J. R. CUSHIER.

Pump.

No. 220,350. Patented Oct. 7, 1879.

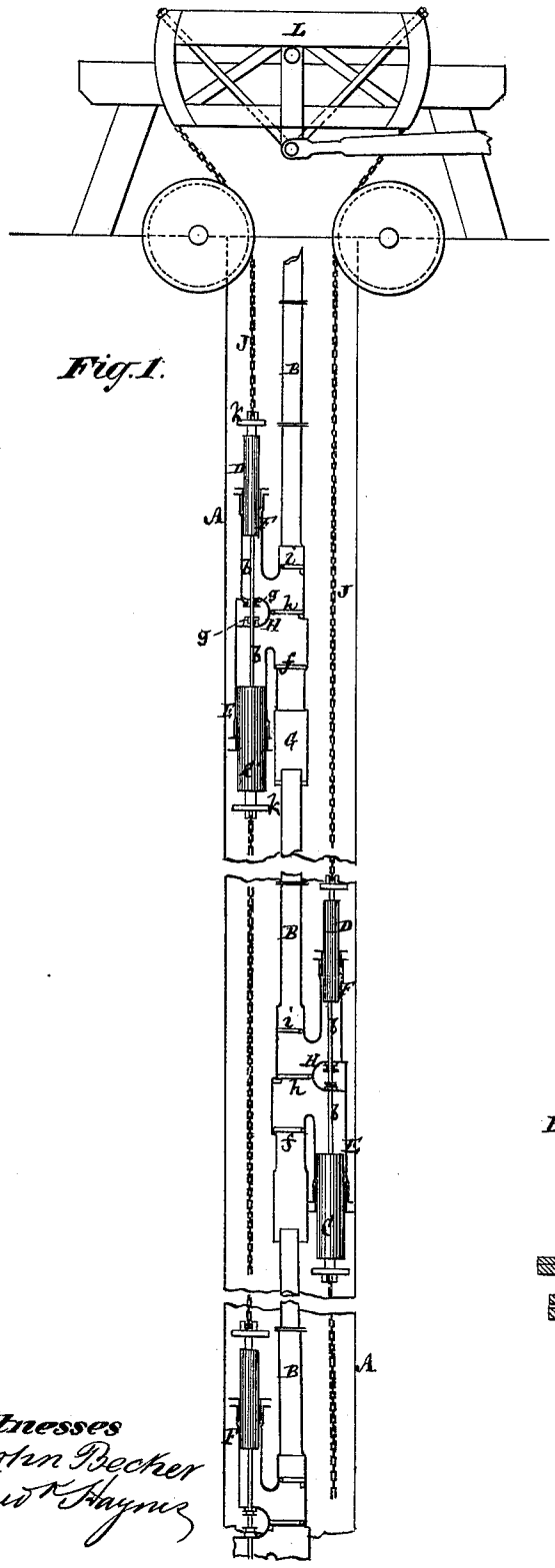

Fig. 1.

