(No Model.) 3 Sheets—Sheet 1.

F. GARDNER.

APPARATUS FOR BORING WELLS.

No. 494,779. Patented Apr. 4, 1893.

Fig. 1.

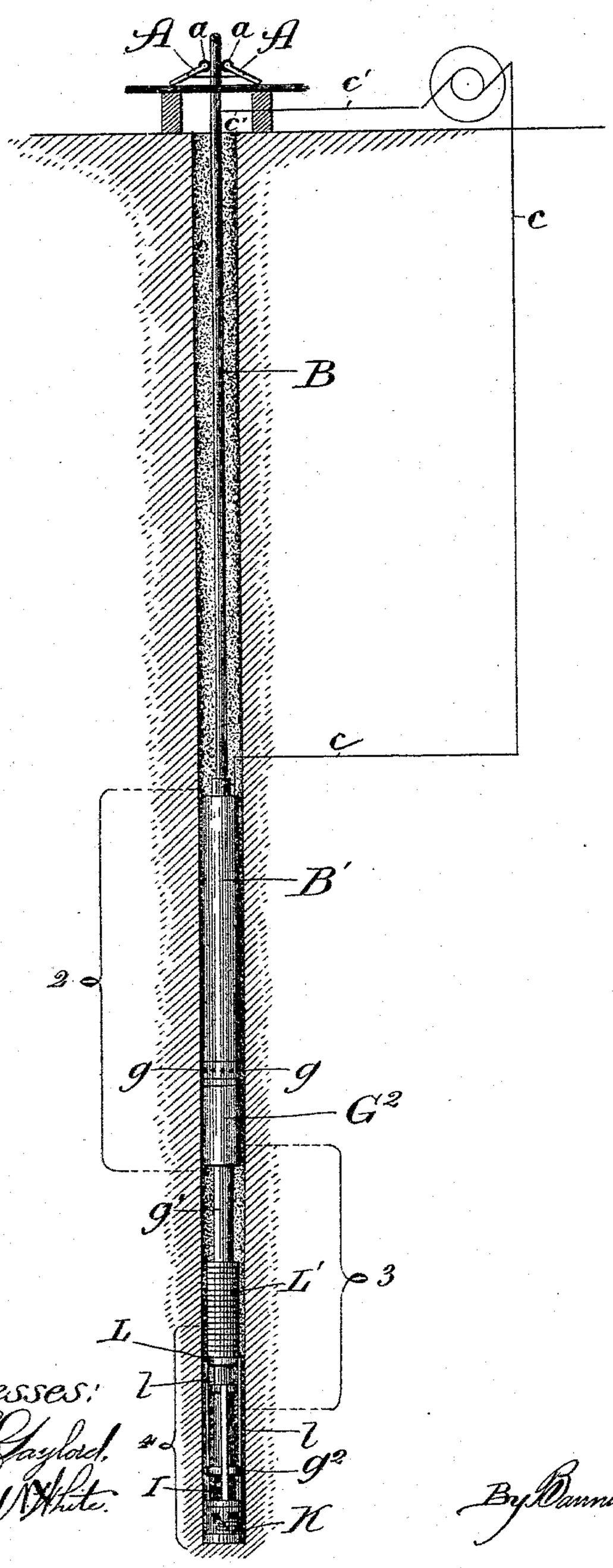
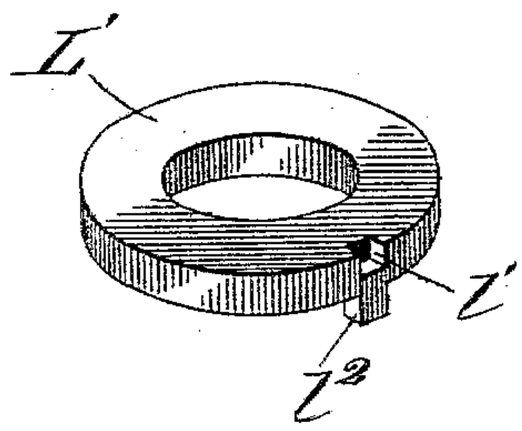


Fig. 11.



Witnesses:
Chas. Gaylord.
Clifford White.

Inventor:
Hilton Gardner,
By Banning & Banning & Payson
Attys.

(No Model.) 3 Sheets—Sheet 2.

F. GARDNER.

APPARATUS FOR BORING WELLS.

