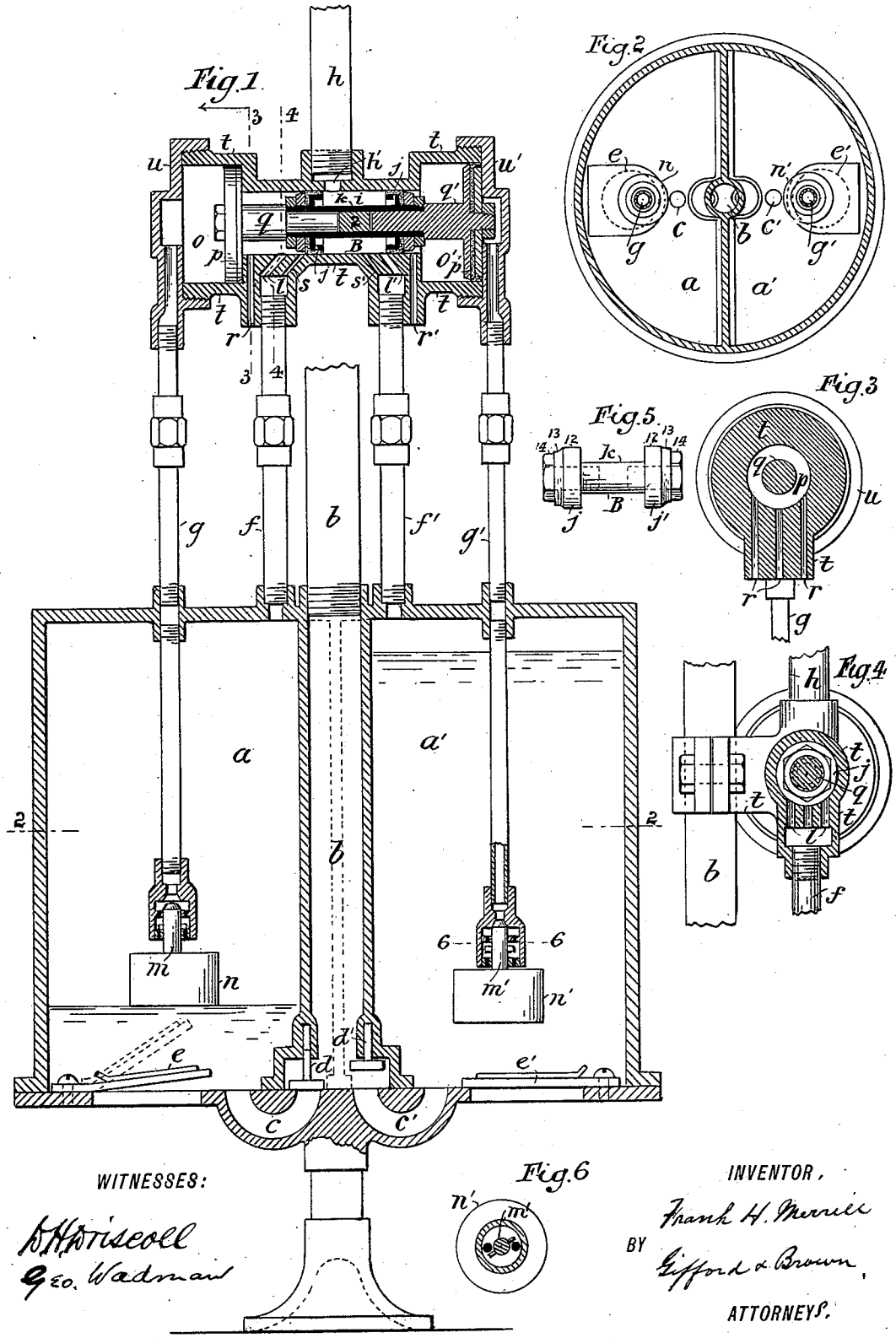
(No Model.) 2 Sheets—Sheet 1.

F. H. MERRILL.

APPARATUS FOR RAISING WATER.

No. 403,125 Patented May 14, 1889.



WITNESSES:

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 7.

