valves and elements of the gas making apparatus.

The valve stem 66 extends through packing gland 68 into the tubular chamber 70 and is provided with valve closures 72 and 74 which control the flow of liquid through the pipes 76 and 78 to and from the cylinder of the operating mechanism 18. In the position shown the liquid under pressure passes from header 47 in pressure line 24 through the channel 80 between the valve closures 72 and 74 to the pipe 76 to force the piston 82 of the operating mechanism downwardly. Liquid below the piston 82 then passes through the pipe 78 to the channel 84, thence to the header 49 in drain line 26 and back to tank 22. When the shaft 56 rotates to bring the cam 58 in contact with roller 64, the valve stem is moved downwardly so that the valve closures 72 and 74 are moved into positions below the connections of the pipes 76 and 78 respectively with the cylinder 70. The direction of flow of the liquid is thereby reversed from that shown and the piston 82 is returned to the position illustrated in Fig. 2.

With each movement of the piston of each operating mechanism from one position to the other, liquid passes from the tank of liquid under pressure to the pressure line 24 and into the cylinder of the operating mechanism. At the same time liquid in the cylinder is forced into the drain line 26 and back into the tank which is not at that time under pressure.

During the period when liquid is being discharged from the tank 20, fluid under pressure, such as steam, is supplied from any suitable source, such as steam line 86, and is admitted to the upper part of the tank through the pipe 88 controlled by pressure valve 90. In passing liquid from the tank under pressure, for instance, tank 20, through the pressure line 24, control nest 48, operating mechanism 18 and drain line 26 to the tank 22, the level of liquid in the tank 20 continuously falls and the level of the liquid in tank 22 rises. Floats 92 and 94 are located in the tanks 20 and 22 respectively and the change in level of the liquid therein therefore causes the float 92 to move downwardly gradually until it reaches the position 92'. At the same time the float 94 rises as the level of the liquid in tank 22 rises until the float reaches the position 94'. Float operated valves 96 and 98 are operatively connected with the floats 92 and 94 respectively by the arms 100 and are rotated thereby.

The operation of the valves 96 and 98 serves to actuate a control device to operate pressure valve 90 to cut off the supply of steam to the tank under pressure and admit steam to the tank which is not under pressure. When the level of liquid in tank 20 has fallen to that represented by the position 92' of the float, the valve 90 is operated automatically to connect the source of steam to the pipe 102 leading to the top of tank 22 and fluid under pressure is admitted to the tank 22 to discharge liquid therefrom. The tanks 20 and 22 are provided with exhaust valves 104 and 106 respectively, operable to close automatically when pressure is applied to the tanks so that the application of steam or other fluid under pressure to either tank closes the exhaust valve associated therewith. The exhaust valves are opened by operation of the control device to relieve the pressure applied to the tank from which liquid has been discharged.

The control device by means of which pressure valve 90 and exhaust valves 104 and 106 are operated, comprises a cylinder 110 within which a piston 112 is movable to operate the shaft 114 to which an arm 116 on the valve 90 is secured by the link 118. The opposite ends of the shaft 114 carry cam members 120 movable into engagement with projections 122 on the exhaust valves 104 and 106. In this way the pressure applied to a tank from which liquid has been discharged is relieved by the control device as the piston and shaft move to operate the pressure valve.

The piston of the control device is movable under pressure of fluid, such as water from a city water main, controlled by the operation of float operated valves 96 and 98. In the position of the float operated valves shown in Fig. 2 water passes from the pipe 124 to T 126 and pipe 128 to valve 98, thence through pipe 130 to the left-hand side of piston 112 in cylinder 110. Water from the right-hand side of the piston passes out of the cylinder through the pipe 132 to valve 96 and thence through pipe 134 to the T 136 and to sewer. The amount of water thus used is negligible since the control device is operated only when the liquid from one tank has been discharged and the pressure valve is reversed. When the float valves move from their full line to their dotted line positions, the positions of valves 96 and 98 are reversed so that water passes through pipe 124, T 126 and pipe 138 to valve