No. 494,779. Patented Apr. 4, 1893.

Fig. 2.

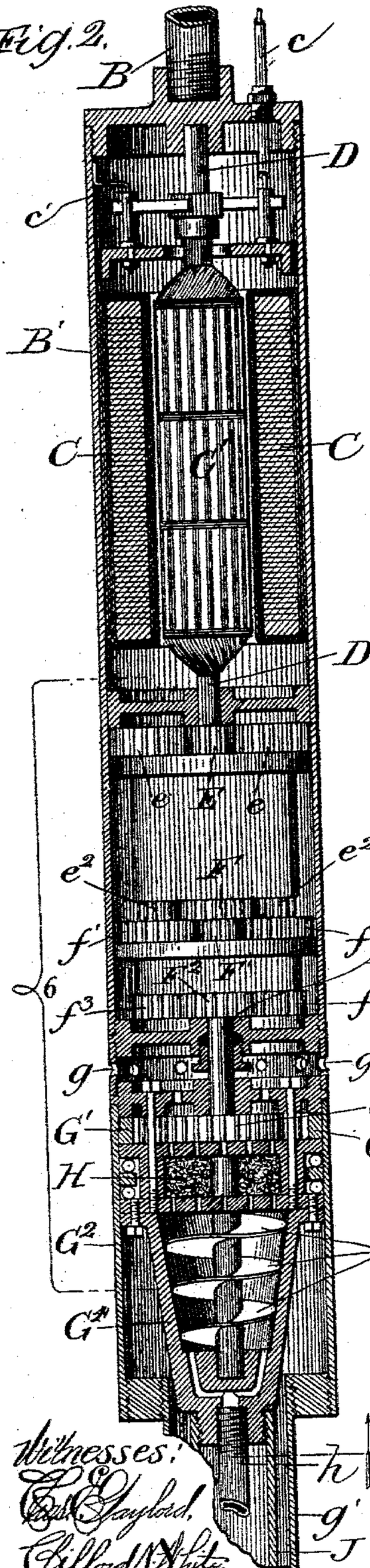


Fig. 3.

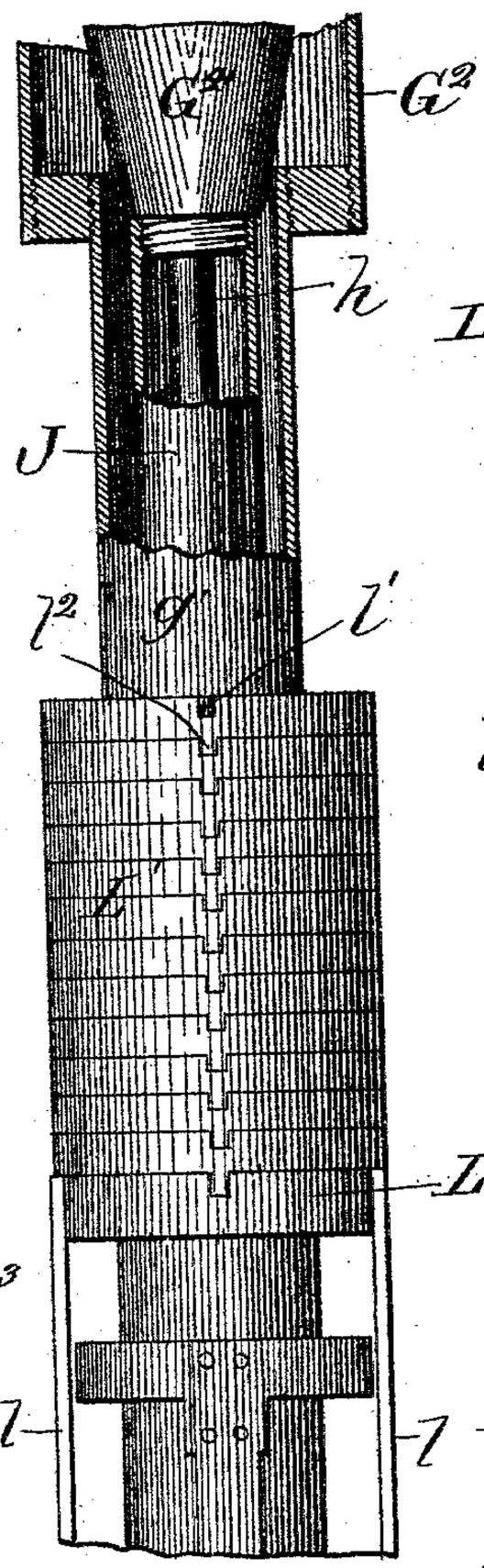


Fig. 4.

