(No Model.)

C. J. VAN DEPOELE.

ELECTRO MAGNETIC RECIPROCATING ENGINE.

No. 320,515. Patented June 23, 1885.

Fig. 1.

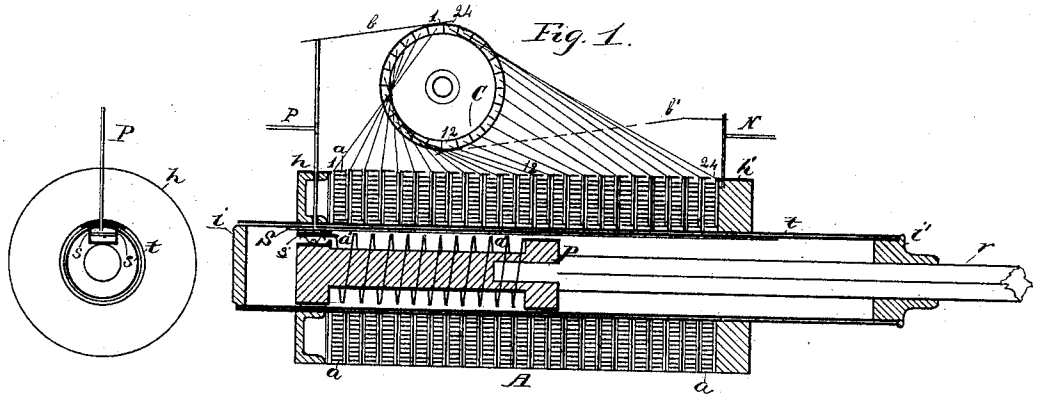
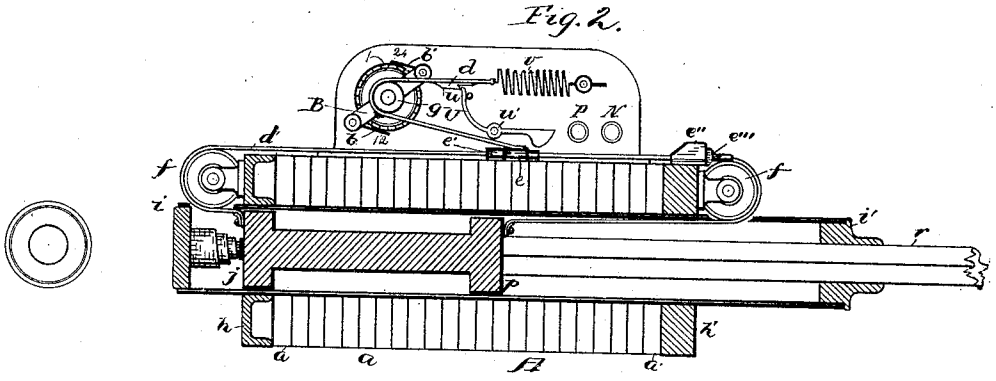


Fig. 2.



Witnesses

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UNITED STATES PATENT OFFICE.

CHARLES J. VAN DEPOELE, OF CHICAGO, ILLINOIS.

ELECTRO-MAGNETIC RECIPROCATING ENGINE.

SPECIFICATION forming part of Letters Patent No. 320,515, dated June 23, 1885.

Application filed February 20, 1885. (No model.)

To all whom it may concern:

Be it known that I, CHARLES J. VAN DEPOELE, a citizen of the United States of America, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Electro-Magnetic Reciprocating Engines, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to certain improvements in electro-magnetic reciprocating engines, more especially of that class designed for mining coal, drilling rocks, &c.; and the invention consists in the peculiar construction and arrangement and the combinations of parts hereinafter more particularly described and claimed.

In the accompanying drawings, Figure 1 represents a diagrammatic section showing the electrical circuits and the connection of the sections of the solenoid with the sections of the commutator. Fig. 2 shows a vertical longitudinal section through the core and solenoid with parts in elevation.

Referring now to the details of construction, A is a solenoid made up of a series of sections, *a a*, formed of coils of copper strips, the layers of which are properly insulated from each other. Each section is slipped on a brass tube, *t*, and then the inside terminal of the first coil is connected to the outside terminal of the second coil, the inner terminal of the second coil to the outer terminal of the third coil, and so on throughout the entire series. The outer terminals are each connected to a corresponding section of a commutator, C, as shown in Fig. 1, the first coil being connected to the first section of the commutator, the second coil to the second section of the commutator, and so on throughout the entire series of coils and sections.

