No. 695,745. Patented Mar. 18, 1902.

# J. W. LIVERMORE.

## DRILL FOR DEEP WELLS.

(Application filed Jan. 14, 1901.)

(No Model.)

Fig. 3.

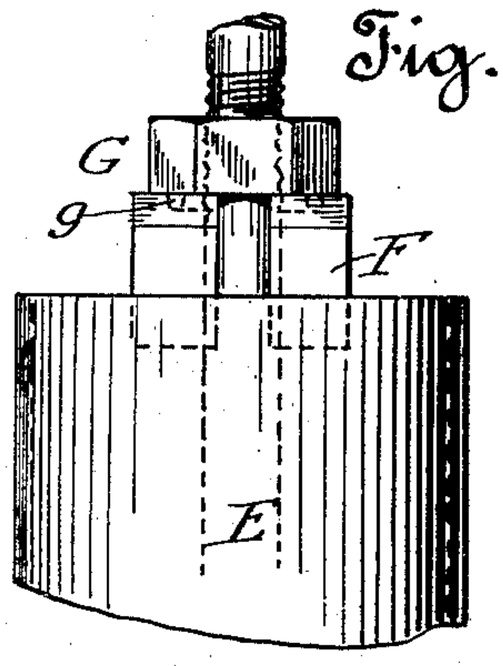



Fig. 1.

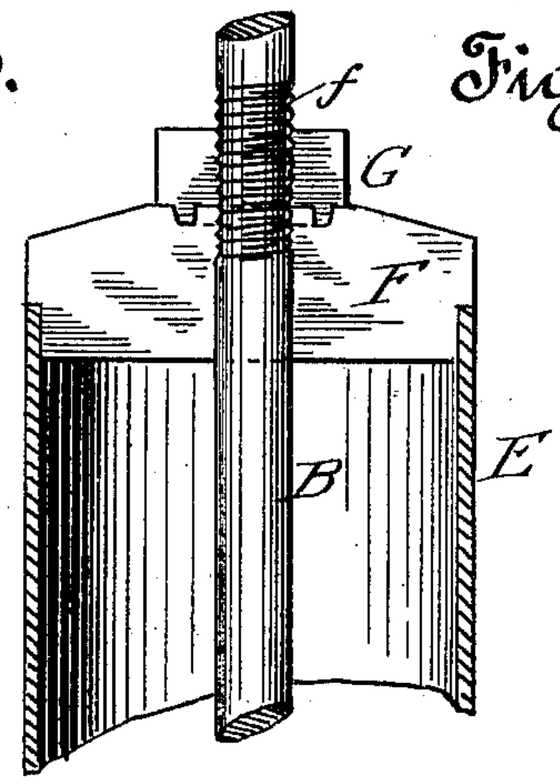



Fig. 4.

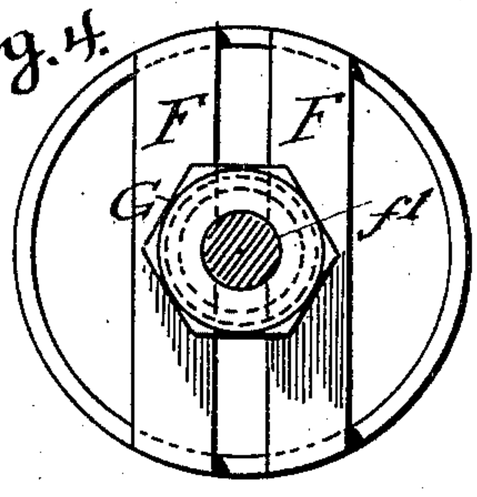



Fig. 2.