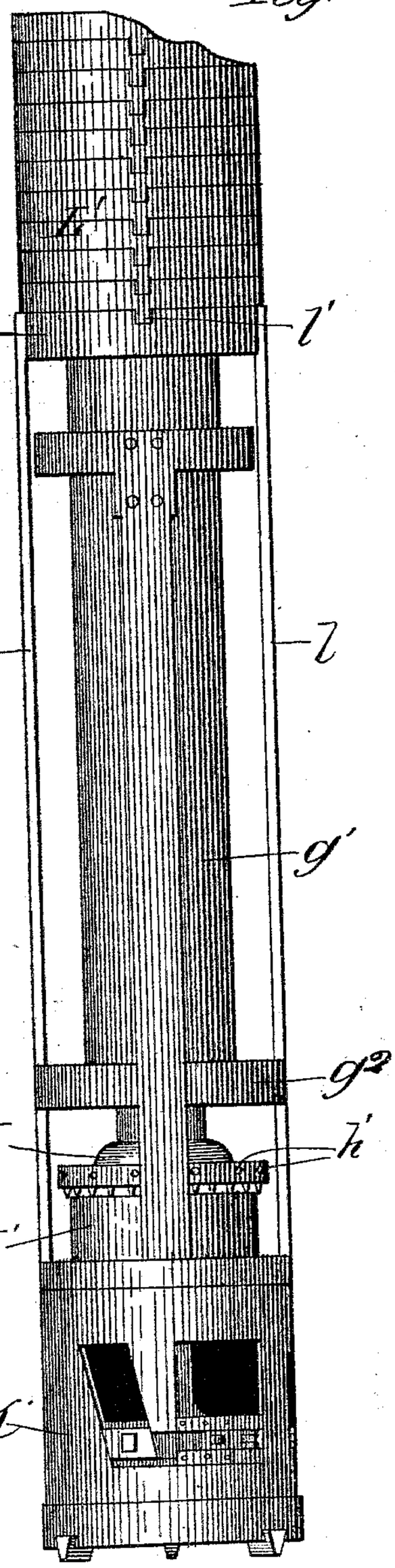
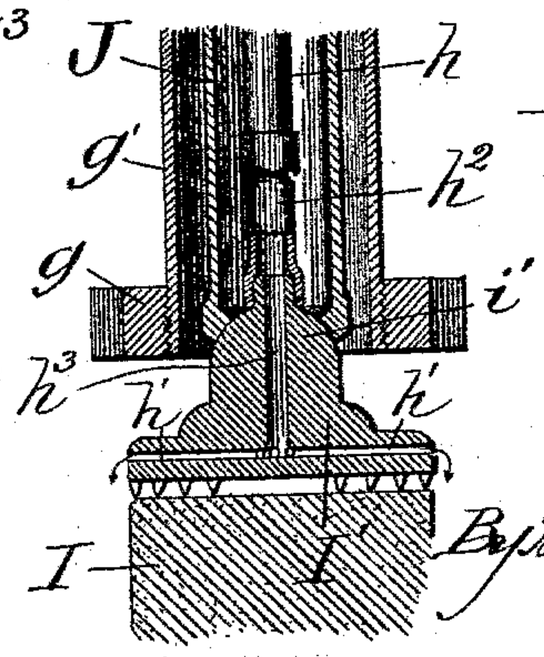


Fig. 5



Witnesses:
Chas. Gaylord.
Clifford N. White.

Inventor:
Fulton Gardner,
By Banning & Banning & Payson.
Att'ys.

(No Model.) 3 Sheets—Sheet 3.

F. GARDNER.

APPARATUS FOR BORING WELLS.

No. 494,779. Patented Apr. 4, 1893.

Fig. 6.

