(No Model.)

G. W. DURBROW.

HYDRAULIC WELL BORING MACHINE.

No. 597,316. Patented Jan. 11, 1898.

Fig. 1.

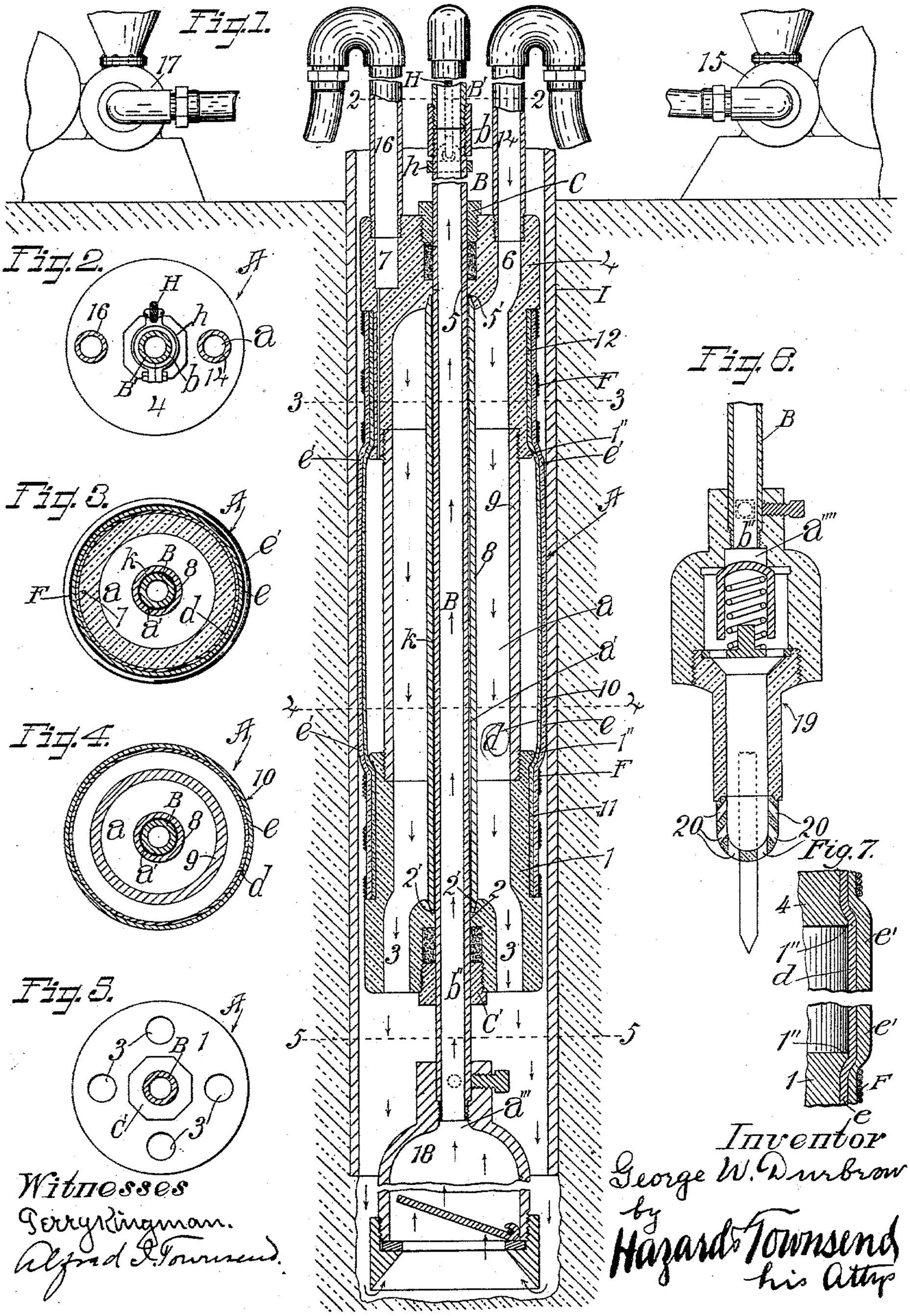

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

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UNITED STATES PATENT OFFICE.

