B. S. H. HARRIS.

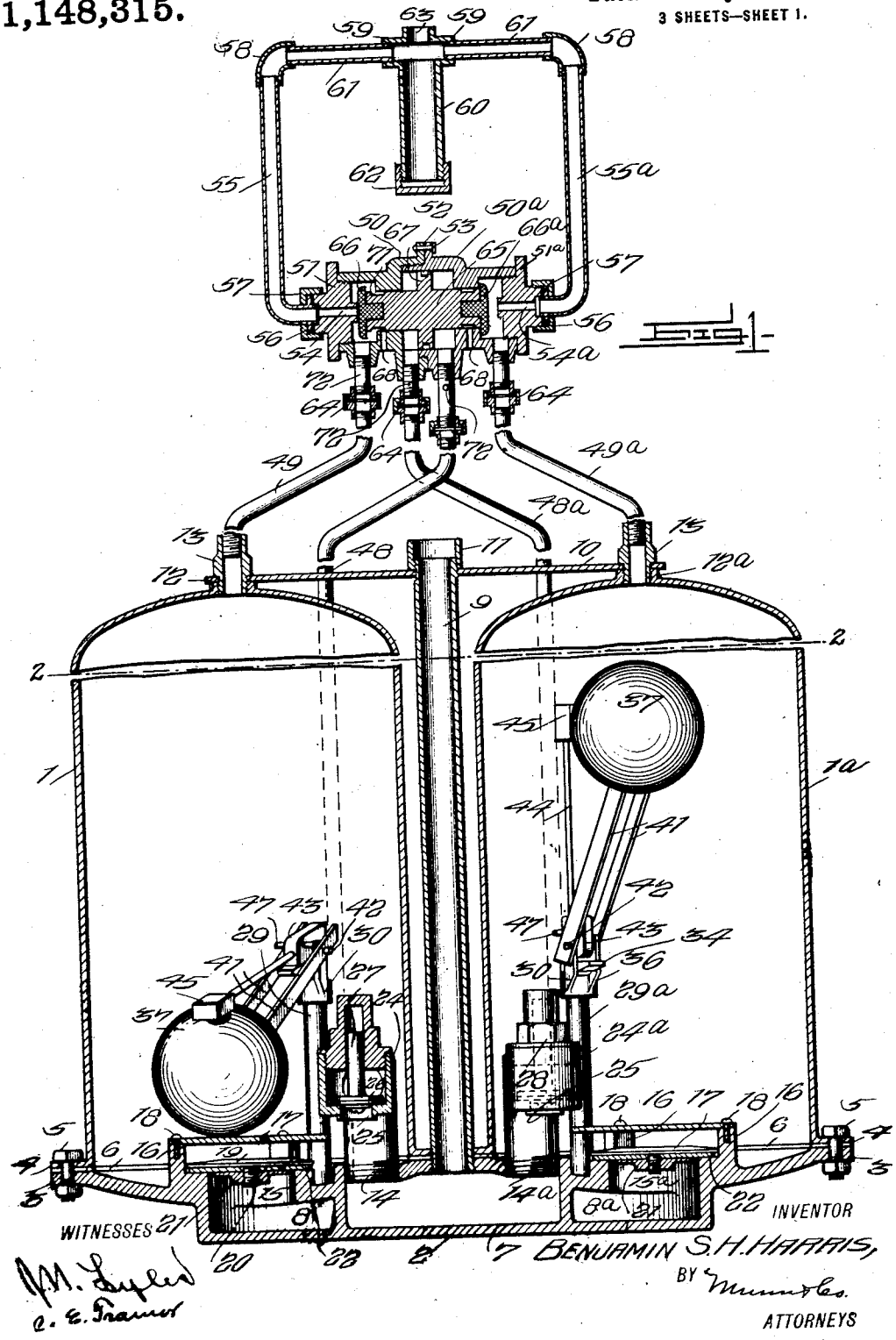
HYDROPNEUMATIC PUMP.

APPLICATION FILED JUNE 23, 1914.

