No. 889,794. PATENTED JUNE 2, 1908.

J. L. LATTA.

VALVE MECHANISM FOR WATER ELEVATORS.

APPLICATION FILED JUNE 26, 1907.

3 SHEETS—SHEET 1.

Fig. 1.

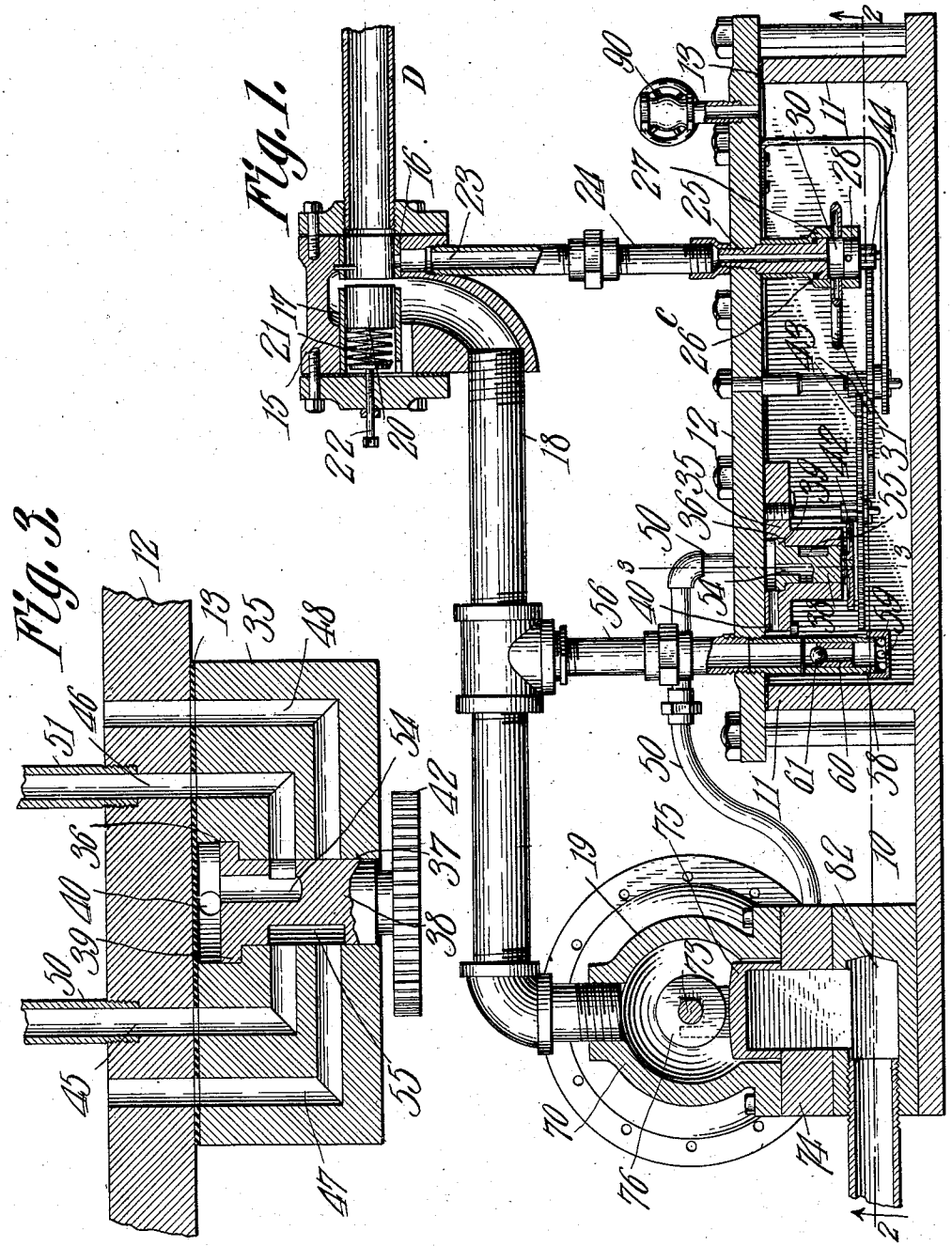

Fig. 3.