96 and thence through pipe 132 to the right-hand side of the piston 112. Water is then discharged from the cylinder 110 through the pipe 130 to valve 98 and thence through pipe 140 to the T 136 and to sewer. The pipes 130 and 132 are each provided with an adjustable valve 142 and a by-pass 144 communicating with the cylinder 110 near the end thereof in position to be closed as the piston approaches the end of the cylinder. Thus when water is passed into the cylinder 110 through the pipe 130, the piston after an initial slow movement which uncovers the by-pass 144 moves toward the right rapidly until the by-pass 144 at the right-hand end of the cylinder is covered. The piston then moves slowly through the remaining short portion of its stroke. During the rapid movement of the piston the pressure valve 90 is moved into position to apply pressure to the liquid in the tank 20, but the cam 120 is not brought into contact with the exhaust valve 106 for tank 22. The piston then moves more slowly toward the end of the cylinder until cam 120 actuates valve 106 to permit steam to escape from tank 22 to relieve the pressure thereon. The brief period of time between the operation of the pressure valve 90 and the operation of exhaust valve 106 gives an opportunity for pressure to build up in tank 20 so that both tanks are momentarily under pressure, thus insuring a continuous supply of liquid under pressure to the pressure line 24 for actuating the hydraulic operating mechanism of the gas making apparatus.

When the valve 90 is operated to admit steam to the tank 22, the exhaust valve 104 of tank 20, which is substantially emptied of liquid, is positively operated to relieve the pressure applied to said tank and communicate with the atmosphere. The tank 22 then being under pressure and the tank 20 under no pressure, the check valves 30, 34, 38 and 44 in the piping leading to the pressure line and drain line, reverse automatically under the influence of pressure on the liquid in tank 22 and liquid under pressure passes from the tank 22 to pressure line 24 and from drain line 26 back into tank 20. Thus the system continuously supplies liquid under pressure for operating the hydraulic mechanism for the valves, etc., whereas the liquid is conserved and passed back and forth from one tank to the other. Each of tanks 20 and 22 is provided with an over-flow valve 108 adapted to permit excess liquid to be discharge from the tank but operable to close under fluid pressure applied to the tank to prevent the escape of steam therefrom.

In the modified form of the apparatus shown in Fig. 4 the construction and operation of the tanks 20' and 22', pressure line 24', drain line 26' and float operated valves 96' and 98' are the same as that of the apparatus shown in Fig. 2. Steam or fluid under pressure is passed from the steam line 86' through pipes 88' and 102' to separate pressure valves 150 and 152 associated with the tanks 20' and 22' respectively. The valves are similar in structure and therefore only one valve need be described in full. Each valve is in the form of a cylinder 154, open to the atmosphere at the outer end and provided with a slidable member 156 having closures 158 and 160 thereon. The pipe 88' communicates with the cylinder at a point spaced from the open outer end thereof and the pipe 162 communicates with the cylinder nearer the open end thereof. When the valve is in the position shown, the slidable member is in its extreme outer position and steam is admitted to the tank 20'. In this position the end of the cylinder is closed to the atmosphere by the closure 158. When water in the tank falls to the level shown in tank 22', the valves 96' and 98' operate to admit water into the left-hand end of cylinder 110' causing piston 112' to move to the left. Shaft 114' is thus moved to throw the operating arm 164 of valve 152 to the left and move the slidable member 156 outwardly into position with the closure 158, closing the end of the cylinder and with the pipe 102' communicating with the pipe 166 of tank 22' to admit steam under pressure thereto. As the piston 112' moves to the left, the shaft 114' moves into engagement with the operating arm 164 of valve 150 retracting the slidable member and moving closure 158 into position to cut off the supply of steam from the pipe 88' and allow steam from the tank 20' to escape to the atmosphere through the end of the cylinder, thus relieving the pressure on the liquid in tank 20. In this form of the apparatus one valve is operated to admit steam to the associated chamber before the pressure is relieved on the other chamber. Therefore it is unnecessary to provide a by-pass for the liquid flowing to cylinder 110, such as that employed in the construction shown in Fig. 2.

