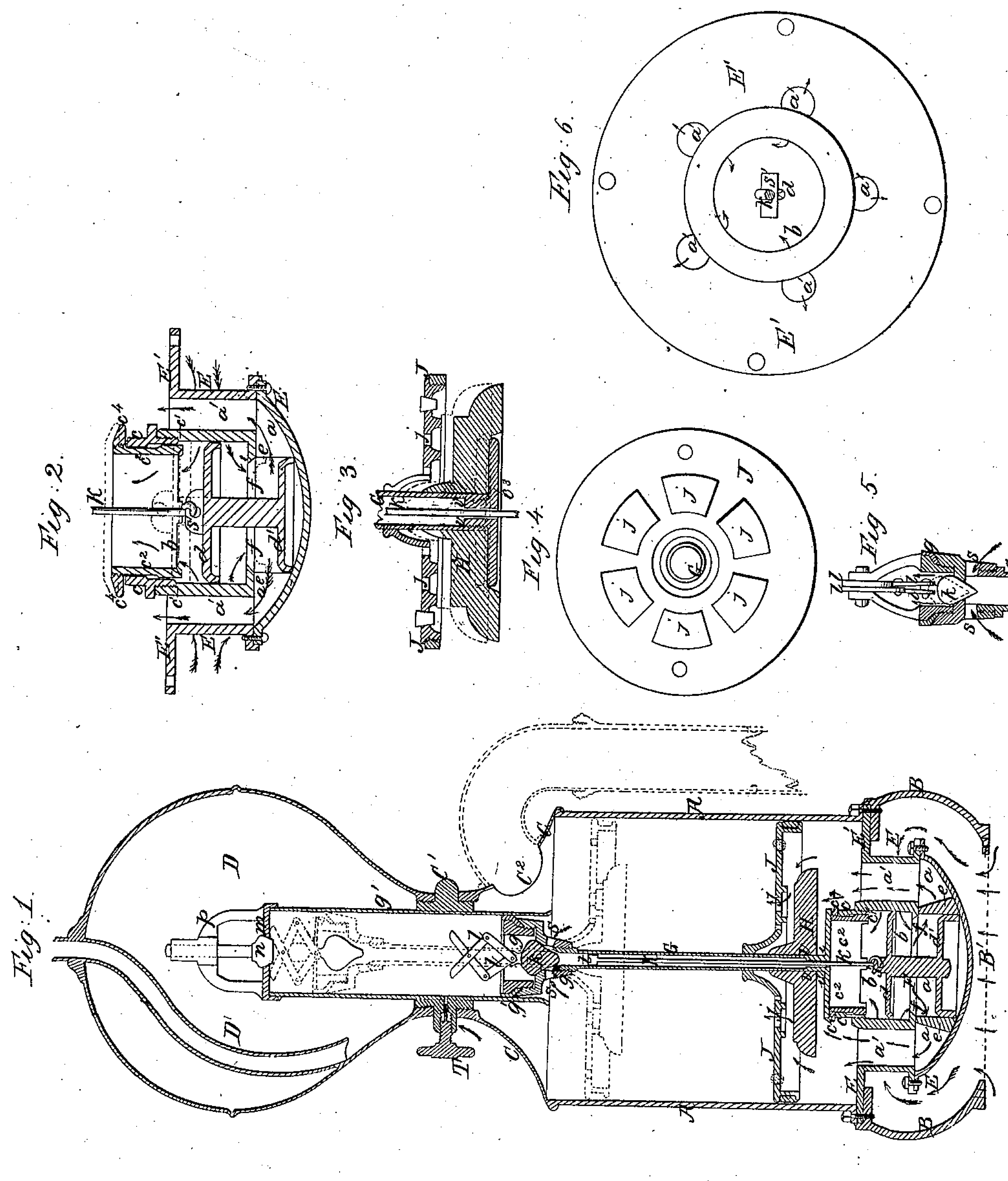
L. Eames,

Hydraulic Ram,

No 36,397. Patented Sep. 9, 1862.