Within the tube *t* runs a plunger or core, *p*, around which is coiled a copper wire, *a'*, through which a current flows constantly in the same direction, thus always magnetizing the plunger or core with the same polarity. One terminal of this coil is permanently connected with the iron plunger, while the other end is insulated from the same, and is connected to a sliding contact-piece, *s*, traveling with the plunger *p*, and rubbing on a stationary contact-piece, S, running the full length of the solenoid and insulated from the tube *t*.

At *b b'* are represented brushes, secured in suitable brush-holders, B, and insulated from each other, which brushes are made to travel to and fro over the commutator C, describing each time a half-revolution or less by means of the following mechanism:

The brush-holders B are attached to a pulley, *g*, around which a belt, *d*, passes, one end of which is attached to a spring, *v*, while the other end is secured to a sleeve, *e*, through which passes another belt, *d'*, passing around pulleys *f f*, and whose opposite ends are secured to the opposite ends of the plunger *p*.

Firmly fixed to the belt *d'* are two collars, *e'* and *e'''*, and loosely sliding thereon is a heavy sleeve or slide, *e''*.

To the belt *d'* is firmly secured a catch, *u*, into which catches the end of a detent, U, pivoted at *u'*.

At opposite ends of the solenoid are shown cast-iron heads *h h'*, the latter being the heavier, and is intended to increase the speed and strength of the forward motion of the plunger *p*, while the other one is hollow or recessed, so as to be lighter and to have less attraction than the opposite head, as the plunger does no work on its return-stroke, and to check the momentum of the plunger at its backward stroke a spring, *j*, is secured inside the head *i*.

To the plunger is firmly fixed a rod, *r*, preferably of brass or bronze, to which is to be affixed a tool—such as a drill, &c.—which rod passes through the head *i'*, carried by the other end of the tube *t*.

P and N are the positive and negative poles, respectively.

The circuits in the apparatus are as follows: The current from any source enters at P, and by suitable connection passes to the brush *b*, thence to the commutator through a certain number of coils of solenoid A, and out of commutator by brush *b'* to negative pole N. The coil *a'* of plunger *p* is in a derivation from the brushes *b* and *b'*, and the current from P thus enters through a suitable conductor the insulated strips S, and by sliding contact *s* enters *a'* and leaves by the opposite terminal through the plunger *p*, tube *t*, and head *h'* to negative

pole N. A number of coils in the solenoid corresponding to the position of the brushes *b* and *b'* are thus always in a derivation from the coil around plunger *p*. As will be readily understood, by moving the brushes *b* and *b'* upon the commutator C the points of entering and leaving of the current through the coils *a' a'* are changed according to the position of the brushes, and since the north and south poles of the solenoid correspond to the points of entrance and leaving of the current, we can thus produce a corresponding motion of the plunger *p*.

Having thus described the different parts of my engine and the mode of sending the current through the different parts, I will now explain the operation of the machine in practice.

On establishing the circuit with a suitable source of electricity between the poles P and N, and admitting the plunger *p* to be at the back end of the stroke and the parts in the position shown in Fig. 2, the brushes upon the commutator will stand in such a position as to send the current through the solenoid A from 12 to 24. Thus the plunger will be thrown forward until it reaches the outer edge of *h'*. At the same time that the plunger makes its forward motion the belt *d'* causes the collars and slide *e'*, *e''*, and *e'''* to move backward, and when *e''* comes in contact with the weighted end of the detent U it lifts the same and causes its opposite end to disengage from the catch *u*, thus freeing the belt *d* and allowing it to be operated by the spring *v*, which causes the brushes *b* and *b'* to change their position, so that the current enters now at 1 and leaves at 12, thus causing the plunger to move backward to its original position, as shown in Fig. 2. The plunger, in moving backward, carries the belt *d'* forward, so that the collar *e'*, striking *e*, pulls on the belt *d*, and thus changes the position of the brushes *b* and *b'*, so as to to send the current to the forward sections. As soon as the catch *u* is drawn far enough back the detent U engages with it, and thus the change of the position of the brushes is prevented until during the forward stroke of the plunger *p*, when the slide *e''* again disengages the detent U from the catch *u*. This causes the plunger *p* and rod *r* to be again thrown back, and these movements are repeated with a force and celerity corresponding to the strength of the current used as long as the current is supplied to the machine. Let us now suppose that the apparatus is set in motion without the tool striking any object in its course. It will be readily seen that the stops *e'* and *e'''* will operate the shifting of the brushes, and that the machine will continue to run perfectly in this condition; but now let us suppose that the tool strikes some obstacle and prevents the full stroke of the plunger. The result will be that the detent U would not be tripped, and consequently the machine would be at a standstill were it not for the loose slide *e''*, which now comes into play, for the moment the plunger comes to a standstill the momentum gained by the slide *e''* (which is made heavy for that purpose) will cause it to move forward and trip the detent U, thus reversing the brushes upon the commutator and causing the plunger to move backward and set the brushes for another forward stroke, when the tool will again be brought in contact with the substance it has to strike, and the slide *e''* will again, through its momentum, fly on its course and trip the detent U. Thus it will be seen that, no matter whether the plunger runs its full course or not, the brushes will be worked just the same, thus keeping up the motion of the machine. It will of course be understood that the backward stroke is always the same, the plunger stopping at the same point, no matter how long or how short may be the forward thrust. It will be seen that as the brushes change their position the course of the current will be gradually changed, for as they move around the commutator they will bear in succession on sections 1 and 12, next 2 and 13, then 3 and 14, and so on, so that the current gradually changes from one half of the sections to the other half.

