(No Model.)

D. L. BARKER.

TUBE WELL.

No. 566,371. Patented Aug. 25, 1896.

Fig. 1.

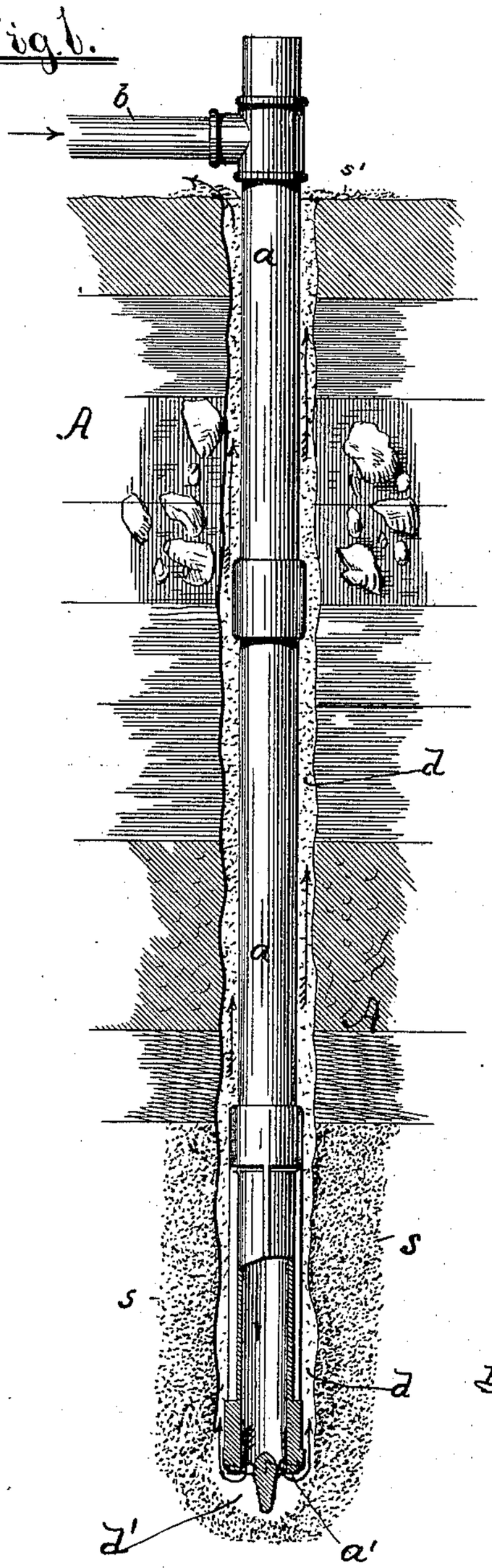
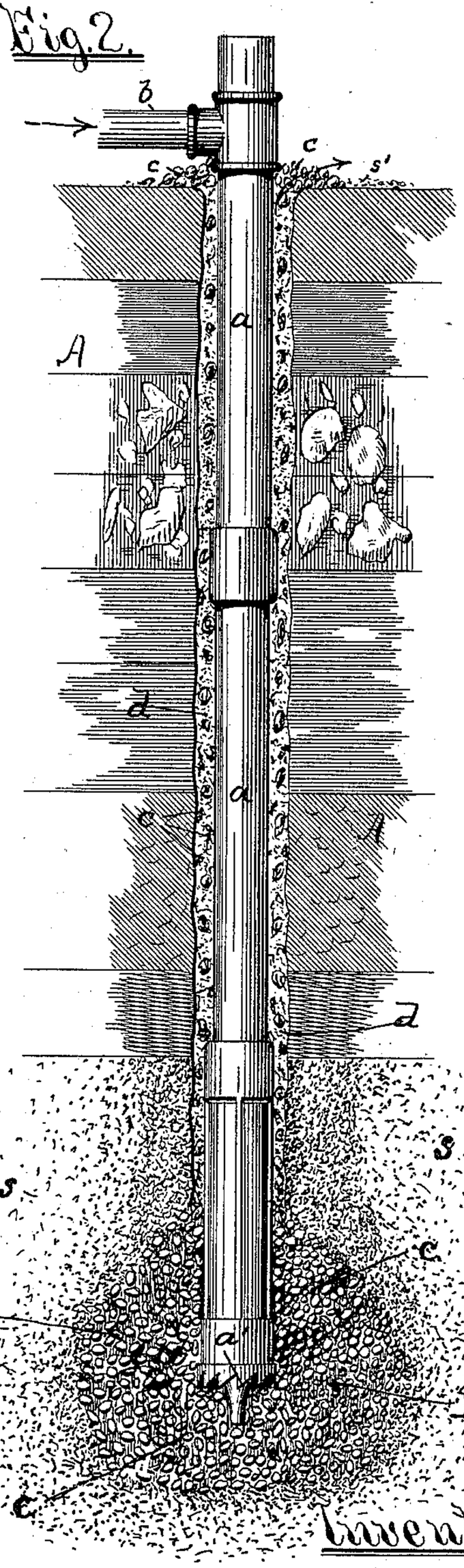