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IMPROVED HYDRAULIC APPARATUS.

Specification forming part of Letters Patent No. **36,397**, dated September 9, 1862.

To all whom it may concern:

Be it known that I, LOVETT EAMES, of Kalamazoo, in the county of Kalamazoo and State of Michigan, have invented a new and Improved Hydraulic Apparatus; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the annexed drawings, making a part of this specification, in which—

Figure 1 is a diametrical section through the entire machine, showing the several parts thereof in their relative positions when at rest. Fig. 2 is an enlarged sectional view of the water-chest and double valve, showing in red lines the position of the latter when firmly held up against its seats. Fig. 3 is a central section through the lower end of the piston-rod, the piston, and loaded valve, the latter being shown by the aid of red lines in a position closing the openings which are through the piston. Fig. 4 shows the top of the piston and the openings therethrough. Fig. 5 is an enlarged vertical section through the center of the plunger on the upper end of the piston-rod. Fig. 6 is an enlarged top view of the water-chest, showing the induction-orifices through its top plate.

Similar letters of reference indicate corresponding parts in the several figures.

This invention relates to an automatic forcing apparatus which is intended for throwing water to great heights and for furnishing water to cities, towns, factories, &c., which may be situated above the level or source from which it is desired to obtain the supply, as will be hereinafter shown and described.

To enable those skilled in the art to make and use my invention, I will proceed to describe its construction and operation.

A is a cylinder, which may be made of any suitable size found best adapted to the purpose it is to serve.

C is the head of cylinder A; C′, its neck; and D is an air globe or chamber having the usual discharge-pipe, D′, common to most air-chambers for force-pumps.

The bottom of cylinder A in the present instance is flanged and bolted to a box, B, having a strainer, B′, covering its bottom, as shown in Fig. 1 of the drawings. Box B should be very roomy, so as not to obstruct the flow of water to the water-chest E, which is also bolted to and forms the bottom of the cylinder A. The water-chest E consists of a hemispherical chamber, *a*, perpendicular tubes *a′ a′ a′ a′*, and a central valve-space, *b*, as shown in Figs. 1, 2, and 3, and this chest E is furnished with a collar, *c*, which projects a short distance above the upper surface of the plate E′ of this chest. The lower edge of this collar *c* is beveled at *c′*, thus forming a valve-seat for the upper plate, *d*, of the double valve F. This double valve F consists of two valve-plates, *d* and *d′*, secured to the extreme ends of a central stem, d^2. The lower plate, *d′*, is somewhat smaller in diameter than the upper plate, *d*. These two valve-plates *d d′* are allowed to have a free perpendicular movement, and they are kept in their proper places by the smoothed sides of tubes *a′ a′ a′ a′*, for the upper plate, *d*, and the guide-pieces *e e* for the lower plate, *d′*. Both valves *d d′* close upward, and *f* is the seat for the lower plate, *d′*.

The collar *c*, above referred to, has fitted within it a short cylinder, c^2, having an annular flange, c^4, projecting from its upper edge outward, which flange rests upon the upper edge of collar *c*, and thus supports the cylinder c^2 within the collar *c*, as shown in Figs. 1 and 2. The cylinder c^2 projects down below the valve-seat *c′* of the upper valve-plate, *d*, and this cylinder is allowed to have a free up-and-down play within its collar *c*, provision being made to prevent cylinder c^2 from getting out of the collar *c*, as shown in Figs. 1 and 2.

Now it will be seen that just before the upper plate, *d*, of the double valve F takes its seat this plate will come in contact with the lowermost edge of cylinder c^2 and will necessarily lift this cylinder and keep it up as long as the double valve is seated. When this double valve F is thus seated, any pressure upon the cylinder c^2 which will overcome that which keeps the double valve to its seat will start the double valve downward. Now, the movable cylinder c^2 may be dispensed with, if desirable, and the same object effected—viz., to start the double valve—without this cylinder. This I will describe in the description of the operation of the machine.