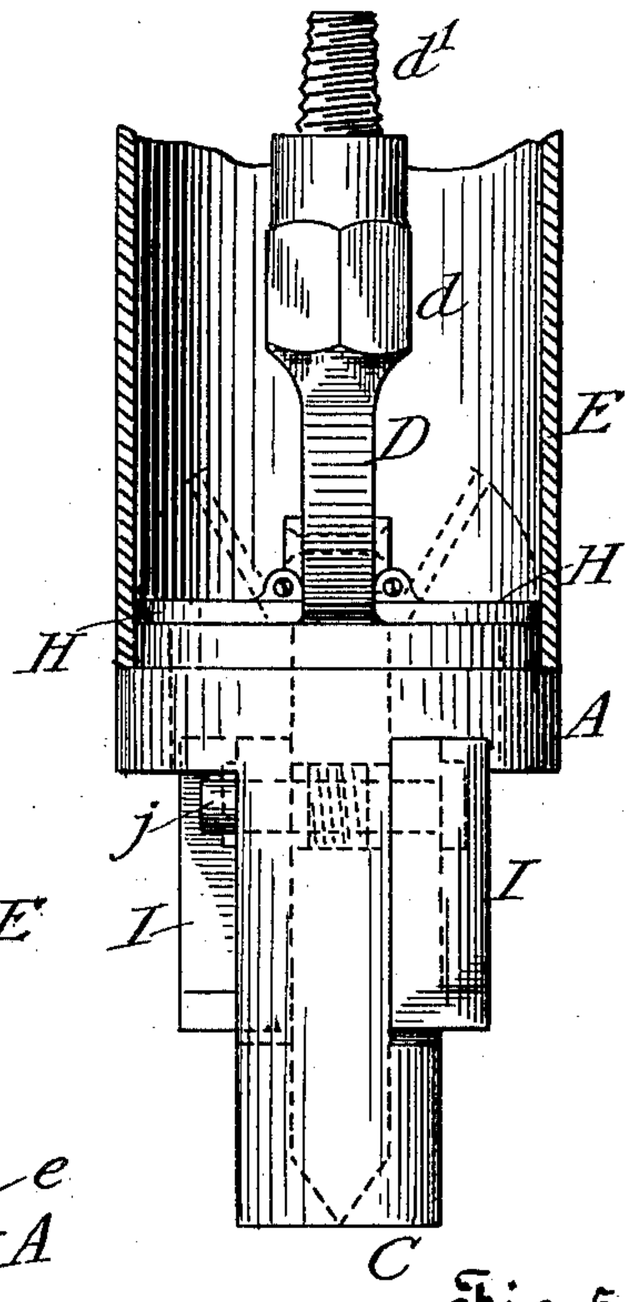
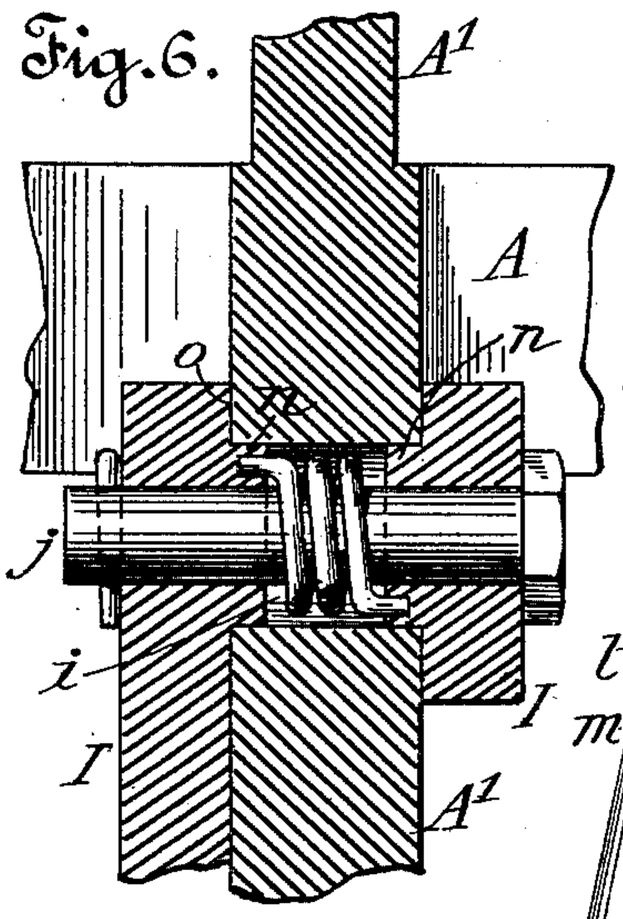



Fig. 6.