GEORGE W. DURBROW, OF SALTON, CALIFORNIA.

HYDRAULIC WELL-BORING MACHINE.

SPECIFICATION forming part of Letters Patent No. 597,316, dated January 11, 1898.

Application filed November 24, 1896. Serial No. 613,331. (No model.)

To all whom it may concern:

Be it known that I, GEORGE W. DURBROW, a citizen of the United States, residing at Salton, in the county of Riverside and State of California, have invented a new and useful Improvement in Hydraulic Well-Boring Machines, of which the following is a specification.

My invention relates to improvements in the hydraulic well-boring machine which was patented to me by Letters Patent of the United States No. 385,600, dated July 3, 1888.

By this invention I provide a drill-pipe to which can be attached well-drilling tools—such as a sand-pump, a drill, an expansion-reamer, or other well-drilling tools, as occasion may require—the same to be below a plug having expansible walls, substantially as shown in my former patent.

This invention is useful for sinking wells through sand, clay, soft earth, rock, or other formations, and more particularly through quicksands, and it is also useful for sinking hollow tubes in quicksands or other formations for piers, bridges, and like purposes.

The accompanying drawings illustrate my invention.

Figure 1 is an axial section of my improvement in position in a well, a fragment of a sand-pump being shown attached to the drill-pipe. Fragments of the pumping mechanism are also indicated. Fig. 2 is a sectional plan of the top of the plug. Line 2 2, Fig. 1, indicates the line of section. Fig. 3 is a plan section of the plug on line 3 3, Fig. 1. Fig. 4 is a plan section of the plug on line 4 4, Fig. 1. Fig. 5 is a plan section looking up at the bottom of the plug. Fig. 6 indicates a form of drill which can be used with this invention. Fig. 7 is an enlarged fragmental detail illustrating the reinforced shaping-tube.

My invention comprises the plug provided with the expansible external wall, a water-passage and a drill-pipe passage extending lengthwise through the plug, and a drill-pipe working in stuffing-boxes in said drill-pipe passage.

In the drawings in a general manner, A indicates the plug, *a* the water-passage therethrough, and *a'* the drill-pipe passage.

B indicates the drill-pipe, and C C' the stuffing-boxes in said drill-pipe passage around the drill-pipe at the opposite ends of the plug.

More specifically the invention comprises the combination of a bottom piece 1, provided with the axial passage 2 for a drill-pipe and also provided with another passage or passages 3 for water, a head-piece 4, provided with an axial passage 5 for the drill-pipe and also with a water-passage 6, and an inflating-passage 7 for inflating the expansible wall of the plug, the drill-pipe B extending through the drill-pipe passages in the head and bottom piece, the stuffing-boxes C C for said drill-pipe in the head and bottom piece, a casing 8 around the drill-pipe between the head and bottom piece and constituting a portion of the drill-pipe passage *a'*, a coupling-pipe 9, connecting the head and bottom piece and surrounding the drill-pipe casing and constituting with said casing a portion of the water-passage extending through the plug, and the expansible tubular wall 10 around the plug. The drill-pipe passages 2 and 5 form at their inner ends, respectively, a seat (2' and 5', respectively) for the drill-rod casing and are conical for this purpose, the ends of the casing being tapered to fit into the conical seats thus formed. A recess 11 is provided at the upper end of the bottom piece and a like recess 12 is provided at the lower end of the head for the reception of the ends of the flexible tubular wall. The connecting-pipe 9 is screwed into the head and bottom piece, so that there is a recess around such pipe between the head and bottom piece and so that when the expansible tubular wall is fastened to the head and bottom piece an annular chamber is formed between the tubular wall, the connecting-pipe 9, and the head and bottom piece.

14 indicates a pipe screwed into the head at the mouth of the water-passage 6 and carried to the top of the well to be used either for supplying water for hydraulicing the well, or, if desired, it will serve as a discharge-pipe, through which the injected water and the debris carried thereby will be discharged from the well.

15 indicates a pump for pumping water down through the pipe 14.

