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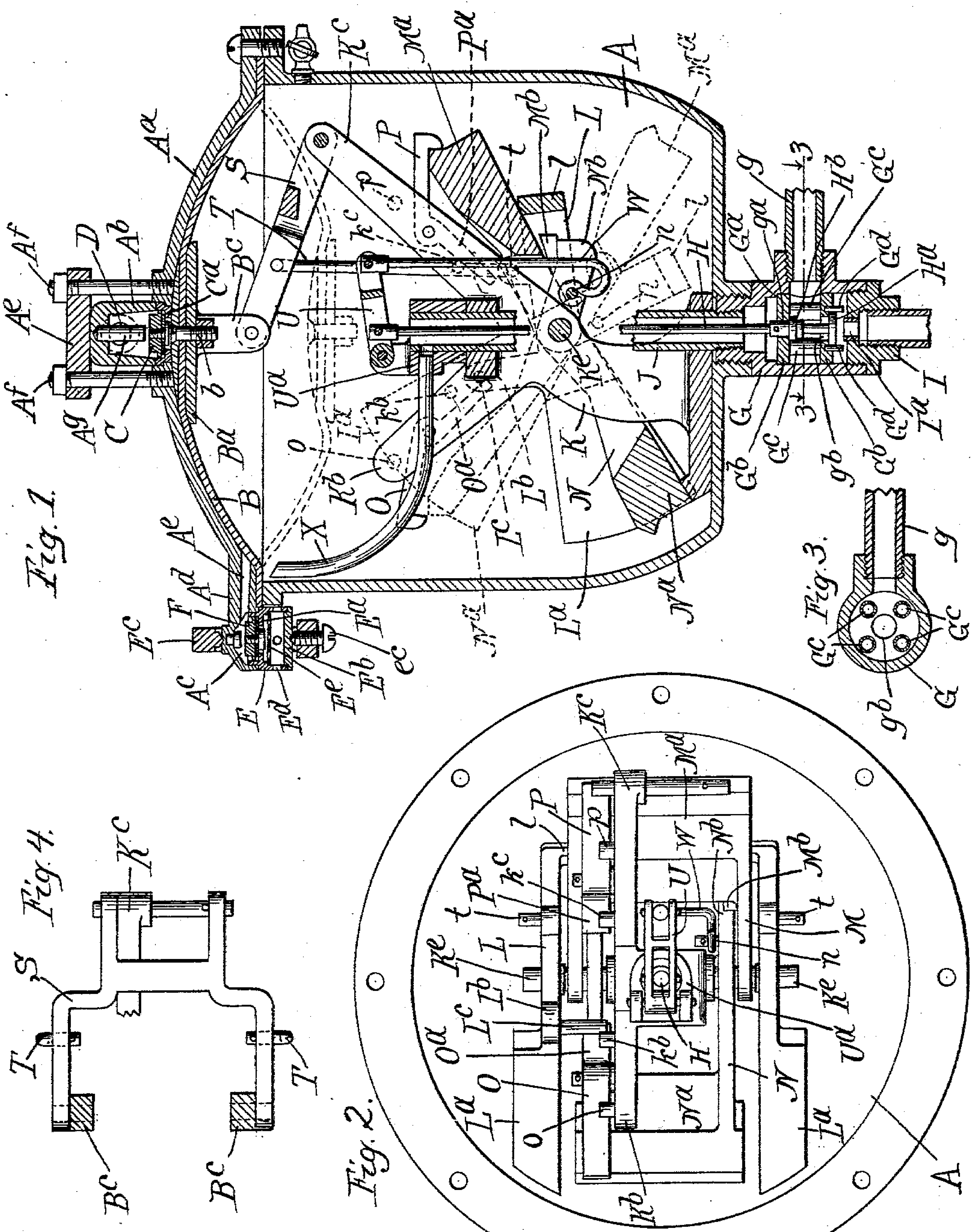
T. O. PERRY.

HYDRAULIC MOTOR AND AIR COMPRESSOR.

(Application filed Apr. 15, 1897. Renewed June 10, 1899.)

(No Model.)



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THOMAS O. PERRY, OF CHICAGO, ILLINOIS.

HYDRAULIC MOTOR AND AIR-COMPRESSOR.

SPECIFICATION forming part of Letters Patent No. 629,869, dated August 1, 1899.

Application filed April 15, 1897. Renewed June 10, 1899. Serial No. 720,084. (No model.)

To all whom it may concern:

Be it known that I, THOMAS O. PERRY, a citizen of the United States, residing at Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Hydraulic Motors and Air-Compressors, which are fully set forth in the following specification, reference being had to the accompanying drawings, forming a part thereof.