G is a hollow rod, closed at its upper end, which serves the twofold purpose of a piston-rod and a plunger-rod. On the lower end of rod G is firmly secured a plate, c^3, whose diameter is greater than that of collar *c* or cylinder c^2, so that it will fit closely over the opening through this cylinder c^2 when the parts are in the positions shown in Fig. 1. Above

plate c^3 is a loaded plate-valve, H, through the center of which passes loosely the hollow rod G. The valve-face is on the top of plate H, and this face is intended to close the openings *j j*, through the piston J, as will be hereinafter shown. Between valve-plate H and the fixed plate c^3 may be interposed washers *i* for regulating by their thickness the up-and-down movement of this loaded valve-plate on the hollow rod G.

J is the piston, which is perforated at *j j j* for allowing the spent water to pass from beneath above this piston, as indicated by the arrows in Fig. 1 of the drawings. Piston J is rigidly secured to the rod G, and it is suitably packed around its circumference, so as to work up and down freely within the upright cylinder A. The orifices *j j* through piston J are closed by the valve-plate H during the full upward stroke of this piston, as will be further described in the operation of the machine.

The depression which is shown in the center of the piston J in Figs. 1 and 3 is intended to receive the corresponding elevation in the center of the loaded valve H, so that a water-cushion will thus be formed, which will prevent the piston J from injury or concussion when the plate H is brought to its seat immediately before the upward stroke of the piston. A similar cushion will be formed between the lower plate, *d'*, of the double valve F and the concave bottom of chamber *a*, to prevent the double valve from injury when it drops from its seats, as shown in Figs. 1 and 2.

On the upper end of the hollow rod G is a plunger, *g*, which is suitably packed to work tightly within the fixed barrel *g'*. Plunger *g* is hollow or cup-shaped, and over the hole through the neck of this plunger is seated a valve, *k*, which valve opens upward and forms, when open, a communication between the barrel *g'* above the plunger and the cylinder A below the plunger, through orifices *s s*. Valve *k* is raised from its seat by means of the extension-jointed levers *l l*, (shown in Figs. 1 and 5,) the upper ends of which come in contact with the under surface of cap *m* of barrel *g'* at the proper time to remove the downward pressure from the plunger *g* for allowing the piston J to descend. The cap *m* on the upper end of barrel *g'* has an orifice through it, which forms a communication between the air-chamber D and this barrel *g'*, and this orifice is closed by a valve, *n*, which opens upward into air-chamber D. The stem of valve *n* is suitably guided and kept in its proper position by a bridge-cap, *p*, on the top of the pump-barrel.

The communication between the barrel *g'* above the plunger *g* and the inside of cylinder A is formed by means of the openings *s s*, above referred to, and these openings are made through the neck of plunger *g*, just below the valve *k*, as shown in Figs. 1 and 5 of the drawings, and the water rushes through these orifices *s s* to fill the barrel *g'* above the plunger *g* during the downstroke of the plunger, as will be further explained in the operation of the apparatus.

K is a rod, which is attached by a hook or otherwise to the projecting eye *s'* on the double valve F, as shown in Figs. 1 and 2. This rod extends up through the axis of hollow rod G a sufficient distance, (as will be hereinafter fully explained,) and has a button-head or enlargement, *t*, formed on its upper end, against which head a shoulder, at *v*, Figs. 1 and 3, comes in contact when the piston J has nearly reached the highest point in its upstroke. This operation lifts the double-valve plates *d d'* toward their respective seats *c' f*, at which moment the valve *k* is raised and the downward pressure upon the piston J is cut off by the closing of valve *n*. The valve-plates of the double valve F now fully close in consequence of the great outward pressure upon them, and the piston J is now allowed to descend to the position shown in Fig. 1 in black lines.

