(No Model.) 2 Sheets—Sheet 1.

J. H. McGOWAN.

WATER EJECTOR.

No. 519,728. Patented May 15, 1894.

Fig. 1.

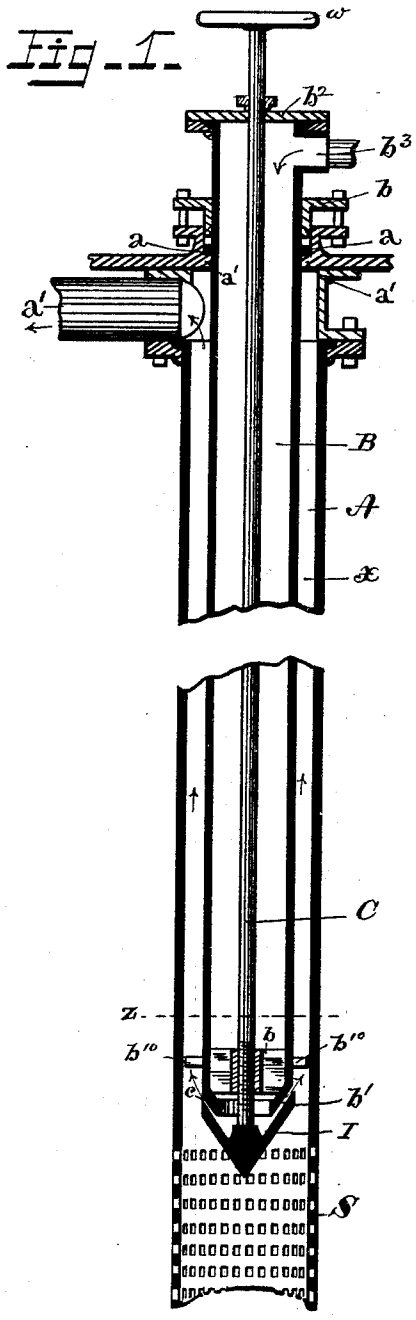


Fig. 2.

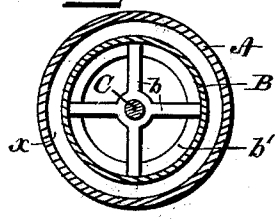
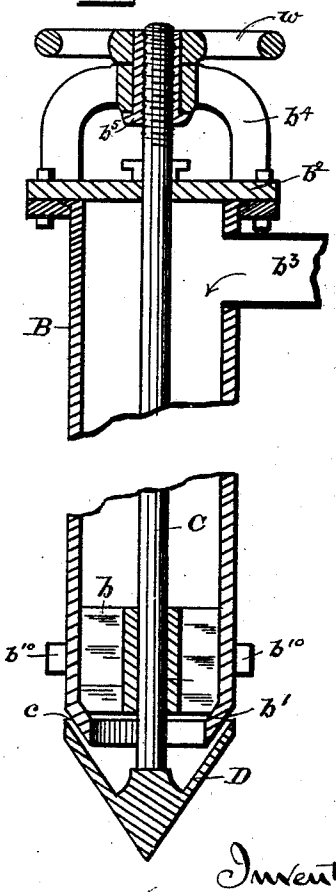


Fig. 3.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 4.