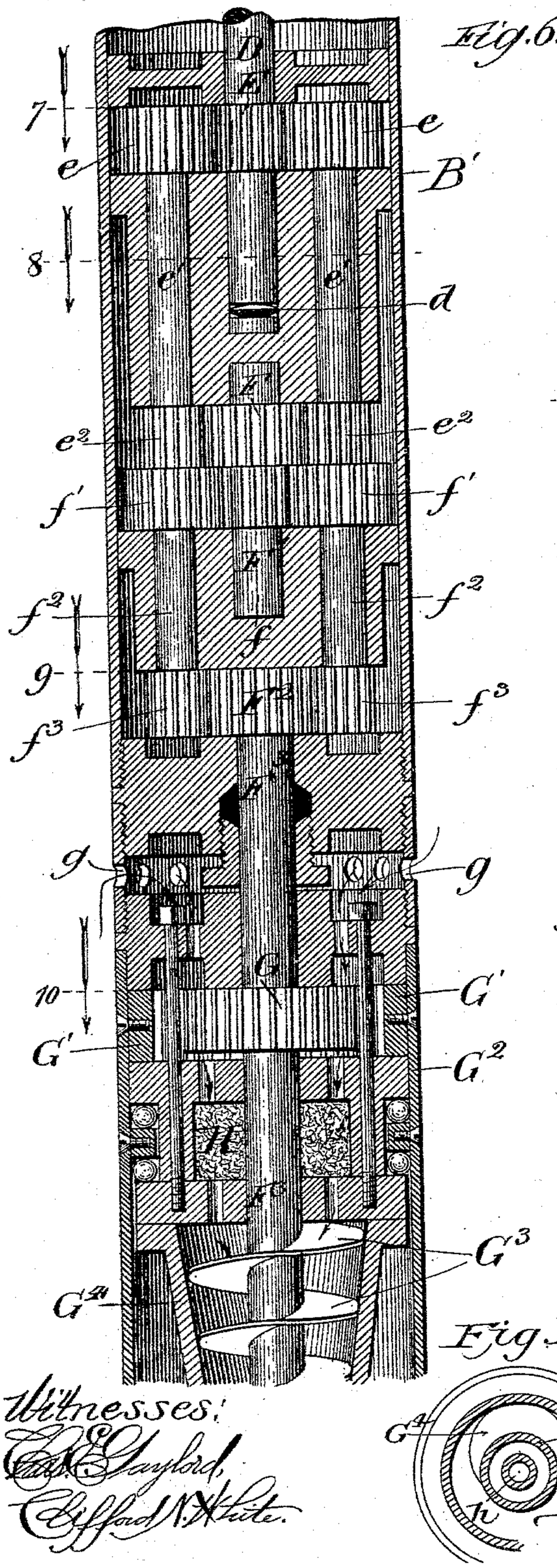


Fig. 7.

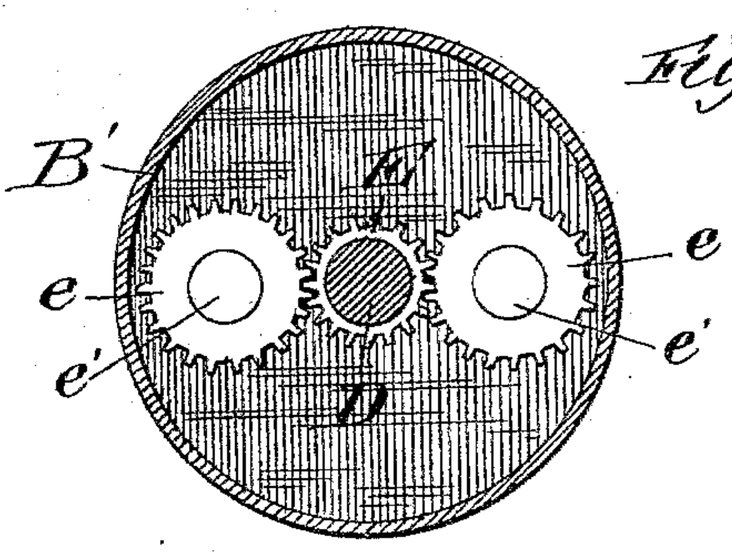


Fig. 8.