This invention is designed to be applicable to all purposes wherein water or other liquid from a source of supply under pressure is employed to produce movement. It is especially applicable to the purpose of producing air compression, elevating water, operating organ-bellows, and other like purposes for which water-motors are employed. I have illustrated it as applied to the purpose of air compression, the whole device constituting a hydraulic air-compressor.

In the drawings, Figure 1 is an axial section of my improved hydraulic motor and air-compressor. Fig. 2 is a plan view of the mechanism by which the valves are automatically operated when the cap of the case containing the same and the diaphragm are removed. Fig. 3 is a section at the line 3 3 on Fig. 1. Fig. 4 is a detail section at the line 4 4 on Fig. 1.

A is a chamber which is closed at the top by a cap or dome A^a, between which and the chamber the diaphragm B is bound at its margin. At the top of the dome an outlet is provided through the cap A^b, the opening into which is controlled by a check-valve C, opening outward from the dome. From the cap A^b the pipe D leads to the compressed-air or storage chamber or service system. At one side the dome A^a there is formed a valve-chamber A^c at the end of the boss A^d, through which the duct A^e leads from the chamber into the dome above the diaphragm. The valve port and seat and a chamber for filtering material to take the dust out of the air are formed in a supplemental cap E, which is a short hollow cylinder, whose upper base E^a constitutes the valve-seat and has the valve-port, the cylinder being formed open at the lower end and provided with a removable head E^b to close the open end, through which a perforated diaphragm E^c is first inserted in the construction and secured a little below the upper head or valve-seat E^a, the lateral wall of the cylinder having apertures E^d, and the space into the cylinder below the diaphragm being designed to be filled with filtering cotton.

F is a valve which is lodged in the chamber E above the valve-seat. A yoke E^c, with a set-screw e^c, serves to bind the cap E onto the under side of the chamber, and said yoke being relieved by slacking the screw e^c the entire cylinder is removable and brings with it the valve lodged above it. This valve is a check-valve opening inward and serving to admit air above the diaphragm and prevent its escape.

A cap A^b is bound into the top of the drum A^a by a cross-bar A^e, which extends above the cap, and is secured by the bolts A^f A^f, which are screwed into the upper boss of the drum at opposite sides of the cap and penetrate the cross-bar, which is secured by nuts on the bolts above it. A check-valve C is lodged on a suitable seat C^a at the center of the drum under the cap A^b, and at the center of the cap there is a downwardly-projecting stop-pin A^g, which allows the valve only a slight upward movement, which prevents it from being dislodged from its seat, while permitting it to lift from the seat sufficiently to permit the proper discharge of the air past it.

At the center of the bottom of the chamber A a T-fitting G is connected thereto, with its cross vertical and its stem lateral, and into the latter there is screwed the water-supply pipe g. The cross of the T is bored out to form a slight stop-shoulder at G^a, and two disks G^b G^b, connected and penetrated by four hollow posts G^c G^c and made rigid with each other by said connection, constitute when driven into the cross of the T until the upper disk is stopped by the shoulder G^a a chamber bounded at top and bottom by the two disks and laterally by the wall of the cross of the T-fitting, into which chamber the water-supply pipe leads through the stem of the T. Both the disks are apertured at the center, the aperture g^b of the lower disk being larger than the aperture g^a in the upper, and in the lower disk there are set projecting guide-pins G^d G^d around the central aperture.

H is a valve-stem carrying the valve H^a at the lower end, said valve being adapted to enter between the guide-pins G^d and rest on the lower surface of the disk G^b, closing the aperture therethrough, which is one of the valve-ports. On the stem between the disks is a stop-collar H^b, which is practically also of the nature of a valve. The diameter of the stop-collar is equal to the diameter of the valve-port, and the valve-stem above this collar fits, but not necessarily water-tight, the aperture g^a in the upper disk G^b and is thence extended upward, as hereinafter described, through the operating-chamber A.