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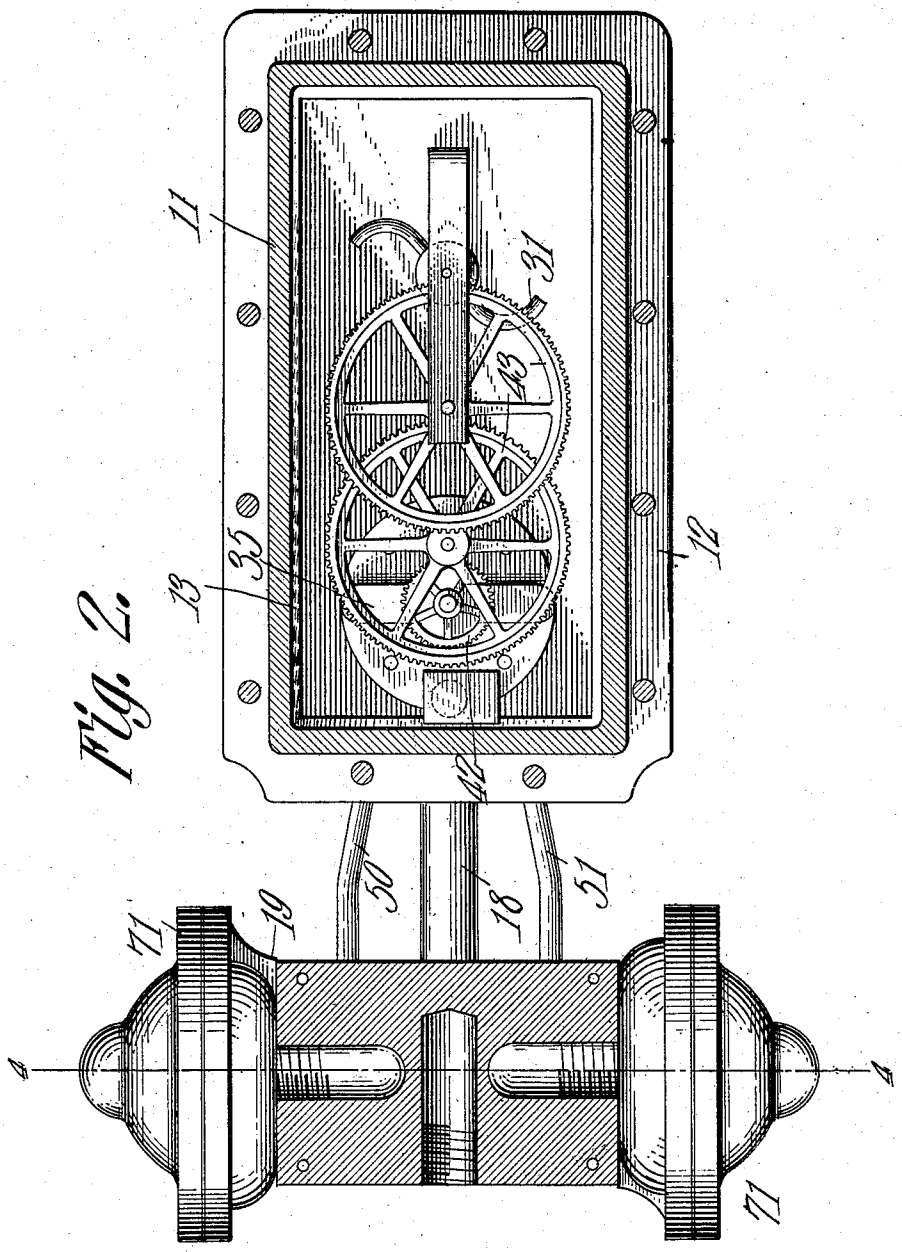
3 SHEETS—SHEET 2.

Fig. 2.



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3 SHEETS—SHEET 3.

Fig. 4.

