(No Model.)

D. H. TICHENOR.

ARTESIAN VACUUM WELL.

No. 260,803. Patented July 11, 1882.

Fig. 1.

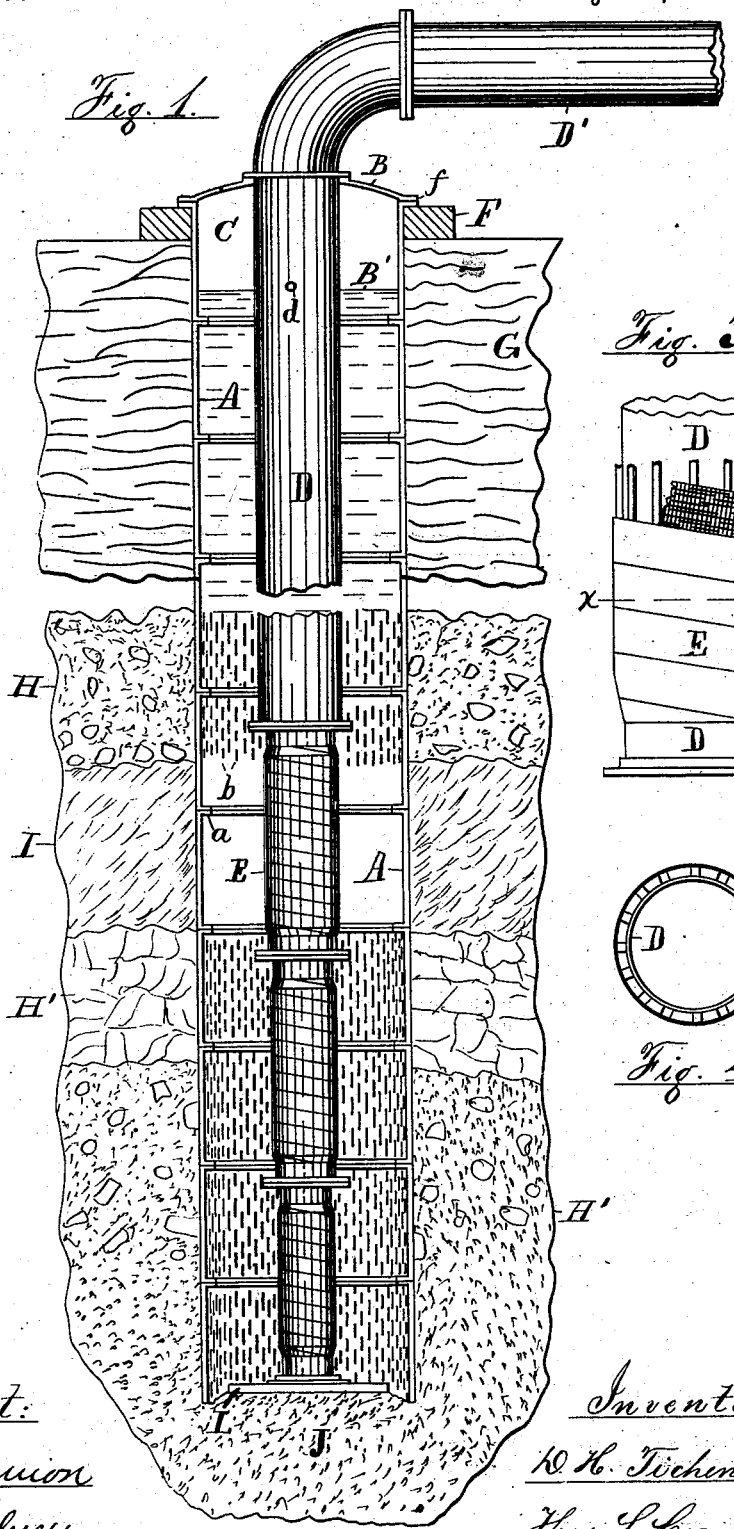


Fig 2.