The operation of the forms of apparatus heretofore described will appear from the foregoing description thereof. In each instance liquid is passed from a tank under pressure through a pressure line to a control nest. The liquid then flows to whichever of the various hydraulically operated mechanisms is to be operated, depending upon the operation of the cam elements of the apparatus in the control nest. The liquid discharged from the hydraulic apparatus then is passed back through the valve in the control nest to the drain line and returned to the tank which is not under pressure. As this progressive discharge of liquid from one tank continues, the level of liquid in the tank under pressure is lowered and the level of liquid in the other tank is raised. When a predetermined amount of liquid has been discharged from the tank under pressure, i. e., when the level of the liquid has fallen to a certain point, the float operated valves operate to admit water to the control device to operate the same and cause steam or other fluid under pressure to be admitted to the tank which previously was under no pressure and which now contains a large amount of liquid, and to relieve the pressure on the tank from which the liquid was previously discharged. The check valves in the pressure and drain lines operate automatically to direct the liquid under pressure to the pressure line and return liquid from the drain line to the tank which now is under no pressure.

Although I have described my invention in detail as embodied in the forms of apparatus illustrated in the drawings, I intend the foregoing description to be illustrative of my invention and not to limit the same. It will therefore be understood that numerous changes and modifications may be made in the apparatus without departing from the spirit and scope of the invention. For example, while an apparatus involving two tanks has been described, it will be understood that more than two tanks may be employed, if desired. Further, while the tanks are shown and described as separate and detached, it will be understood that they may be combined in a single casing or housing which is divided by

one or more partitions into two or more compartments or tanks.

I claim:

1. Apparatus for supplying liquid under pressure to hydraulically operated mechanism comprising a plurality of tanks each adapted to contain liquid, means for supplying fluid under pressure to one of said tanks to cause discharge of liquid therefrom while permitting return of the liquid discharged into another of said tanks, and means controlled by the level of liquid in said tanks to interrupt the supply of pressure fluid to the tank to which pressure fluid has been supplied and to supply the pressure fluid to another of said tanks.

2. Apparatus for supplying liquid under pressure to hydraulically operated mechanism comprising a plurality of tanks adapted to contain liquid under pressure, means for conducting liquid from a tank under pressure to said hydraulically operated mechanism and thence to another of said tanks whereby the level of liquid in said tanks is changed, a source of fluid under pressure, a float in each of said tanks and means connected to said floats operable when the level of the liquid in a tank under pressure has fallen to a predetermined level to admit fluid from said source to another tank and to relieve the pressure applied to that tank from which liquid has been discharged.

3. Apparatus for supplying liquid under pressure to hydraulically operated mechanism comprising two tanks adapted to contain a body of liquid under pressure, a pressure line and a drain line connected to each of said tanks and to said hydraulically operated mechanism, check valves in said lines constructed and arranged to allow liquid to flow from whichever tank is under pressure to the hydraulically operated mechanism and thence to the other tank, a source of fluid under pressure, a pressure valve movable to admit fluid from said source to either of said tanks, exhaust valves for relieving pressure applied to said tanks, a control device for operating said pressure valve and said exhaust valves, and actuating mechanism operated in response to the discharge of a predetermined amount of liquid from the tank which is under pressure to operate said control device and reverse said pressure and exhaust valves to admit fluid under pressure to that tank which previously was under no pressure, and to relieve the pressure on that tank which previously was under pressure.

4. Apparatus for supplying liquid under pressure to hydraulically operated mechanism comprising two tanks adapted to contain a body of liquid under pressure, a pressure line and a drain line connected to each of said tanks and to said hydraulically operated mechanism, check valves in said lines constructed and arranged to allow liquid to flow from whichever tank is under pressure to the hydraulically operated mechanism and thence to the other tank whereby the level of the liquid in said tanks is changed, a source of fluid under pressure, a pressure valve movable to admit fluid from said source to either of said tanks, exhaust valves for relieving pressure applied to said tanks, a control device for operating said pressure valve and said exhaust valves, a float in each of said tanks, mechanism rendered operative by the joint movement of the float in one tank to a predetermined upper level and the movement of the float in the other tank to a predetermined lower level to actuate said control device to reverse said pressure and exhaust valves whereby fluid under pressure is applied to that tank in which the float is at a predetermined upper level and the pressure applied to the other tank is relieved through said exhaust valve.