Fig. 2.



Witnesses.

Willard A. Smith.

Remington Sherman

Inventor.

Delbert L. Barker.

by. Groff, Remington & Co

Attorneys.

UNITED STATES PATENT OFFICE.

DELBERT L. BARKER, OF PROVIDENCE, RHODE ISLAND.

TUBE-WELL.

SPECIFICATION forming part of Letters Patent No. 566,371, dated August 25, 1896.

Application filed January 8, 1896. Serial No. 574,687. (No model.)

To all whom it may concern:

Be it known that I, DELBERT L. BARKER, a citizen of the United States, residing at Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Tube-Wells; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

My invention relates to improvements in the art of constructing and developing bored or driven pipe-wells, and more especially to the class of pipe-wells which are sunk for the purpose of securing a permanent water supply, the water in such case being usually raised to the surface or tube-outlet by means of a pump, as distinguished from flowing wells.

In sinking "pipe-wells," as they are commonly termed, it is usual to continue the operation, if possible, until the lower end of the tube or pipe penetrates a suitable water-carrying stratum of gravel. It is a well-known fact that any considerable degree of success or permanency of the water supply must depend to a great extent upon the uncertain chance of encountering stratified gravel of such thickness and porosity that water will circulate freely enough through it to supply a pump continuously. Very frequently it happens that in developing pipe-wells the extent and formation of the underlying strata are such that a stratum of suitable gravel is not encountered, but instead a stratum of wet sand or fine gravel. Under such conditions the well must be abandoned and the time, labor, and cost of sinking it be reckoned, practically, as a total loss. While water may be present and the sand be pervious, yet the quantity of water capable of filtering through the sand to supply the pump would be altogether too small to render the well of any practical use. Moreover, the screens or inlet-passages at the lower end of the tube are liable to become choked or clogged with impacted sand or foreign matter.

The object I have in view is to successfully develop pipe-wells in sand strata where the natural conditions are substantially as just described, or, in other words, where the flow of water is limited or restricted by the presence of fine sand or other slightly-porous material to such an extent as to render the well practically unserviceable.

To that end my invention consists, essentially, in the novel manner of introducing and forming artificial filter-beds at the base of tube-wells, thereby increasing their efficiency or productiveness, all as will be more fully hereinafter set forth and claimed.

By means of my invention it has been practically demonstrated that the flow of water in pipe-wells (which at first could not be made to discharge a continuous supply of water, even in small volumes, owing to the presence of fine sand and the inherent imperviousness of it to the passage of water to a great extent) can be rendered continuous and permanent and in sufficient volume. This result is due to the fact that the considerable body of gravel or other suitable filtering material artificially introduced at the bottom of the well and replacing a corresponding volume of sand having much less perviousness forms a reservoir or filtering-chamber into and through which the water percolates, and being of sufficient capacity to supply the pump continuously.