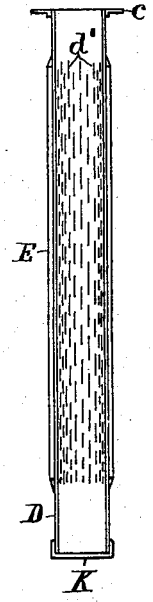
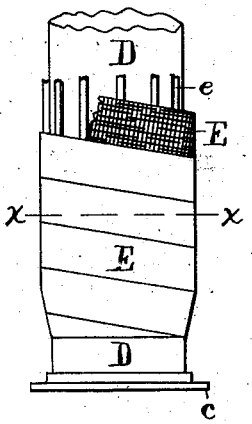


Fig. 3.



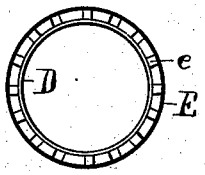


Fig. 4.

Attest:

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Thos. S. Crane, Atty.

UNITED STATES PATENT OFFICE.

DAVID H. TICHENOR, OF NEWARK, NEW JERSEY.

ARTESIAN VACUUM-WELL.

SPECIFICATION forming part of Letters Patent No. 260,803, dated July 11, 1882.

Application filed May 10, 1882. (No model.)

To all whom it may concern:

Be it known that I, DAVID H. TICHENOR, a citizen of the United States, residing in the city of Newark, county of Essex, and State of New Jersey, have invented certain new and useful Improvements in Artesian Vacuum-Wells, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention is intended as an improvement in wells formed with an air-tight casing having an exhausted space above the water for the purpose of inducing an atmospheric pressure upon the water-supplying veins or strata, and is designed as a means of adapting the principles of operation patented to me October 26, 1880, to soil where a reservoir is impracticable or where it is desirable to extract the water from strata at different levels. To effect this object I employ a casing perforated at the respective points where the water is to be taken from the strata, and where a quicksand or other flowing sand liable to injure pumping machinery is found I combine with such casing a suction-pipe, drawing its water through openings in its sides, and cover the openings by screens adapted to exclude such sand.

My device will be understood by reference to the annexed drawings, in which Figure 1 is a section of a well constructed with my improvements, the suction-pipe not being sectioned, but shown with the covering of perforated metal applied to the lower three joints of pipe. Fig. 2 is a central section of one of the same joints, showing the interior perforations and the external screen in section. Fig. 3 is an enlarged view of part of one pipe, showing the mode of applying the screen; and Fig. 4 is a cross-section on line *x x* in Fig. 3.

A is the air-tight casing, sunk in the ground in any convenient manner, and having its sections joined by screw-couplings or by flanges, as shown in Fig. 1, and at *c* in Fig. 2.

B is an air-tight cover, through which the suction-pipe may be passed, as shown in the drawings, or the pipe may be introduced at any point in the side of the casing.

C is the exhausted space above the water, which is shown standing at the level of B′.

D is the suction-pipe shown provided with a hole, *d*, at the desired water-level, and formed with several perforated sections at its lower end for drawing the water from the well through the side of the pipe instead of its lower end. The lower end may thus be closed, as shown at K in Fig. 2, to exclude sand from the pipe, and a much greater suction area secured than is attainable at the end of the pipe. This is especially desirable, as I cover the suction-openings with straining-cloth or perforated metal for excluding the sand in such cases, as shown at E, which obstructs the water-openings somewhat and necessitates a large suction area to secure a free passage into the pipe.

The mode of applying the perforated metal is shown in Fig. 3, *e* being sticks inserted inside the sheet metal, which is formed in a long strip and wound spirally around the pipe outside the sticks. The ends and edges of the metal strip are soldered tightly together or to the pipe, and perforations *d′* being formed through the sides of the pipe, as shown in Fig. 2, the water is drawn into the pipe exclusively through the perforated covering E. In place of the sticks *e* ribs of metal may be formed upon the outside of the pipe if cast, and the perforations *d′* in the pipe itself may be cast in or drilled or punched if wrought pipe be used.

To exclude water from the well at any particular level, and to draw it from any strata previously determined upon, I make the casing tight at all points except where the water is to be taken from the strata and form apertures, as *b*, in the sides of the casing to admit the water at the determined points.