16 indicates a pipe screwed into the head

and communicating with the inflating-passage 7 and led to the top of the well, where it preferably connects with a pump 17 for forcing air or water down into the chamber 13 to inflate the expansible wall 10.

Water is a very convenient medium for inflating the wall, but air will be found preferable in view of the fact that as soon as the air-pressure is relieved the expansible wall will be allowed to retract, while in the case of water-pressure the weight of the water will continue the expansion of the wall unless the well be filled with water above the plug, so that the pressure of the water on the outside of the expansible wall will equal the pressure on the inside.

The tool—such as the sand-pump 18, drill 19, or other tool screwed onto the bottom of the drill-pipe—will prevent the plug from sliding down off of the drill-pipe.

b indicates a coupling which couples the lower section B of the drill-pipe with the upper section B′. The lower section B of the drill-pipe is of sufficient length to run far enough below the plug to give the depth desired to be sunk below the plug before the casing is pushed down.

In commencing a well it is customary to excavate a place about ten feet deep, place the casing in the excavation, plumb the same and secure it in upright position, and then fill in around it. Then the plug, with such tool as it is wished to start the well with, is placed upon the lower end of the drill-pipe B below the plug. The plug and tool are then placed inside of the casing and lowered by the pipes B′, 14, and 16, or any of them, to a depth in the casing, usually about two feet from the bottom of the casing. The position of the plug above the bottom of the casing depends upon the length of the drill-rod. In some instances it is best to have a long drill-rod, say ten or twelve feet, so that the tool can work six or eight feet below the bottom of the casing. Before drilling or sand-pumping is commenced pressure is applied through pipe 16 to expand the expansible wall. Then the hydraulicing water is forced down through pipe 14, through the plug, and out of the apertures 3 3 at the bottom. The drill-pipe is then raised and lowered by means of walking-beam or other appliances in the derrick. (Not shown.) As the sand-pump touches the bottom it partly fills itself with sand or other material, and as raised the hydraulicing water is forced in at the bottom of the sand-pump and forces the sand through the drill-pipe to the surface, where it is discharged. When working in rock, a drill 19 instead of a sand-pump is fastened to the lower end of the drill-pipe. This drill is provided with passages, as at 20, through it leading to the drill-pipe, so that the drillings will be carried up through these passages by the hydraulicing water into the drill-pipe and be discharged at the surface. In sinking the casing I have found it better to hydraulic and remove the material some three or four feet below the casing before forcing the casing down. Usually the casing is being forced down by hydraulic jacks or levers (not shown) while the drilling or sand-pumping is going on. If the well is worked in this manner, it is better that the plug be placed higher in the casing, so that the sand-pump will reach only to the bottom of the casing. When drilling in rock, it is necessary to always drill ahead of the casing.

In practice I have found that where a stratum of quicksand is encountered with a pressure of water in it the quicksands will be forced up into the casing if the well is being sunk in the old style of sand-pumping, and it has been impossible to get these sands out of the well-casing with only a sand-pump, for the reason that when the sand has been sand-pumped close to the bottom of the casing the sands will rush in again and fill the casing. I have known it to fill from eighty to three hundred feet. Many wells have been abandoned on account of quicksands or what are known as "heaving" sands. With my present invention the quicksands or heaving sands can be held by the plug from rising into the casing, which is above the plug, and in cases where a well has filled with heaving sands they can be taken out with this invention and a good permanent well be obtained by pushing the casing on down through the quicksands to the underlying gravel.

The expansible wall is preferably formed of an inner flexible tube *d* and an outer flexible chafing-tube *e*, which is reinforced in thickness intermediate its ends. The inner flexible tube is fitted around the head and bottom piece and the other flexible tube is fitted around the inner flexible tube, said tubes being bound onto the head and bottom piece by bands F of any suitable form, preferably copper-wire wrapping.