In the lower end of the cross of the T-fitting G is screwed a hollow plug or coupling I, whose upper end constitutes a second port to be closed by the valve H^a, a suitable valve-seat being formed by screwing into said upper end a thimble or bushing I^a. Into the lower end of the coupling there is connected a discharge-pipe I^b, which may be of any convenient or desired length, the variations in the length having only the effect to vary the force and consequent rapidity with which the chamber is relieved of water at the times in the operations of the service when such relief is the proper action. Upon an inspection of this structure it will be observed that water entering through the pipe g when the valve H^a is seated over the downwardly-opening port through the bushing I^a will pass through the port g^b into the space below the lower disk G^b and cannot escape through the port I^a, but can find its way upward through the hollow posts G^c to the space above the upper disk G^b and thence into the chamber A, and that water in the chamber A when the valve H^a is seated, closing the port g^b, can pass down through the small hollow posts G^c and under the valve H^a out through the port I^a into and through the waste-pipe I^b. Into the upper end of the T-fitting G, I screw the pipe J, which extends up into the chamber A to a point somewhat below the lowest position of the diaphragm B, and the stem H of the valve H^a is extended up through the pipe J and protrudes above it and is connected to mechanism, which will now be described, which is operated by the diaphragm, so that the diaphragm causes the seating of the valve over the ports which it controls.

At the bottom of the chamber A there is mounted a standard K, which is penetrated at the center by the pipe J and has arms K^b K^c, which afford fulcrums for the levers concerned in the operations hereinafter described. On said standard are trunnions K^e K^e, which project in opposite directions at a diametric plane through the chamber, and on said trunnions are fulcrumed three levers. The first lever L is weighted, as seen at L^a L^a—that is, at the outer end of the side bars of said lever, which is made in the form of a yoke whose side bars are connected by a cross-bar l—while the second lever N, also made in the form of a yoke, with side bars connected by a cross-bar, is weighted at the cross-bar, as seen at N^a. The third lever M, also in the form of a yoke having side bars connected by cross-bars, is weighted at cross-bar, as seen at M^a. The lever N has a finger N^b projecting beyond its fulcrum alongside one of the side bars of the lever M, and said lever has an abutment M^b, under which the finger N^b engages when the two levers are extended in substantially opposite directions from the fulcrum. Normally it will be seen that these two levers tend to stand thus extended with the abutment M^b lodged upon the finger N^b, and if the opposite weighted ends of both of said levers are lifted, so that they stand at an angle to each other about their common fulcrum, each is free to fall independently of the other until said finger of the one is encountered by the abutment on the other. The lever M is so heavily weighted that when the two levers are thus engaged by the engagement of the finger and abutment the weighted end of the lever M will descend and the weighted end of the lever N will rise and the two levers will occupy positions in which they will extend, respectively, in opposite directions from their fulcrum, the lever M being below and the lever N above the level of the fulcrum, as shown in dotted lines in Fig. 1, unless that is prevented by the action of the other parts. The cross-bar of the lever L extends across under the lever M, and the latter therefore tends to rest upon said cross-bar whenever said lever L is in any position where it can arrest the descent of the lever M—that is to say, whenever said lever, being free to fall and falling, engages by means of its abutment M^b the finger N^b of the lever N, as above described, with a tendency to overbalance and lift the latter up. To the arms K^b K^c of the standard K there are pivoted latches O and P, respectively, which are adapted to engage the weighted ends of the levers N and M, respectively, when said weighted ends are elevated, and the studs k^b k^c, which project from the arms K^b K^c, respectively, overhang the tails O^a and P^a of the latches O and P, respectively, and keep the latches from falling out of the position suitable for becoming engaged with said weighted ends of the levers when they are respectively elevated. On the arms K^b K^c there are also stop-pins o p, which project above the latches, respectively, and keep them from being thrown or carried out of position upwardly. One side bar of the lever L has an upwardly-extending finger L^b, from which pin L^c projects horizontally, the range of oscillation of said pin as the lever L rocks over its fulcrum between the limits indicated in full line and dotted line in the positions shown in Fig. 1 being such as to carry the pin from a position where it operates upon the tail of the latch O to disengage it from the weighted end N^a of the lever N to a position at which it performs a similar office in respect to the latch P, disengaging it from the weighted end of the lever M.

