(No Model.) 4 Sheets—Sheet 1.

P. SEMMER.

ELECTRICAL APPARATUS FOR DRILLING WELLS, TUNNELS, &c.

No. 556,718. Patented Mar. 17, 1896.

Fig. 1.

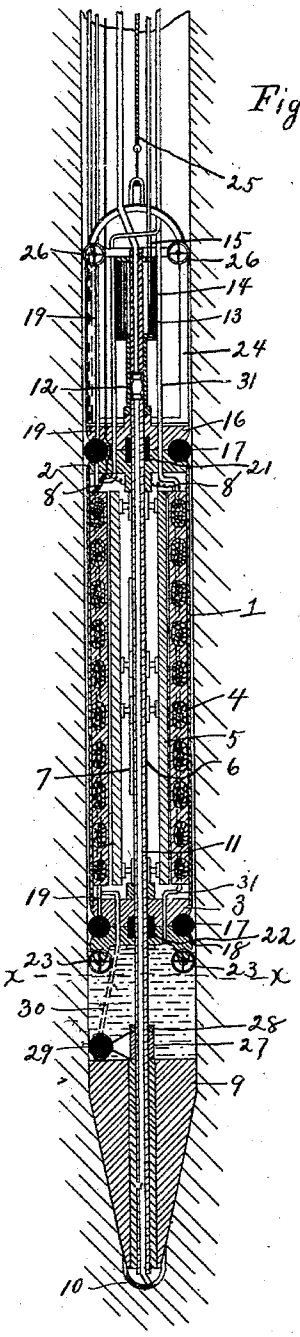


Fig. 2.

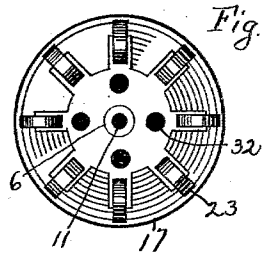


Fig. 3.

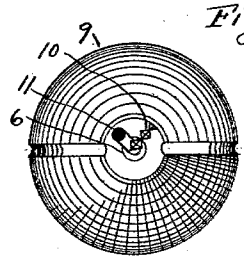


Fig. 4.

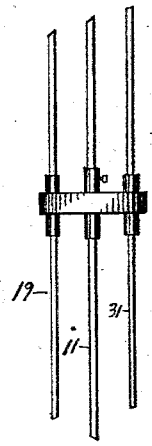
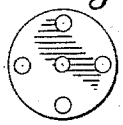


Fig. 5.



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(No Model.) 4 Sheets—Sheet 2

P. SEMMER.

ELECTRICAL APPARATUS FOR DRILLING WELLS, TUNNELS, &c.

No. 556,718. Patented Mar. 17, 1896.

Fig. 6.

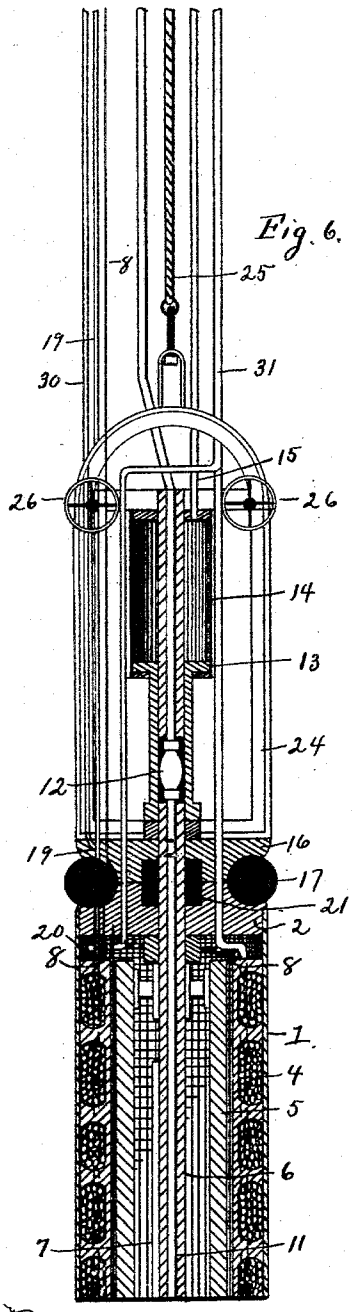


Fig. 8.

