F. E. BANEY.

ELECTROMAGNETIC DRILL.

APPLICATION FILED APR. 24, 1908.

968,729.

Patented Aug. 30, 1910.

3 SHEETS—SHEET 1.

Fig. 1.

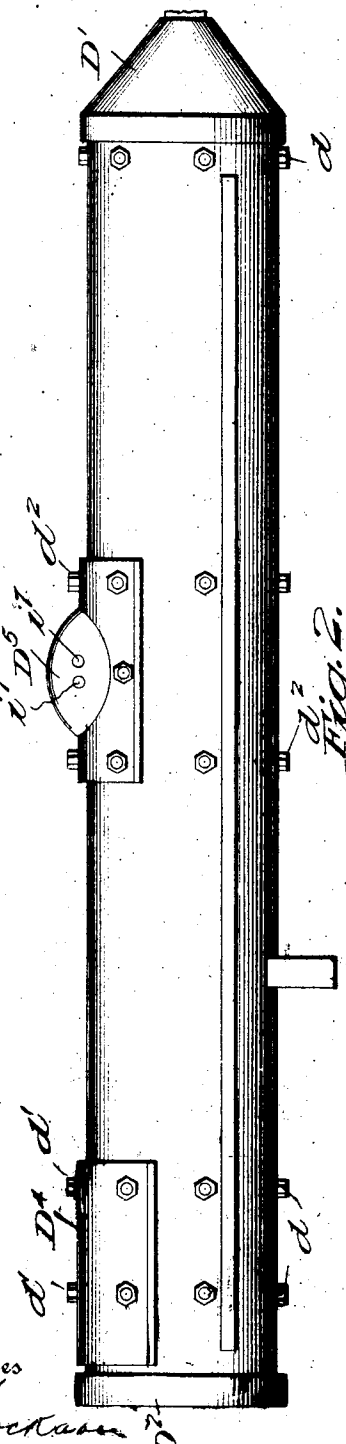
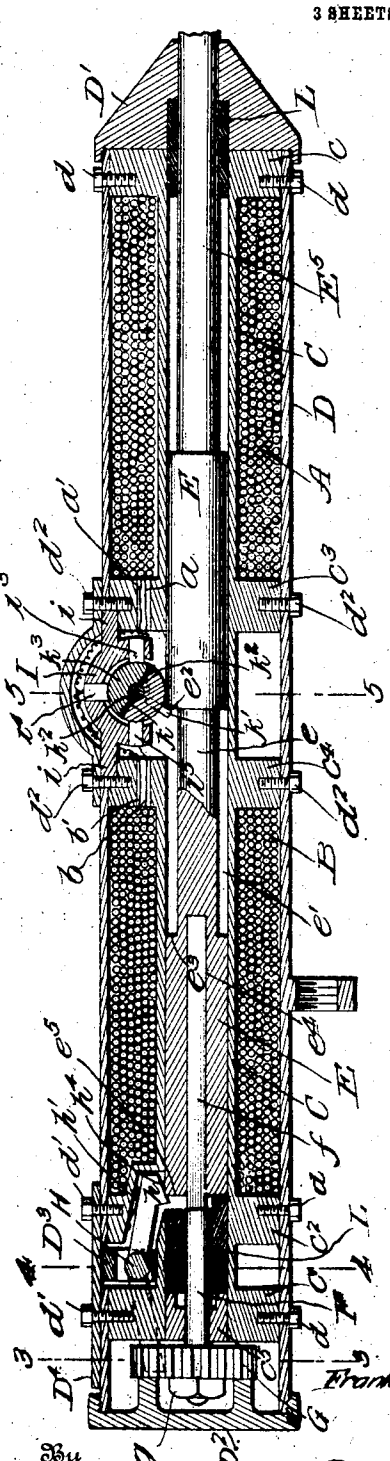


Fig. 2.



Witnesses

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3 SHEETS—SHEET 2.

Fig. 3.

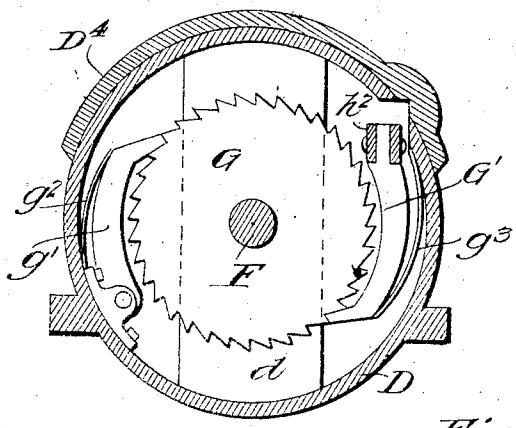


Fig. 4.