1,148,315.

Patented July 27, 1915.

3 SHEETS—SHEET 1.



WITNESSES

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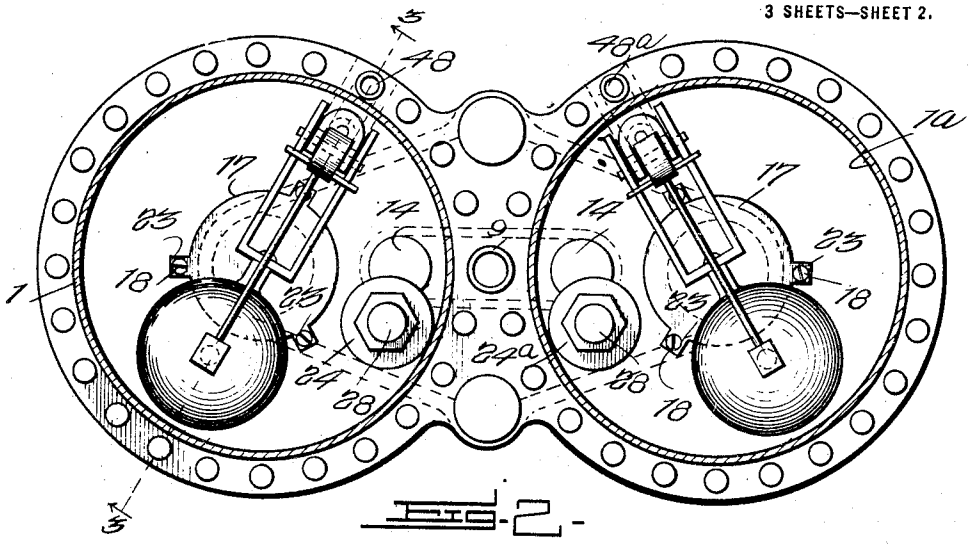

Fig. 2.

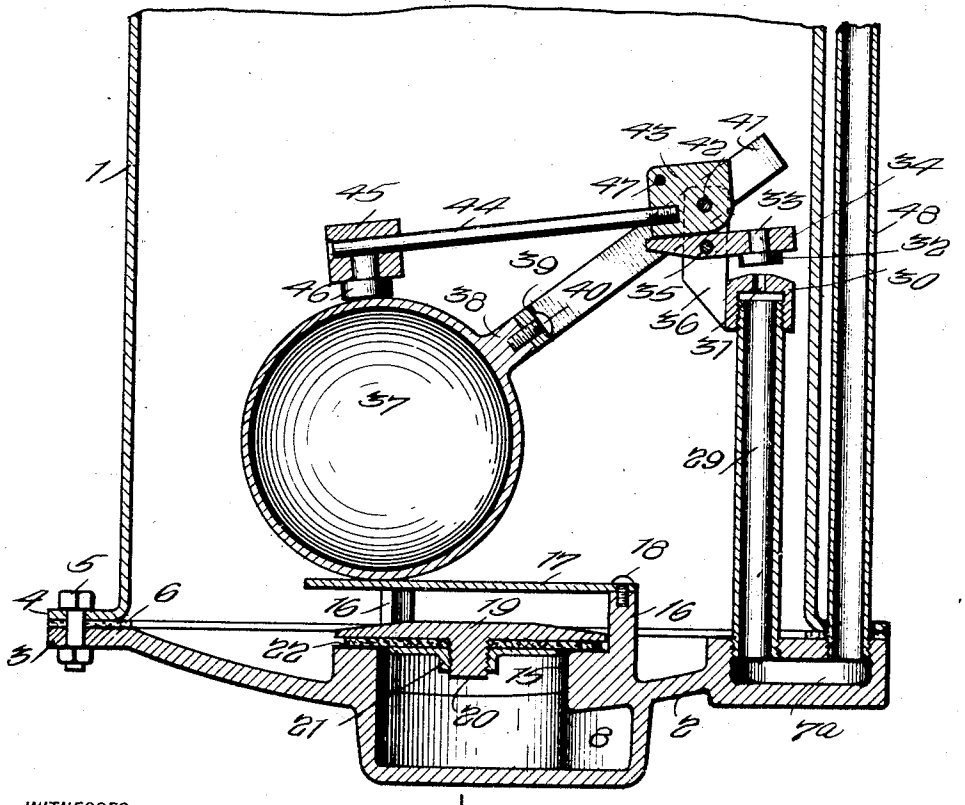

Fig. 3.

