(No Model.) 2 Sheets—Sheet 1.

F. GARDNER.

APPARATUS FOR SINKING SHAFTS.

No. 473,570. Patented Apr. 26, 1892.

Fig. 3.

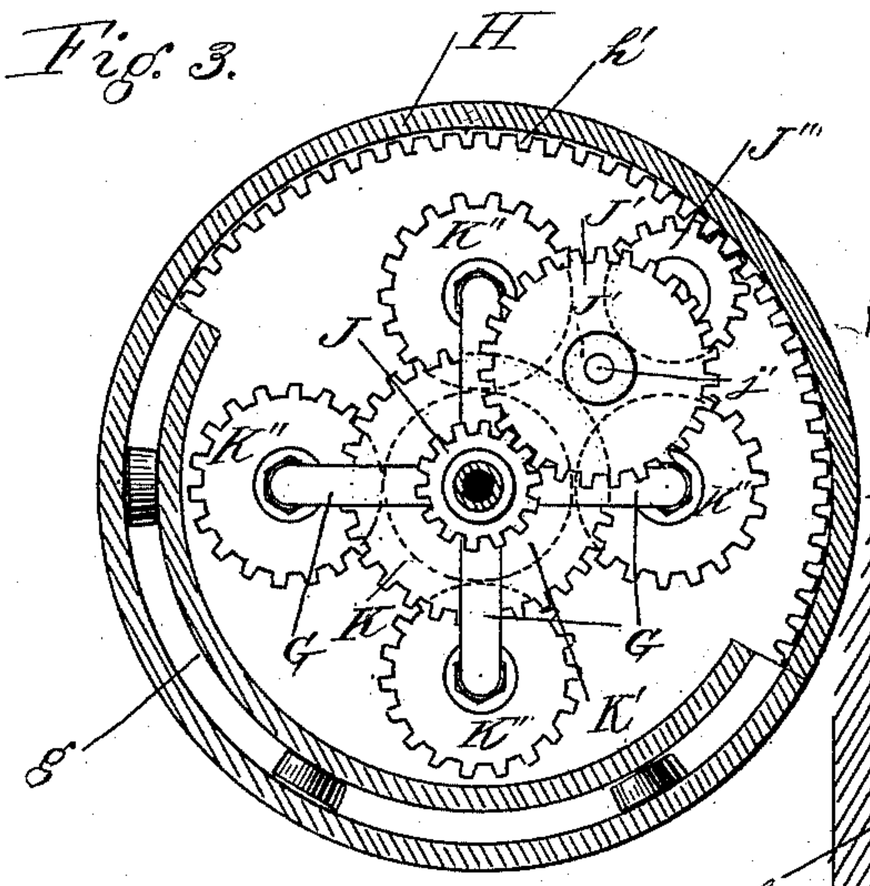


Fig. 4.

