No. 615,412. Patented Dec. 6, 1898.

H. C. SERGEANT.

APPARATUS FOR RAISING LIQUIDS.

(Application filed Nov. 29, 1897.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

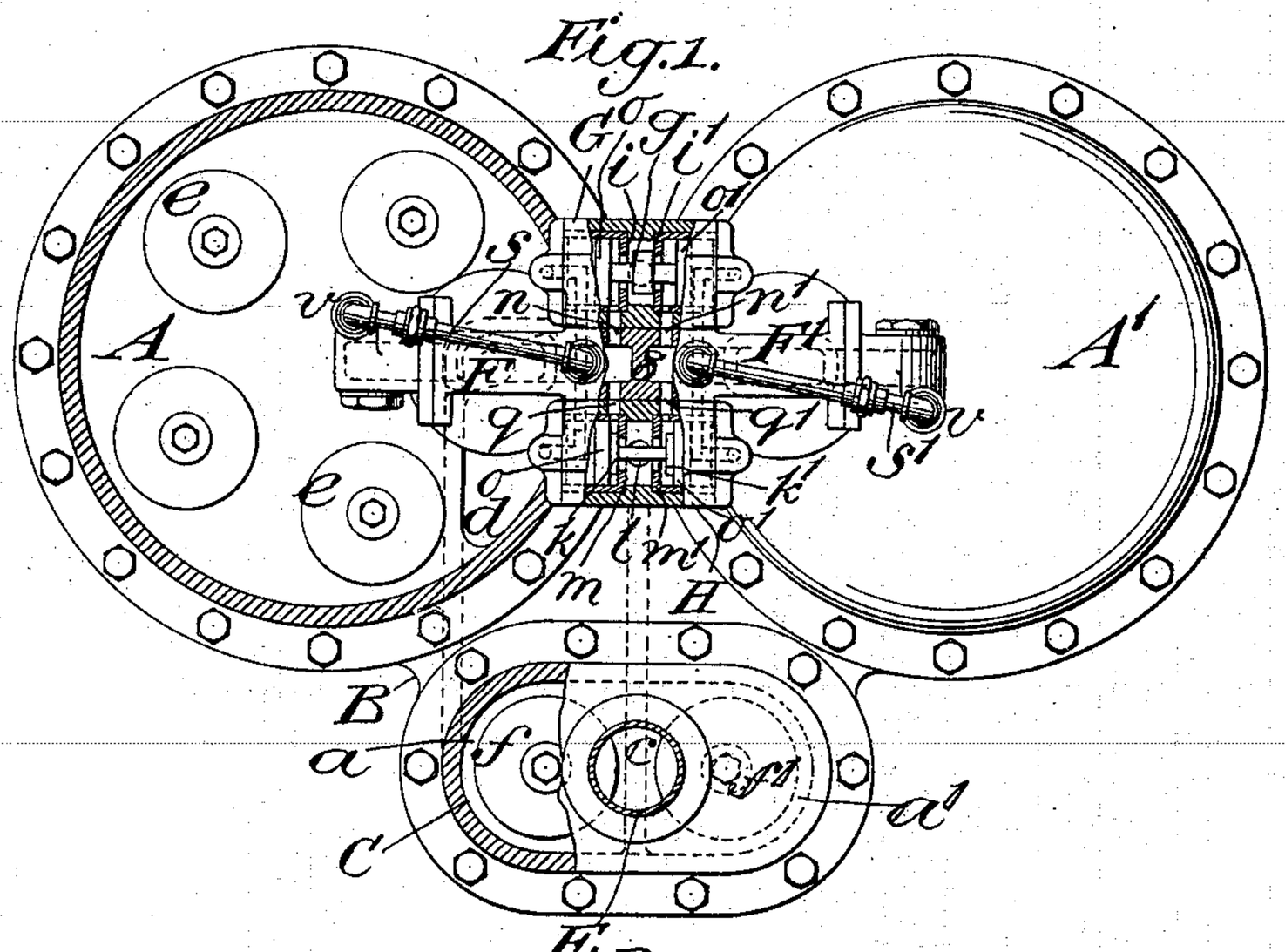

Fig. 2.

