(No Model.) 2 Sheets—Sheet 1.

H. S. McKAY.

ELECTRIC MECHANISM FOR RECIPROCATING MOTION.

No. 475,410. Patented May 24, 1892.

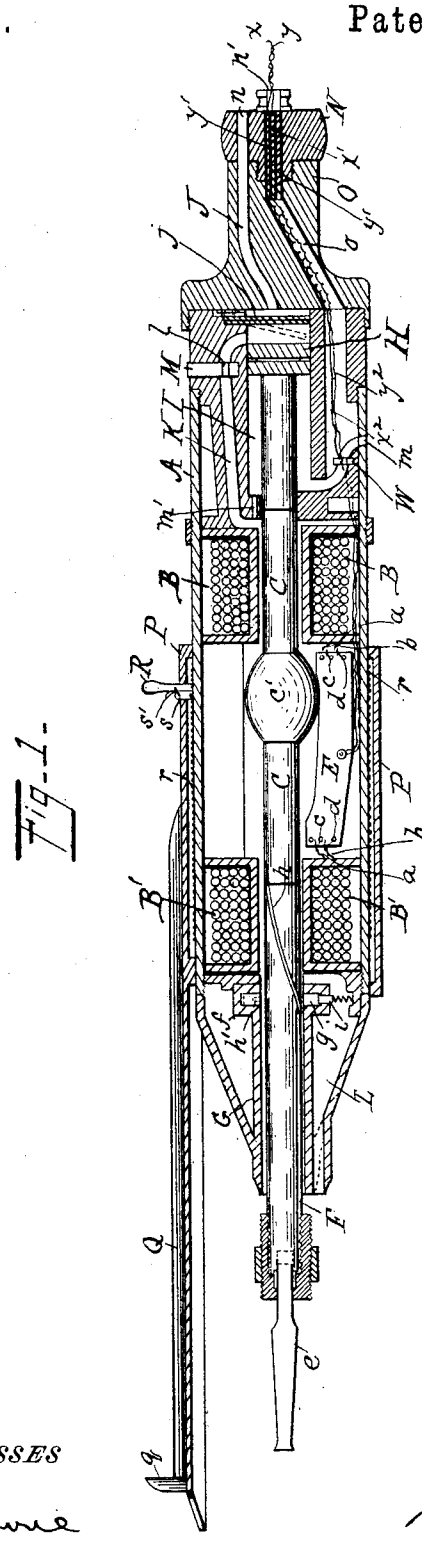

Fig. 1.

WITNESSES

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 5.

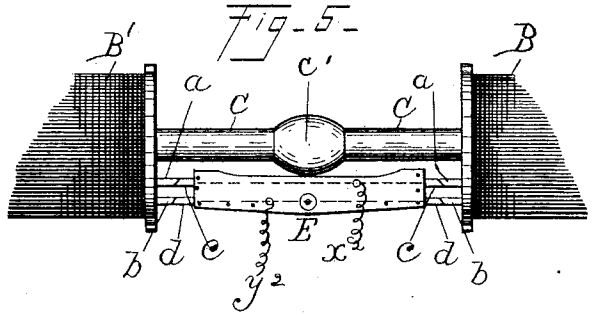


Fig. 3.

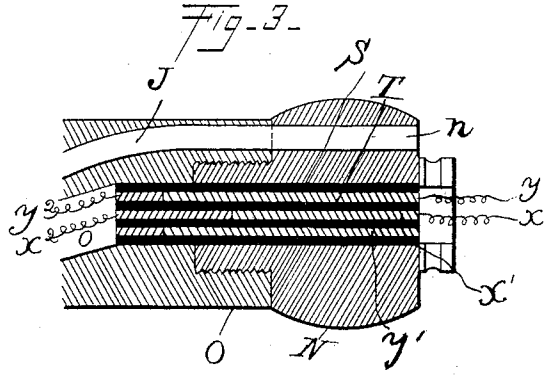


Fig. 2.