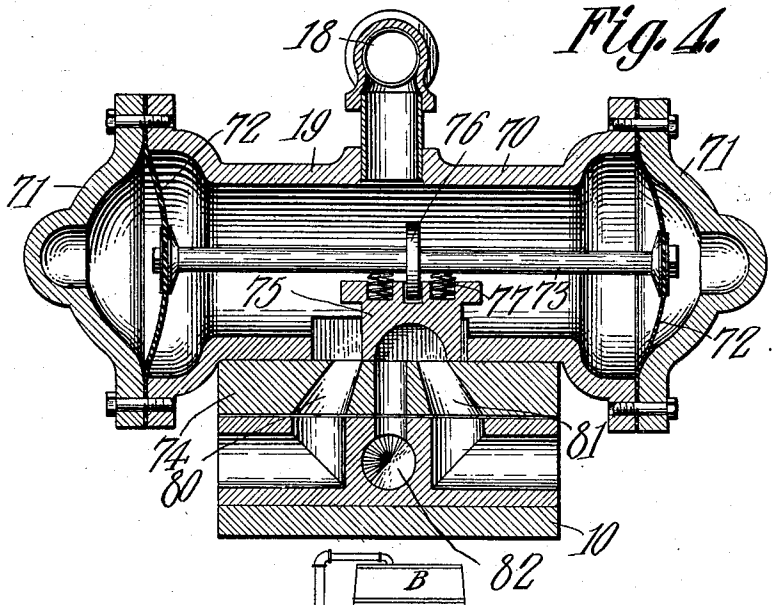
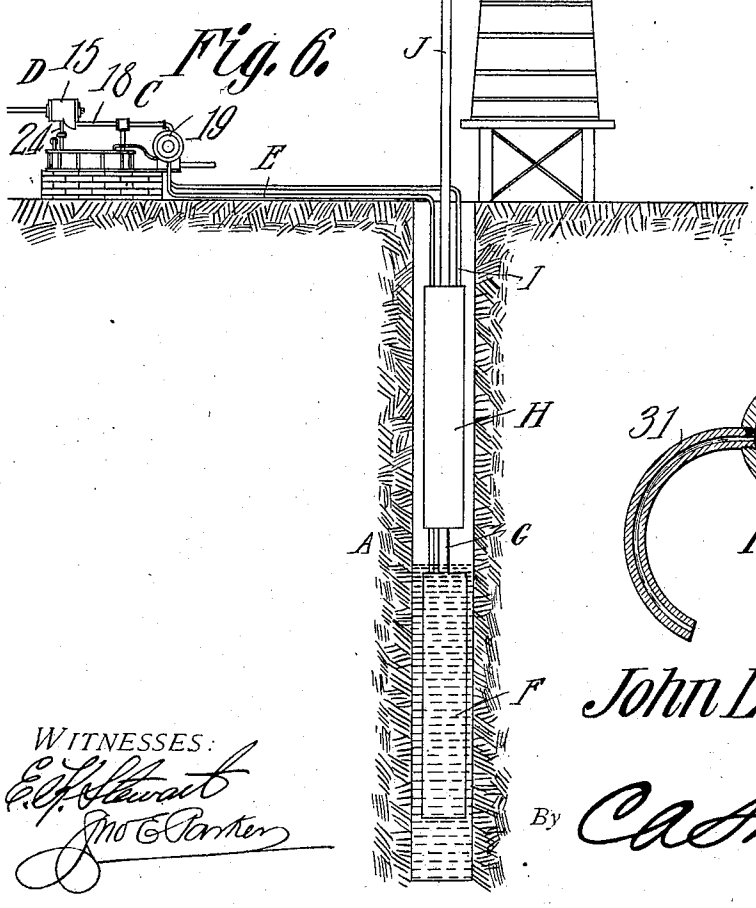


Fig. 6.



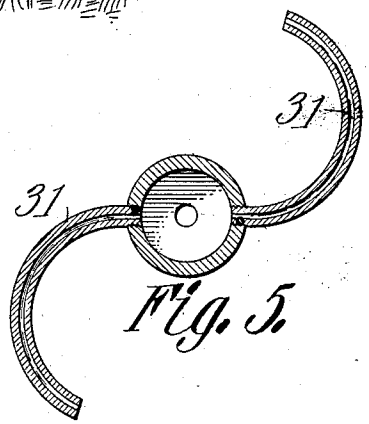


Fig. 5.