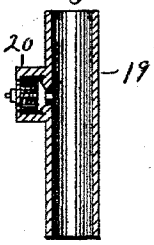
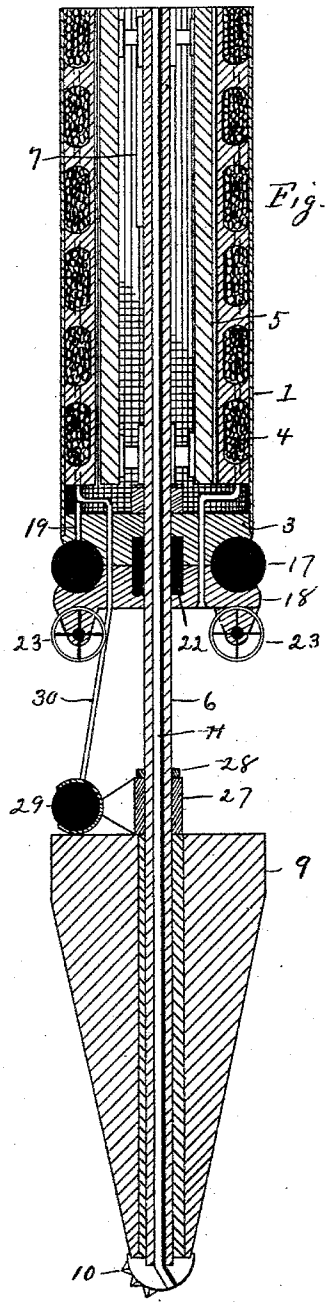


Fig. 7.



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(No Model.) 4 Sheets—Sheet 3.

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ELECTRICAL APPARATUS FOR DRILLING WELLS, TUNNELS, &c.

No. 556,718. Patented Mar. 17, 1896.

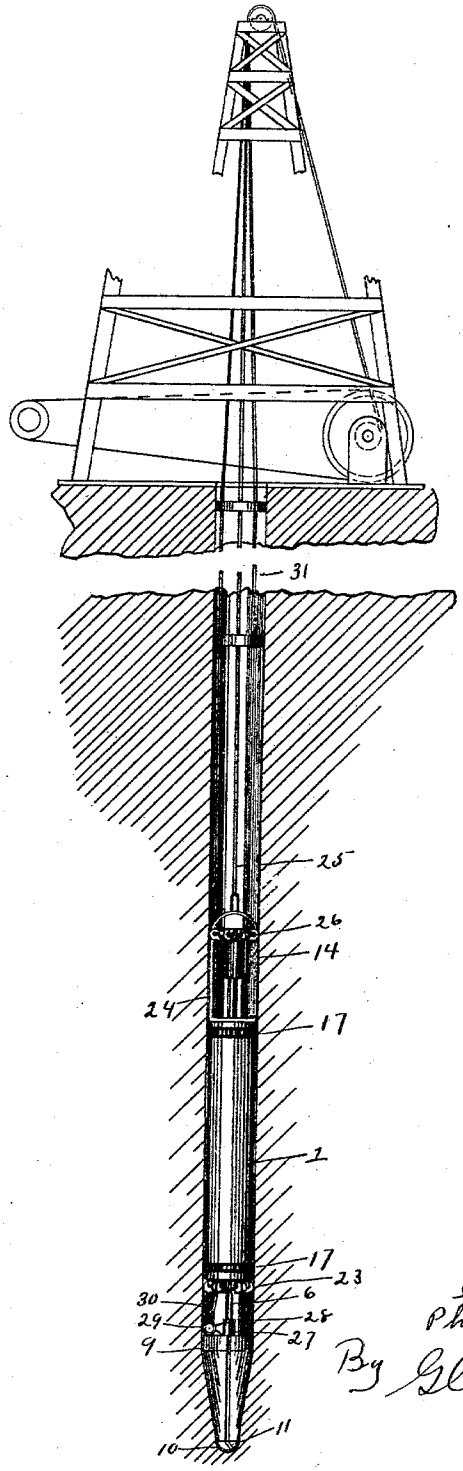

Fig. 9.

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(No Model.) 4 Sheets—Sheet 4.

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ELECTRICAL APPARATUS FOR DRILLING WELLS, TUNNELS, &c.

No. 556,718. Patented Mar. 17, 1896.