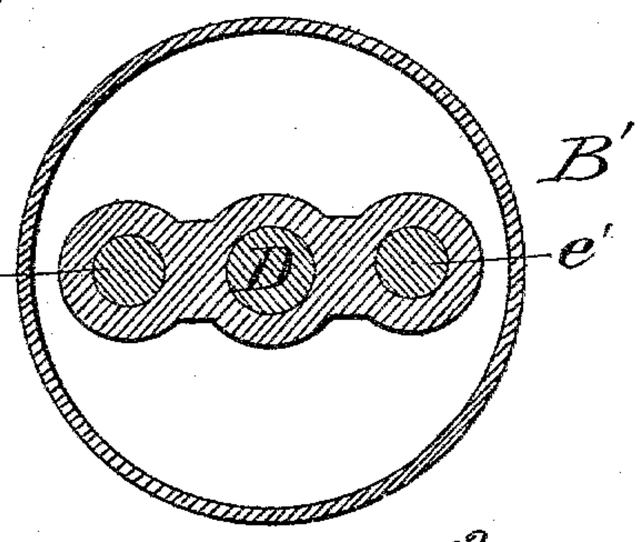


Fig. 9.

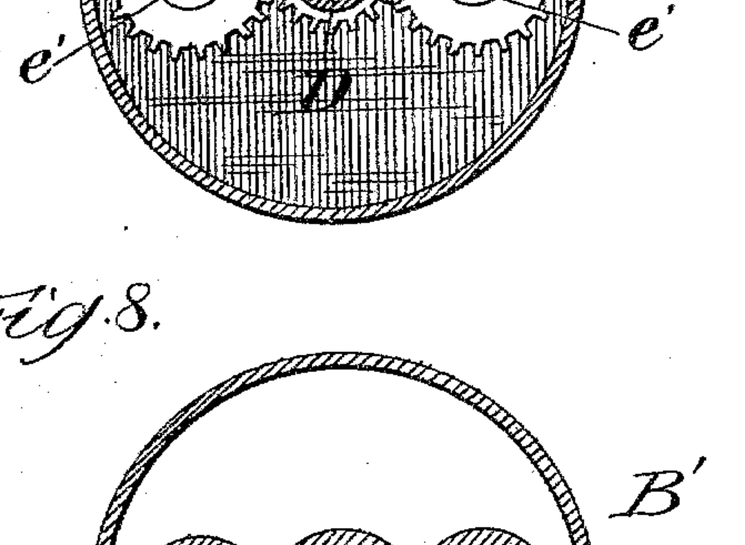


Fig. 10.

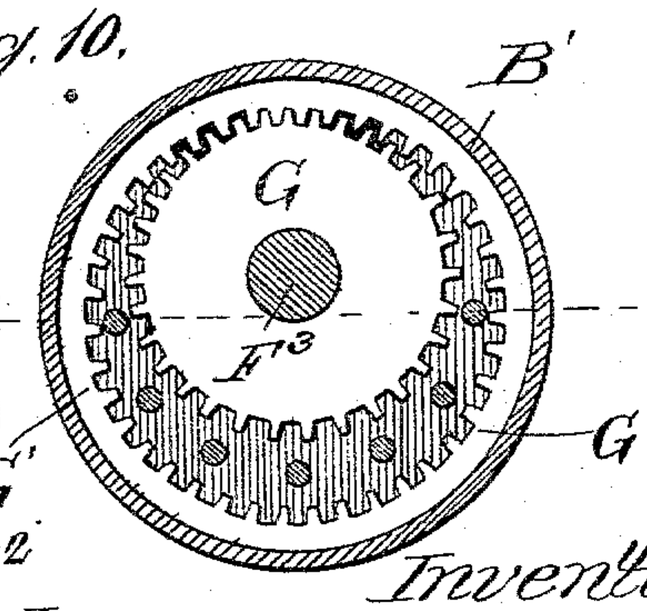


Fig. 12.

Witnesses:
Chas. Gaylord,
Clifford N. White.

Inventor:
Fulton Gardner.
By Banning & Banning & Payson.
Att'ys

UNITED STATES PATENT OFFICE.

FULTON GARDNER, OF CHICAGO, ILLINOIS, ASSIGNOR OF ONE-HALF TO SAMUEL T. WHITE, OF SAME PLACE.

APPARATUS FOR BORING WELLS.

SPECIFICATION forming part of Letters Patent No. 494,779, dated April 4, 1893.

Application filed November 15, 1892. Serial No. 452,020. (No model.)

To all whom it may concern:

Be it known that I, FULTON GARDNER, a citizen of the United States, residing at Chicago, Illinois, have invented certain new and useful Improvements in Apparatus for Boring Wells, of which the following is a specification.