In carrying out my invention I prefer to sink a pipe having an open lower end into the earth until it penetrates the best water-carrying stratum of pervious material it is possible to obtain under the conditions existing at the time and place. The pipe may be sunk by the employment of the hydraulic or pneumatic process. The water or air, or other medium used under pressure, passes down through the inside of the pipe and returns by flowing upward around the outside of it, the pipe, if desired, being turned axially meanwhile. I may add that usually in sinking wells of this class the diameter of the lower end portion of the pipe generally exceeds that of the pipe proper, thereby producing in the earth a continuous annular space (more or less uniform in diameter) around the pipe. Now, since the pressure of the water forced down the pipe exceeds the resistance offered by the contiguous earth, the latter is thereby disintegrated and becomes

mingled with the water, and escapes by flowing upwardly in the space around the pipe. When the pipe has penetrated the water-carrying stratum of fine pervious material the desired distance, its further advance is stopped, but the downward flow of water is continued, thereby producing a cavity in said stratum. At the same time gravel or other suitable filtering material having a greater specific gravity than the outflowing sand is introduced into the mouth of the annular space. It (the gravel) then works its way downward by gravity to the bottom of the pipe and fills the space formerly occupied by the discharged sand, and thus forming in the midst of a naturally slowly-flowing or even stagnant water-carrying stratum an artificial filter bed or reservoir through which water will freely circulate, and having the suction end of the pipe located in the filter-bed. The latter can be easily enlarged so as to increase its capacity by simply continuing the "hydraulicking" operation, thereby loosening the sand contiguous to the introduced gravel or filter bed, the thus loosened sand at the same time percolating or passing through the interstices of the filter-bed and flowing upwardly with the discharge-water. While this is taking place additional gravel is fed down to the bed below, the latter in turn gradually taking the place of the discharged sand, thereby augmenting the size of the filter-bed and increasing its water-holding capacity. Thus it will be apparent that a stratum of slightly-pervious material, which in its natural state is unable to set water free in sufficient volume, may by my invention be rendered permanently efficient at a comparatively small cost, and capable of supplying a greatly-increased amount of water freely to the pump in a continuous manner.

In the appended sheet of drawings, Figure 1 is a vertical sectional view showing a tube sunk in the usual manner by "hydraulicking," as it is termed, the lower end having penetrated a natural stratum of fine sand; and Fig. 2 is a similar view of the tube-well, showing a bed of filtering material artificially introduced into the sand stratum.

In the drawings, A indicates various strata of earth overlying a stratum *s* of water-bearing sand or fine material through which water cannot percolate very freely. *a* indicates a tube sunk into the stratum *s*. The lower end *a'* of the tube is, as drawn, slightly enlarged and open and provided with cutting-teeth, as common. In sinking the tube water (although air, steam, or other suitable medium can be employed) under considerable pressure is introduced into the tube through a suitably-connected nozzle or hose *b*. The water escapes by flowing outwardly through the pipe end *a'*, and as a rule flows upwardly, carrying with it the loosened earth, &c. At the same time the pipe may be rotated axially to facilitate the sinking operation. As the pipe descends it will be found that an annular space *d*, more or less regular in size, will be formed in the earth adjacent to and around the pipe, and since this space offers less resistance to the force of the discharge-water the latter, together with the loosened material mingled with it, passes freely upward under pressure through the space and overflows at the surface, as indicated at *s'*. The arrows indicate the course of the water, &c.

In case the pipe penetrates a stratum *s* of fine water-carrying sand, as may be determined by examination of the outflowing material by the experienced person in charge, the sinking operation is continued until the end of the tube is well advanced into the sand, when the sinking process is suspended, but circulation of the water under pressure is not discontinued. Such continued action of the water soon scours or washes away the sand around the mouth of the tube and produces a small chamber, as *d'*, Fig. 1. Now, it having already been decided upon to form an artificial filter-bed in the natural stratum *s* of fine sand, a quantity of gravel *c* or other suitable coarse filtering material having greater specific gravity than the outflowing sand or material is deposited at the mouth of the said annular space or hole *d* and gradually worked into the hole, whence it falls to the bottom and fills the small chamber *d'*. By continuing this part of the operation the water will be forced through the mass of gravel in said chamber, thereby gradually loosening the contiguous sand, which latter then flows through the interstices of the gravel, &c., into the hole *d* and overflows at its mouth. At the same time, too, an additional quantity of gravel *c*, equaling in volume that of the sand displaced, is introduced into the hole, the gravel at the bottom gradually spreading out and taking the place of the removed sand, and resulting in the formation of an artificial filter-bed B, having any desired capacity within practical limits, as clearly represented in Fig. 2. The supply of water employed for sinking the pipe or tube *a* and discharging the sand surrounding its outlet end *a'*, as just described, is now cut off, after which a pump is suitably connected with the tube for the purpose of lifting water from the well.