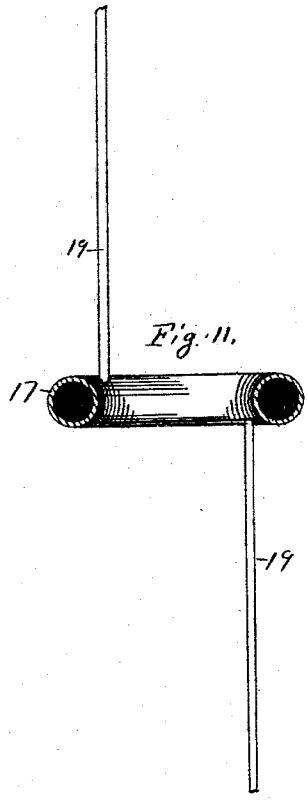

Fig. 11.

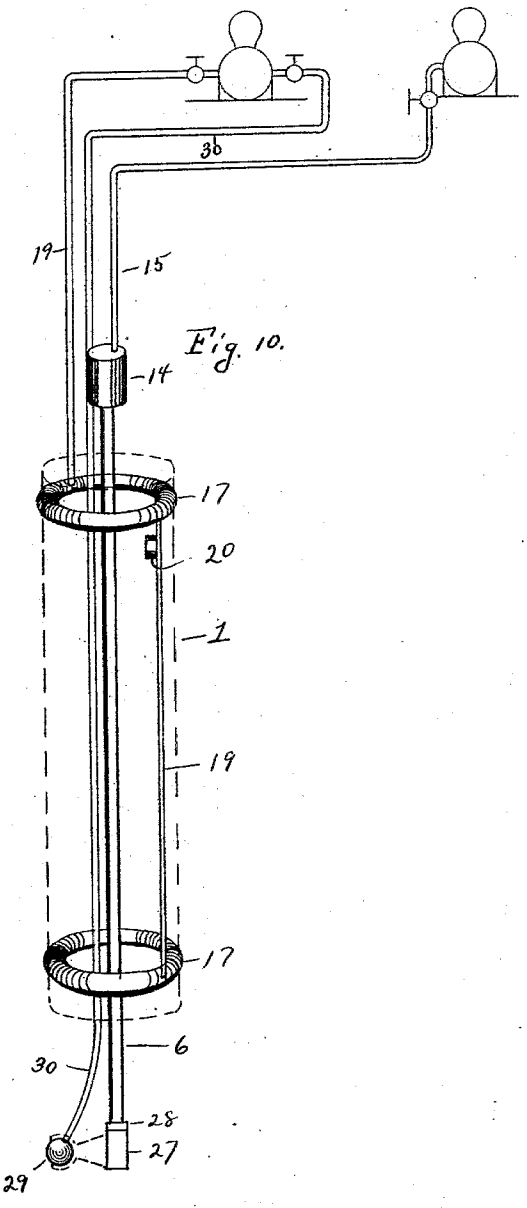

Fig. 10.

Witnesses:-
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UNITED STATES PATENT OFFICE.

PHILLIP SEMMER, OF IRWIN, ASSIGNOR OF ONE-HALF TO CHARLES A. O'BRIEN, OF PITTSBURG, PENNSYLVANIA.

ELECTRICAL APPARATUS FOR DRILLING WELLS, TUNNELS, &c.

SPECIFICATION forming part of Letters Patent No. 556,718, dated March 17, 1896.

Application filed August 16, 1895. Serial No. 559,484. (No model.)

To all whom it may concern:

Be it known that I, PHILLIP SEMMER, a citizen of the United States, residing at Irwin, in the county of Westmoreland and State of Pennsylvania, have invented a certain new, useful, and valuable Improvement in Electrical Apparatus for Drilling Wells, Tunnels, &c., of which the following is a full, clear, and exact description.

My invention has relation to electrical apparatus for drilling wells, tunnels, &c.; and it consists in the novel construction and arrangement of its parts, as hereinafter described.

In the accompanying drawings, Figure 1 is a longitudinal sectional view of the apparatus embedded in rock. Fig. 2 is an end view of the apparatus at the lines *x x* of Fig. 1. Fig. 3 is an end view of the cutter located at the extreme lower end of the apparatus. Fig. 4 is a side view of a device for carrying and supporting the different flexible hydraulic and pneumatic tubes and also débris-discharge hose and necessary electric wires in the well. Fig. 5 is a top view of the device. Figs. 6 and 7 are longitudinal sectional views of the respective upper and lower parts of the drilling apparatus enlarged. Fig. 8 is a sectional view of a pop-valve that may be used in the apparatus. Fig. 9 is a longitudinal sectional view of a well, showing the apparatus in place therein. Fig. 10 is a perspective view of the air-cushions used in my invention and their attachments. The figure also shows the pumps for forcing air into the cushions and a pump for forcing air or water into a cylinder 14 attached to the apparatus. Fig. 11 is a sectional view in detail of an air-cushion 17.