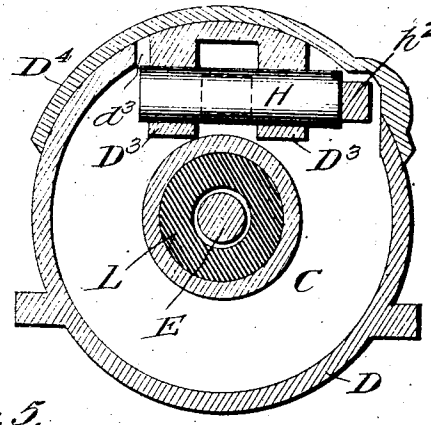


Fig. 5.

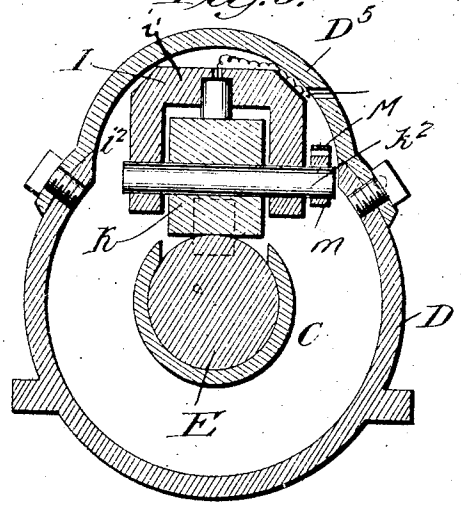
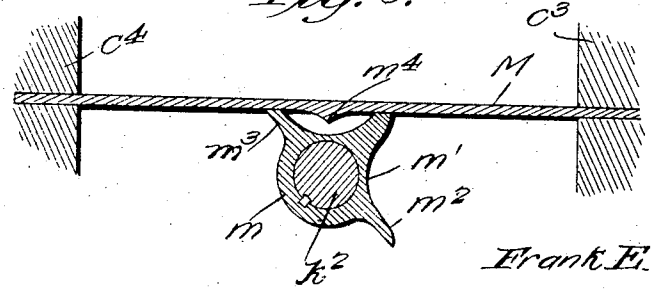


Fig. 6.



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3 SHEETS—SHEET 3.

Fig. 7.

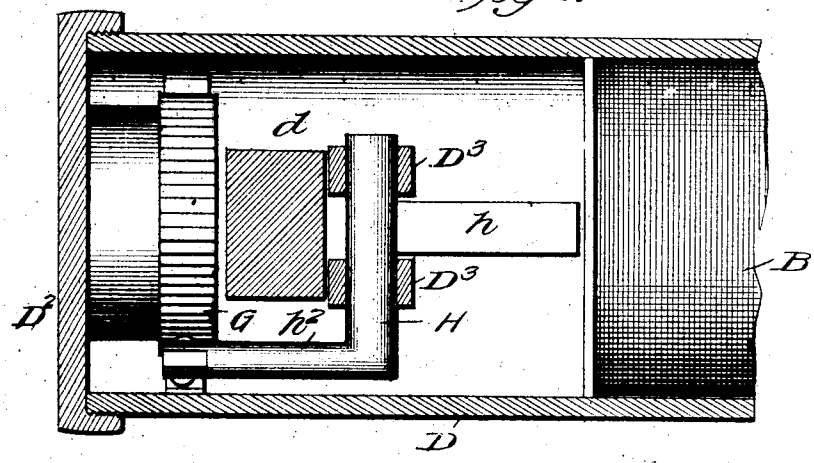


Fig. 8.