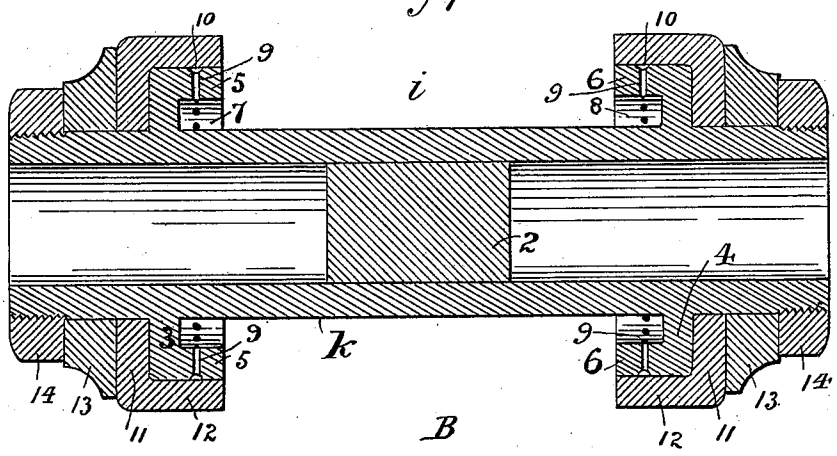
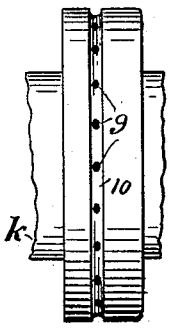


Fig 8



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UNITED STATES PATENT OFFICE.

FRANK H. MERRILL, OF BOUND BROOK, NEW JERSEY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE HARTFORD COMPRESSED AIR PUMP COMPANY, OF NEW JERSEY.

APPARATUS FOR RAISING WATER.

SPECIFICATION forming part of Letters Patent No. 403,125, dated May 14, 1889.

Application filed January 31, 1888. Serial No. 262,541. (No model.)

To all whom it may concern:

Be it known that I, FRANK H. MERRILL, of Bound Brook, in the State of New Jersey, have invented a new and useful Improvement in Apparatus for Raising Water, of which the following is a specification.

This invention is intended as an improvement upon the water-raising apparatus described in the application of Amos B. Merrill, filed January 12, 1888, Serial No. 260,518, which improvement consists, primarily, in the combination of a valve of such construction that it tends to balance the pressure of the compressed air exerted upon it, and also in other combinations set forth in the appended claims.

In the drawings, Figure 1 is a vertical section of the apparatus. Fig. 2 is a horizontal section through the line 2 2 of Fig. 1. Fig. 3 is a sectional view through the line 3 3 of Fig. 1, looking in the direction of the arrow. Fig. 5 is a side view of the main valve detached. Fig. 6 is a horizontal section through the line 6 6, Fig. 1. Fig. 7 is a longitudinal section of the main valve enlarged. Fig. 8 is the packing-flange of the same.

a a' are two chambers, or the separate compartments of one chamber, which respectively communicate with the water-pipe *b* by the passages *c c'*, which are closed by the check-valve *d d'*. At the bottom of each compartment *a a'* is an opening for the admission of water, which opening is closed by the valves *e e'*.

f f' are the passages by which the compressed air enters the respective compartments *a* and *a'*.

g g' are the passages by which the compressed air escapes from the respective compartments.

The compressed air is supplied to the apparatus through the pipe *h*, from which it enters the valve-chamber *i*. Within this valve-chamber is located the valve B. (Shown in Fig. 5.) Exteriorly this valve is spool-shaped, being provided at each end with the heads *j j'*. These heads are provided with suitable packing, so as to make an air-tight connection with the inner walls of the valve-chamber *i*. The body or part of smallest diameter, *k*, of the valve B being surrounded by the valve-chamber *i*, the lateral pressure of air contained in the chamber *i* upon the valve is equal in all directions, and the friction between the valve-heads and the walls of the valve-chamber is not increased by an increase of pressure.

When the valve B is in the position shown in Fig. 1, the compressed air from pipe *h* finds a free passage through the port *l'* into the pipe *f'*. When the valve B is at the opposite extremity of its stroke, the compressed air from the pipe *h* will find a free passage to the pipe *f'* through the port *l'*. By the use of suitable devices to move the valve B backward and forward at the proper intervals the water can be alternately forced out of compartments *a* and *a'* into the pipe *b*.