5. Apparatus adapted for supplying liquid under pressure to the operating mechanism of each of a plurality of hydraulically operated valves of a gas producing apparatus comprising two tanks adapted to contain a body of liquid under pressure, a pressure line and a drain line connected to each of said tanks and to said hydraulically operated mechanism, check valves in said lines constructed and arranged to allow liquid to flow from whichever tank is under pressure to the hydraulically operated mechanism and thence to the other tank, a source of fluid under pressure, a pressure valve movable to admit fluid from said source to either of said tanks, exhaust valves for relieving pressure applied to said tanks, a control device for operating said pressure valve and said exhaust valves provided with a cylinder, a piston movable in said cylinder, members operated by movement of said piston to actuate said pressure valve and said exhaust valves to admit fluid under pressure to that tank to which liquid previously flowed from said operating mechanism and to relieve the pressure applied to that tank previously under pressure, a float in each of said tanks, a float operated valve associated with each of said tanks and operated by the float therein, and pipes connecting said float operated valves to said cylinder, said float operated valves being movable to admit fluid under pressure to said cylinder and to permit fluid to be discharged from said cylinder.

6. Apparatus for supplying liquid under pressure to hydraulically operated mechanism of gas making apparatus comprising a plurality of hydraulically operated elements, a plurality of tanks adapted to contain liquid under pressure, means for passing liquid from a tank under pressure to each of said hydraulically operated elements and thence to another tank, a control device for controlling the passage of liquid to and from said elements, a source of fluid under pressure, and means operable when a predetermined amount of liquid has been discharged from a tank under pressure to admit fluid under pressure to another tank and relieve the pressure applied to the tank from which liquid has been discharged.

7. Apparatus adapted for supplying liquid under pressure to the operating mechanism of each of a plurality of hydraulically operated valves of a gas producing apparatus comprising two tanks adapted to contain a body of liquid under pressure, a pressure line and a drain line connected to each of said tanks and to said hydraulically operated mechanism, check valves in said lines constructed and arranged to allow liquid to flow from whichever tank is under pressure to the hydraulically operated mechanism and thence to the other tank, a source of fluid under pressure, a pressure valve movable to admit fluid from said source to either of said tanks, exhaust valves for relieving pressure applied to said tanks, a control device for operating said pressure valve and said exhaust valves provided with a cylinder, a piston movable in said cylinder, elements movable in response to movement of said piston to first operate said pressure valve to admit pressure to that tank to which liquid previously flowed from said operating mechanism and thereafter to operate the exhaust valve for that tank previously under pressure, a float in each of said tanks.

a float operated valve associated with each of said tanks and operatively connected to a float therein, pipes connecting said valves to said cylinder, a second source of liquid under pressure communicating with said valves, and means connected to said pipes to control the flow of liquid therethrough to regulate the movement of said piston whereby said pressure valve is operated prior to the operation of said exhaust valves.

8. Apparatus for supplying liquid under pressure to hydraulically operated mechanism for operating the valves of water gas making apparatus comprising, hydraulic apparatus for supplying liquid under pressure to the operating mechanism for said valves comprising two tanks adapted to contain a body of liquid under pressure, a pressure line and a drain line connected to each of said tanks and to the hydraulic operating mechanism for said valves, check valves in said lines to cause fluid to flow from whichever tank is under pressure to said hydraulic operating mechanism and then to the other tank, whereby the level of liquid in said tanks is changed, a control nest communicating with said pressure line and drain line to control the passage of liquid under pressure from said pressure line to the hydraulic operating mechanism for said valves and to control the flow of liquid from said hydraulic operating mechanism to said drain line, a source of fluid under pressure, a pressure valve movable to admit fluid from said source to either of said tanks, exhaust valves for relieving the pressure applied to each of said tanks, a control device movable to operate said pressure valve and said exhaust valves, and float operated mechanism controlling the operation of said control device to reverse said pressure and exhaust valves and cause fluid from said source to be admitted to that tank in which liquid is at a higher level and to relieve the pressure applied to that tank in which the liquid is at a lower level.