The apparatus consists of a cylindrical case 1, having fitted in its upper end a head 2 and in its lower end a head 3. A motor 4 is located in the said case between the heads, or several motors arranged in tandem may be located between the heads. The armature 5 is located in the center of the case 1. The said armature is mounted or keyed on the shaft 6, which passes perpendicularly through the center of the said armature. The said shaft 6 is adapted to pass perpendicularly through the said armature, but the key 7 retains the said shaft laterally rigid with the said armature.

A current of electricity is conveyed to the motor or motors 4 through the wires 8 8, which pass up through the device and up and out of the well at its top.

A cutter 9 is rigidly attached to the lower end of the shaft 6, the said shaft passing through the cutter. The lower end of the cutter 9 is provided with the diamond cutting-points 10. The center of the shaft 6 is hollow throughout its entire length, and through said hollow passes the hose 11, the lower end of the hose passing down beyond the lower end of the shaft and adapted to discharge water in the well at the point where the diamond points 10 are operating. Near the upper end of the shaft 6 the hose 11 is provided with a revolving joint 12, and at this point the hose in the shaft 6 is connected with the hose that leads to the top of the well; or the hollow shaft may be connected at that point direct with hose 11.

The upper end of the shaft 6 is connected with the piston 13, which is located in the cylinder 14. The pipe 15 is adapted to introduce air or a fluid under pressure in the said cylinder, or by means of said pipe 15 a vacuum may be created in the said cylinder. By introducing an element in the said cylinder under pressure the shaft 6 and the cutter 9 will be sent forward relative to the body of the apparatus, and by creating a vacuum in the said cylinder the said shaft and the reamer will be drawn toward the body of the apparatus.

A plate 16 is arranged opposite and secured to the head 2 of the casing 1. Between the said plate 16 and the said head 2 there is a recess in which is located an air-cushion 17 which extends all the way around the plate and the head. The outer periphery of the said cushion when inflated is adapted to extend slightly beyond the outer periphery of the balance of the apparatus. A similar air-cushion is located between the head 3 and the plate 18 at the lower end of the apparatus. These cushions are connected by a hose or air-tube 19 with a suitable air-pump located above the surface of the ground. Between the two cushions the said air-tube is provided with a

pop-valve 20, (see Fig. 8,) which is adapted to let air under pressure escape into the interior of the motor or motors 4, the object of which will be explained hereinafter. The heads 2 and 3 and their respective adjoining plates are provided with the packings 21 and 22 about the shaft 6, thus as nearly as possible hermetically sealing the cavity between the two heads. The lower side of the plate 18 is provided with a number of caster-wheels 23, which are adapted to run against the sides of the well. The outer peripheries of these wheels are coated with rubber or other flexible material.

A cage 24 is attached to the upper side of the plate 16. Said cage supports the cylinder 14, and the rope 25 is attached to the upper end of the said cage. Said rope 25 passes up and out of the well. The upper part of the cage 24 is provided with a number of wheels 26, similar in construction and operation to the wheels 23.

Just above the cutter 9, on the shaft 6, is journaled a collar 27, the shoulder 28 keeping said collar in place. An air-cushion 29 is attached to said collar, and the outer edge of said air-chamber when inflated is adapted to come closely in contact with the side of the well. The air is fed to the said air-cushion 29 through the flexible tube 30, which passes through the entire apparatus and up and out of the top of the well, and is connected with a suitable air-forcing apparatus. A hose 31 also passes through the entire apparatus and has an outlet at its lower end in the space between the lower end of the body of the apparatus and the upper end of the cutter. Said hose is adapted to remove the débris or borings from the well while the apparatus is in operation. This is done by connecting the upper end of the said hose 31 with a suitable pump and the débris is pumped up, or the water and débris may be otherwise forced up.