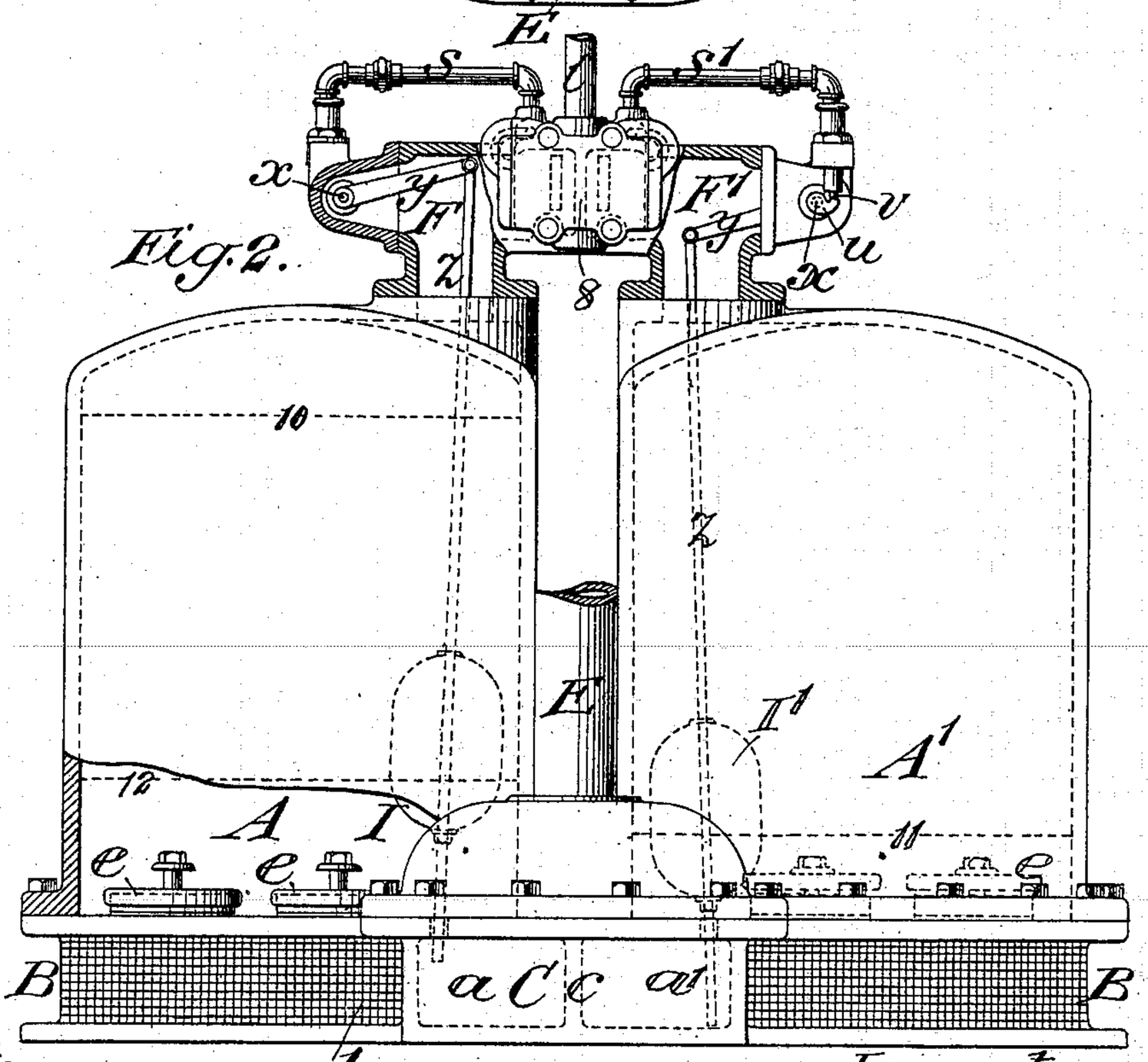

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Fig. 3.