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UNITED STATES PATENT OFFICE.

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VALVE MECHANISM FOR WATER-ELEVATORS.

No. 889,794. Specification of Letters Patent. Patented June 2, 1908.

Application filed June 26, 1907. Serial No. 380,919.

To all whom it may concern:

Be it known that I, JOHN L. LATTA, a citizen of the United States, residing at Hickory, in the county of Catawba and State of North Carolina, have invented a new and useful Valve Mechanism for Water-Elevators, of which the following is a specification.

This invention relates to deep well displacement pumping apparatus, and more especially to the mechanism for controlling the flow of air to and from the water cylinders.

A further object of the invention is to provide an apparatus of this character in which the controlling valve is operated by an air driven motor which may be adjusted to operate at any desired speed in accordance with the volume of air to be used at each operation.

A still further object of the invention is to provide an apparatus of this class in which the air to actuate the motor is utilized in the pumping operation after its passage from the motor.

A still further object of the invention is to provide means for regulating the pressure of air employed and to insure the return of the exhaust air from the motor to the main service or delivery pipe.

With these and other objects in view, as will more fully hereinafter appear, the invention consists in certain novel features of construction and arrangement of parts, hereinafter fully described, illustrated in the accompanying drawings, and particularly pointed out in the appended claims, it being understood that various changes in the form, proportions, size and minor details of the structure may be made without departing from the spirit or sacrificing any of the advantages of the invention.

In the accompanying drawings:—Figure 1 is a longitudinal sectional elevation through the valve mechanism of a displacement pumping apparatus constructed in accordance with the invention. Fig. 2 is a horizontal section of the same, on the line 2—2 of Fig. 1, looking in the direction indicated by the arrow. Fig. 3 is a transverse sectional view through the controlling valve on the line 3—3 of Fig. 1, the view being on an enlarged scale. Fig. 4 is a longitudinal sectional view through the main valve chest on the line 4—4 of Fig. 2. Fig. 5 is a sectional plan view of the motor for actuating the controlling valve. Fig. 6 is an elevation of the complete apparatus arranged to pump water from a deep well.

Similar numerals of reference are employed to indicate corresponding parts throughout the several figures of the drawings.

The apparatus is shown in Fig. 6 as arranged for use in connection with a deep well A from which water is to be elevated to a tank B. The controlling apparatus C is supplied with compressed air through a pipe D and delivers the air first through a pipe E to the lowermost cylinder F in the well. This cylinder is submerged and the water flows thereinto by gravity through an ordinary flap valve at the bottom. When filled, the compressed air entering through the pipe E displaces the water, causing the same to flow up through a pipe G to the upper cylinder H, and when this cylinder is filled with water, the compressed air is directed through a pipe I and the water is again displaced, being forced up through the pipe J to the tank B.

The controlling apparatus C which forms the subject of the present invention may be located at any distance from the well, and, if necessary, may be used for displacing water from two wells adjacent to each other, or at widely separate points.

The apparatus C is carried by a base or sole plate 10 which forms at one end the bottom of a motor box or casing 11, the side walls of this box or casing being formed integral with the base plate, and on top is bolted a cover plate 12, a gasket or packing strip 13 being interposed between the upper edges of the walls and the cover in order that the box may be perfectly air tight. At the opposite end of the base plate is arranged the main valve which controls the flow of air alternately through the pipes E and I to the displacement cylinders. The main air pipe D which leads from the compressor or compressed air reservoir is connected to one end of a casing 15 in which is arranged a sectional bushing 16 and 17, the space between the two bushings forming a port through which the air passes through a pipe 18 and from thence to the main air chest 19, from which it is directed through the pipes E and I to the displacement cylinders. The working pressure of the air is under the control of a pressure reducing valve that is located in the bushing 17. This valve is in the form of a simple piston 20, fitting snugly in the

bushing 17 and pressed in the direction of the pipe D by a helical compression spring 21, the stress of which may be adjusted by a set screw 22. The pressure reducing valve tends to move across and close the port between the two bushings, but as its end area is exposed to the action of the air, the valve will be moved to open position, the extent of the opening movement depending on the initial pressure and the adjustment of the screw 22.