In the drawings, Figure 1 is a sectional view of a well, with the drill shown in elevation and the electric circuit shown diagrammatically. Fig. 2 is an enlarged vertical, sectional view of the motor, or that portion of the drill mechanism lying within and indicated by the bracket 2 of Fig. 1. Fig. 3 is an enlarged, broken, sectional elevation of that portion of the drill mechanism lying within the bracket 3 of Fig. 1. Fig. 4 is an enlarged elevation of the drill mechanism lying within the bracket 4 of Fig. 1. Fig. 5 is a sectional view of the step bearing or motor support, taken on a line through the center and parallel to the plane view of Fig. 4. Fig. 6 is a still further enlarged, vertical, sectional elevation of that portion of the mechanism lying within the bracket 6 of Fig. 2. Figs. 7, 8, 9 and 10 are cross-sectional views taken on the lines 7, 8, 9 and 10, respectively, of Fig. 6, viewed in the direction of the arrows. Fig. 11 is a perspective view of one of the weight sections or rings, and Fig. 12 is a plan section taken on line 12 of Fig. 2.

In describing my improved drill, I may refer to other patents for certain parts for a fuller and more ample description, so as to save unnecessary prolixity in this application.

Beginning with the mechanism at the top of the ground, I arrange, on a suitable support, a clutch which will permit the shaft used in the preliminary stages of the work, as hereinafter explained, to descend, but which will prevent its rotation. This clutch is made up of members A, carrying wheels or rollers *a*, which are adjusted to the shaft in any suitable manner to accomplish the purpose intended. The shaft, B, that is used until the drill has reached solid rock—whether that be at a depth of fifty or one hundred or two hundred feet—may either be solid or hollow as preferred. Its lower end is engaged by screw threads, or in any other suitable manner, to the top of the cylinder B′, in which the motor and its operative parts are arranged. It is intended to hold the motor cylinder from rotation until solid rock is reached, when its use may be dispensed with and the motor held as hereinafter described. The motor is an electric one, having its field pieces C on the outside, and its armature C′ arranged within them, as shown in Fig. 2. The current for supplying the motor with power is generated at the surface of the ground, and brought down through a wire *c*, which, in Fig. 1, is represented diagrammatically as at one side of the well hole; but this is done merely for convenience, and it will be understood that the wire is let down through the hole by the side of the shaft. Where the shaft B is used, the other member *c*′, of the electric circuit, may connect with the metal motor shell, so that the current can pass up through the rod B; but where the shaft is dispensed with, it will be understood that the wire C′ is carried up to the top of the well hole in any other suitable or desired way. I may say, however, that where a wire cable is used I prefer to carry the wire *c* down through its center, but properly insulated from it, and to carry the wire *c*′ to the outside of the metal cable, so that it may serve to continue the circuit to the top of the well, where it will of course be understood the current is properly carried to the brush of the dynamo. The armature C′ is mounted on a steel shaft, D, which rotates with it. To prevent friction, the lower end of this shaft rests on what I term an oval button *d* shown in Fig. 6, which is properly arranged within a step to afford practically a ball bearing. The armature and the steel shaft D, as will be understood, are rotated at a high rate of speed, and I have found in practice that it is desirable to greatly reduce this rate of speed for the drilling or cutting mechanism. In order to do this, I mount on the steel shaft a small pinion E, which engages or meshes with two larger pinions *e e*, on spindles *e*′. These spindles carry at their lower ends smaller pinions e^2, which engage with the pinion F mounted on a spindle *f*, which carries a smaller pinion F′, which engages or meshes with larger pinions *f*′ *f*′. These pinions are in turn

mounted on spindles f^2, which carry at their lower ends smaller pinions f^3, which engage with a larger pinion F^2. This larger pinion is mounted on a shaft F^3 and carries, at a suitable position on it, a large pinion G. This large pinion engages with the internal teeth of a gear wheel G′ arranged on a shell or barrel G^2, so as to impart rotation to it. The shaft F^3 and the large pinion G are arranged eccentric to the true center of the barrel or shell, as particularly shown in Fig. 10, so that the teeth of the pinion G may engage or intermesh with the teeth of the gear G′. The lower end of the shell G^2, which is thus rotated, is connected with the upper end of a small shell g', so as to impart rotation to it. This shell in turn carries and imparts rotation to a ring g^2 at its lower end, through the instrumentality of which the case or barrel, carrying the cutting tools hereinafter referred to, is rotated. As this matter, however, is explained in my patent No. 488,354, issued December 20, 1892, I need not enter into it in detail. I have thus reduced the speed of rotation from the armature to the barrel or shell G^2, and through it to the cutting tools, so that they rotate about once to the armature ten times. Of course, it will be understood that the rotation of the shell G^2 and cutting tools may be still further reduced in the same way, if desired. I mount on the shaft F^3 veins or blades G^3, inclosed in a case G^4, to form a rotary pump. I prefer, in the arrangement of my present application, to locate this pump below the motor, instead of above it, as in my patent No. 478,791, issued July 12, 1892.