9. Apparatus comprising in combination, a hydraulic mechanism operable in a plurality of directions by liquid under pressure, means for supplying liquid under pressure to said hydraulic mechanism to operate the same in each of said directions, said supplying means comprising a plurality of tanks adapted to contain liquid under pressure, means for conducting liquid from a tank under pressure to said hydraulic mechanism and thence to another of said tanks, said conducting means including valve means operable to establish a path of flow for the liquid from the tank under pressure to said hydraulic means and a path of flow from said hydraulic mechanism to another of said tanks to operate said hydraulic mechanism in one direction, said valve being also operable to establish a second path of flow from said tank under pressure to said hydraulic mechanism and a second path of flow from said hydraulic mechanism to another of said tanks to operate the mechanism in another direction, and means operable when a predetermined amount of liquid has been discharged from a tank under pressure to admit fluid under pressure from a source thereof to another tank and to relieve the pressure applied to the tank from which liquid has been discharged.

10. Apparatus comprising in combination, a cylinder and a hydraulically operated piston therein, means for supplying liquid under pressure to either side of said piston to operate the same in either of two directions, said supplying means comprising a plurality of tanks adapted to contain liquid under pressure, means for conducting liquid from a tank under pressure to either side of said piston to operate the same in either direction, and thence to another of said tanks, a source of fluid under pressure and means operable when a predetermined amount of liquid has been discharged from the tank under pressure to admit fluid under pressure from said source to another tank and to relieve the pressure applied to the tank from which liquid has been discharged.

11. Apparatus comprising in combination, hydraulic mechanism operable by liquid under pressure in a plurality of directions, a plurality of tanks adapted to contain liquid under pressure, means for conducting liquid from a tank under pressure to said hydraulically operated mechanism to operate said mechanism in any of said directions and thence to another of said tanks, a source of fluid under pressure, and means operable when a predetermined amount of liquid has been discharged from the tank under pressure to admit fluid under pressure from said source to another tank and to relieve the pressure applied to the tank from which liquid has been discharged.

12. Apparatus comprising in combination, hydraulic mechanism operable by liquid under pressure in a plurality of directions, a plurality of tanks each adapted to contain liquid under pressure, a source of fluid under pressure, a valve operable to admit fluid from said source to one of said tanks, means for passing liquid from a tank under pressure to said hydraulically operated mechanism to operate said mechanism in any of said directions and thence to another of said tanks, and means actuated when a predetermined amount of liquid has been discharged from the tank under pressure to operate said valve to admit fluid from said source to another tank.

13. Apparatus for supplying liquid under pressure to hydraulically operated mechanism comprising a plurality of tanks, each adapted to contain liquid, means for supplying fluid under pressure to one of said tanks to cause discharge of liquid therefrom while permitting return of the liquid discharged into another of said tanks, a valve individual to each of said tanks, said valves being movable to interrupt the supply of pressure fluid to the tank to which pressure fluid has been supplied and to supply the pressure fluid to another of said tanks, and means controlled by the level of liquid in said tanks to actuate said valves.

14. Apparatus for supplying liquid under pressure to hydraulically operated mechanism comprising a plurality of tanks adapted to contain liquid under pressure, means for conducting liquid from a tank under pressure to said hydraulically operated mechanism and thence to another of said tanks whereby the level of liquid in said tanks is changed, a source of fluid under pressure, a valve individual to each of said tanks, said valves being movable to interrupt the supply of pressure fluid to the tank to which pressure fluid has been supplied and to supply the pressure fluid to another of said tanks, a float in each of said tanks and means connected to said floats operable when the level of the liquid in a tank under pressure has fallen to a predetermined level to actuate said valves to relieve the pressure applied to the tank from which liquid has been discharged and to admit pressure fluid from said source to another of said tanks.

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