Leading through the bushing 16 is a small port 23 through which a portion of the air flows to a pipe 24. The lower end of this pipe is coupled to the upper end of a hollow stem 25 that is screwed in a threaded opening in the cap or cover 12 of the motor box. The stem 25 is provided at its lower end with an enlarged annular flange 26 which serves as a support for a sleeve or hub 27 that is free to revolve on the stem, and in the lower end of the sleeve or hub is secured a cylindrical plug 28 that is arranged some distance below the bottom of the flange 26 in order to form an open air space 30 with which the bore of the stem communicates, this space 30 being always filled with air from the pipe D.

Secured to and projecting from the hub are curved tubes 31 through which the air passes, these tubes being diametrically opposite each other and forming a reaction engine that is revolved by the pressure of the air, and the air passes from the ends of the tubes into the motor box.

Secured to the cover 12 of the motor box is a valve casing 35 having two bores 36 and 37 the latter being arranged for the reception of a slightly tapered rotary valve 38 at the upper end of which is an annular flange 39 that fits within the larger bone 36 of the valve casing. The top of the flange 39 is spaced some distance below the cover 12, and the space thus formed is placed in communication with the interior of the motor box through port 40, so that a portion of the air previously utilized in actuating the motor will pass through the port 40 and by exerting this pressure on the flange 39 will hold the valve 38 down tightly in place. On the stem of the valve 38 is secured a gear wheel 42 that is connected by a train of gearing 43 to a pinion 44 that is carried by the cylindrical block 28 of the motor hub and movement is transmitted from the motor through this train of gearing to the valve 38, so that the latter is continuously revolved.

In the valve casing 35 and extending through the cover plate 12 are two pressure ports 45 and 46, and two exhaust ports 47 and 48, the ports 45 and 46 being connected respectively to pipes 50 and 51 that lead to the opposite heads of the valve chest 19, Fig. 4. The valve 38 is provided with a pressure port 54 and an exhaust port 55 and when the valve is in the position shown in Fig. 3, the air under pressure entering through the port 40 will be directed through port 54 to the port 46 and thence to one end of the main valve chest, while air from the opposite end of said valve chest will pass through the pipe 50, port 45, to valve port 55, and thence through exhaust port 47 to the outer air.

The greater part of the air utilized in the operation of the motor passes through a pipe 56 to the pipe 18, and thence on to the main valve, where it passes through the pipes E, I, to the displacement cylinders. At the lower end of the pipe 56 is secured a casing 58 in which are formed vertical ports 59 opening downward from the top of the casing, and thence communicating through the casing with the lower end of the pipe 56 for the purpose of allowing the flow of air from the motor box and permitting the passage of moisture which may be deposited in the bottom of the box. In the lower portion of the pipe 56 is a seat 60 for a check valve 61 which prevents the back flow of any air from pipe 18 into the motor box, although this can never occur except through accident owing to the fact that the air passing to the pipe 18 is reduced by the pressure valve 20, while the air which passes through the pipe 24 to the motor box is the same as that in the pipe D, and generally is somewhat less than a pound in excess of the pressure in the pipe 18.

The main valve chest 19 is in the form of a cylinder 70 having movable heads 71 and at the ends of this cylinder are bolting flanges to which the flanged heads are secured. Secured between these flanges are diaphragms 72, and the diaphragms are connected to the valve operating rod 73. The cylinder is mounted on a casting 74 the top of which is faced to form a seat for a D-valve 75 that is provided with a recess for the reception of a disk or lug 76 carried by the rod 73, and between the rod 73 and the upper portion of the valve are small compression springs 77 that tend to hold the D-valve to its seat.

In the seat are formed ports 80 and 81 and an exhaust port 82, the port 80 communicating with the pipe E and the port 81 communicating with the pipe I, while the port 82 leads to the outer air. The pipes 50 and 51 are connected by suitable ports to the heads 71, as previously described.