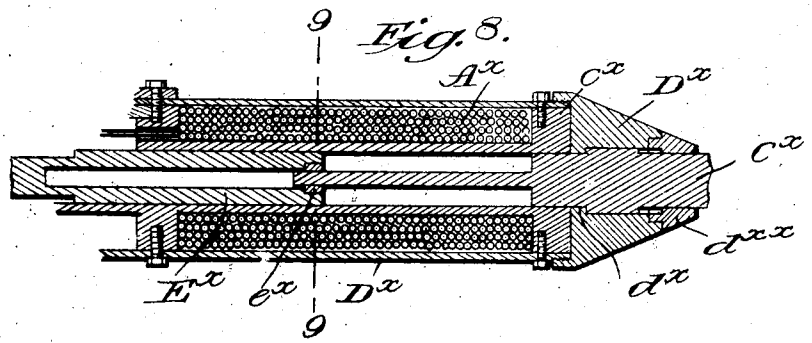
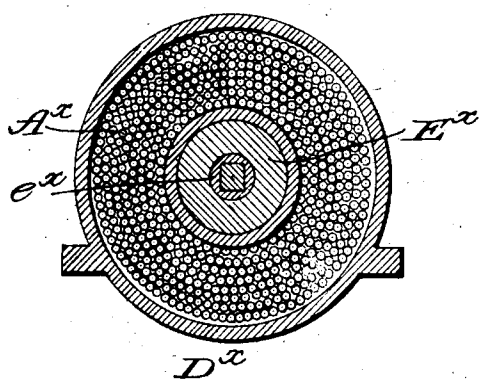


Fig. 9.



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ELECTROMAGNETIC DRILL.

968,729. Specification of Letters Patent. Patented Aug. 30, 1910.

Application filed April 24, 1908. Serial No. 428,893.

To all whom it may concern:

Be it known that I, FRANK E. BANEY, a citizen of the United States, and a resident of Smelser, in the county of Grant and State of Wisconsin, have invented certain new and useful Improvements in Electromagnetic Drills, of which the following is a specification.

My invention relates to electric power drills of the reciprocating type and more particularly to that class of portable drills used for rock drilling, quarrying, tunneling and the like.

The invention is designed to produce an electro-magnetic drill in which all the parts are self contained and the shifting of the electrical current regulated, automatically, by the machine itself.

In general the drill consists of a solid plunger, surrounded by two coils of wire through which the electric currents are caused to pass. The two coils of wire through which the currents are caused to pass alternately, exert a reciprocating magnetic attraction, forward and backward upon the plunger, thus producing the stroke of the machine. The current passing through one coil at a time there is always a magnetic attraction in one direction and therefore a corresponding movement on the part of the plunger. The current is shifted from one coil to the other automatically by a mechanical arrangement so placed between the two coils that it is operated by each forward and backward stroke of the plunger. By this current shifting device a positive pull is always obtained on the plunger and less heat developed than in machines where the current is shifted independently of the movement of the plunger. Rotation of the plunger is obtained by means of a lever and connected parts operated by the plunger on its backward stroke.

The object of the invention is to produce an automatically operating tool of this character wherein all the parts are self contained, that is, housed within an inclosing case, having detachable parts carrying the shifting mechanism.

The invention consists in the matters hereinafter described and particularly pointed out in the claims at the end of the description.

The invention may be embodied in various forms for practical use, the construction which I prefer and have most highly developed being shown in the accompanying drawings, wherein—

Figure 1 is a side elevation of a complete drilling apparatus, with the exception of the guide shell, feed screw and chuck; Fig. 2 is a longitudinal section thereof; Fig. 3 is a transverse section on line 3—3 of Fig. 2; Fig. 4 is a similar section taken on line 4—4 of Fig. 2; Fig. 5 is a similar section on line 5—5 of Fig. 2; Fig. 6 is a detail section, showing a part of the current shifting device; Fig. 7 is a longitudinal detail section of the rear end of the machine; Fig. 8 is a longitudinal section, showing a modified form of the forward end of the machine; and Fig. 9 is a transverse section on line 9—9 of Fig. 8.

Referring to the drawings, wherein similar letters of reference are used to indicate corresponding parts in each of the several views, the motor coils A and B are wound upon a spool C provided at its front end with a flange c, and at the rear end with flanges c', c^2; similar flanges c^3 and c^4 are located on either side of and adjacent to the longitudinal center of the spool as shown, said flanges c, c^2, c^3, c^4, serving as heads for the motor coils.

Inclosing the motor coils and spool is an exterior casing D, to which the spool is rigidly secured by screw bolts d, d', d^2, passing through the casing D into tapped holes in the flanges of the spool, as shown. Caps or heads D' and D^2 are secured to the casing D at front and rear, the former bored centrally to constitute a guide for a piston E^5 hereinafter referred to.