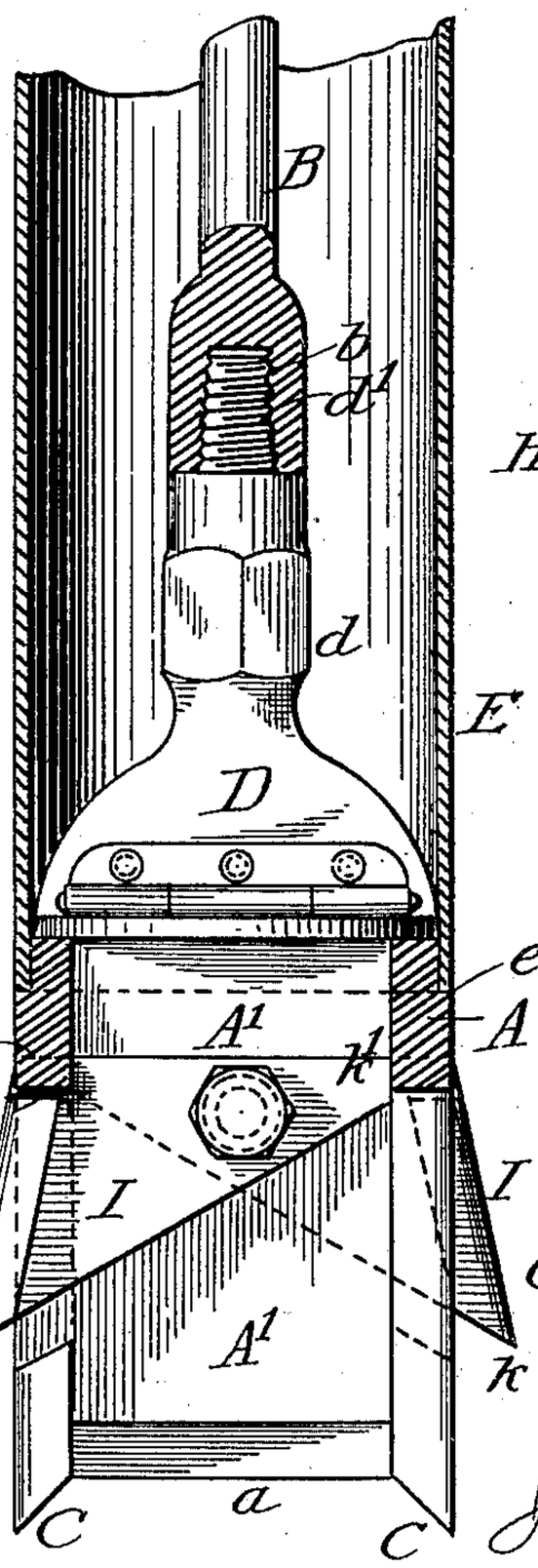
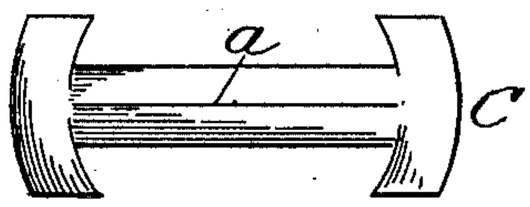




Fig. 5.




Witnesses.

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# UNITED STATES PATENT OFFICE.

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## DRILL FOR DEEP WELLS.

SPECIFICATION forming part of Letters Patent No. 695,745, dated March 18, 1902.

Application filed January 14, 1901. Serial No. 43,170. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN W. LIVERMORE, a citizen of the United States, residing at Berkeley, in the county of Alameda and State of California, have invented certain new and useful Improvements in Drills for Deep Wells, of which the following is a specification.

My invention relates to drills for boring wells, and is particularly adapted for use in boring oil-wells.

My object is to make a simple and effective tool which will automatically keep the well clean by disposing of drillings, so that the drill works in a clean hole. I also provide means for making the diameter of the bore of the full size to receive the casing at one operation. By accomplishing these objects much time, expense, and labor are saved in boring deep wells.

My invention is illustrated in the accompanying drawings, in which—

Figure 1 is a vertical section of the drill and the chamber connected to it. Fig. 2 is a similar section, but at right angles. Fig. 3 is an elevation showing the manner of connecting the drill-rod to the said chamber. Fig. 4 is a top plan of the said chamber. Fig. 5 is a bottom plan of the main drill. Fig. 6 is a cross-section at the joint of the reaming-bits.

The drilling or boring tool is secured to the drill-rod B, the latter being connected to driving machinery at the mouth of the well. This connection is not shown and forms no part of my invention, but may be a jointed rod or a wire cable, as may be preferred. The tool is preferably a simple forging. A heavy base-ring A has a diametrical web A′, which extends below it and is sharpened to an edge *a*. Formed with the web are also the beveled tools C C, which are curved to form arcs of the circular bore of the well and which project somewhat below the edge *a*. The relative positions of these three parts of the tool are clearly shown in Figs. 1 and 5. Above the ring as a base rises a solid neck D, formed with an angular cross-section *d* and terminating in a tapered screw *d′*, the latter being connected to a correspondingly-threaded opening *b* in the rod B. By any suitable operating machinery above the tool is turned and also raised and allowed to drop, so that the cutters penetrate the ground and are shaped and cross cuts, the former defining the bore of the well. The ring A is offset at *e* to form a shoulder upon which rests the shell or chamber E, which becomes a part of the tool and adds its weight to that of the main forging. This shell is of any suitable length and capacity and forms a storage-chamber for drillings loosened by the cutters. The upper end of the chamber is open, and a thread *f* is formed in the rod B above the open end. Parallel cross-pieces F are fitted within and upon the edge of the chamber and are recessed at *f′*, where the rod B passes between them, so that they bear firmly upon the rod. A nut G, having a circular rib *g*, is turned down upon the thread until said rib enters circular recesses formed in the cross-pieces. In this way the cross-pieces are held firmly to the upper edge of the chamber and the chamber is forced down and held rigidly to the base-ring of the main forging. On both sides of its diametrical web the ring A is open in order to permit the drillings to pass into the chamber above. These openings are normally closed by the hinged valves H H, but are automatically opened by upward pressure of such material at each downstroke. At each upstroke the valves close automatically, so as to retain the material which has entered. The drill is operated until it is estimated that a sufficient amount of material has entered the chamber, when the whole tool is drawn up and the material discharged in any suitable manner. The simplicity of the fastening devices make it easy to disconnect the chamber from the drill and to reconnect them.