Now, considering the parts thus far described of this mechanism, it will be seen that normally the weighted arm L^a will be at the lowest position unless otherwise stopped and the weight M^a will be elevated, thus permitting the weight N^a to be at lowest position, also that the weight M^a in rising to its elevated position will become engaged with the latch P. If now by any means the weighted arms L^a are lifted, depressing the cross-bar l, the stud L^c will be carried over against the tail of the latch P and will disengage said latch from the weight M^a, and thereupon the weight will fall, and will thereby cause the weight N^a to rise and become engaged with the latch O, and that if, the parts being in the position thus reached, the weighted arm L^a of the lever L is caused or permitted to descend the cross-bar l of that lever, encountering the weighted end M^a of the lever M, will lift the latter to the position shown in full lines in Fig. 1, where it will become engaged again by the latch P, and in such movement of the lever L the stud-pin L^c will have encountered the tail of the latch O and released the weight N^a of the lever N, permitting the same to fall until its finger N^b encounters the abutment M^b on the lever M. It will be seen that in each of these movements the unlatching and consequent fall of the weights M^a N^a, &c., occurs only at the limit of the oscillation of the lever L. These parts are thus contrived and related for the purpose of effecting instantaneously the complete opening and closing of the valve H^a—that is, the lifting of said valve from its seat over one of the ports which it controls instantaneously to its seat over the other port, so that the water entering through the pipe g shall find escape into the waste-pipe closed and the passage into the chamber A opened, or, the valve being reversed, the supply shall be cut off at the instant that the waste-passage is opened to permit the chamber A to drain. It will be observed that such action is essential, since otherwise—that is, in case of the slow movement of the valve from one port to the other—there will be an interval during which water would be entering through the supply-pipe g and passing out directly into the waste-pipe, and thereby wasting the water during the entire period of movement of the valve. The movements thus described of these levers L, M, and N are made available for the purpose of connecting the lever L to the diaphragm B and the lever N to the valve-stem H^a. The connection of the lever L with the diaphragm is made by means of a lever S, fulcrumed on the arm K^c of the standard K and connected to the lugs B^c B^c, which constitute the stem of the disk B^a, which is clamped at the center of the diaphragm B by the bolt b, which binds the diaphragm and the counter-clamp B^a. The form of the lever S is a yoke or H shaped frame, adopted merely for convenience in pivoting and connecting the same in view of the grouping of the parts.

Links T T, operating practically as one link, extend from the side bars of the lever S to the side bars of the lever L, being pivoted thereto at t t comparatively near to the fulcrum of the lever. The purpose of interposing between the diaphragm and the lever L the parts described instead of making a direct connection is that thereby the diaphragm is not liable to be distorted, as it might be by an oblique strain upon it, which would be the result of a direct connection. At the same time I am able with this connection to operate with leverage. The connection of the valve-stem H to the lever N is made by means of a lever U U, fulcrumed on a fitting U^a, secured at the upper end of the pipe J and connected to the valve-stem near its fulcrum and connected by a link W at a point relatively remote from its fulcrum downward to said lever N, to which it is pivoted at n. (See Fig. 2.) The arc of the movement of the pivot of the valve-stem to the lever U is so short and the range of movement being about equal above and below the horizontal plane through the fulcrum of the lever U that the path of the pivot is nearly a straight line, it is not necessary to provide any accommodation for the departure from said line. The arc of movement of the pivotal connection of the lever S to the lugs which constitute the stem of the diaphragm, while somewhat longer, nevertheless involves a range of movement from a point above the horizontal plane for the fulcrum from the lever to a point equally below said plane, so that the diaphragm itself affords by its flexibility sufficient accommodation for the departure of the stem from the vertical path. The link W is at its lower end deflected and made U-shaped for connection with the lever N, and thereby made somewhat elastic and constituting an elastic element in the connection between the lever N and the valve-stem, the purpose of which is to insure the full seating of the valve by the time the lever N falls to its stopped position, the range of elastic extensibility of the lever constituting a slight margin for movement of the lever after the valve seats.

It will be understood from an inspection of this structure that when the chamber is emptied, the diaphragm being drawn down to a position shown in dotted lines in Fig. 1, the waste-port I^a is closed, and water being admitted through the supply-pipe g, passing down through the port g^b and up through the hollow posts G^c and entering through the chamber A, will force the diaphragm upward, driving the air out above it through the check-valve C. When the limit of this movement is reached, the lever has been rocked over to the position where it encounters the tail of the latch and permits the weight N^a to drop, with the result above described of instantly lifting the valve-stem H, closing the port g^b, cutting off the water-supply, and opening the waste, so that the chamber A may drain. The drainage of the chamber will cause air to be drawn in through the check-valve above the diaphragm B, and the downward movement of the diaphragm consequent upon the drainage of the water will by rocking the lever L in an opposite direction release the latch P and reverse the movements of the several levers and drop the valve again to its former position. Thus with a continuous supply of water under pressure through the pipe *g* the device operates to pump air into any chamber connected to the cap A^b above the valve-seat.

In order to afford an opportunity for the escape from the upper part of the water-chamber of air which is liable to accumulate therein from the water which ordinarily contains more or less air, I provide the vent-pipe X, leading from the top of the chamber into the water inlet and outlet pipe, so that as the water flows out through that pipe it will draw with it the air through the pipe X.