Mounted to reciprocate freely within the spool C is a core E, preferably of soft iron, the central part thereof being turned down as at e, in order that an elongated annular recess e' may be formed between the central part of the core and the walls of the spool. The inner parts of the core, adjacent the reduced portion e form shoulders e^2, e^3.

The rear end of the core E is drilled centrally to leave a longitudinal recess or socket e^4, angular in cross section, to receive the squared elongated shank f of a ratchet rod F journaled in a plug c^5 seated within the rear end of the spool C.

Upon the rear end of the rod F is mounted a ratchet wheel G, a lock nut g, being em-

ployed to secure the wheel tightly to the rod, and at one side of the casing is pivoted a dog g', (Fig. 3) pressed toward the ratchet wheel by a spring g^2.

The casing D is cut away at one side at the rear, and closing such opening d^3 is a cover plate D^4, (see Figs. 1, 2, 3 and 4) carrying lugs D^2 (Fig. 4), in the lower ends of which is journaled a rock shaft H, having a forwardly extending arm h, normally depressed or thrust from the casing by a spring h'. Another arm h^2 extends rearwardly from the rock shaft H near one end and to its end is pivoted one end of a pawl G', pressed by a spring g^3, to engage the ratchet wheel G.

The inner side of the arm h of rock shaft H is tapered or beveled as at h^4 toward the end and its free end is normally pressed downward in the path of the core E, which on making a full stroke to the rear will lift the arm h, rock the shaft H in its bearings, and through its connection by arm h^2 depress the pawl G', thereby rotating the ratchet wheel G, rod F and with it the core; sufficient lateral play of the shaft H being provided to permit of the escape of the teeth of ratchet wheel G by pawl G' on the return stroke of arm h^2. The dog g', it will be understood, serves to lock the ratchet wheel and prevent a reverse movement or back lash when the pawl G' is retracted, as the shoulder e^5, of the core leaves the beveled portion h^4 of the lever arm h, the spring h', forcing said arm h to its normal depressed position.

The automatic shifting of the current and hence the core is accomplished by the following mechanism. Intermediate its ends the casing D is cut away to admit a frame I, having arms i, seated in recesses in the flanges e^3 and c^4, of the spool C, and shaped centrally to form a yoke i', the legs i^2 of which have bearings in which is journaled the shaft of a rocker or current shifter K. The yoke is provided with three contacts or brushes i^3, i^4 and i^5, which are constantly in contact with the surface of the rocker K. This rocker is in the form of a roll, the journals thereof having bearings in the legs of the yoke, the roll being divided by an insulating strip k, and provided with a projection or lug k', which protrudes into the recess c', between the core and the casing, and lies in the path of the shoulders e^2, e^3, of the larger diameter of the core, so that on reciprocation of the core the rocker will be shifted from the position shown in Fig. 2, wherein the brush i^5 is in contact with the dead or insulated half k^2 of the roll, and the brushes i^3 and i^4, are in contact with the live part k^3, of said rocker roll, adapted to transmit current. The opening in the casing is closed by a center plate D^5, carrying the live contact plugs i^7.

The coil A is connected through wire a with the brush i^3 of the yoke, and through wire a' with the line through contact plug i^7, while the coil B is connected through wire b, with brush i^5, through wire b', through its contact plug with the line, as shown in Figs. 1 and 2. As shown the coil A is energized and will draw the core forward until the shoulder e^3 of the rear of the core advances and moves the rocker or current shifter by contact with the projection k', to a position where the brush i^3, will contact with the insulated or dead half of the roll, thus cutting off current to coil A, the live part of the rocker roll then connecting with brushes i^5 and i^4, thus energizing coil B and shifting the current and causing the movement of the core in the opposite direction.

Buffers L, of rubber, are seated in the spool C at its ends, and at or near the limit of movement of the core, the purpose being to cushion the shock or jar that would result from the core striking unyielding metal at the end of each stroke. These buffers also serve to assist the initial return movement of the core.

M, Fig. 6, is a straight flat spring secured at its ends to the flanges c^3 and c^4 of the spool.

m indicates a hub keyed to the rocker shaft and having a smooth double cam surface m', with wings m^2 and m^3, arranged on either side and at right angles to it, all keyed to the projecting end k^2 of the journal of the rocker K. When the shoulder e^3 of the core strikes the shift lug or projection k', the rocker and its journal rotate as one, and cam m with wings m^2 and m^3 partake of the movement. During this rotation the cam m bears upward against the spring M. The maximum upward pressure is attained when the cam m is on a line with the raised portion m^4 of the spring and the center of the journal. This construction insures against dead centers, as the spring will move the cam onward forcibly, until stopped by contact of one or the other of the wings with the spring.