By taking trial-borings at the place where the well is to be sunk the various strata may be examined in advance and the casing prepared so as to admit the water only at the desired points. Such casing would be preferably made tight at its upper part to exclude the surface-water, and is shown formed with a flange, *f*, at its upper end, resting upon timbers F to prevent settling. By making the upper part of the casing tight the desired vacuum may be maintained for the purpose of increasing the flow of water into the well, as

described in the patent referred to above, and it is therefore best to make the casing tight to a depth of thirty feet at least, to prevent air from entering the well at any point before a vacuum equal to the atmospheric pressure is reached, as it is obvious that if the air-hole *d* in the suction-pipe be thirty feet above the water-inlet it must require about the full pressure of the atmosphere to lift it to the level of the hole. Such an elevation of the water is effected by pumping from the suction-pipe until the air is exhausted from the well above the highest apertures, *b*, and the water elevated by the atmospheric pressure operating in the strata to a point where it covers the hole *d*, after which water would be pumped continuously. In such an operation it is of course assumed that the water may be found in strata not more than thirty feet below the level of the pumping apparatus, and the entire system is therefore especially adapted to localities along water-courses and sea-shores, where the soil is filled with water quite near the surface, and where fine or quick sand is likely to be found. It may, however, be applied to locations where the water-bearing strata lie more than thirty feet below the surface by sinking the pump inside the casing to the required depth. The arrangement of the apertures *b* in the casing is shown in Fig. 1, where G is the surface-stratum through which the casing passes unperforated.

H is the first water-bearing stratum, communicating with the interior of the casing by the apertures *b*.

I is a succeeding stratum, through which the casing is unperforated, and H′ is a second stratum, from which it is desired to take water. This stratum is shown extending to the bottom of the casing, which is therefore perforated with apertures *b* to its lower end. These apertures may be cast in the casing, or punched, if made of wrought-iron, and are preferably in the form of narrow slits to exclude sand or fine gravel and admit the water, unmixed, as nearly as possible, with other matters. To exclude such sand from the bottom of the well, and thus prevent it from being soon filled with loose material, I have shown a plate, L, placed beneath the end of the suction-pipe D for filling almost entirely the opening at the bottom of the casing.

The plate may, if preferred, be bolted to a flange upon the end of the pipe P, or may be secured to an internal flange attached to the end of the casing.

As the casing can only be conveniently sunk with an open end, it is obvious that such means must be used to prevent the inflow of loose material where it exists; but it is immaterial what means are used, as concrete might be formed in the bottom in lieu of such a plate. The purpose accomplished by my construction is therefore the formation of a double barrier against the fine material so destructive to ordinary pumps and wells; but as the several improvements I have made are not strictly dependent upon one another, I have claimed them separately so far as they are independent.

I am fully aware that it is not new to close the bottom of a well-tube and cover it with straining fabric to exclude sand, and I do not therefore claim such a construction; but having devised the exhausted air-chamber in a well provided with a reservoir at the bottom, my present invention is intended to secure a large suction area in contact with the strata where the latter will not permit the formation of a reservoir by reason of their loose or flowing character.

I therefore claim my invention as follows:

1. The combination, in a well having an exhausted air-space maintained above the surface of the water in the manner set forth, of a suction-pipe arranged to draw off the water at some point below the top of casing and a casing provided with apertures at one or more points in its sides for draining the water from the strata at specific levels, substantially as and for the purpose set forth.

2. The combination, in a well having an exhausted air-space maintained above the surface of the water, in the manner set forth, of a casing perforated at the sides, as described, at different levels and a suction-pipe provided with apertures in its sides covered with straining fabric, substantially as and for the purpose set forth.

3. The combination, with a casing closed at the bottom and perforated at the sides, as set forth, of a suction-pipe closed at the bottom and provided with straining-apertures in its sides and operating to draw off the water from some point below the cover, so as to maintain a partial vacuum in the upper part of the casing, substantially as herein set forth.

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

DAVID H. TICHENOR.

Witnesses:
WM. F. D. CRANE,
THOS. S. CRANE.