It should be noticed that the weighting of the lever L, while not essential to the mechanical movement described, performs a very important function in that it serves to distribute and equalize the strain upon the diaphragm, which otherwise would be subjected to the greater strain during the upward movement while the water is entering, thus diminishing the total work which it is capable of doing in both movements or else imposing upon it in the upward movement a strain which tends to rapidly deteriorate it. The same general utility pertains to the entire structure—viz., that the weighted levers serve, by the duty which they impose upon the diaphragm of lifting weight during its entire movement in either direction, to distribute the work of the diaphragm throughout the entire movement, although the effect of that work, consisting in lifting the valve or operating any other device, is obtained at the limits of the movement.

I claim—

1. In combination with a water-receiving chamber having inlet and outlet ports and a wall or partition adapted to move with the entrance and discharge of water; valve mechanism which controls said ports, and mechanism within the chamber operating and operated by the moving wall or parts thereon and connected to or adapted to operate the valve mechanism and comprising weighted levers which move the valve mechanism, to open and close the inlet and outlet ports; detaining devices for said levers, and releasing devices for the detaining devices which are operated by the moving wall or partition toward the limits only of its movements respectively.

2. In combination with the water-receiving chamber, the moving partition therein, air inlet and outlet valves at one side of said partition and water inlet and outlet ports and a valve mechanism to control the same at the other side of said partition, mechanism within the chamber operated by the moving partition thereof and connected to and adapted to operate the water-controlling valve mechanism, and comprising weighted levers which move the water-controlling valve to open and close the inlet and outlet ports, detaining devices for the same and releasing devices for said detaining devices operated by the moving partition toward the limits only of its movements respectively.

3. In combination with the water-chamber having a moving wall or partition and inlet and outlet ports and valve mechanism to control such ports; two weighted levers fulcrumed within the chamber and adapted to operate together in one direction and independently in the other direction about their respective fulcrums; a third lever which is fulcrumed within the chamber and is adapted to lift one of the weighted levers, and which is operatively connected to the moving wall or partition; latches adapted to engage the two weighted levers respectively to hold them in elevated position, the third lever having suitable means for disengaging the latches alternately as it oscillates and approaches the limits respectively of its oscillation, and connections from one of the two weighted levers to the valve mechanism.

4. In combination with the chamber A, its moving wall or partition and the inlet and outlet ports and a valve which controls both of said ports; two weighted levers fulcrumed within said chamber adapted to operate together in one direction and independently in the other direction about their fulcrums, a third lever fulcrumed within the chamber adapted to lift one of the weighted levers and operatively connected to the moving wall; latches adapted to engage the weighted levers to hold them in elevated position, the third lever having suitable means for disengaging the latches alternately as it oscillates and toward the limits respectively of its oscillation, and connections from one of said weighted levers to the valve-stem.

5. In combination with the water-chamber having a movable wall or diaphragm, the water-inlet extending up through the bottom of the chamber; the valve which controls the same having a stem which extends up through said inlet; the levers M and N having their fulcrums fixed with respect to the chamber and being relatively weighted so that the lever M predominates over the lever N, said levers being adapted to engage by the descending movement of their weighted ends and to be disengaged by the opposite movement; the lever L adapted to lift the lever M and operatively connected to the moving wall, and the lever N being operatively connected to the valve-stem, whereby the rise and fall of said wall operates the valve.

6. In combination with the water-chamber of a hydraulic air-compressor, the movable wall or diaphragm thereof, the water-inlet pipe extending up through the bottom of said chamber and the water-controlling valve having

its stem extending through said pipe and operatively connected with the moving wall, the air-vent opening at the upper part of the chamber and leading into the water-outlet pipe.

7. In combination with the water-chamber A, the water-connection fitting having the apertured disks G^b G^b, constituting diaphragms therein connected by hollow posts, G^c, the valve-stem penetrating said disks and having the valve adapted to seat below the lower thereof, the waste-port below said valve adapted to be closed thereby when it moves away from the port in the diaphragm, and the water-inlet leading laterally into the fitting between the diaphragms.

8. In combination with a chamber and its moving wall, the levers L, M and N operating therein, as described, the lever L being connected to the moving wall and the lever N connected to the valve-stem, said latter connection comprising an elastic link.

9. In combination with the air-chamber of the hydraulic air-compressor, the air-inlet valve having its chamber formed on the body of the air-chamber and the removable chamber E on its outer surface having a seat for said valve and a cavity for filtering material and a clamp to bind said chamber onto the valve-chamber; whereby upon releasing the clamp the chamber E and valve are removable.

In testimony whereof I have hereunto set my hand, in the presence of two witnesses, at Chicago, Illinois, this 10th day of April, 1897.

THOMAS O. PERRY.

Witnesses:
CHAS. S. BURTON,
JEAN ELLIOTT.