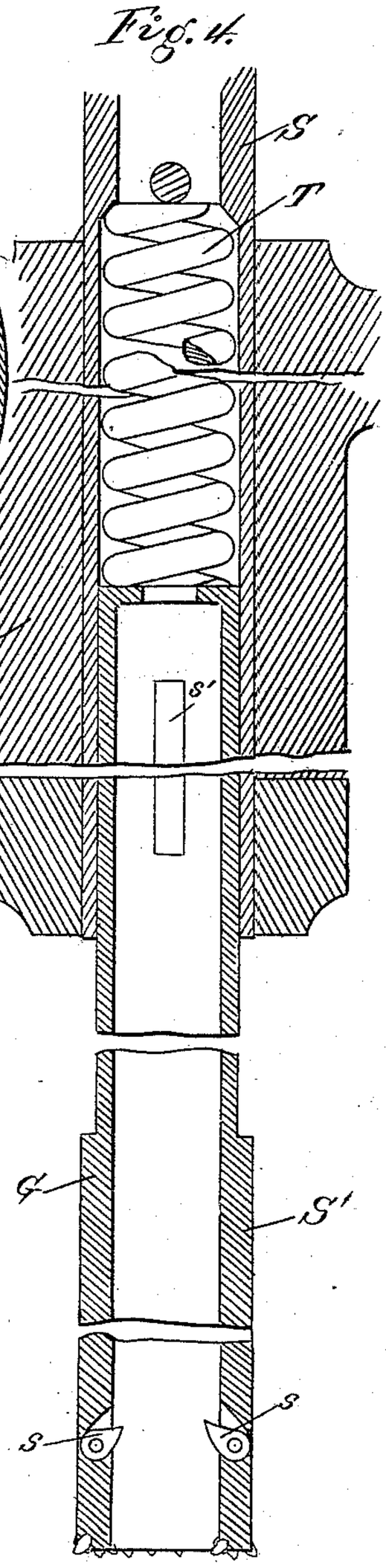
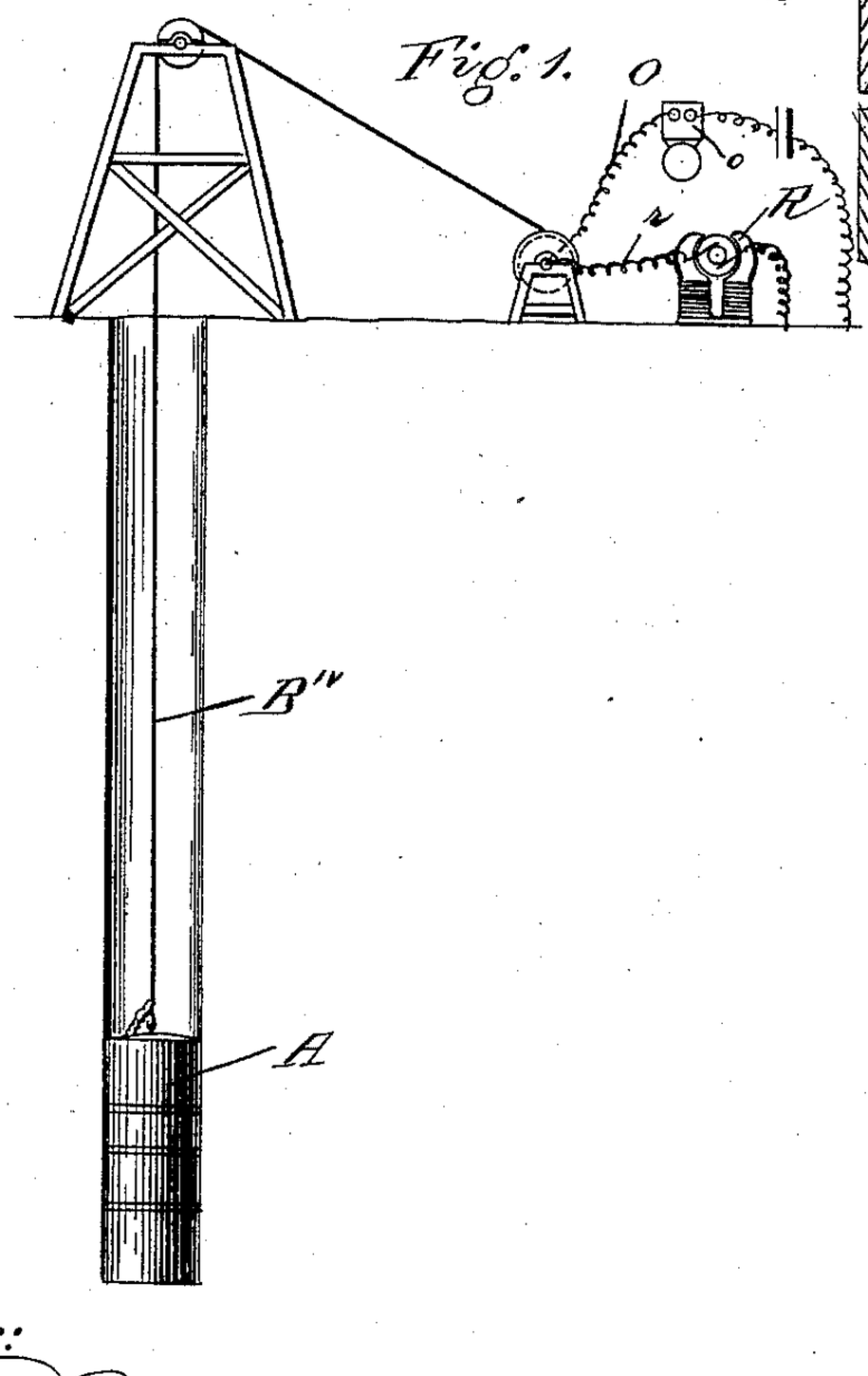