I will now proceed to describe a useful contrivance for thus operating the valve, referring first to the portion of the contrivance connected with the compartment *a*.

The pipe *g* extends well down into the compartment *a*, as shown, and is stopped at a short distance from its bottom by a check-valve, *m*, which extends downward and is connected with the float *n* in the compartment *a*. The valve *m* is provided with suitable means to permit a limited reciprocation sufficient for opening and closing the passage-way in pipe *g*, but at the same time to hold it in proper position. This may be accomplished by forming a bell-shaped mouth-piece on the pipe below the valve-seat. A cross-pin projects from the valve across the interior of this mouth-piece. A perforated plug is inserted in the end of the mouth-piece around the valve-stem, so as to form a stop for the cross-pin and at the same time allow for the passage of air into the pipe.

The pipe *g* leads to a cylinder, *o*, arranged at one end of the valve-cylinder and preferably in line with the same. Within this cylinder is a piston, *p*, having the end of its piston-rod *q* abutting against one end of the valve B. A shank may be formed on the end of this piston-rod somewhat longer than the stroke of the piston, which fits in a hole bored in the end of the valve, as shown. The operation of this piston will push the valve in

one direction. Corresponding mechanism is used in connection with compartment a', by which the valve B is pushed in the opposite direction.

$s\ s'$ are supplemental air-passages leading from the valve-chamber i respectively into the pipes f and f'. The arrangement and object of these supplemental passages may be described as follows: Suppose, in starting the apparatus, the valve B to be centered, so that the passages l and l' are cut off by the heads j and j', the passages s and s', which are of comparatively small area, are so placed that both will be open. The air, therefore, will enter both the pipes $f\ f'$, and, both compartments of the bucket being full of water, will force the contents of both of them into pipe b. One of the floats $n\ n'$ is arranged at a slightly higher level than the other, so that as the water in both compartments is forced down one of the valves $m\ m'$ will be open before the other. As soon as either opens, the other being still closed, the air entering the pipe g or g', as the case may be, will force the valve B off of its center to one end of its stroke. Thereupon the passages $l\ l'$ will be brought into alternate communication and the regular operation of the apparatus will proceed.

The arrangement of the passages s and s' is such that when the valve is at either end of its stroke the passage at that end will be closed, and so that it is only when the passages l and l' are both closed by the valve being centered that the passages s and s' will both be open, as described. Thus the presence of these supplemental passages will not impair the workings of the main passages.

I will now proceed to describe more in detail some of the features of construction. The cylinders o, o', and i are all formed in one casting, the various parts of which are lettered t. The centers of all three cylinders being in the same line, they can be readily turned out, leaving the cylinders o and o' open at each end of the casting. Caps $u\ u'$ screw on the casting at the ends and close the openings, as shown, each cap being provided with a channel through which the pipe g or g', as the case may be, communicates with the cylinder. The air-passages $l\ l'$, $s\ s'$, $r\ r'$, and h' are bored through the walls of the casting where required.

The valve B, which is shown in exterior view in Fig. 5 and in longitudinal section in Fig. 7, and the packing-flange of which is shown in Fig. 8, is preferably of the following construction:

k is the body of the valve, which is hollow from end to end, excepting at the middle, where the hole through it is stopped by the plug 2.

3 and 4 are flanges, the outer edges of which are turned at right angles toward each other, as at 5 and 6, leaving a groove, 7 and 8, under each.

A description of one end of the valve will now suffice for an understanding of both, because both are alike.

Through the overhanging portions of the flange are bored radially a series of holes, 9. 10 is a groove extending around the periphery of the flange. Each of the holes 9 leads into this groove, which, in use, will therefore be filled by compressed air from the valve-chamber i. The packing may be of leather or other suitable material. It is formed in the shape of a disk, 11, with a flange, 12, the disk 11 to fit against the face of flange 3 and the flange 12 to fit around the periphery of the flange 3, covering the groove 10. 13 is a follower which holds the packing in place and is itself secured by the nut 14. It will be observed that this valve may be packed without difficulty by simply unscrewing the nuts 14, removing the old and putting on new packing. The pressure of the compressed air in the grooves 10 will always keep the packing tight and take up any wear which may occur. The valve being in general form spool-shaped, the pressure of the compressed air in the valve-chamber i upon it will be substantially equal in all directions, so that its friction will be reduced to a minimum. The holes in the end of the valve serve to receive and support the shanks of the piston-rods $q\ q'$. Now, if access is required to remove the valve B for repairing or renewing of the packing, it is only necessary to slide it out endwise by the removal of one or both of the caps $u\ u'$ and one or both of the pistons $p\ p'$. Thus the valve can be kept in order by an unskilled person.