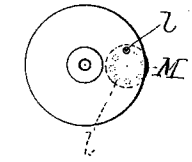
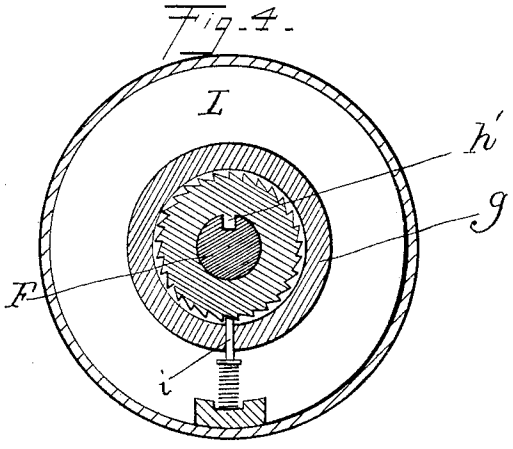


Fig. 4.



WITNESSES

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INVENTOR

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UNITED STATES PATENT OFFICE.

HENRY S. McKAY, OF BOSTON, MASSACHUSETTS.

ELECTRIC MECHANISM FOR RECIPROCATING MOTION.

SPECIFICATION forming part of Letters Patent No. 475,410, dated May 24, 1892.

Application filed August 20, 1891. Serial No. 403,193. (No model.)

To all whom it may concern:

Be it known that I, HENRY S. McKAY, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Electric Mechanism for Giving Reciprocating Motion; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The principal object of my invention is to furnish a new and useful electrical mechanism for operating reciprocating tools, though my invention can be used for other purposes.

My invention consists generally of such an arrangement and combination of the electrical and other devices of the apparatus as is hereinafter set forth.

My invention is particularly adapted for a drill or stone-cutting tool, and in such case the armature or armatures should be attached to the tool-stock.

In the accompanying drawings I have shown my invention as applied to a drill, in which—

Figure 1 illustrates a longitudinal section. Fig. 2 is a diagrammatical detail. Figs. 3 and 4 are sectional details enlarged. Fig. 5 is a detail illustrating the position of the parts when the circuit is made continuous through both magnets.

A is the cylindrical casing of the machine.

B B′ are two solenoids of insulated wire inclosed in the casing A at some distance apart.

C is a reciprocating armature or plunger, of magnetic material, having the swelled portions c' between its ends, and said armature adapted to play between and through the two solenoids B B′, attracted by the magnetism of said solenoids.

E is a rocking lever pivoted within the casing A between the solenoids B and B′ and adapted to rock back and forth in the inner casing D and be operated by the central swelled portion c' of the reciprocating armature C.

The two terminals a b of each solenoid B B′ are in the form of spring contact-points and extend toward the ends of the lever E. Corresponding spring contact-points c d extend out from each end of the lever E, and are adapted to come in contact with those of the adjacent solenoids at one end and at the other end of the lever alternately.

F is the tool-stock, of non-magnetic material, which is secured at one end to the end of the armature C, which is adapted to move in the solenoid B′, the other end of said stock having an attachment for the drill-tool e. The outer portion of the tool-stock F reciprocates in a cylindrical stationary sleeve G, and the inner end of said sleeve terminates in a circular enlargement or casing f, in which a ratchet-wheel g is adapted to revolve. The shank F and armature C pass loosely through a hole in the center of the ratchet g, and a feather or spline h, extending from the ratchet into said hole, engages with the spiral groove h' on said shank and armature. A spring-dog i, passing through the side of the box f, engages with the teeth of the ratchet g and serves to lock the same and prevent its turning in one direction. During the inward or upward play of the shank F and armature the ratchet g is prevented from rotating in the direction of the spiral groove h' by means of the locking-dog i, and said shank and armature will consequently rotate during said course by reason of its spiral groove h' sliding over the feather or spline h on the ratchet g.