Fig. 1.



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Inventor:
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By his Attorneys
Banning & Banning & Payson.

(No Model.) 2 Sheets—Sheet 2.

F. GARDNER.

APPARATUS FOR SINKING SHAFTS.

No. 473,570. Patented Apr. 26, 1892.

Fig. 2.

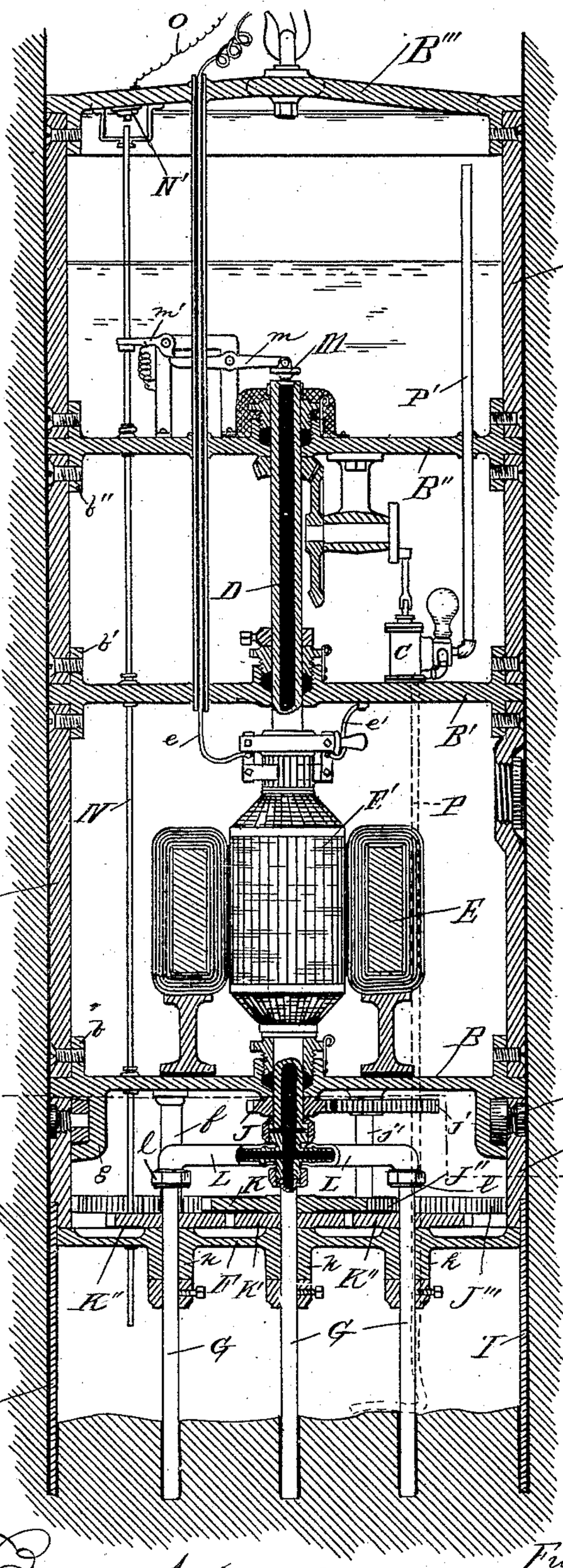


Fig. 5.