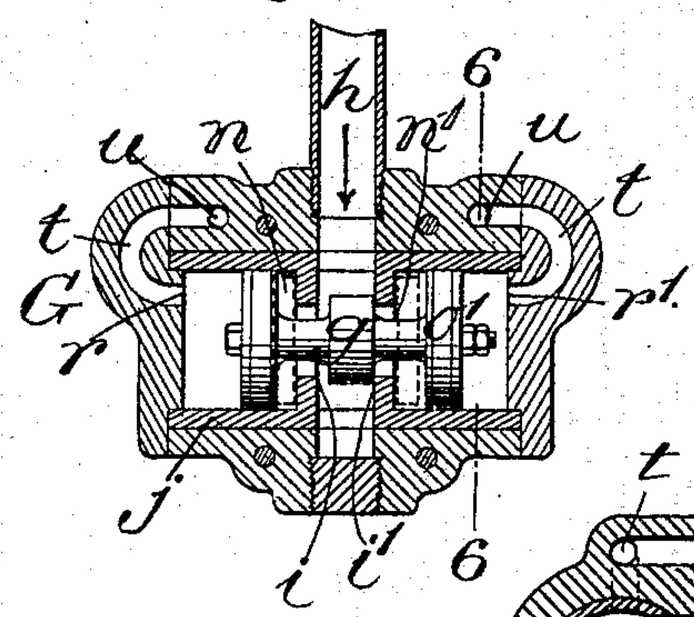


Fig. 6.

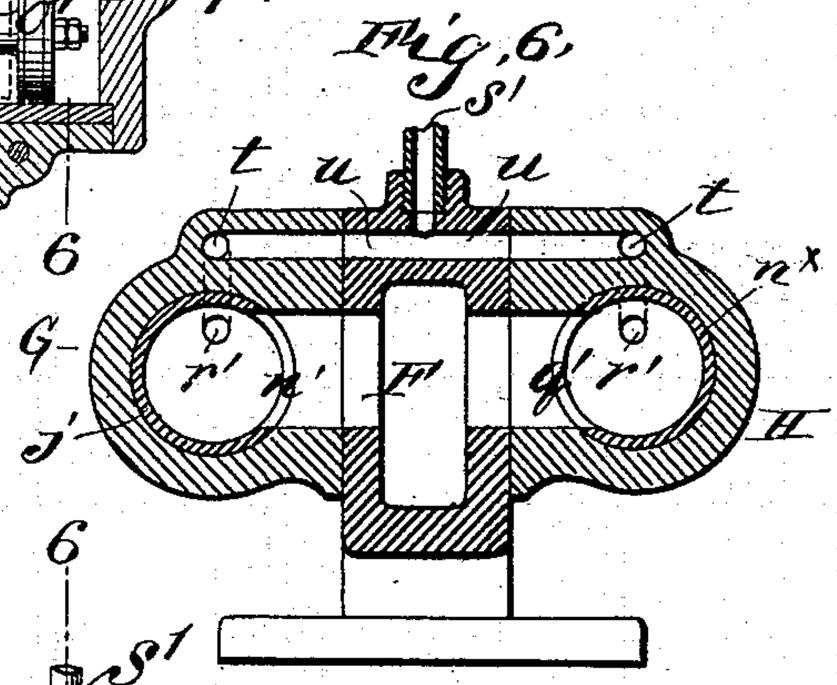


Fig. 4.