During the outward or downward movement of the shank F and armature C, said shank will reciprocate in a straight line, and the ratchet g will rotate over the course of the spiral groove h'. This ratchet can be placed at either end of the machine.

Secured to the opposite side of the armature C from the shank F is a piston-rod, of non-magnetic material, having a piston H at its other end, which is inclosed and adapted to slide in a cylinder I. The outer end of said cylinder communicates with an air-passage J, which is covered by a valve j. Said valve is adapted to be opened to admit air to the cylinder I by suction through the passage J when the piston H moves away from said valve, and the valve j to be closed by the pressure of the air on the same, caused by the piston H moving toward said valve. The outer end of the cylinder I also communicates with an air-passage K, which opens into the cylinder D, and another air-passage L communicates with the central passage of the solenoid B′ and has its outlet at the conical end

of the casing A. On the backward movement of the piston H, or when it approaches the valve *j*, as the latter will be closed by the pressure of the air, said air not having an opportunity to escape through the valve *j* will be forced by the pressure of the piston H through the passage K, cylindrical casing D, opening in the solenoid B′, and passage L, and out through the conical end of the casing A near the tool-stock F. A flexible tube may, if desired, be attached to the conical end of the casing A and communicating with the passage L, and if the free end of said tube be placed near the end of the tool *e* the air being forced out of said tube can be utilized to blow away the dust and broken particles caused by the action of said tool.

M is a disk having a series of different-sized eccentric holes *l* extending transversely through the same. This disk M is concentrically pivoted in a transverse slot of the machine-body and extends across the air-passage K near its inlet end, and with each of the eccentric holes *l* adapted to be brought into line with the passage K by the rotation of the disk M. This construction is for the purpose of regulating the outflow and pressure of the air through the passage K, and consequently the resistance of the back of the piston H, the smaller being the hole *l* in the line of the passage K the more slowly the air will pass through said hole and passage and the greater will be the resistance at the back of the piston H to retard the backward movement of the same.

Communicating with the lower end of the cylinder I are two air-outlets *m* and *m′*, the outlet *m* extending laterally to the outside of the air-casing A and the outlet *m′* extending into the central opening of the solenoid B. The object of said outlets *m* and *m′* is to allow the air in front of the piston H to escape from the cylinder I during the forward movement of said piston, and that there may be as little or as much resistance as is desired to said forward movement the passage M is covered by a perforated disk W, similar to the disk M.

The air which is forced by the piston H through the opening *m′* passes through the central opening of the solenoid B to and through the opening of the solenoid B′ and air-passage K and out of the conical end of the casing A, and will be utilized to blow away the dust and small particles made by the action of the drill-tool *e*, just as the air from the passage K is utilized.

The disk W operates, like disk M, to control the force of the blow struck by the tool by controlling the outflow of the air through the passage *m*.

N is a cap attached to the back end or head O of the machine-frame and having two transverse openings, one of which *n* communicates with the air-passage J, forming an inlet for the air, and the other *n′* communicating with a passage *o* in the head O and casing A. The two circuit-wires *x* and *y* enter the passage *o*, where they are connected to the pole-pieces *x′* and *y′*. Other wires x^2 y^2, connected to the other ends of said pole-pieces, pass from thence outside of the solenoid B, but inside the casing A to the lever E, and are then connected, respectively, to the terminal spring contacts *c d* of said lever.

P is a cylindrical sleeve surrounding the lower part of the casing A and provided with a leg Q, extending parallel with the tool-stock F and tool *e*. This leg Q is for the purpose of supporting the machine while it is being operated. A lateral extension *q* projects outwardly from the leg Q near the lower end of the same to serve as a foot-rest for the operator, so that the tool can be better braced when being used.

A portion of the outer periphery of the casing A is provided with a screw-thread *r* and a spring-dog *s*, having teeth on its inner end engaging with said thread. A lateral handle R extends outward from the sleeve P above the dog *s* and furnishes means for drawing back said sleeve on the casing A when said dog is released from the thread *r* by its trigger *s′*.