By such a construction as described the well, no matter how deep or what the character of the material may be, is automatically kept clean as the boring progresses.

In Figs. 1, 2, and 6 is illustrated an important feature of my invention, whereby the well is reamed out or enlarged to the proper size to receive the casing as the ordinary drilling progresses. In this way great economy in time, labor, and expense are secured, as the casing can follow the drill down as the work progresses. In fact, the well is finished,

with casing in place, by what is practically a single operation. The parts are so arranged that the casing offers no obstruction to the raising of the tool in the well.

The auxiliary tools for reaming out and enlarging the bore are carried by the main forging. It is essential to their proper operation that they shall project beyond the radius of the normal bore and be rigidly held upon the downstroke, but shall be capable of being withdrawn, so as not to project when the drill is being raised to the surface. In Figs. 1, 2, and 6 I have shown a practicable arrangement of these tools. A hole *i* is formed in the main web of the forging, through which passes a pin *j*, considerably smaller than the hole. Upon this pin are hung the bits I I, one on each side of the web. These bits are of generally triangular shape in side elevation. At one angle of the triangle is formed an arc-shaped cutting edge *k*. The angle *k'* bears against the opposite inner surface of the ring. At the third angle a slot *l* is formed in the ring, which forms a bearing for the bit. The latter is also offset at *m*, beneath the lower edge of the ring. In Fig. 6 it will be seen that the tools are formed with bosses *n*, which enter and fit the hole in the web, and that the inner surfaces *o* of the tools bear against the web. Thus the tools are pivoted upon the pin, but are provided with numerous bearings and points of resistance, so as to be perfectly rigid on the downward strokes. I prefer to use means for positively holding these bits outwardly, and for that purpose have illustrated a tension-spring K, coiled upon the pivot-pin, whose ends enter holes in the bits and tend to throw the latter outwardly in opposite directions. In the operation of drilling these arc-shaped bits ream out and enlarge the bore made by the main cutters working simultaneously with the latter. This prepares the well for the casing, which follows down and is put in place as the boring proceeds. These bits can yield inwardly against the pressure of the spring or other means for holding them out, and consequently when the whole device is raised in the well the auxiliary cutters strike the lower edge of the well-casing and are forced inwardly when they are held by such casing until removed from the well.

I do not limit myself to the exact construction and arrangement herein described and shown in the drawings, as I desire to avail myself of such modifications and equivalents as fall properly within the spirit of my invention.

The advantages of my device are at once apparent. It forms in itself a well-boring outfit which makes the complete well. It does the actual drilling, disposes of the drillings, reams out the bore for the casing, and all simultaneously. The solid forging which composes the tool is also adapted to work in all kind of materials, whether hard or soft.

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

1. In a drill, a drill-tool comprising an open base-ring, having a rabbeted edge, a diametrical web extending across and also below said ring, and formed at the bottom into two arc-shaped cutters connected by a diametrical cutter, a solid neck projecting upwardly from the base-ring and hinged valves for opening and closing said ring; all in combination with a casing fitted to said rabbeted edge, a drill-rod having a screw connection to said neck, a threaded section on the drill-rod adjacent to the upper end of the casing, and means for securing the upper end of the casing to said threaded section.

2. A drill for boring and finishing wells at one operation, comprising a drilling-tool for forming the main bore, a chamber connected thereto, and having a valved bottom for receiving and retaining drillings, and oppositely-located spring-pressed reaming-bits connected to said drilling-tool and normally projecting beyond its radius of operations, but capable of yielding inwardly to permit the withdrawal of the entire tool from the well.

3. A drill for boring and finishing oil-wells comprising a ring having a diametric and arc-shaped cutters depending therefrom, a casing having its lower edge seated in a rabbet in said ring, pivoted valves controlling the opening in said ring, reaming-cutters having inwardly-extending pivoted portions and having portions for abutting against the lower edge of said ring for holding them rigid on the downward thrust of the rod, substantially as described.

In testimony whereof I have affixed my signature, in presence of two witnesses, this 4th day of January, 1901.

JOHN W. LIVERMORE.

Witnesses:
L. W. SEELY,
F. M. BURT.