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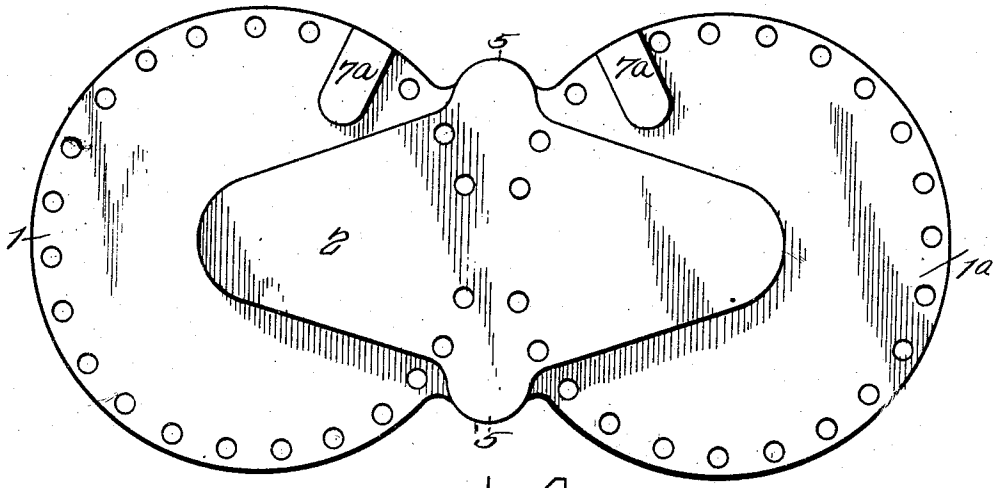

FIG. 4.

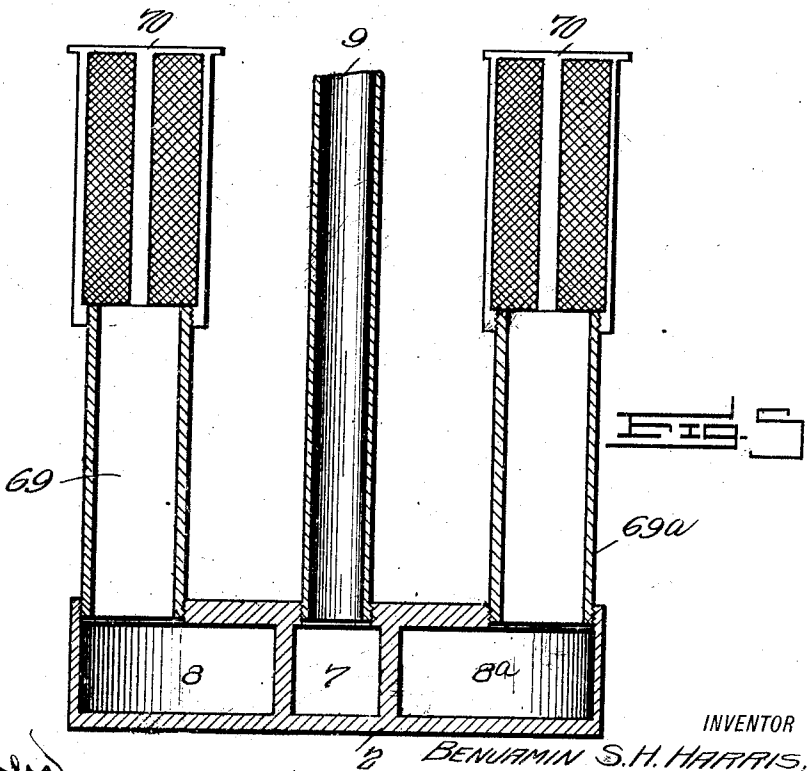

FIG. 5.