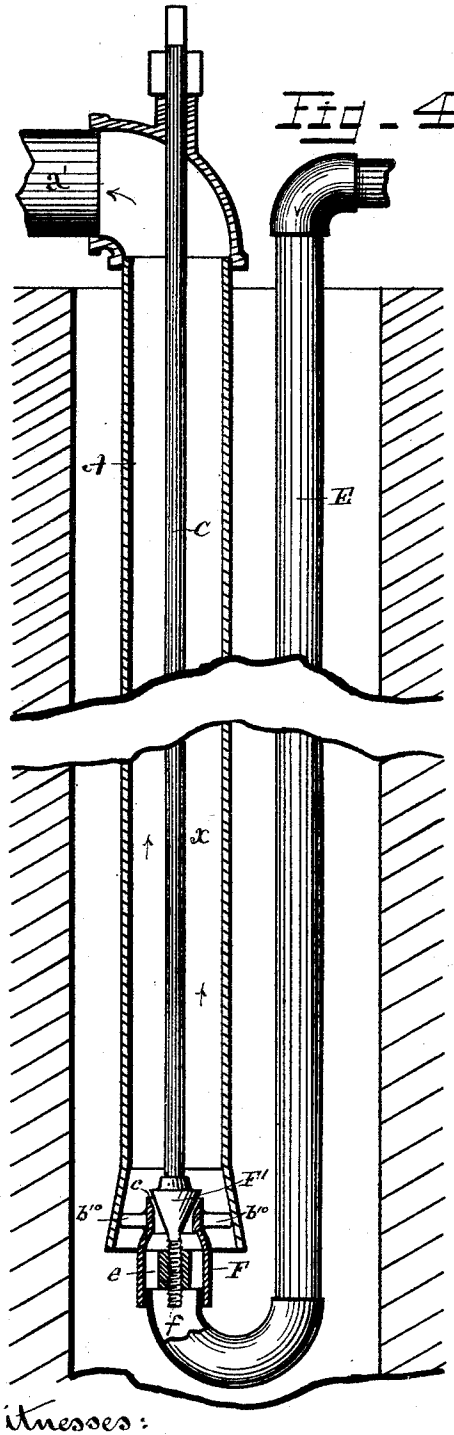
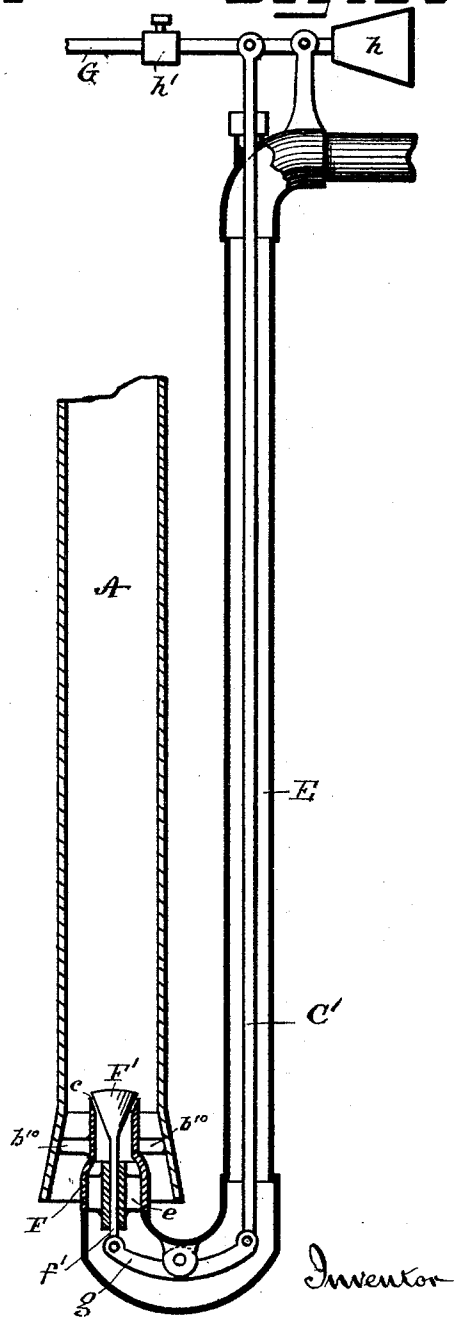


Fig. 5.



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UNITED STATES PATENT OFFICE.

JOHN H. McGOWAN, OF CINCINNATI, OHIO.

WATER-EJECTOR.

SPECIFICATION forming part of Letters Patent No. 519,728, dated May 15, 1894.

Application filed February 23, 1894. Serial No. 501,169. (No model.)

To all whom it may concern:

Be it known that I, JOHN H. McGOWAN, a citizen of the United States, residing at Cincinnati, Ohio, have invented new and useful Improvements in Water-Ejectors, of which the following is a specification.

My invention relates to ejectors used for elevating water from wells, mines, &c., in which a jet of steam, air, or other motor fluid is discharged in the outlet in the direction of the flow of a column of water superinduced by its action, keeps up the outward motion of the discharge flow. Such apparatus is largely used in situations where the ordinary suction pump is unavailable,—as in cases where the water contains an excess of sediment destructive to pump-valves, pistons, &c.; but, as heretofore constructed, and used, the expenditure of air or steam was excessive in proportion to the quantity of water elevated. This want of efficiency in such apparatus results from several causes, of which the want of adjustability to the varying demands of service is foremost, and forms the starting point of my present invention.

To the end of attaining a more efficient and economical application of the power employed, and of adapting the apparatus more perfectly to the requirements of service, my present invention consists, practically, in a new apparatus utilizing air or steam under pressure by its direct flow and impact against the discharge-column of water, for raising water from subterranean and other reservoirs: in which apparatus, some old and some new features are embodied, as will more fully hereinafter appear.