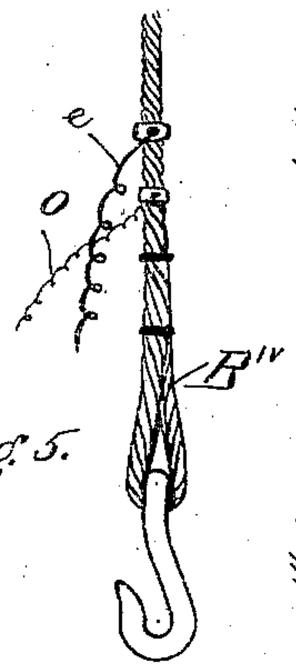
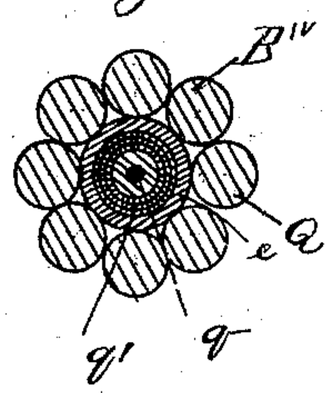


Fig. 6.



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Inventor:
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By his Attorneys:
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UNITED STATES PATENT OFFICE.

FULTON GARDNER, OF CHICAGO, ILLINOIS.

APPARATUS FOR SINKING SHAFTS.

SPECIFICATION forming part of Letters Patent No. 473,570, dated April 26, 1892.

Application filed September 1, 1891. Serial No. 404,435. (No model.)

To all whom it may concern:

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

It has heretofore been customary to sink shafts in various ways—as, for instance, by drilling suitable holes and exploding charges of powder or dynamite in the same. One of the objections to this method has been that the sides of the shaft so formed have been rough, jagged, and uneven, owing to the uncontrolled and uneven action of the explosive. My method is intended to avoid this difficulty; and this I accomplish by an annular channel through the rock or other substance in which the shaft is to be sunk and drilling one or more holes within the channel, within which holes the charges of dynamite or other explosive are to be placed. By employing this method I form a shaft of uniform diameter and with even and unbroken sides, since when the explosive is discharged it will rend or tear the rock or other material within the annular channel, but will not act on the material outside thereof, the resistance ceasing when the channel is reached.

My invention furthermore relates to various improvements in apparatus for carrying out the above method; and it consists in the method and apparatus hereinafter described and claimed.

In the drawings, Figure 1 is a side elevation of a shaft with my improved apparatus at the bottom thereof, showing means for raising and lowering the apparatus. Fig. 2 is a central vertical section of the improved cutting or drilling apparatus; Fig. 3, a section on line 3 3 of Fig. 1, looking in the direction of the arrows, these views being on an enlarged scale; Fig. 4, a central vertical section, on a still larger scale, of one of the drills; and Figs. 5 and 6 are detail views showing the vertical connection.

In constructing my improved apparatus I first make a shell or case A of any form and dimensions suitable to enable it to accommodate the various parts of the apparatus and allow them to operate, as hereinafter described, the case being preferably circular in cross-section and of any suitable diameter, as six feet. Within this case I secure various partitions or bed-plates B B′ B″, (shown more particularly in Fig. 2,) these partitions being preferably flanged, as shown at *b b′ b″*, and the separate sections of which the shell is preferably composed being bolted or fastened to these flanges in any suitable manner. This of course is but one form of construction, and I do not intend to limit myself strictly thereto, since the partitions need not extend across the entire width of the case, provided they are sufficiently large to afford support for the various operating parts of the apparatus and to enable it to act as hereinafter described. At the top of the shell I preferably provide any suitable number of cross-bars B‴, to which is secured in any suitable manner the hoisting-cable B⁗.