l″ indicates a bead at the lower end of the head and a like bead at the upper end of the bottom piece. In practice the inner tube and upper tube are drawn over the beads *l*″ and brought to fully inclose the recessed portions of the head and bottom piece. The outer tube of the wall is reinforced in thickness and bulges outward, as at *e*′, intermediate its ends at the portion which extends between the beads of the head and bottom piece, and the beads also cause a bulging out of the wall around said beads. The recesses are of such depth that when the bands F are applied the upper end of the head and the lower end of the bottom piece will be flush with or project beyond the wrapping to protect the same, and the reinforced portion *e*′ of the outer chafing-tube of the expansible wall is ordinarily flush with such wrappings or extends slightly therebeyond. This reinforced portion is made about three-sixteenths of an inch thick, so as to avoid liability of being punctured or worn through, and the inner tube is made about one-eighth of an inch in thickness and is intended to make the wall perfectly air-tight,

even though the outer tube might by imperfection in the casing or from any other cause become punctured or worn.

When the tool is to be used to drill to a great depth, say two thousand feet or more, a steel cable H should be attached to the bottom joint of the drill-pipe to take the strain off the threads of the drill-pipe when drilling.

h indicates a band fastened on the lower joint of the drill-pipe for attaching the cable to such pipe.

I indicates the well-casing.

In the drawings two kinds of tools are shown to fully illustrate the principle employed in this invention.

It is to be understood that in case of other tools for use with this invention a passage or passages corresponding to *a'''* in the sand-pump and *a''''* in the drill shown will be provided through the top of the tool to communicate with the bore *b''* of the drill-pipe to receive or discharge water without or with the drillings or other debris, thus to take the drillings or other debris from the bottom of the well.

The expansible wall is preferably made of rubber. Preferably the bore of the pipe-casing is one-fourth of an inch greater in diameter than the drill-pipe, and the chamber *k* thus provided around the drill-pipe between the stuffing-boxes is preferably filled with thick oil for lubrication; but, if desired, the lower stuffing-box may be dispensed with. Other variations may also be made without departing from the spirit of my invention.

The drawings show a convenient and preferable form of the invention, but I do not limit myself to the form shown.

In practical working with the drill the drill will be turned round as well as reciprocated vertically, the round drill-pipe and the stuffing-boxes allowing this to be done.

When operating the sand-pump at great depths, difficulty may be encountered in forcing out sand or clay if the same is loosened so rapidly as to entirely fill the drill-pipe. To avoid this difficulty, the operator will at intervals hold the sand-pump from striking the bottom of the hole long enough to allow the water to force up into the sand-pump to wholly or partly fill it before the sand-pump is allowed to again strike the bottom of the hole to take up more earth. In this way the pipe will be filled with alternate layers or charges of earth and water, which will discharge at the surface.

Now, having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination of the bottom piece provided with the passage for a drill-pipe and also provided with another passage or passages for water; a head-piece provided with a passage for the drill-pipe and also with a water-passage, and a passage for inflating the expansible wall of the plug; a drill-pipe casing between the head and bottom piece; a drill-pipe extending through the casing and drill-pipe passages; stuffing-boxes for said pipe in the head and bottom piece; a coupling-pipe connecting the head and bottom piece and surrounding the drill-pipe casing with a water-passage therebetween, and the expansible tubular wall around the coupling.

2. The combination of the bottom piece provided with a water-passage or water-passages and with a passage for a drill-pipe, such passage forming at its inner end a seat for the drill-pipe casing, and a recess being provided at the upper end of the bottom piece for the reception of the end of a flexible tubular wall; a head-piece provided with a water-passage and with a passage for a drill-pipe, the inner end of such drill-pipe passage being arranged to form a seat for a drill-pipe casing; a drill-pipe casing seated in said seats; a drill-pipe extending through the drill-pipe casing and through the drill-pipe passages of the head and bottom piece; a coupling screwed into the head and bottom piece and surrounding the drill-pipe casing with water-passage therebetween; a tubular flexible wall fastened to the head and bottom piece, and surrounding the coupling, with inflation-chamber therebetween; an inlet being provided through the head into the inflation-chamber; and stuffing-boxes for the drill-pipe in the head and bottom piece.

3. The inflation-tube composed of an inner expansible tube surrounding the head and bottom and the outer expansible chafing-tube being of reinforced thickness between its ends surrounding the inner tube and the head and bottom and bound thereonto, means being provided for expanding the inner expansible tube to expand the outer expansible tube.

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