Mechanism embodying my invention is illustrated in the accompanying drawings, in which—

Figure 1, is a vertical sectional elevation of a deep-well ejector embodying my invention, in preferred form, complete. Fig. 2, is a horizontal cross-section in the plane, *z*, of Fig. 1, showing the lower "spider" or guide-support for the deflector-valve. Fig. 3, is a vertical sectional elevation of an alternative construction showing minor modifications of structure. Fig. 4, is a vertical sectional elevation of further modifications, illustrating a second type of structure embodying the general principles of my invention, with special reference to its application to existing structures; and Fig. 5, is a detail exhibiting a third type of same.

I may premise, as one of the leading principles involved in my improvements, that it seeks to obtain a relatively high velocity of discharge, by spreading the air or steam blast over a large surface, and adapting the discharge channel in size and form thereto. To secure this result in the best manner, I preferably employ the apparatus shown in Fig. 1 of the drawings herewith: in which, A, designates the discharge tube; and, B, the interior air-tube,—the construction being in detail as follows:

The discharge tube, A, is of sufficient length to extend into the reservoir of water, at whatever depth, and may be terminated below by a "strainer," S, of any suitable description. The tube, A, may be "driven" to position and supported by the earth surrounding or otherwise placed and maintained in position according to circumstances: and its relative size is determined by the maximum capacity of the supply.

The discharge tube, A, is provided at the top with an inner supporting ledge, *a'*, and a stuffing-box gland, *b*, to support and maintain, by a water-tight connection, the air tube, B, placed concentrically within the discharge tube, A, and extending nearly to the bottom. Within the tube, B, at the lower end, is secured a "spider," *b;* and the lower end of the tube is contracted to form an annular conical surface, *b'*. Through the central boss of the "spider," *b*, is threaded a valve rod, C, carrying at its lower terminus, below the tube, B, an annular conical deflector-valve, D, adapted to seat and close against the conical surface, *b'*, or open to produce an annular conical exit-channel, *c*, for the motor fluid passing through the tube, B. The threaded connection of the valve-rod in the supporting "spider," renders the rotative movement of the rod effective to close or open the valve, D, or regulate the size of the annular air-discharge opening, *c*.

At its upper terminal, the tube, B, is provided with a stuffing-box-opening for the valve-rod, C, and the latter is provided with a hand wheel, *w*, for its manipulation; and the lower end of the tube B is provided with

centering projections b^{10} to retain it in concentric relations with the tube A.

The tubes, A, B, are sufficiently differentiated in size to form an annular channel, *x*, surrounding the inner tube within the outer, into which is upwardly discharged the air or steam blast issuing from the valve aperture, *c*. The area of this annular channel in an outer tube of given size will be determined by the size of the inner tube: and as this, together with the discharging velocity of the motor fluid, determines the actual discharging capacity of the apparatus, it must be governed by circumstances, and adjusted according to the conditions by engineering rules and experience. Where, however, the capacity is to be adjusted, in reference to a given outer tube, by the uncertain capacity of the supply, or other uncertain factors only experimentally determinable, inner tubes of various sizes may be experimentally tried until the best results are attained, and the permanent structure then inserted proportioned according to these results. For this purpose, the inner tube, B, may be a hose or tube of any description: and a series of such sections of hose of different dimensions may be provided for such experimental work: and, indeed, the hose of rubber, canvas, leather or other material may be used for the permanent inner tube: although a metallic tube is preferable.

The operation has already been partially indicated. Air or steam being admitted by the entrance branch, b^3, to the tube, B, is discharged through the annular valve-opening, *c*, while the ascending column of water is discharged through the channel, *x*, and side exit, *a'*.

The construction shown in Fig. 3, differs only in this, namely: that instead of supporting the valve-rod operatively upon and by the "spider," *b*, the latter is employed as a guide only, and the valve-rod operatively supported by a screw-connection in a collar, b^5, attached to the hand wheel, *w*, and itself rotatively supported by the guide, b^4, whereby the rotation of the hand-wheel lifts or depresses the valve-rod, C.

The first construction is preferred for its adaptability to maintain the valve in given relations with the tube, B, or valve-rod, C, independently of expansion or contraction of any of the parts; while, in some situations, the second construction is preferable because the supporting and operative element, namely: the screw-threads are within view and easy reach and therefore under more direct observation and control.