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UNITED STATES PATENT OFFICE.

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HYDROPNEUMATIC PUMP.

1,148,315. Specification of Letters Patent. Patented July 27, 1915.

Application filed June 23, 1914. Serial No. 846,751.

To all whom it may concern:

Be it known that I, BENJAMIN S. H. HARRIS, a citizen of the United States, and a resident of Greenville, in the county of Greenville and State of South Carolina, have invented a new and useful Improvement in Hydropneumatic Pumps, of which the following is a specification.

My invention is an improvement in hydropneumatic pumps, and has for its object to provide a device of the character specified, of double construction and adapted to be arranged within a well or other source of supply, and having two pump cylinders or casings for containing the water and from which the water is intended to be driven to the place of utilization by fluid under pressure, and wherein check controlled inlet valves are provided for admitting the water to the cylinders, and wherein fluid controlled mechanism is provided, controlled by the height of the water in the cylinders for cutting off each cylinder from the source of pressure when it is nearly exhausted, and for connecting the other cylinder to the said source.

In the drawings:—Figure 1 is a vertical section through the improved pump, Fig. 2 is a transverse section on the line 2—2 of Fig. 1, Fig. 3 is an enlarged section on the line 3—3 of Fig. 2, looking in the direction of the arrows adjacent to the line, Fig. 4 is a bottom plan view, and Fig. 5 is a section on the line 5—5 of Fig. 4.

In the present embodiment of the invention, a casing is provided, consisting of substantially cylindrical receptacles 1 and 1^a, seated on a common base 2. The base is provided with a marginal flange 3, and the casings 1 and 1^a have flanges 4 at their bottoms, resting upon the flanges 3 and secured thereto by means of bolts and nuts 5. Packing rings or gaskets 6 are arranged between the flanges for making a fluid tight joint, and the base is chambered or recessed on its upper face to form three compartments, namely, a central compartment 7 and lateral compartments 8 and 8^a, adjacent to the casings 1 and 1^a, respectively.

The delivery pipe 9 extends upwardly from the base from the compartment 7 opening through a brace plate 10, which is arranged above the double casing 1—1^a, and the upper end of the pipe 9 is threaded into a coupling 11, at approximately the center of the said plate. At each end the plate 10 is provided with openings which register with internally threaded nipples 12 and 12^a, in the casings 1 and 1^a, and unions 13 are passed through the openings of the plate and threaded into the nipples, for permitting the casing sections 1—1^a to be connected with mechanism to be later described. Each union has an annular rib fitting against the upper face of the plate to hold it in place.

The compartment 7 is a closed compartment, and the delivery pipe 9 has its lower end threaded into an opening in the top of the compartment. Valve casings 14 and 14^a, respectively, are threaded into other openings in the top of this compartment, the said casings being in the sections 1 and 1^a, respectively, of the double casing. Valve seats 15 and 15^a are provided between each compartment 8 and 8^a, and the adjacent casing sections 1 and 1^a, and each seat is provided with three studs 16, extending upwardly around the seat in spaced relation. A plate 17 is connected with the studs by means of screws 18, passing through registering openings in the plate and engaging threaded openings in the studs.

It will be noted that the valve seats 15 and 15^a are elevated above the general level of the top of the base, and the studs 16 are for guiding the movement of a valve 19, coöperating with the seat. The plate 17 limits the upward movement of the valve, the top of the valve engaging the under face of the plate. Each valve 19 is provided with a central depending threaded stem 20, and a washer or nut 21 is threaded on to each stem for holding a packing 22 against the under face of the valve. The packing is adapted to engage the seat when the valve is seated.