The casing A and all the mechanism inclosed therein are adapted to be adjusted relatively to each other to a fine degree by simply turning said mechanism within the casing A in either direction, the adjustability being regulated by the screw-thread *r*, riding over the teeth of the dog *s*. The wires are brought in contact with each other by the moving armature C, which armature is attracted by the solenoids B B′. To make the circuit in starting the machine it is only necessary to let the armature *c* drop by its own weight to one end or the other of the machine, which will connect or make the circuit to either one or the other of the solenoids, according to where the armature drops. The electric current for energizing the solenoids B B′ passes through the wires *x* and *y* at the rear of the machine to the lever E, and from thence to the terminals or contacts *c d* at either end of said lever.

The solenoid B is energized so as to form a magnet when the contacts *c d* of the lever E adjacent to said solenoid are in contact with the contacts *a b* of said solenoid, and the armature C will be attracted to said solenoids, carrying the tool-stock F and tool *e* and the piston H with it, and thus force the air which is behind said piston through one of the holes *l* in the disk M and through the air-passage K and then to the outlet near the tool end of the machine. The above movement of the armature C will cause the swelled part *c′* to strike the lever D and rock or move it, so as to bring the contacts *c d* at the end nearest the solenoid B′ in contact with the contacts *a b* of said solenoid, when the lever E will be rocked or moved so as to separate the contacts of the solenoid B and the adjacent contacts of the lever E, when the solenoid B′ will be mag-

netically energized and will attract the armature C, and thus drive out the tool-stock F and the tool *e* and carry the piston H in an outward or downward direction, forcing the air in front of said piston through the opening *m'* in front of the piston to the tool end of the machine and out through the opening *m* and disk W, sucking open the valve *j* and sucking in the air through the passage J into the cylinder I back of the piston H. The above operation will then be repeated.

When the swelled portion *c'* of the armature is midway between the solenoids or midway of the lever E, the contacts of said levers will be in conjunction with the contacts of the two solenoids. (See Fig. 5.) The current will pass through both solenoids and energize the same equally, so that if neither gravity nor any other power be exerted to move the armature in either direction the pull will be equal at both ends of the armature and it will remain at rest, with a current passing through both solenoids. As soon as the lever E is rocked in either direction the contacts at one end or the other will not be separated before those at the other end are in conjunction, and consequently the circuit will never be broken and the armature will never entirely lose its magnetism.

As before stated, the tool-stock F and connecting parts will be slightly rotated in their inner movements to enable the tool *e* to make its next stroke at a different angle; but said stock and connecting parts will make their outward stroke in a direct line.

The speed of the movement of the armature and tool-stock in either direction may be regulated by the disks M and W, as above described, owing to the cushions of air formed in front of and back of the piston and the regulation of the withdrawal of such air.

The reciprocating movement of the piston will cause a blast of air to be forced down within and through the solenoids and through the passage L to the tool end of the machine, and through the passage-way K, and the solenoids, said blast acting to blow away the dust and chips caused by the operation of the tool. During the operation of the machine and the movement of the reciprocating parts there will be a current of air through the solenoids and surrounding the armature and tend to keep them cool.

By the adjustment of the spring-contacts *a b* and *c d* and the adjustment of the lever E the current is switched off from one solenoid to the other before the circuit is broken by the movement of the armature C *c'*.

S and T are two insulating-tubes, the latter being inclosed within the former and said tubes being inserted transversely in the cap N. Each of said tubes incloses a pole-piece of some conducting material. The pole-piece *y'*, inclosed within the larger tube, is also in the form of a tube and surrounds and is in contact with the smaller insulating-tube T, and the pole-piece *x'* is in the form of a cylindrical core and fills the inner and smaller insulating-tube T. The two pole-pieces *x'* and *y'* will thus be insulated from each other and from the rest of the machine by the tubes S and T. Similar tubes and pole-pieces are inserted in the end of the head O and are in line with those in the cap N, so that when the cap is secured to said head the corresponding pole-pieces and insulating-tubes will be in contact with each other. The wires *x* and *y* connect with the pole-pieces *x'* and *y'* in the cap N, and the wires x^2 and y^2 leading to the lever B connect with the pole-pieces *x'* and *y'* in the head O.