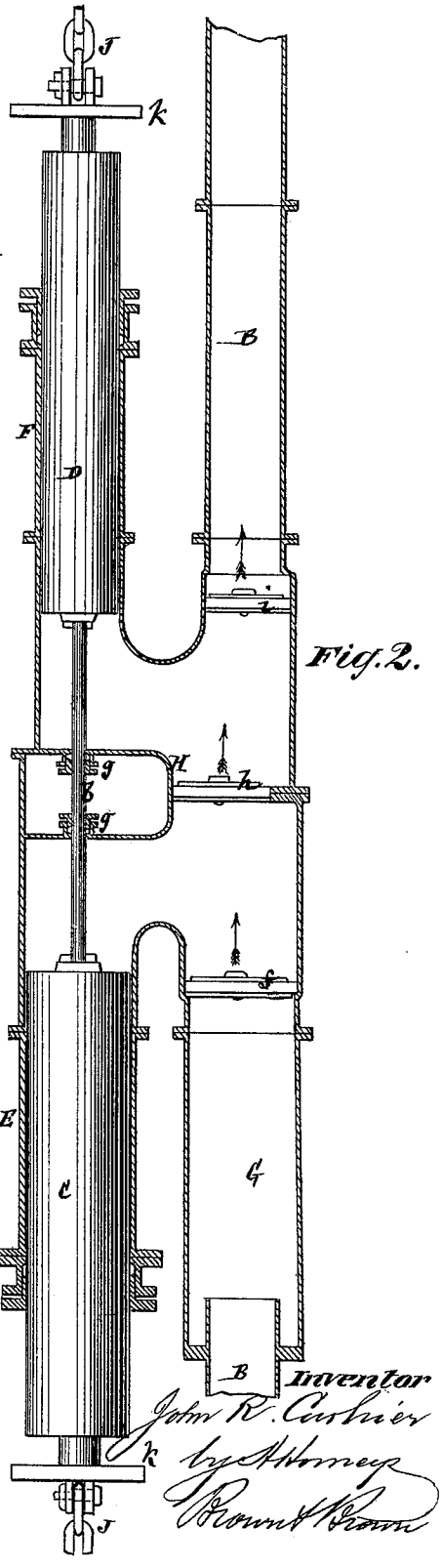

Fig. 2.

Witnesses

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JOHN R. CUSHIER, OF BELLPORT, NEW YORK.

IMPROVEMENT IN PUMPS.

Specification forming part of Letters Patent No. **220,350**, dated October 7, 1879; application filed June 5, 1879.

To all whom it may concern:

Be it known that I, JOHN R. CUSHIER, of Bellport, in the county of Suffolk and State of New York, have invented certain new and useful Improvements in Pumps for Deep Wells, Mines, and other Purposes, of which the following is a description, reference being had to the accompanying drawings, forming part of this specification.

This invention is more particularly intended to be applied to deep wells, shafts, or mines, and has for one of its objects the substitution for what are known as the "Cornish pumps," with their long and weighty pump-rod extending the length of the shaft and a pump-bob equal to the length of the stroke of the pump, of a balancing arrangement of pumps, in which are combined two lines or series of pumps, an intermediately-arranged series of suction and discharge pipes, with which the several pumps, arranged one above the other, in each series respectively connect, a rocking beam arranged to actuate said pumps simultaneously in reverse directions on opposite sides of the main discharge-pipe, and wire cables or chains connecting said beam on opposite sides of its axis with the plungers of said pumps, for maintaining a continuous delivery through said main discharge-pipe.

The invention also consists in a pump system of two pumps of unequal diameters, arranged to work in concert, suction and delivery pipes or ducts common to both pumps, suction and delivery valves, and a bulk-head having an auxiliary valve interposed between said pumps, whereby a continuous discharge is kept up in a very perfect and simple manner.

Furthermore, the invention consists in certain combinations and arrangements of details for putting into practice said pump system, and for operating the plungers in a series of such pump systems.

In the accompanying drawings, Figure 1 represents a vertical section of a deep well or mine-shaft having my invention applied; and Fig. 2, a vertical section, upon a larger scale, of a system of pumps used in and forming part of my invention.

A indicates the well or mine-shaft, down the center of which is arranged a main discharge-pipe, B, on opposite sides of which are two lines or series of pumps, each series consisting of any number of pumps, preferably in sets of twos, arranged at any suitable distance apart, one above the other.

The pump system which is here represented is incorporated in each of these sets of pumps, and requires for its development two pumps of unequal diameters, and arranged to work in concert, one with another, as by a rod, *b*, connecting the plungers C D of said pumps, the upper one of which, as here arranged, is the pump of smaller diameter, and the lower one of the pumps of larger diameter. Ordinarily, the larger pump or pump-cylinder, E, will be of twice the diameter or cubical capacity of the other pump or pump-cylinder, F, and the main discharge-pipe B, which also forms a suction-pipe, but will here, for convenience' sake, be termed the "main discharge-pipe," be of the same diameter, or thereabout, between each set of pumps as the smaller pump, F.