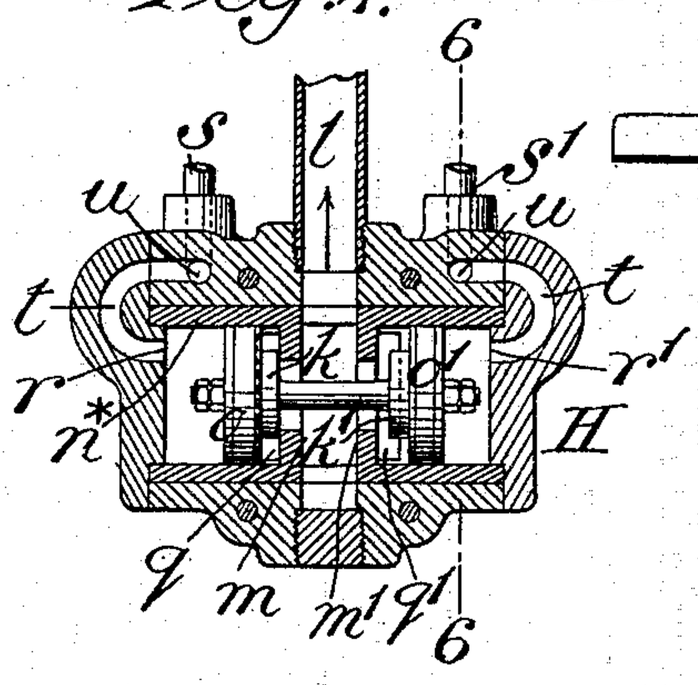
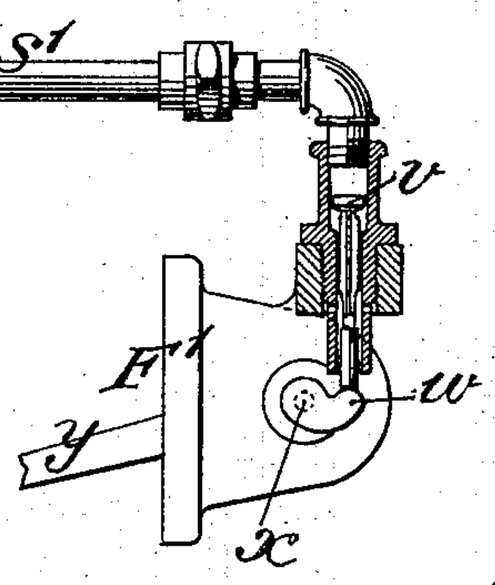


Fig. 5.



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR RAISING LIQUIDS.

SPECIFICATION forming part of Letters Patent No. 615,412, dated December 6, 1898.

Application filed November 29, 1897. Serial No. 660,037. (No model.)

To all whom it may concern:

Be it known that I, HENRY C. SERGEANT, of Westfield, in the county of Union and State of New Jersey, have invented a new and useful Improvement in Apparatus for Raising Liquids, of which the following is a specification.

This invention relates to apparatus such as are commonly known as "compressed air or gas pumps," for raising water or other liquid by the direct action upon it of compressed air or gas having a pressure greater than that of the atmosphere.

In the accompanying drawings, Figure 1 represents a plan, partly in section, of an apparatus embodying my invention; Fig. 2, an elevation of the same, also partly in section; Fig. 3, a central vertical section of the valve-chest containing the inlet-valve for the compressed air or gas; Fig. 4, a central vertical section of the valve-chest containing the exhaust-valve for the compressed air or gas; Fig. 5, a vertical sectional view of a supplemental valve by which the action of both the inlet and exhaust valves is controlled; Fig. 6, a transverse sectional view of the valve-chests of the inlet and exhaust valves in the line 6 6 of Figs. 3 and 4 and of an intermediate passage-box, showing the passages in said chests and box controlled by said supplemental valves.

The apparatus will be described as for raising water by the pressure of compressed air.