The above construction allows a complete and very tight joint, especially if the pole-pieces project outward from the cap N or head O to enter into the tubes S and T of adjacent part of machine. Said construction also permits of the machine being stopped or operated in a moment by simply separating or bringing the pole-pieces of the head O and cap N together by unscrewing or screwing up said cap.

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

1. In combination with an electric circuit, two or more electro-magnetic devices, an armature adapted to be reciprocated by the magnetic devices, and a non-circuit-breaking commutator adapted to be actuated directly by the reciprocating armature to alternately change the course of the current to alternately energize the magnets, and thereby cause the armature to reciprocate without breaking the circuit and without said armature losing its magnetism.

2. In combination with an electric circuit, two or more electro-magnetic devices, an armature and rod connected to said armature and said armature and rod adapted to be reciprocated by the magnetic devices, and a non-circuit-breaking commutator adapted to be actuated directly by the reciprocating part of the apparatus to alternately change the course of the current to alternately energize the magnets, and thereby cause the armature and rod to reciprocate without breaking the circuit and without said armature losing its magnetism.

3. An electro-magnetic engine composed of electro-magnetic devices, an armature and rod connected with said armature, said armature and rod adapted to be reciprocated by the magnetic devices, and a non-circuit-breaking commutator for changing the course of the current from one magnet to the other, and the entire mechanism above named inclosed in a casing, and means for making the electrical connections between the electrical parts in the casing and an outside electric circuit.

4. An electro-magnetic engine composed of electro-magnetic devices, an armature and rod connected with said armature, said armature and rod adapted to be reciprocated by the magnetic devices, and a non-circuit-breaking commutator for changing the course of

the current from one magnet to the other and actuated directly by the reciprocating part of the engine, and the entire mechanism above named inclosed within a casing, and means for making the electric connections between the electric parts in the casing and an outside electric circuit.

5. An electro-magnetic engine composed of electro-magnetic devices, an armature and rod connected with said armature, said armature and rod adapted to be reciprocated by the magnetic devices, and a non-circuit-breaking commutator for changing the course of the current from one magnet to the other, and a pneumatic speed-regulator for said reciprocating parts, and the entire mechanism above named inclosed within a casing, and means for making the electric connections between the electric parts within the casing and an outside electric circuit, and means by which air is admitted to and allowed to escape from the pneumatic regulator.

6. In combination with two or more electro-magnetic devices, a reciprocating armature, a rod connected with said armature and having a spiral groove, the ratchet *g*, loosely journaled on said rod, inclosed in the casing *f*, and having a spline engaging with said groove, and a spring-dog extending inwardly from said casing and engaging with the teeth of the ratchet *g*, all as and for the purpose set forth.

7. In combination with two or more electro-magnetic devices, a reciprocating armature, a piston connected with the same, the piston-cylinder, a pneumatic speed-regulator for said piston, and means for controlling the passage of air through the regulator, all as and for the purpose set forth.

8. In combination with two or more electro-magnetic devices, a reciprocating armature, a piston connected with the same, the piston-cylinder, and an air-passage leading from said cylinder to the tool end of the machine, all as and for the purposes set forth.

9. In combination with an electro-magnetic engine, the casing A, having the screw-thread *r*, the sleeve P, and leg Q, the handle R, spring-dog *s*, and trigger *s'*, all arranged and adapted for the purposes set forth.

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

HENRY S. McKAY.

Witnesses:
HAYES LOUGEE,
JOHN G. ROBINSON.