The overplus or spent water which changes places from the lower to the upper side of the piston J in the descent of the piston, and that portion of water which does not pass into the barrel *g'*, is allowed to escape through the cap C of cylinder A at a point or points above the terminus of the upper stroke of the piston, and this waste water may be conducted off by means of a siphon-shaped pipe, as shown in red lines, Fig. 1, or in any other manner adapted to the best mode of putting up and arranging the apparatus to receive the "head" of water.

The mode of regulating the supply of air to the air-chamber D is represented in Fig. 1. It consists of a delicately-constructed air-cock, T, of any suitable kind, which is tapped through the barrel *g'* at a point which is above the plunger *g* when this plunger has attained its lowest downward stroke. The air, when let into the barrel *g'* at such a point, will be forced into the air-chamber D by the piston *g*.

The operation of my machine is as follows: The machine being properly located, so that a head of water can be made to act upon it, the water is conducted in any suitable manner into the box B through the strainer B', from whence it will rush through the spaces between the tubes *a' a' a' a'* of the box E, and a portion of water will pass down into the compartment *a* and up through the tubes *a' a' a' a'*, while a portion will pass into the central chamber, *b*, above the upper valve-plate, *d*, of the double valve F. The water which passes through chamber *a* and tubes *a' a' a' a'* will instantly throw up the loaded valve H and close the valve-openings through the piston, as indicated in red lines, Fig. 2. Subsequently, however, to the closing of valve H water is allowed to flow in small quantities through the piston J; but when the water has attained its full force the valve H is started toward the piston J, and this valve suddenly checks the flow of water through the piston, as above

described, and causes the full force of the head of water to act in moving the piston upward. Again, as soon as the piston J has started, in consequence of the operation just described, the plate C^3 rises, and allows the water to rush directly up through the central opening also, so that we now have a full head of water operating to move the piston J, with its loaded valve H, upward. The water is now rushing over as well as under the upper valve, *d*, and also over the lower valve, *d'*, as indicated by the course of the red arrows in Figs. 1, 2, and 6 of the drawings. The piston J is in this manner forced up to the position indicated in red lines, Fig. 1; but at a proper time, before the piston J reaches this point, the terminus of its stroke, the shoulder *v* comes in contact with the head *t* on rod K and carries up this rod, together with the double valve F, thus gradually cutting off the flow of water into the cylinder A through the double-valve openings. When the double valve plates *d d'* have nearly closed their respective induction-orifices, the plunger *g* of the pump will have moved up to the position indicated in red lines in Fig. 1. The upper ends of the extension levers *l l* will come in contact with the cap *m*, which will compress these levers and raise the valve *k* in the top of plunger *g*. This operation will instantly give a preponderance to the upward pressure of the head of water, which will instantly close and seat the double-valve plates *d d'*, and thus cut off the head of water. Valve H will now drop so as to open the ports in the piston J, and both valve and piston will descend, allowing the water which was below the piston to pass above it through the ports *j j j* in the piston J. It is now desired to open the double valve to let on the head of water again. This can be done by means of the short sliding cylinder c^2, as before described, or by making the plate c^3 small enough to enter the space formed by the collar *c* a short distance, and thus cause the weight of piston J and valve H to operate, through the medium of water confined in this chamber upon the valve-plate *d*, to start the valves *d d'* from their seats; but in the former instance the plate c^3 presses suddenly upon the cylinder c^2, and this cylinder is made to serve as a medium through which the weight and concussion of the descending piston J and valve H are brought to act upon the double valve. As soon as the double valve F is started from its seats, the influx of water into chambers *a* and *b* will, together with the weight of the double valve itself and the neutralizing effect of the chamber now formed over plate *d*, cause this double valve to drop to the position represented in Figs. 1 and 2 of the drawings in black lines.