It will be noted from an inspection of Fig. 2, that each of the plates 17 has radial lugs 23, through which the screws 18 are passed. Each of the valve casings 14 and 14^a has a laterally offset portion 24 and 24^a, respectively, at its upper end, and each of the said offset portions has a valve seat or port 25 in its under surface. A disk valve 26 coöperates with each seat, and each valve is provided with a stem 27, which moves in a guide nut 28, threaded into the upper open top of the offset portion of the casing. The valves 26 control the communication between the central chamber 7 of the base and the respective casing sections 1 and 1^a.

Pipes 29 and 29^a extend from compart

ments 7ª into the casing sections 1 and 1ª. Each pipe at its lower end is threaded into an opening in the top of the said compartment 7ª, and a cap 30 having a central opening 31 is threaded on to the upper end of each of the pipes. A valve 32 in the form of a disk is provided for coöperating with each cap to close the opening 31, and each of the valves is provided with a stem 33, received in an opening in one end of a lever 34. Each of the levers is pivoted intermediate its ends as indicated at 35, between a pair of brackets 36, extending upwardly from the adjacent cap. A float 37 in the form of a ball or hollow sphere is provided for closing the valves 34, and each float is provided with a stem 38, to which is connected the body 39 of a yoke, by means of a screw 40, or the like. The arms 41 of the yoke engage the outer faces of the brackets 36, and a pivot pin 42 is passed through the arms of the yoke and the brackets to pivotally connect the arms to the bracket. A block 43 is also pivoted on each of the pivot pins 42, before mentioned, and a rod 44 is connected with each block. Each of the rods has one end threaded into an opening in the block and the other end is passed through a weight 45 in the form of a block and each block is provided with a bumper 46 of rubber or the like on the side adjacent to the float, and adapted to engage the float under conditions to be presently set forth.

The block 43 it will be noted is between the arms 41 of the yoke or yoke-shaped lever which supports the float, and the said block is provided with a transverse pin 47 at its outer corner, the pin extending far enough from the block on each side to engage the upper edges of the arms of the yoke under conditions to be presently mentioned.

Pipes 48 and 48ª, respectively, extend upwardly alongside the casing sections 1 and 1ª, adjacent to the pipes 29 and 29ª, each pipe 48 and 48ª communicating with the adjacent compartment 7ª of the base at its lower end, and it will be evident that when either valve 34 is open, there will be a communication between the interior of the casing 1 or 1ª, as the case may be, and the pipe 48 or 48ª. Pipes 49 and 49ª are connected with the unions 13 of the respective casing sections 1 and 1ª, and the pipes 48—48ª—49—49ª are connected at their upper ends with an air shift valve casing, consisting of detachable valve casings 50 and 50ª, and heads 51 and 51ª.

Referring to Fig. 1, it will be seen that the casing section 50ª is threaded into the adjacent end of the casing section 50, and that both sections have marginal lugs 52, which lap upon each other and are secured together by bolts and nuts 53. The heads 51 and 51ª have ports 54 and 54ª, respectively, the said ports being axial of the casing, and the pipe sections 55 and 55ª are connected with the ports 54 and 54ª, respectively.

Each pipe section has an elbow at its lower end, and each elbow is provided with an annular rib 56, near its end, which fits against an externally threaded nipple at the end of the adjacent head. Each pipe registers with the port of the adjacent head, and packing nuts 57 are threaded on to the nipples for holding the pipe sections in place. Elbows 58 are connected with the upper ends of the pipe sections 55, and each elbow is connected with a lateral nipple 59 of a casing 60, by means of a pipe section 61, each pipe section engaging the elbow at one end and the nipple 59 at the other.

A cap 62 is threaded on to the lower end of the casing 60, and the casing has a port 63 at its upper end for connection with the air supply pipe not shown. The pipe sections 48—48ª—49—49ª may be of any desired length, and each pipe is connected at its upper end to a shorter section directly engaging the valve casing, by means of a union 64. A piston or valve 65 is mounted for sliding movement in the sectional casing, and the ends of the piston or valve have heads 66 and 66ª, for engaging the inner ends of the ports 54 and 54ª, respectively.