The partition B″ is made water-tight, the upper compartment of the case serving as a water-tank for the purposes hereinafter described. The partition B′ serves to support the pump C, and, together with the other partitions, forms a bearing for a driving-shaft D. On the partition B is supported the field-magnet E of the electric motor used to operate the apparatus. The armature E′ of this motor is secured to the shaft D and provided, as shown, with suitable brushes, the current of electricity entering these brushes by the wire *e* and being led away out of the motor by the wire *e′*, which is connected to the shell, thus earthing the circuit.

Beneath the platform B is suspended, by means of rods or posts *f*, another platform F, which forms a support for the various gears, hereinafter to be described, and a bearing for the drills G. From the platform B depends an annular arm or channel *g*, in which is supported by means of wheels or rollers *h* a ring H, provided, as shown, with teeth *h′* upon its interior circumference. To this ring is rigidly secured in any desired manner the circular channel-cutter I, the lower edge of which is preferably set with suitable cutting-points. It is necessary to communicate motion to the drills and to this channel-cutter, and this I accomplish in the following manner: Mounted on the shaft D is a gear J, meshing with the gear J′, mounted on the shaft *j′*. The gear J″ on this shaft meshes with a gear J‴,

which in turn meshes with the teeth h', by which means the revolution of the shaft D is imparted to the ring H and the channel-cutter secured thereto. The gear J'' also engages with and revolves the gear K, mounted on the central drill G, whereby this drill is revolved. Also mounted on this drill is a gear K', meshing, as shown, with the gears K'', mounted upon the other drills, whereby the motion of the shaft D is communicated to each of the drills. These drills are connected to an arm or arms L by means of swiveling water-tight joints l and are supported in bearings k, secured to the under side of the partition F. From this construction it will be obvious that as the armature of the motor revolves the shaft D will revolve with it, and that the motion of this shaft will be communicated by the various gears to the drills and channel-cutter, causing the former to revolve independently within the latter. I have herein shown five of these drills, one in the center and the other four at equal distances therefrom; but this number and relative arrangement are both non-essential, since any desired number of drills may be used and they may be placed relatively to each other in any desired position, the purpose of this part of my invention being to provide one or more drills adapted to revolve within the rotating channel-cutter.

The shaft D is made hollow, as shown, communicating with each of the drills, which are also made hollow, and the upper end of the shaft is adapted to be closed by a valve M, mounted upon the pivoted lever m and normally held in a raised position by means of a spring-catch m'. A rod N is provided, moving vertically in suitable guides and engaging, as shown, with this spring-catch. While the valve M stands open the water in the upper part of the shell passes under a considerable head down through the shaft and the drills, tending to raise the detritus out of the holes being bored. When the drill is operated or cut to a certain depth, the lower end of this rod M will strike against the bottom of the shaft, and, the rod being raised, will raise the lever m, whereupon the valve will close by the water-pressure, shutting off the supply of water. At the same time the upper end of this rod will strike against a push-button N', closing an electric circuit O. The current in this circuit then passes through and rings a bell o, warning the operator that the drill is cut to the desired depth.

A pump C, operated by the revolution of the shaft D, acting through suitable gearing, as shown, raises the water through a tube P from the bottom of the shaft and conveys it through a pipe P' into the tank. I prefer, also, to make use of the hoisting-cable B'''' for the purpose of conveying the electric current, though this is not essential. A cross-section of this cable is shown in Fig. 6, there being first a central wire q, forming a part of the circuit O, then an insulating layer, then several layers q' of suitable wire, connecting with the wire e for conveying the current to the motor, then another layer of insulation, and on this central core I wind the strands Q.

R represents any suitable dynamo used to generate the current for operating the motor, and r a wire connecting the cable B'''' with this dynamo.