We have now made two strokes of the piston, described the manner of introducing, regulating, and cutting off the head or supply of water to the piston J of the apparatus below the pump proper. It will be seen that when the piston J descends and carries down with it the plunger *g* of the pump the valve *n* will be closed and a vacuum will thus be formed in the pump-barrel *g'*, which will be instantly filled with water from the cylinder A through the orifices S S and the opening of valve *k*, and thus at every downward stroke of the piston J and plunger *g* water will be injected into the pump-barrel *g'*, to be forced into the air-chamber D through the opening which is closed by the valve *n* at the succeeding upward stroke of the piston and plunger *g*. At the next upward stroke of the piston J, to continue with the operation of the apparatus, the water which is now above the plunger will be forced into the air-chamber D, and water from cylinder A will also follow the plunger up. When the piston (and plunger) has reached (nearly) its highest point and the supply of water is nearly cut off in consequence of the double valve F approaching its seats, as before described, the upper ends of the extension-joints *l l* will come in contact with the cap *m* of the pump-barrel, lift and open the valve *k* in the plunger *g*, and cause the valve *n*, leading to air-chamber D, to instantly shut, thus removing all resistance to the further rise of the plunger and piston J and allowing the force under the piston to give it a sudden upward start, which carries the double supply-valve F firmly to its seats and allows the loaded valve H to separate from its seat of its own gravity, thus again initiating the change of motion.

There is a chamber, *b*, formed above the top plate, *d*, of double valve F, when the parts are in the positions represented in Fig. 1, which chamber has for its bottom the plate *d* and for its top the plate c^3, both of which plates are capable of being separated from their places. This chamber serves some very important purposes in the operation of the apparatus, as will be now described. When the plate c^3 drops upon the top of this chamber *b* and closes the upper opening, it is first received by the water which is above the plate *d*, and thus as the piston J drops down the water in chamber *b* will serve as a cushion and prevent any concussion. Then, again, when this plate c^3, with the piston J and loaded valve H, all drop or press suddenly upon the water in chamber *b*, the double valve F will be started from its seats, as before described, and a certain quantity of water from the supply will pass over the upper plate, *d*, and impinge on the under side of plate c^3, not sufficiently strong at first to lift this plate, but the water, which will now rush unobstructedly through the opening of the lower valve, *d'*, will pass up through the tubes *a' a' a' a'* into the cylinder A, and while the double valve F is dropping the water which has thus passed into the cylinder A will close the valve H under the ports *j j* to allow the piston to start upward with the force of the full head of water.

The opening C^2, which is made through the cap of cylinder A, is intended for the es-

cape of the waste water. The cap C may have a number of these openings through it, as many as it will be found necessary for allowing the waste water to escape freely above the piston.

Should it be found desirable and circumstances permit, pure water may be supplied to the pump of my apparatus, while the piston below the pump may be operated and made to operate the pump with impure water. The mannner of accomplishing this is not shown in the drawings, and it is only one of the incidental advantages attending my improved hydraulic apparatus.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The piston J, working in an upright cylinder, A, and so constructed that it will be acted upon in its upward stroke by the force of a head of water and then allowed to descend by virtue of its own gravity when the head is cut off, substantially as herein set forth.

2. The water-chest or divisional water-box E, arranged below the main piston J at the bottom of the body of the machine, and furnished with a double disk-valve, F, valve-seats *f* and *c'*, and eduction-chambers, substantially as herein set forth.

3. Controlling and regulating the passage of the spent water below the piston through said piston by means of a loaded plate-valve, H, or its equivalent, substantially as herein set forth.

4. Cutting off the pressure under the piston and its loaded valve at the instant the water has exerted its maximum force upon the piston, by means substantially as herein set forth.

5. Arranging above the piston J a force-pump when this pump receives its power from, is connected to, and operates in combination with the mechanism in the body of the machine, substantially as herein shown.

6. The central equalizing-chamber, which is immediately above the double valve F, for regulating the flow of water to the piston J at the commencement of its upward stroke, substantially as herein set forth.

7. Tripping the valve *k* by means of the extension-jointed levers *l l*, or their equivalents, as herein set forth.

8. Cutting off the supply of water to the chamber A previously to the tripping of valve *k* by means of rod K' and double valve F, so that the double valve F can be driven firmly to its seats by the force of the head of water, essentially as set forth.

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Witnesses:

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