It will be noted from an inspection of Fig. 1 that the sectional casing is annularly enlarged at its center and that the valve or piston has an annular rib 67 fitting the enlargement and provided with a packing on its peripheral surface sufficiently tight to hold the piston or valve in place after it has been moved. The casing is also enlarged at its ends, and the heads 66 and 66ª extend beyond the periphery of the piston or valve into the enlarged end. The pipes 48 and 48ª open into the central enlargement and the pipes 49 and 49ª open into the enlargement at the end. The valve casing is also provided with exhaust ports 68 between the pipes 48, 48ª, and the pipes 49 and 49ª. The valve 65 controls the supply of air to the pump for operating the same, and the heads 66 and 66ª are of rubber forming bumpers for cushioning the movement of the valve in opposite directions. The casing 60 is a scale trap for trapping scale and the like.

Referring to Fig. 5, which is a transverse section of the base between the casing sections 1 and 1ª, it will be noted that inlet pipes 69 and 69ª are provided at opposite sides of the base and between the casing sections 1 and 1ª. A cap-shaped strainer 70 is threaded on to the upper end of each of the said inlet pipes for straining the water as it enters the inlet pipes. The inlet pipes 69 and 69ª communicate at their lower ends with the chambers 8 and 8ª, respectively.

In use the pump is operated by fluid under pressure as for instance, compressed air pro-

vided by an ordinary air compressor driven in any suitable manner as for instance, by a gasolene engine or other power, and the compressor stores the air in a tank (not shown), where it is delivered as needed to the pump to operate the same. Preferably an air reducing valve, as for instance, a Westinghouse valve, is provided for controlling the feed to the shifting valve, which in turn supplies it to the pump.

The pump is arranged in the source of water supply as for instance, in a well or the like, and it will be evident that as the water enters through the inlet pipes 69 and 69ª the casings 1 and 1ª will gradually fill, the water passing from the compartments 8 and 8ª, past the valve 19, until both of the casings or cylinders 1 and 1ª are filled. As the cylinders fill, the floats will be swung upward into the position shown at the right in Fig. 1.

The air being turned on, and the shifting valve 63 being in the position shown in Fig. 1, the port 54 is closed fluid tight by the engagement of the bumper 66 with the inner end of the seat where the port opens. The air may enter however, by way of the port 54ª from the source of supply and entering through the port 54ª the air will pass down through the pipe 49ª to the casing 1ª. When the floats are lifted as shown at the right of Fig. 1, the rod 44 adjacent to the float will be moved into the position shown, that is, into vertical position, and the valve 34 will be tightly closed on the cap 30.

As water is drawn off for use, the float 37 will follow the water down, leaving the block 45 and the rod 44 standing in erect position, until the arms 41 of the yoke-shaped lever 39—41 strike the pin 47 in the trip block 43. The weight 45 and the bumper 46 will be over-balanced by this engagement with the pin, and the weight will take the position shown at the left of Fig. 1 and in Fig. 3, opening the port 31 in the cap 30.

The trip block 43 engages the opposite end of the lever 34 from the weight, thus lifting the valve. The air in the cylinder 1ª may now pass through the port 31 of the pipe 29ª to the compartment 7ª and by way of the pipe 48ª to the enlarged portion of the shifting valve casing 50—50ª at the left of the rib 67, and the shifting valve will be immediately moved to the right, closing the port 54ª and opening the port 54. The air will thus be shut off from the casing or cylinder 1ª, and will be admitted to the cylinder or casing 1. The pressure of the air in the cylinders causes the water to flow when the faucets are open, and whenever one cylinder is exhausted to a point where the port 31 is opened, the air is immediately cut off from the said cylinder and turned on to the other cylinder, so that the flow of water will be continuous, flowing first from one cylinder and then the other. While the water is flowing from one cylinder to the place of utilization the other cylinder is filling. As a cylinder fills, the air is driven out through the pipe 49 or 49ª to the valve casing 50—50ª and by way of the vent or exhaust ports 68 adjacent to the pipe to the atmosphere.