As thus described the machine is of that class wherein the drill is rigidly connected with the piston and reciprocates with it, but my invention is equally applicable to that class of machine using an independently movable hammer to strike the drill, as shown in the modifications, Figs. 8 and 9. Referring to said Figs. 8 and 9 it will be noted that the forward end of the core $E^\times$ is chambered longitudinally and provided at its forward end with a nut $e^\times$, having an angular opening to fit the angular stem of the hammer $C^\times$ the outer enlarged end of which is mounted in a longitudinal, step-like opening $d^\times$ in the front cap or head $D^\times$. The head terminates in a cap $d^{\times\times}$, also

having a steplike opening for the hammer, the bore of larger diameter in both head and cap being designed to receive a rubber or other buffer L[x] to cushion the stroke at the outer end of the implement.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent of the United States, is:—

1. In a tool of the character described, a casing, a plurality of motor coils mounted therein, a core or plunger having a reduced central portion, a frame interposed between the ends of the coils, a shaft journaled in said frame, a rotary current shifter mounted on said shaft, a projection on said shifter, adapted to contact with the shoulders formed at the ends of said reduced portion of the core, whereby said shifter is actuated on the forward and backward movement of the core to shift the current from one to the other of said coils.

2. In a tool of the character described, the combination of coils alined and spaced apart, a core adapted to reciprocate within the coils and having shoulders facing each other, electrical connections between the coils and source of power, a frame between said coils, a shaft journaled in said frame, a rocker or current shifter secured to said shaft and having a lug or projection adapted to contact with the shoulders of the core and actuate said rocker thereby shifting the current from one coil to the other, and a spring pressed cam mounted on the shaft of the rocker, substantially as and for the purpose described.

3. In a tool of the character described, the combination of the coils alined and spaced apart, a core adapted to reciprocate within the coils and provided at its rear end with an angular socket, connections between the coils and power, means to automatically shift the current at the end of each stroke, a ratchet wheel mounted on an angular ratchet rod journaled at the rear of the one of the coils with its angular portion in said angular socket of the core, a dog engaging the ratchet, and a rocking lever having a pawl to engage and rotate said ratchet and thereby rotate the rod.

4. In a tool of the character described, the combination of the coils alined and spaced apart, a core adapted to reciprocate within the coils and provided at its rear end with an angular socket, connections between the coils and power, means to automatically shift the current at the end of each stroke, a ratchet wheel mounted on an angular ratchet rod journaled at the rear of one of the coils with its angular portion in said angular socket of the core, a cover plate having lugs provided with bearings and a rocking lever fulcrumed in said bearings and carrying a pawl adapted to engage and rotate said ratchet and thereby rotate the rod.

5. In a tool of the character described, the combination of the casing, coils alined and spaced apart therein, a core adapted to reciprocate within the coils and provided at its rear with an angular socket, connections between the coils and power, an angular ratchet rod journaled adjacent the rear of the casing with its angular portion in said angular socket of the core and carrying a ratchet wheel, a dog pivoted to the casing to engage the ratchet wheel, a rocking lever having a pawl to engage the ratchet wheel, and a rocker or current shifter having a lug or projection on its insulated side adapted to engage the core, and brushes on the live side of said rocker to make contact with the coil terminals and line.

6. In a tool of the character described, the combination of the casing, coils alined and spaced apart therein, a core adapted to reciprocate within the coils and provided at its rear with an angular socket, connections between the coils and power, an angular ratchet rod journaled adjacent the rear of the casing and carrying a ratchet wheel, a dog pivoted to the casing to engage the ratchet wheel, a rocking lever having a pawl to engage the ratchet wheel, a rocker or current shifter having a lug or projection on its insulated side adapted to engage the core, brushes on the live side of said rocker to make contact with the coil terminals and line, a double cam mounted on the shaft of the rocker and having wings at right angles thereto, and a spring mounted above said cam and provided with a central ridge adapted to be engaged by the wings of the cam, substantially as and for the purpose set forth.

In testimony whereof I have affixed my signature in the presence of two witnesses.

FRANK E. BANEY.

Witnesses:
HAROLD C. GEORGE,
GEORGE DOBSON, JR.