It will be seen that by means of my invention or improvement in the art of sinking and developing tube-wells the natural stratum of sand *s*, surrounding the thus-introduced filtering material *c*, is not disturbed. Consequently its original water-holding capacity is not reduced or disturbed. Therefore water can percolate through it and is collected or centered in the artificial bed B, from which latter it is sucked into the pump, and since the volume or extent of the bed B may be comparatively large it follows that the amount of water slowly flowing into it from the surrounding stratum *s* will be sufficient to supply the pump continuously.

It is apparent that without departing from the spirit of the invention a second tube may

be employed, the same being somewhat larger and surrounding the tube *a* and forming a casing for the hole *d*. In such case the water used may, if desired, be forced down the space between the tubes and be discharged upwardly through the central tube, or vice versa; or an independent tube may be sunk alongside of the tube *a*, both of them being in communication with the stratum *s*, the gravel or filtering material *c* in that event being introduced into the independent tube, which conducts it to the bottom outlet of tube *a*. However, I make no claim herewith to the manner of sinking the tube, since any well-known means may be employed that is capable of loosening portions of the natural stratum of the sand around the end of the tube and forcing it upward therefrom. I would further state I make no claim, broadly, to tube or pipe wells having artificial filter beds or reservoirs surrounding the lower portion of the tubes, as such wells have been produced prior to my invention. Such former wells, however, were of comparatively small depth and were formed by first excavating or digging a hole to the desired depth practicable, then placing a tube or pipe vertically in the center of said hole, then filling the hole around the lower portion of the pipe with cobble-stones or other suitable material to a suitable height to form a water-reservoir, then covering the thus-formed reservoir with any hard or cementitious substance through which water will not percolate, and, finally, after the parts are in place the well is filled with the earth, &c., which was thrown out in digging the same, the earth at the same time being well tamped down.

I claim as my invention—

1. The process of substituting a bed of gravel or coarser material for a bed of sand or finer material around the bottom of a tubular well in a water-bearing stratum, which consists in providing an upward or return passage, independent of the tube, from said bed to the surface, forcing a fluid under pressure down the tube to create a high pressure in said bed at the mouth of the tube, thereby forcing the sand or finer material away from the mouth of the tube and along the return-passage to the surface, and depositing the gravel or coarser material in the upper end of the return-passage, the fluid-pressure being so regulated as not to prevent the descent of said coarser material by gravity along the return-passage in the opposite direction to the upwardly-borne particles of sand, substantially as described.

2. The process of substituting a bed of gravel or coarser material for a bed of sand or finer material around the bottom of a tubular well in a water-bearing stratum, which consists in providing an annular space or passage around the tube, forcing a fluid under pressure down the tube to create a high pressure in said bed at the mouth of the tube, thereby forcing the sand or finer material away from the mouth of the tube and upward by the annular passage to the surface, and simultaneously depositing the gravel or coarser material in the upper end of the return-passage, the fluid-pressure being so regulated as not to prevent the descent of said coarser material by gravity in the passage around the tube against the upwardly-flowing stream therein created by said pressure, substantially as described.

3. The process of substituting a bed of gravel or coarser material for a bed of sand or finer material around the bottom of a tubular well in a water-bearing stratum, which consists in providing an annular space or passage around the tube, and then discharging the sand or finer material upwardly through said annular space by means of fluid-pressure transmitted down the tube and continuously replacing the discharged portions of said sand by gravel deposited in the top of said annular passage and allowed to descend by gravity to the bottom, substantially as described.

In testimony whereof I have affixed my signature in presence of two witnesses.

DELBERT L. BARKER.

Witnesses:

GEO. H. REMINGTON,

REMINGTON SHERMAN.