It will be noted that the piston is grooved annularly near each end as indicated at 71, to place the adjacent port 68 in communication with the pipe 49 or 49ª, when the valve is adjacent to the said pipe. It will be understood that the pump cylinders 1—1ª may be of any desired height, thus containing any desired amount of water. The shifting valve 65 is located above the water in the well or other source of supply and each trip pipe 48—48ª is provided with a vent or port 73, near its connection with the casing 50—50ª for preventing congestion of air in operating the shifting valve.

It will be evident that the large area of the valve shutting the air off from the atmosphere is amply sufficient to hold the opposite end firmly against its seat. The surface exposed to the air pressure at each face of the rib 67 is large enough to overcome any tendency of the valve to stick, as for instance, at the inner end of the end enlargements of the casing.

It should be borne in mind that the hammer or weight 45 does not begin to move downward until it is tripped by the engagement of the arms 41 with the pin 47, and the weight is near the bottom when the arms engage the pin to overbalance the weight. The valve 32 is not however, moved until the weight falls, that is, until the weight is practically in engagement with the float. At this time the tripping block 43 engages the end of the lever 34 remote from the valve, instantly opening the valve.

The water passes from the several cylinders to the delivery pipe 9, by way of the valve casings 14—24 and 14ª—24ª. The water raises the valves and passes into the chamber 7 and from thence to the delivery pipe. The water however, cannot return to the cylinders. The water will flow from each cylinder until the port 31 is open, that is, until the air within the cylinder can pass through this port and by way of the pipes 29 and 48 to the valve to move the same.

I claim:—

1. A device of the character specified, comprising a pump adapted to be immersed in the water of a source of supply, and comprising a pair of cylinders, each having an inlet port at its bottom for admitting water thereto, a check valve controlling each inlet port, a common delivery pipe for the cylinders, each cylinder having a port communicating with the said pipe, and a check valve coöperating with each port to prevent the return of the water to the cylinder, a con-

trolling valve comprising a casing having inlet ports at its ends for connection with a source of fluid under pressure, a valve movable longitudinally of the casing and having resilient heads for engaging the inner ends of the end ports to close the same, said casing having an outlet port adjacent to each end port, and adapted to be connected with the adjacent end port when the valve is at the opposite end of the casing, and having an exhaust port adjacent to each outlet port and adapted to be connected with the outlet port when the valve is at the same end of the casing, a pipe connecting each outlet port to the top of the adjacent cylinder, said casing having an annular enlargement intermediate its ends and the valve having an annular rib fitting the enlargement, the opposite faces of the rib being adapted to be acted upon by the fluid under pressure to move the valve longitudinally, said casing having a plurality of ports at the enlargement and near the ends thereof, a pipe leading from each port to the bottom of the opposite cylinder, a valve casing connected with each of the said pipes in the cylinder and extending above the bottom of the same, and having an opening at its top, a lever pivoted to each of the said casings and having a valve for closing the port, a float provided with an arm pivoted to the casing, a trip block pivoted to the casing at the lever, a rod extending outwardly from the block and having a weight at its outer end, and a cushion on the weight for engaging the float and normally resting against the float, said block being arranged to move the lever to close the valve when the float is lifted, and being balanced to stand with the rod in vertical position when lifted into such position by the float, said float arm and block having interengaging means for tripping the block to lower the weight when the float is near the end of its movement downward.

2. A device of the character specified, comprising a pump adapted to be immersed in the water of a source of supply, and comprising a pair of cylinders, each having an inlet port at its bottom for admitting water thereto, a check valve controlling each inlet port, a common delivery pipe for the cylinders, each cylinder having a port communicating with the said pipe, and a check valve coöperating with each port to prevent the return of the water to the cylinder, a controlling valve comprising a casing having inlet ports at its ends for connection with a source of fluid under pressure, a valve movable longitudinally of the casing and having resilient heads for engaging the inner ends of the end ports to close the same, said casing having an outlet port adjacent to each end port, and adapted to be connected with the adjacent end port when the valve is at the opposite end of the casing, and having an exhaust port adjacent to each outlet port and adapted to be connected with the outlet port when the valve is at the same end of the casing, a pipe connecting each outlet port to the top of the adjacent cylinder, said casing having an annular enlargement intermediate its ends and the valve having an annular rib fitting the enlargement, each cylinder having a pipe leading from the bottom of the cylinder and opening in the enlargement of the valve casing at the opposite side of the rib from the cylinder, a valve in the cylinder for controlling the said pipe, a float in each cylinder, means for closing the valve and for holding the valve closed, said means being operated by the float as it moves upward, and means operated by the float near the end of its downward movement for releasing the said holding means.