In operation, the air entering through pipe D divides at the casing 15, the greater portion of the volume of air passing through the pipe 18 to the main chest 19. Another portion of the volume of air passes through the port 23, the pipe 24 to the stem 25, for the purpose of actuating the motor, and after passing through the motor the air enters the motor box 11. The greater part of this air passes upward through the pipe 56 to the pipe 18 and passes with the latter to the main valve casing 19. Another portion of the volume of air from the motor box passes through the port 40, entering the valve casing

35, and when the valve is in the position shown in Fig. 3, this air flows through the port 54, port 46, pipe 51 to the right hand end of the cylinder 19, where it acts on the diaphragm 72 to force the valve 75 from the position shown in Fig. 4 to the opposite position. The opposite head 71 of the main valve casing is connected to the pipe 50 and the air flows from thence through port 45, valve port 55 and exhaust port 47 to the outer air. While the parts are in the position shown in Fig. 4, the main volume of air from the valve chest will pass through the port 80 to the pipe E and thence to the lower cylinder F, displacing the water therein and forcing the water up to the displacement cylinder H, and meantime the air is exhausting from the cylinder H through the pipe I, port 81, the cavity of the D-valve 75, and exhaust port 82 to the outer air. By the time the cylinder H is filled with water, the motor has shifted the position of the valve, so that the port 54 of the valve 38 is moved into communication with the port 45, and the port 55 of the valve is moved into communication with the ports 46 and 48, so that the operation is reversed and the valve 75 is shifted for the purpose of allowing the air to exhaust from the displacement cylinder F, and air under pressure to flow into the displacement cylinder H, so that another quantity of water may enter cylinder F, while the water in cylinder H is being elevated through the pipe J into the tank B.

In order to clear the motor and train of gearing in case of clogging, the cover 12 is provided with a valve 90 which may be opened in order to allow the free exhaust of air from the motor box, and thus reducing the pressure in the box to that of the atmosphere. This permits the motor to run free and the train of gearing will run with sufficient rapidity to clear itself of any accumulated dirt or grease, after which the valve 90 may be closed. This, however, is only necessary after the apparatus has been standing idle for a considerable length of time.

I claim:—

1. In apparatus of the class described, a main air valve, a casing within which the valve is arranged, a compressed air pipe connected to the casing, a valve for controlling the movement of the main valve, an air driven motor for actuating the controlling valve, means for connecting the motor to a source of compressed air supply under a pressure greater than that supplied to the main air valve, and means for directing a portion of the exhaust from the motor into said pipe.

2. In apparatus of the class described, a main air valve, a casing within which the valve is arranged, a compressed air pipe leading to the casing a reducing valve in said pipe, a valve for controlling the movement of the main valve and a valve actuating motor connected in a by-pass of the main compressed air pipe, the by-pass connections with the pipe being in advance of the reducing valve.

3. In apparatus of the class described, a main air valve, a casing within which the valve is arranged, a compressed air pipe leading to the casing, a valve for controlling the movement of the main valve, an air driven motor for actuating the controlling valve, means including a reducing valve for supplying the motor with air under pressure greater than that delivered to said casing, means for directing a portion of the exhaust from the motor to the valve casing to actuate the main valve, and means for directing the remainder of the exhaust from the motor into said compressed air pipe.

4. In apparatus of the class described, a main air valve, a casing within which the valve is arranged, a compressed air pipe leading to the casing, a reducing valve in the air pipe, a valve for controlling the movement of the main valve, a controlling valve actuating motor, means for diverting a portion of the air from the pipe to the motor in advance of the reducing valve, and means for returning a portion of the exhaust from the motor to the pipe between the reducing valve and the casing.

5. In apparatus of the class described, a main air valve, a casing within which the valve is arranged, a compressed air pipe leading to the casing, a reducing valve in said pipe, a valve for controlling the movement of the main air valve, a ported casing for said controlling valve, ducts leading from such ports to the main valve casing, means in the main valve casing and operated by air passing through such ducts for moving the main valve, an air driven motor for actuating the controlling valve, means for connecting the motor to the compressed air pipe in advance of the reducing valve, and means for directing the exhaust from the motor to the main compressed air pipe at a point beyond the reducing valve.