I arrange above the pump holes or orifices g to permit the water to have access to the inside of the barrel or shell, and I arrange above the pump a filter chamber H, which may be filled with any loose filtering material—such as hair, excelsior, shavings, or similar material—to free the water, as it passes to the pump, from sand, gravel, shale and other matter that it is undesirable to pump down to the cutting tools. The water is drawn to the pump through this filter chamber and discharged into a pipe h, whence it is carried down to a point immediately above the core and discharged out through holes or orifices h', and forced down around the sides of the core to the cutting tool, as shown in Figs. 4 and 5. I have said above that at the commencement of the operation I employ a shaft B to hold the motor firm and from rotation until solid rock has been reached. When this core and the cutters are at work in the rock, I dispense with the shaft, and employ other means for holding the motor from rotation. These means are shown particularly in Fig. 5. They consist of a locking device, comprising a foot I, provided with sharp spikes i, which rest upon the upper surface of the core I′. As the upper end of this core may not at all times be smooth and level, so as to present a horizontal plane for the foot to rest upon, I have arranged the upper portion of the foot, as at i', with an oval or ball shaped surface, around which the lower end of the hollow stanchion or post J rests. This stanchion or post is connected to the lower end of the pump case, and sustains the weight of the motor and of all of the parts above the foot I. The pipe h, which carries the water from the pump to the cutting tools terminates just before reaching the upper or ball shaped end of the foot, and a flexible section of pipe h^2, made of rubber or other suitable material, is used to form a connection between the two. The foot is provided with a hole h^3 down through it, to permit the water to pass down and be carried out through the orifices h', as above explained. This arrangement permits the foot to oscillate sufficiently to the one side or the other to enable it to accommodate itself to the possible slanting of the upper end of the core, so that it will rest securely thereon at all parts. The cutting tools are arranged at the bottom of a case K, which is provided with core cutters, as described in my patent above referred to, to which patent I refer for a fuller description of these parts. In order to make the cutting tools feed, or force them into the rock, I have arranged a ring L at the top of the rods l, which carry the case on which the cutters are mounted. This ring is provided with a depression l', and I provide other rings L′, each with a depression l' and a tongue l^2, adapted to fit into such depression. The rings can thus be built up one above another in series, as shown in Figs. 3 and 4, to any desired extent to secure the requisite weight on the cutting tools. These rings, as will be understood, can be made of lead or other heavy material, so that any desired amount of weight can be imparted to the cutting tools. In boring through hard strata of rock, their number can be increased, and in boring through soft strata of rock their number may be diminished by removing the upper rings when the cutting tool has been hoisted to the top of the well. By arranging the rings with tongues and depressions or grooves, so that they will be connected together in use, they will all be rotated, and thus operate or serve as a balance wheel to assist in preserving the proper momentum and equilibrium of the drill.

What I regard as new, and desire to secure by Letters Patent, is—

1. In a boring tool, the combination of a shaft, an electric motor carried thereon and adapted to enter the hole, a set of cutters rotated by the motor, and a clutch arranged exterior to the hole extraneous to the shaft for preventing the shaft from rotating while permitting it to descend, substantially as described.

2. In a boring tool, the combination of a case, an electric motor arranged in the case, and a foot for supporting the case and provided with spikes resting on the top of the

core being cut for preventing the case from rotating, substantially as described.

3. In a boring tool, the combination of a case, an electric motor arranged in the case, a base for supporting the case, motor and other parts, and a foot for supporting the base and resting on the top of the core being cut and adapted to conform to an inclination of its surface while the post remains vertical, substantially as described.

FULTON GARDNER.

Witnesses:
THOMAS A. BANNING,
SAMUEL E. HIBBEN.