Each set of pumps may be arranged at any suitable distance apart, and the main discharge-pipe B is interrupted at each set of pumps by compartments or ducts provided with suitable valves. Thus G is a suction pipe or duct common to both pumps, constructed to form an enlarged continuation of the main dischage-pipe B, and virtually constituting a tank for each set of pumps at or near the base of the latter. This suction-pipe, which it is preferred to make of the same or greater capacity than the pump-cylinder E, is provided at its upper end with an inlet or suction valve, *f*.

The several sets of pumps, E F, which are arranged on opposite sides of the shaft A, in two lines or series, discharge the water into and take it from these tanks or suction-pipes in succession until the water is raised to the upper surface of the ground. The combined pumps of each set of pumps form double-acting lift and force pumps, and the plungers C D and their connections should be of sufficient weight to provide for their descent by gravity. The rods *b*, which connect the plungers C D of each set of pumps, work through stuffing-boxes *g* in a bulk-head, H, separating said pumps. This bulk-head H has in it an auxiliary valve, *h*, opening upward, to establish com-

munication between the upper and lower pumps, E F. The pumps E F discharge the water through a delivery-valve, *i*, applied to the main discharge-pipe B, on the upper side of the compartment formed by the bulk-head H.

In the downstroke of the plungers C D of the pumps E F the auxiliary valve *h* closes, and water enters, by the inlet-valve *f*, the larger pump-chamber, E; and in the succeeding ascent of said plungers half or a portion of such water is discharged through the auxiliary valve *h*, and, through the discharge-valve *i*, into the main discharge-pipe above, and the other half or portion of such is caused to fill the pump-cylinder F. In the succeeding descent of the plungers C D the water thus filling the smaller pump-cylinder, F, is discharged through the valve *i*, thereby keeping up a continuous delivery, and the plunger C of the larger pump, E, simultaneously caused to draw in a fresh supply of water below the auxiliary valve *h*, for expulsion in the next ascent of the plungers, as before.

The plungers C D are provided beyond their outer ends with cross-heads *k*, so that in case of the rod *b*, which connects said plungers, breaking or the pumps otherwise giving way, said cross-heads will fall on timbers in the shaft A, to prevent the falling of the plungers down the shaft. Beyond these cross-heads are shackle-bolts, to which chains or wire cables J are attached to connect the several pumps in each series with one another, and to transmit the power to the pumps through the centers of their cylinders, said cables being attached at their upper ends to a rocking beam, L, on opposite sides of the axis of the latter, whereby the lines or series of pumps on opposite sides of the well or shaft are simultaneously operated in reverse directions, and the plungers of said two lines or series of pumps and their respective connections are made to balance each other.

I claim—

1. The combination of two lines or series of pumps, an intermediately-arranged series of suction and discharge pipes, with which the several pumps, arranged one above the other in each series, respectively connect, a rocking beam arranged to actuate said pumps simultaneously in reverse directions on opposite sides of the main discharge-pipe, and wire cables or chains connecting said beam on opposite sides of its axis with the plungers of said pumps, for keeping up a continuous delivery through the main discharge-pipe, substantially as specified.

2. The pump system composed of two pumps of unequal diameters, arranged to work in concert, one with another, the suction and delivery pipes, the suction and delivery valves, and a bulk-head and auxiliary valve interposed between said pumps, substantially as specified.

3. The combination, with a series of pump systems, each composed of two pumps of unequal diameter, of rods connecting the pistons or plungers of the two pumps of each system, and wire cables connecting the rods of the several systems with each other and with the working-gear, substantially as specified.

4. The combination, in a pump system, of a pair of upper and lower pump-cylinders, E F, the lower one of which is of greater capacity than the upper one, connected plungers C D, fitted to work in said cylinders, the suction pipe or duct G common to both pumps, a discharge pipe or duct, B, also common to both pumps, the bulk-head H, separating said pumps, the suction-valve *f*, the discharge-valve *i*, and the intermediate auxiliary valve *h*, substantially as shown and described.

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