A A′ are two chambers or compartments of one chamber set up and secured water-tight upon a hollow base B, which, together with the said chambers or compartments, hereinafter referred to as "water-chambers," are intended to be submerged in a well or body of water whence the water to be raised is to be taken. The hollow base B is freely open at the sides, but is represented as provided with a wire screen or strainer *b*, and it has on one side of it a valve-box C, which has no direct communication with its interior. The said valve-box is divided by a partition *c* (shown by dotted lines in Figs. 1 and 2) into two compartments *a a′*, one of which has an always-open communication through an opening *d* (see Fig. 1) with the water-chamber A, and the other has a similar communication through a similar opening (not shown) with the other water-chamber A′. Between the hollow base B and each of the water-chambers A A′ there are water-inlet valves *e e*, opening upward to said chambers. Each of the compartments *a a′* of the valve-box C has in it an upwardly or outwardly opening delivery-valve *f* or *f′*, (see Fig. 1,) both of these delivery-valves opening to the water-delivery pipe or rising-main E.

F F′ designate a passage-box arranged upon the water chambers or compartments A A′ and divided by a partition 8, Fig. 1, into two compartments F and F′, of which F is always in free communication with the chamber or compartment A, and F′ is always in free communication with the chamber or compartment A′, the said compartments being practically parts of the chambers A A′, respectively. To one side of the said passage-box F F′ is secured a cylindrical valve-chest G, containing the two-faced inlet-valve *g*, of the puppet class, for the introduction to the chambers A A′ of the compressed air supplied by the pipe *h* for the purpose of expelling the water from said chambers, the said valve working between two seats *i i′*, provided in a cylindrical brass lining *j*, with which said valve-chest is fitted, and the inlet-pipe *h* communicating with the valve-chest between said seats. To the other side of said passage-box F F′ is secured a similar valve-chest H, containing the two-headed outlet-valve *k k′*, also of the puppet class, for the eduction from the chambers A A′, through the exhaust-pipe *l*, of the air which has done its work therein, the two heads of the said valve closing, respectively, against the two seats *m m′* provided in the cylindrical lining *n** of the valve-chest and the exhaust-pipe *l* communicating with the said valve-chest between the said seats. The valve-chest G is always in communication outside of the valve-seat *i* with the compartment F of the passage-box through a side port *n* and in communication outside of the valve-seat *i′* with the compartment F′ of said box through a similar port *n′*, the said ports being shown in Fig. 1 and in dotted outline in Fig. 3. The valve-chest H is always in communication outside of its valve-seat *m* with the compartment F of the

passage-box, and consequently with the water-chamber A, by a side port q and in communication outside of the valve-seat m' with the compartment F′ of said box and with the water-chamber A′ through a similar port q', the said ports being shown in Figs. 1 and 4.

The stems of the valves g and $k\,k'$ are each provided with two pistons $o\ o'$, one at each end, working air-tight in the portions of their respective valve-chests G and H outside of the valve-seats, in which portions of both of said chests there are at one end openings $r\ r$ for communication with the atmosphere through a pipe s and at the other end openings $r'\ r'$ for communication with the atmosphere through a pipe s'. The communication between the openings $r\ r$ and $r'\ r'$ in the two valve-chests and the pipes s and s' is illustrated in Figs. 3, 4, and 6, the two openings at each end of both chests communicating through curved passages t (see Figs. 3 and 4) with one common straight cross-passage u, (see Fig. 6,) which extends through the upper parts of the valve-chests and the passage-box F F′, as shown in Fig. 6, and the pipe s or s' being connected with the said cross-passage at an opening in the top of the passage-box.

The pipes $s\ s'$ are each fitted at the outer end with an air-escape valve v—such, for example, as is shown in Fig. 5—these two valves being automatically or normally closed by the pressure of air in the ends of the valve-chests, but being each opened and permitted to close at proper times by the action of a float I or I′ in its respective water-chamber A or A′. The connection between these floats and their respective valves is illustrated in Figs. 2 and 5. The stem of the valve protrudes downward beyond the pipe and over a cam-toe w on a shaft x, which passes through the passage-box and is furnished therein with an arm y, to which the float is attached by a rod z. When the water in either chamber A or A′ is above a certain level, the float therein brings its cam-toe to a position to allow its valve v to remain closed; but when the water in the chamber falls below that level the weight of the float causes the cam-toe to open the valve, as shown in Fig. 5.