In operation the apparatus works as follows: The apparatus is lowered into the well. Air under pressure is then let into the air-cushions 17 17. The outer peripheries of these cushions will bear tightly against the sides of the well, and the body of the apparatus is thus secured stationary in the well. A current of electricity is applied to the motor or motors 4, and thus the armature 5 is set in rapid motion, which revolves the shaft 6 and the cutter at the lower end of the shaft and the diamond points 10. At the same time a jet of water is passed under pressure down the hose 11, and as the rock is cut by the diamond the small particles are washed up into the cavity between the top of the cutter and the lower end of the body proper of the apparatus. This water, together with the débris thus formed, is drawn up through the hose 31 and is removed from the well. As the rock is cut away and the well is reamed out it is necessary that the cutter and the diamond-point arrangement attached thereto should progress farther into the rock. This is accomplished by introducing into the cylinder 14, through the pipe 15, an element, such as air or water under pressure, and this, as hereinbefore described, will force the cutter and its attachments forward. When the cutter has advanced as far as possible into the rock, air under pressure is let into the air-cushion 29, and thus the cutter is made fast to the bottom of the well. The pressure is then let out of the cushions 17 17, and by creating a vacuum in the cylinder 14 the body proper is brought down to the cutter. Then the air is let out of the cushion 29 and again applied in the cushions 17 17 and the boring is continued.

The object of letting the air under pressure into the casing between the heads 2 and 3, through the pop-valve 20, is that the said air will prevent any moisture from getting into the said space should there be any leakage at any of the joints.

In Fig. 2 the perforations 32 are those through which the various tubes, wires, &c., pass. Said perforations are located in the plates 16 and 18.

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

1. An apparatus for drilling wells, &c. consisting of a casing, a device fixed to the casing and adapted to secure the casing to the side of the well, a motor located in said casing, a shaft fixed to the armature of the motor, said shaft adapted to revolve and having a longitudinal movement through the motor, a revolving cutting device fixed to the lower end of the said shaft, a device for forcing said shaft and cutting device forward, a perpendicularly-journaled arm located on the shaft, a receptacle located at the outer end of said arm, an air-cushion located in said receptacle, a tube connected with said cushion and adapted to convey air to the same, said cushion when inflated adapted to come in contact with the side of the well and retain the shaft in a stationary position.

2. An apparatus for drilling wells, &c. consisting of a casing, a device fixed to the casing and adapted to secure the casing to the side of the well, a motor located in said casing, a shaft fixed to the armature of the motor, said shaft adapted to revolve and having a longitudinal movement through the motor, a revolving cutting device fixed to the lower end of the shaft, a device for forcing said shaft and cutting device forward, a hose adapted to carry a jet of water to the cutting-point of the apparatus whereby the débris may be removed, a perpendicularly-journaled arm located on the shaft, a receptacle located at the outer end of the said arm, an air-cushion located in said receptacle, a tube connected with said cushion and adapted to convey air to the same, said cushion when inflated adapted to come in contact with the side of the well and retain the shaft in a stationary position, as set forth.

3. An apparatus for drilling wells, &c. con-

sisting of a casing, a motor located in said casing, a means for temporarily securing said casing to the sides of the well, a shaft fixed to the armature of the said motor, said shaft adapted to revolve and having a longitudinal motion through the motor, said shaft being connected with a piston, a cylinder retaining said piston, said shaft adapted to be moved back and forth by the introduction or removal of an element in the cylinder behind the piston, a revolving cutting device fixed to the lower end of the shaft, a perpendicularly-journaled arm located on the shaft, a receptacle located at the outer end of said arm, an air-cushion located in said receptacle, a tube connected with said cushion and adapted to convey air to the same, said cushion when inflated adapted to come in contact with the side of the well and retain the shaft in a stationary position, as set forth.

4. In an apparatus for drilling wells, &c. a device for temporarily securing a section of the apparatus to the side of the well, said device consisting of a perpendicularly-journaled arm, a receptacle located at the outer end of said arm, a substantially globular air-cushion located in said receptacle, a tube connected with said cushion and adapted to convey air to the same, said cushion when inflated adapted to come in contact with the side of the well and retain the section, as set forth.

5. An apparatus for drilling wells, &c. consisting of a casing, a motor located in said casing, a suitable cutting device operated by said motor, a tube leading into said casing and having an outlet therein, said tube adapted to inject air under pressure into the said casing, as set forth.

6. An apparatus for drilling wells, &c. consisting of a casing, a motor located in said casing and a suitable cutting device operated by said motor, said casing having at its end a head, a plate secured to the said head, a recess between the head and the adjoining plate, an air-cushion located in said recess, a tube connected with said cushion and adapted to convey air to the same, said cushion when inflated adapted to come in contact with the side of the well and retain the casing in a stationary position, as set forth.

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

PHILLIP SEMMER.

Witnesses:
H. E. SMYTHE,
H. T. NEWELL.