3. A device of the character specified, comprising a pair of casings adapted to be immersed in the source of water supply, each having a check controlled inlet port, a common delivery pipe to which the casings are connected, a check valve in each casing for preventing the return of the water from the delivery pipe, a controlling valve for supplying fluid under pressure to the casings for forcing the water through the delivery pipe, said valve comprising a casing having inlet ports at its opposite ends connected with the source of fluid supply, and having an outlet port near each end and adapted to be connected with the adjacent inlet port when the valve is at the opposite end of the casing, each outlet port being connected to the top of the adjacent cylinder, said casing having an annular enlargement intermediate its ends and a valve movable in the casing and having heads for closing the ports and having an annular rib moving in the enlargement, the valve casing having ports at each side of the rib, each port being connected to the opposite cylinder near the bottom thereof, a valve in each of the said casings for controlling the communication thereof with the controlling valve and supported above the bottom of the casing, a valve in connection with each casing, means in each casing for closing the valve and for holding it closed, a float, and means operated by the float when it moves upward for actuating the said holding means to close the valve and hold it closed, and means operated by the float near the end of its downward movement for releasing the holding means.

4. A device of the character specified, comprising a pair of casings adapted to be immersed in the source of water supply, each having a check controlled inlet port, a common delivery pipe to which the casings are connected, a check valve in each casing for preventing the return of the water from the delivery pipe, a controlling valve for sup-

plying fluid under pressure to the casings for forcing the water through the delivery pipe, said valve comprising a casing having inlet ports at its opposite ends connected with the source of fluid supply, and having an outlet port near each end and adapted to be connected with the adjacent inlet port when the valve is at the opposite end of the casing, each outlet port being connected to the top of the adjacent cylinder, said casing having an annular enlargement intermediate its ends and a valve movable in the casing and having heads for closing the inlet ports, and having an annular rib moving in the enlargement, the valve casing having ports at each side of the rib, each port being connected to the opposite cylinder near the bottom thereof, a valve for closing each port, means in each cylinder for closing the valve pertaining thereto and for holding it closed, and means operated by the water when it attains a predetermined depth for operating the said means to close and to open the valve.

5. A device of the character specified, comprising a plurality of fluid tight compartments, each having inlet and outlet valves, a controlling valve for supplying fluid under pressure to the compartments to force the water therefrom, fluid controlled means for shifting the valve to disconnect a compartment from the source of fluid pressure supply when the compartment is empty and for connecting the other compartment to the said source, a valve in each compartment for connecting the said compartment to the valve operating means, a float in each compartment, a lever pivoted intermediate its ends adjacent to the valve and connected at one end to the valve, an arm pivoted adjacent to the valve, the float being connected to the arm, a trip block for operating the lever to open and close the valve, and a rod connected with the block and arranged to be engaged by the float and the arm to which it is connected near the end of the movement of the float and arm in each direction to operate the trip block to open and close the valve.

6. A device of the character specified, comprising a plurality of fluid tight compartments, each having inlet and outlet valves, a controlling valve for supplying fluid under pressure to the compartments to force the water therefrom, fluid controlled means for shifting the valve to disconnect a compartment from the source of fluid pressure supply when the compartment is empty, and for connecting the other compartment to the said source, a valve in each compartment for connecting the said compartment to the valve operating means, a float in each compartment, and means operated by the float near the end of its movement in each direction for opening and closing the valve.

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