6. In apparatus of the class described, a main air valve, a casing within which said valve is arranged, a valve operating means in said casing, a compressed air pipe connected to the casing, a reducing valve in said pipe, a valve for controlling the admission and exhaust of air through the operating devices of the main valve, an air driven motor for actuating the controlling valve, a connection between the compressed air pipe and the motor for supplying air to the latter, said connection being disposed in advance of the reducing valve, means for directing a portion of the exhaust from the motor to the controlling valve for the purpose of actuating the main valve, and means for directing another portion of the exhaust back to the compressed air pipe.

7. In apparatus of the class described, a main valve, a casing within which the valve is arranged, a compressed air pipe connected to the casing, a motor box, an air driven motor arranged therein and connected to the compressed air pipe, a reducing valve arranged in said pipe at a point beyond the motor connection, said motor exhausting into the box, a valve arranged within the box, and receiving a portion of the exhaust, said valve being operatively connected to the motor and being arranged to control the movement of the main valve, and a connection for leading the exhaust of the motor to the compressed air pipe.

8. In apparatus of the class described, a main valve, a casing containing the same, a valve operating means within the casing, a compressed air pipe connected to the casing, a reducing valve in the pipe, a motor box, an air driven motor in the box, a connecting pipe between the compressed air pipe and the motor and disposed in advance of the reducing valve, a connection between the box and the main pipe beyond the reducing valve, a valve arranged in the box, and receiving a portion of the exhaust of the motor, said valve being arranged to control the movement of the main valve, connections between the controlling valve and the main valve casing, and means for connecting the motor to the controlling valve.

9. In apparatus of the class described, a main valve, a casing containing the same, a valve operating means within the casing, a compressed air pipe connected to the casing, a motor box, an air driven motor arranged therein and exhausting into the box, a reducing valve in the compressed air pipe, a piping connection between the main air pipe and the motor and disposed in advance of the reducing valve, a connection between the motor box and the main air pipe beyond the reducing valve, a valve casing within the box and ported to permit the passage of a portion of the motor exhaust, a continuously revoluble controlling valve in the casing, means for connecting the controlling valve to the motor, and ducts leading between the two valve casings.

10. In apparatus of the class described, a main air valve, a casing containing said valve, a pair of diaphragms disposed within the casing and connected to the valve, a controlling valve for regulating the admission and exhaust of air to the end portions of the casing for actuating said diaphragms, and thus moving a valve, a motor box within which the controlling valve is arranged, a motor disposed within the box and exhausting thereinto, connections between the motor and the controlling valve, a main air pipe leading to the valve casing, a reducing valve in said main air pipe, a motor driving connection between the air pipe and the motor at a point in advance of the reducing valve, and a return connection between the motor box and the pipe at a point beyond the reducing valve.

11. In apparatus of the class described, a main air valve, a casing within which the valve is arranged, a compressed air pipe leading to said casing, a valve for controlling the movement of the main valve, a motor box in which the controlling valve is arranged, said box being air tight, a hollow stem disposed within the box and connected to the compressed air pipe, a motor hub mounted on the stem, a plurality of hollow arms carried by the hub and through which the air passes to form a reaction engine, and gearing connection arranged between said motor and the controlling valve.

12. In apparatus of the class described, a pressure pipe, a main pressure valve and a pressure reducing valve located in the line of said pipe, a by-pass leading from the high pressure side of the pressure reducing valve, a motor box in the line of said by-pass, a motor actuated valve communicating therewith, a pressure motor actuating said valve and exhausting into said box, a pipe leading from said box to the pressure pipe on the low pressure side of said reducing valve, and a branch pipe leading from said motor actuated valve to said main valve to carry pressure to and actuate said main valve.

In testimony that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

JOHN LEE LATTA.

Witnesses:

C. M. SHERRILL,

U. W. CLARK.