In the operation of the apparatus described the water-chambers are caused to be alternately filled and discharged by the alternate shifting of the valves g and $k\ k'$ to admit the compressed air to one of the said chambers and exhaust it from the other, the shifting of said valves being effected by the opening of one or other of the escape-valves v to the atmosphere, and thus disturbing the equilibrium of the pressure on the pistons $o\ o'$. To explain this operation, I will first suppose the valves g and $k\ k'$ to have moved to the right, as shown in Figs. 1, 3, and 4, so that the compressed air introduced by the pipe h is passing to the chamber A and is driving out the water therefrom through the pipe E, the level of the water in A being about the line 10 of Fig. 2. The air which had previously done its work in the chamber A′ will then be exhausting to the pipe l and the latter chamber be filling with water, which may be supposed to be now at the level of the line 11 in Fig. 2. The weight of the float I′ now holds the escape-valve v of the pipe s' open, and the buoyancy of the float I holds the cam-toe on its shaft x out of the way of the escape-valve of the pipe s, so that the latter valve remains closed and the valves g and $k\ k'$ are held to the right by the pressure on their pistons $o\ o'$. As the float I′ rises it will soon permit the escape-valve v of the pipe s' to close; but this will not disturb the valves g and $k\ k'$, the pressure from the pipe h still holding them in the same position until the water in the chamber A falls so low—say to about the line 12 in Fig. 2—that the float I, losing its buoyant effect, descends by its weight and by its action on the arm y opens the escape-valve of the pipe s, when, the outer faces of the pistons $o\ o$ being relieved of pressure, the valves g and $k\ k'$ are instantaneously moved to the left by the pressure on the outer faces of the pistons $o'\ o'$ of compressed air which may have escaped more or less past the said pistons into the right-hand ends of the valve-boxes. The chamber A now fills with water, and the chamber A′ is discharged until the float I′ again descends far enough to open the escape-valve v of the pipe s', when the valves g and $k\ k'$ resume the positions shown in Figs. 1, 3, and 4 and A′ again fills and A is discharged. These operations are repeated indefinitely so long as water remains in the well or source and compressed air is supplied through the pipe h.

In carrying out my invention I generally make the valves g and $k\,k'$ and their stems and the bodies of their pistons $o\ o'$ of vulcanite, that material rendering them capable of adapting themselves closely to their seats and by reason of its lightness rendering them more sensitive to the action of the air, by which their operation is produced.

What I claim as my invention is—

1. In a compressed air or gas pump, the combination of a water-chamber provided with valves for the entrance and discharge of water, two valves and separate valve-chests therefor one of the said valves being an induction-valve for the admission of compressed air or gas to said chamber and the other an eduction-valve for the exhaust of the air or gas from said chamber, pistons attached to said valves within their chests, air-escape valves at opposite ends of said valve-chests and common to both of them for opening and closing communication with the atmosphere, and floats in the water-chamber for controlling the operation of said escape-valves and thereby producing the operation of said induction and eduction valves, substantially as herein described.

2. In a compressed air or gas pump, the

combination of two water-chambers provided with valves for the entrance and discharge of water, an air-induction valve and an air-exhaust valve both common to both chambers and a separate chest for each valve, two pistons for each valve working in their respective chests one on each side of the valve, an air-inlet to the induction-valve chest between its pistons, an air-outlet from the exhaust-valve chest between its pistons, air-escape valves at the ends of the valve-chests outside of the pistons, and floats one in each of the water-chambers for controlling the operation of the said escape-valves, substantially as herein described.

3. In a compressed air or gas pump, the combination with the water-chamber, of a passage-box having two compartments which are separately in free communication with the said chamber, valve-chests one on each side of said passage-box each having communication with said box, one of the said chests containing a valve for the induction of compressed air through said passage-box to the water-chamber and the other one containing a valve for the eduction of air from said chamber, pistons connected with said valves on opposite sides of each and working in said valve-chests, and an air-escape pipe common to the two valve-chests and communicating with both through a cross-passage traversing the said passage-box, substantially as herein described.

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