The object of using a coil around the plunger and making it an electro-magnet is to diminish the current required in the large solenoid without decreasing the power of the machine, and at the same time to reduce to a minimum the spark on the commutator and brushes on the shifting of the current by the same. I find in practice that the coil around the plunger should be in a derivation from the coils in the large solenoid, (the coils brought in circuit by the brushes *b* and *b'*,) so that the coils *a a a* between *b* and *b'* are parallel with the coil *a'* of the plunger.

I do not intend to limit myself to the precise device shown in Fig. 2 for the shifting of the brushes, as many other equally efficient devices may be devised to accomplish the same result without departing from the spirit of my invention.

What I claim as new is—

1. In an electro-magnetic reciprocating engine, a sectional solenoid, as described, having an iron core wound with suitable coils of wire, making the same an electro-magnet, the coils of said core being in parallel circuit with the coils in the solenoid A, through which the current flows, substantially as described.

2. In an electro-magnetic reciprocating engine, a sectional solenoid, A, having an electro-magnet for its core and current-controllers for shifting the current in the sectional solenoid, so as to cause the electro-magnetic core to make a to-and-fro movement within the solenoid, substantially as described.

3. In an electro-magnetic reciprocating engine, a sectional solenoid, A, provided with an electro-magnet for its core, having its coil connected alternately with the sections on the opposite ends of the solenoid, and through which the current is passing, substantially as described.

4. In an electro-magnetic reciprocating engine, a sectional solenoid having movable core

and a belt connected with and moved by said core for shifting the current in the sectional solenoid to produce a continual reciprocating motion of said core, substantially as described.

5. In an electro-magnetic reciprocating engine, a sectional solenoid, the successive coils of the same in electrical communication with the sections of a commutator, said commutator being provided with a semi-rotary brush-holder carrying positive and negative brushes and automatically moving said brushes over the commutator to shift the current in the sectional solenoid, and thus cause it score to be moved to and fro, substantially as described.

6. In an electro-magnetic engine, a sectional solenoid having a movable core, which in its backward movement moves the brushes over the commutator, in combination with a sliding weight for changing the position of the brushes on the cessation of the forward motion of the core, substantially as described.

7. In an electro-magnetic engine, a sectional solenoid, an electro-magnet, as a core, having its current always in the same direction, and a current-controller for changing the course of the current through the solenoid, substantially as described.

8. In an electro-reciprocating engine, a sectional solenoid having a commutator and movable brushes upon the same, and a core or plunger moved to and fro by the electro-magnetic action of the solenoid, said core or plunger carrying at its forward end a rod for receiving a tool, and connection between the core and the brushes for shifting the brushes of the commutator and causing the displacement of magnetic attraction between the sections of the solenoid and the movable plunger, substantially as described.

9. In an electro-magnetic reciprocating engine, a sectional solenoid having at each end thereof an iron disk for strengthening the action of the core and preventing its motion being carried too far, substantially as described.

10. In an electro-magnetic reciprocating engine, a sectional solenoid having at each end thereof an iron disk, the disk at one end being the heaviest to increase the force at that end, substantially as described.

In testimony whereof I affix my signature, in presence of two witnesses, this 13th day of February, 1885.

CHARLES J. VAN DEPOELE.

Witnesses:

WM. A. STILES,

J. EASON.