A simple way of supporting the casting t is shown in the drawings. The pipe b is continued up, and a bracket, as shown in Fig. 4, is cast onto one side of the casting t. This bracket is secured to the pipe b by any suitable means.

The operation of the apparatus is as follows: Suppose the bucket to be immersed in water so that both compartments are full, and that the valve is at the right-hand end of its stroke, as shown in Fig. 1. Now, the compressed air entering the valve-chamber through pipe h will pass freely into pipe f' and force the water out of compartment a' until the water-level has fallen, so as to lose its buoyancy on float n' and permit valve m' to open. Then the air will enter cylinder o' through pipe g' and will drive piston p' before it. The rod q' of the piston will force the valve B before it to the left-hand end of its stroke. Then pipe f' will be cut off from pipe h, but will be connected with the valve-cylinder i outside of the valve-head j'. The compressed air still in the pipe f' and compartment a' will expand between the valve B and the piston p', forcing the latter back to its starting-point. The shank on the piston-rod q' is long enough to permit this to be done while the end of it is still retained in the hole in the valve. The expanding air finally escapes from between the valve and

piston p through an open air-passage, r', which is so placed as to be intermediate the strokes of the valve and piston, and therefore to be always cut off from communication either with pipe h or pipe g'. As soon as the valve B has been forced to the left-hand end of its stroke, as above described, a similar operation to that already described will be performed on the water in compartment a, the pipes f and g, cylinder o, piston p, and their connected parts being now brought into play. As soon as the water has been forced out of either compartment and the air-pressure released therein, the outside water will rush in through the valve e or e', as the case may be, and fill up the compartment.

I do not desire to limit myself to the precise form, arrangement, or number of parts shown, as I am aware that the construction may be considerably modified without departing from the principle of my invention.

I claim—

1. The casting t, containing at either end the cylinders o and o', connected by a cylinder, i, of lesser diameter, in combination with a sliding valve within the cylinder i and the pistons p p' within the cylinders o and o', substantially as described.

2. In combination, the valve-chamber i, the cylinders o and o', the valve B, the compressed-air passage h, leading to the valve-chamber between the flanges of the valve, the pistons p and p', each having its piston-rod supported in the end of the valve, and the compressed-air passages g and g', leading, respectively, into the cylinders o and o' on the outsides of the pistons, the said valve being spool-shaped, whereby the flanges thereof exclude the pressure of the compressed air from the inner sides of the pistons, substantially as described.

3. In an apparatus for raising water by means of compressed air or gas, the combination, with two compartments adapted to contain water and each provided with an exit-passage for the water, of a valve controlling the direction of the air or gas into one compartment or the other, and return-passages from the respective compartments for the air or gas, whereby the compressed air or gas, after forcing the water, is brought to bear upon mechanism whereby the valve is moved, the said valve being constructed spool-shaped, substantially as described, whereby the pressure of the air upon it is balanced, substantially as described.

4. A valve for controlling the flow of compressed air, consisting of a body, k, provided with end flanges, 3 4, and said flanges being perforated and grooved, substantially as described, whereby the pressure of the compressed air in the valve-chamber is brought to bear upon the packing, as set forth.

5. In an apparatus for raising water by means of compressed air or gas, the combination, with two compartments adapted to contain water and each provided with an exit-passage for the water, of a slide-valve controlling the direction of the air or gas into one compartment or the other, a passage conducting the compressed air or gas into the valve-chamber between the flanges of the valve, passages leading thence to the respective compartments, and passages leading from the respective compartments back to mechanism for moving the valve, the said valve being spool-shaped, and the last-named passages leading from below the high-water level in the respective compartments and being respectively controlled by float-operated valves, substantially as described.

FRANK H. MERRILL.

Witnesses:
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F. S. KEMPER.