In Fig. 4 I have shown, on an enlarged scale, one of the drills, together with its bearing k. The drill is made in two parts S and S', the latter telescoping within the former and both parts being preferably hollow, as already described, for the passage of water. The lower end of the part S' is provided with suitable cutting-points, and also with pivoted teeth s, adapted to engage with and remove the core cut out by the drill. The two parts of the drill are secured together by means of a feather or spline s', being free to move vertically relatively to each other, but forced to rotate together, and within the part S is a spring T, one end of which abuts against a shoulder or pin in the part S and the other end against the top of the part S'. By means of this construction the drills adjust themselves relatively to the depth of the shaft, and are always held against the work with sufficient force by means of the spring T, and in this manner the inequalities of the bottom of the shaft are compensated for and all the drills brought into work.

The device having been constructed and put together as hereinbefore described, my method is carried out thereby as follows: The casing is first placed in position and a current of electricity supplied to the motor, the armature of which, together with the shaft D, revolves at a high rate of speed, revolving the channel-cutter and the drills. The former cuts an even channel into the rock or other material in which the shaft is to be sunk, and the drills simultaneously bore holes within this channel, the detritus being washed out by means of the water fed in, as already described, through the drills, which water also serves to preserve the points of the channel-cutter and drills. When the shaft has been sunk for any predetermined distance—as, for example, two feet—the rod N acts to shut off the supply of water and to notify the operator, as already described. The apparatus is then hoisted out of the shaft and cartridges inserted into the holes formed by the drills and exploded. The force of this explosion expends itself upon the rock or other material within the channel, but does not pass beyond the same, since when it reaches this open channel there is no resistance and the force is simply expended upward. The broken rock or other material can then be hoisted out and the apparatus once more placed in the shaft and operated to sink the same still farther, and this operation may be repeated until the shaft has been sunk any desired depth. By this means I am enabled to sink any desired size of shaft through any substance, the shaft

being even and uncracked, thereby avoiding the necessity of dressing the sides thereof or of removing pieces of rock, &c., which threaten to fall in.

While I have shown and described more or less precise forms, I do not intend to limit myself thereto, but contemplate changes in form, proportion, and relative location of the parts, as already indicated, and in any other particulars, and I also contemplate the substitution of equivalent members as the same may be desirable or necessary, the gist of my invention consisting in the method of shaft-sinking wherein an annular channel is cut or formed and within which one or more holes are drilled to receive the charge of explosive, and any form of apparatus capable of carrying out this method falls within my invention.

I claim—

1. In an apparatus for sinking shafts, a water-tight shell or case entering the bore of the shaft, following up the same, and divided into compartments, one of such compartments serving as a water-tank, so that the water necessary to wash the detritus away from the drill and keep it clean while in motion may be taken down into the shaft and serve as a weight to keep the drill to its work, substantially as described.

2. In an apparatus for sinking shafts, a water-tight shell or case entering the bore of the shaft and divided into compartments, one of such compartments serving as a water-tank to carry the necessary water down into the hole, acting as a weight to keep the drill to its work, and another such compartment serving as a receptacle for the pump and the necessary gearing to drive the same, in combination with such pump and gearing, substantially as described.

3. In an apparatus for sinking shafts, a water-tight shell or case entering the bore of the shaft, following the same, and divided into compartments, the uppermost compartment serving as a water-tank, whereby the necessary water may be carried into the hole to wash away the detritus and keep the drill to its work, the next compartment affording a receptacle for the pump and its gearing, and the third compartment serving as a water-tight receptacle for the electric motor, in combination with such pump, gearing, and motor, substantially as described.

4. In a shaft-sinking apparatus, a water-tight shell or case entering the bore of the shaft, following up the same, and divided into compartments, the uppermost of such compartments serving as a tank whereby the necessary water can be carried into the shaft to wash away the detritus and keep the drill to its work through gravity and the other compartments serving, respectively, as receptacles for the pump with its gearing, the electric motor, and the gearing operating the cutting devices, in combination with such pump, motor, and gearing, substantially as described.

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Witnesses:

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ANNIE C. COURTENAY.