The functions of the tube, B, in conveying the motor fluid, and in constituting the inner wall of the annular discharge channel, *x*, are separate and distinct, as is shown in the apparatus exhibited in Fig. 4. Here the inner tube is wholly omitted, and the valve-rod, C, constitutes the inner boundary of the annular discharge channel, *x*. The motor fluid is delivered by an independent pipe, E, passing downwardly independently of and below the pipe, A, into which it is turned upward and terminated by a discharge nozzle, F, provided for the seating of a conical plug or valve, F', at the discharge orifice. The discharge channel thus formed, is precisely the same as that produced by the construction first described: the only difference being that, in the former case, the valve-seat was the interior and the valve the exterior element; whereas, in the present construction, these relations are reversed. The conical valve F' is extended into a screw-threaded stem, *f'*, seating in a "spider" support, *e*, so that, by rotation of the valve by its rod, C, (by means of a wrench or key applied at its squared upper end, or a hand-wheel as described,) it is raised or lowered in relation to its seat, and the discharge of motor-fluid regulated and controlled. This construction embraces the same general principles as that first described.

It will be obvious that the constructions herein shown readily adapt themselves to adjustment of the discharge channel and the discharge orifice of the motor fluid, to each other and to the various conditions upon which the problem of proportioning parts depends: and that the most essential adjustment, namely: that of the motor-discharge-orifice, can be made from time to time, as required, without trouble or delay.

As illustrated in Fig. 5, the valve rod, C, may be wholly exterior to the discharge tube, A. The construction shown in this modification embodies a lever, *g*, centrally pivoted in the lower bight of the separate air tube, E, and connected at one end to a lower projection of the valve stem, *f'*, and at the other to a rod, C', passed down through the air tube, E. In this case I have shown the valve-moving rod, C', connected above to a counter-weighted lever, G; having at one end a fixed over-weight, *h*, tending to keep the valve seated, and at the other side of its fulcrum an adjustable counter weight, *h*, by whose adjustment in relation to the fixed weight an automatic action of the valve may be had, proportioned to the air pressure. Other modes of external connection will readily suggest themselves to the skilled mechanic. By thus controlling the discharge of motor fluid, any number of wells may be operated from the same reservoir of compressed air, either alternately or together; or, a well of intermittent capacity may be operated according to its varying rate of supply with great economy of power; also the same apparatus may be made serviceable in wells of varying depth with like economy and greater efficiency.

I claim as my invention and desire to secure by Letters Patent of the United States—

1. In a water ejector for wells, in combination with a water discharge tube and an air-delivery tube opening into the same, an adjustable air-deflector arranged concentrically in relation to the mouth of the air discharge

tube and provided with means for adjusting the same from the surface of the ground at will, substantially as set forth.

2. In a water ejector for wells, in combination with a water discharge tube and an air-delivery tube opening into the same, an adjustable air-deflector arranged concentrically in relation to the mouth of the air discharge tube, adapted also to seat against the mouth of said tube as a stop valve, and means for operating the same from the surface of the ground at will, substantially as set forth.

3. In a water ejector for wells, in combination with a water-discharge tube and an air-delivery tube opening into the same at the lower end, a conical air-deflector adapted to seat upon and control the mouth-opening of the air-discharge nozzle, and a rod connected to said deflector and extending to the surface of the ground and provided with means for manipulating the same to control or regulate the air-discharge opening, substantially as set forth.

4. In a water ejector for wells, the combination of the water-discharge tube, the air-delivery tube, the conical deflector, the operating rod extending to the surface of the ground, and a screw threaded support for the valve rod, whereby the air-discharge opening is regulated and controlled by rotating the valve rod, substantially as set forth.

5. In a water ejector, the combination of a water discharge tube, an air-delivery tube passing downward within the same to near its mouth, and a deflector-valve seated at the mouth of the air tube as a valve and adjustable to open positions to deflect the air into the space between the tubes in the direction of the discharge flow, substantially as set forth.

6. In a water ejector, the combination of a water discharge tube, an air-delivery tube passing downward concentrically within the same, a valve rod within the air tube, and a deflector-valve at the mouth of the air tube controlled by said rod, substantially as set forth.

7. In a water ejector the combination of a discharge tube provided at the top with an internal supporting ledge, and a stuffing box and an air delivery having an external ledge, adapted to hang suspended within the water discharge tube and emerge through the stuffing box, substantially as set forth.

8. In a water ejector the combination of a discharge tube an air delivery tube extending downward through the same and carrying an adjustable deflector valve below, a valve operating rod extending upward through the air tube and external means for operating the same, substantially as set forth.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

JOHN H. McGOWAN.

Witnesses:
LANDON FREYBLER,
L. M. HOSEA.