No. 812,511. PATENTED FEB. 13, 1906.

E. H. MILLER.

ELECTROMAGNET.

APPLICATION FILED APR. 25, 1904.

2 SHEETS—SHEET 1.

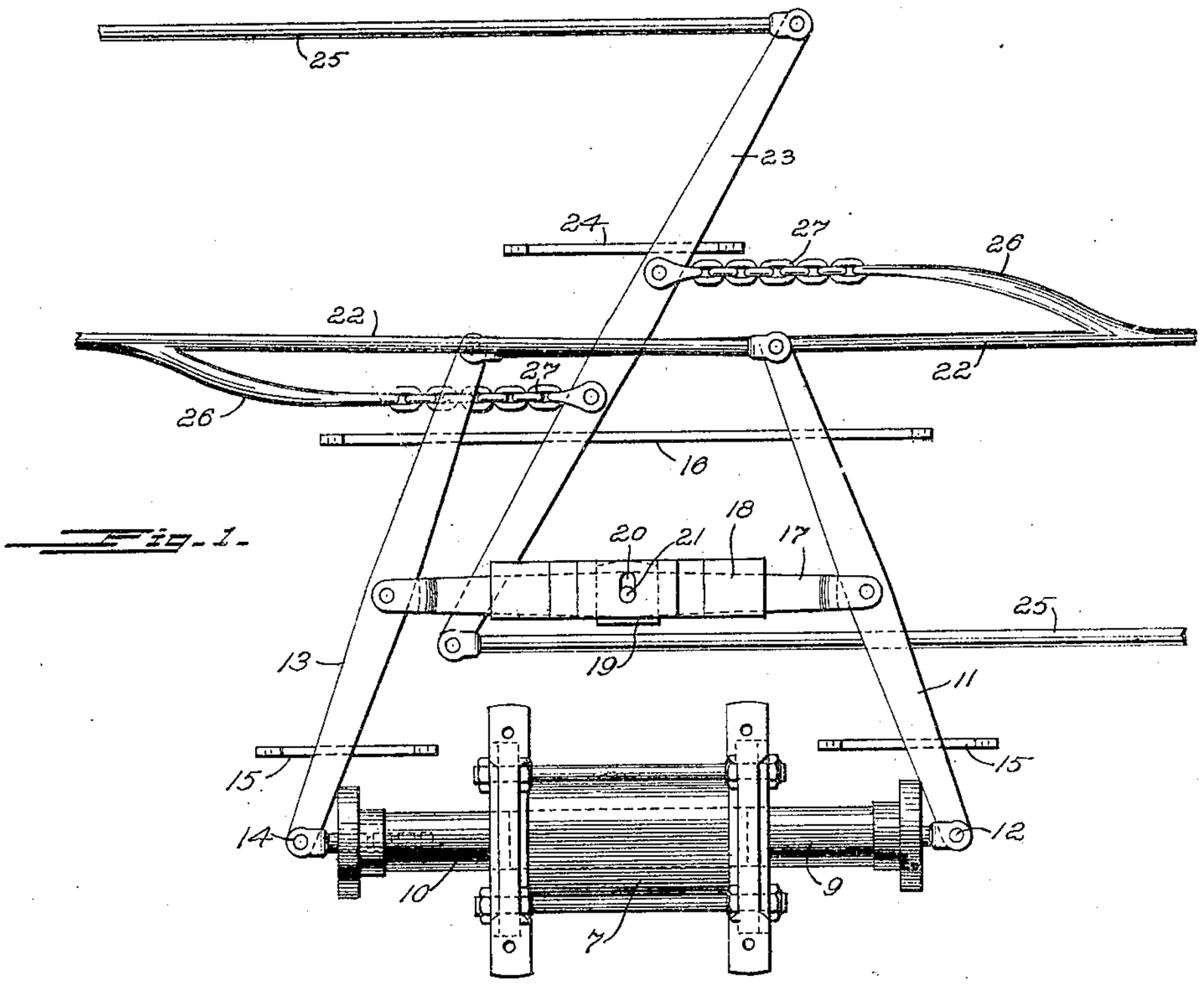

Fig. 1.

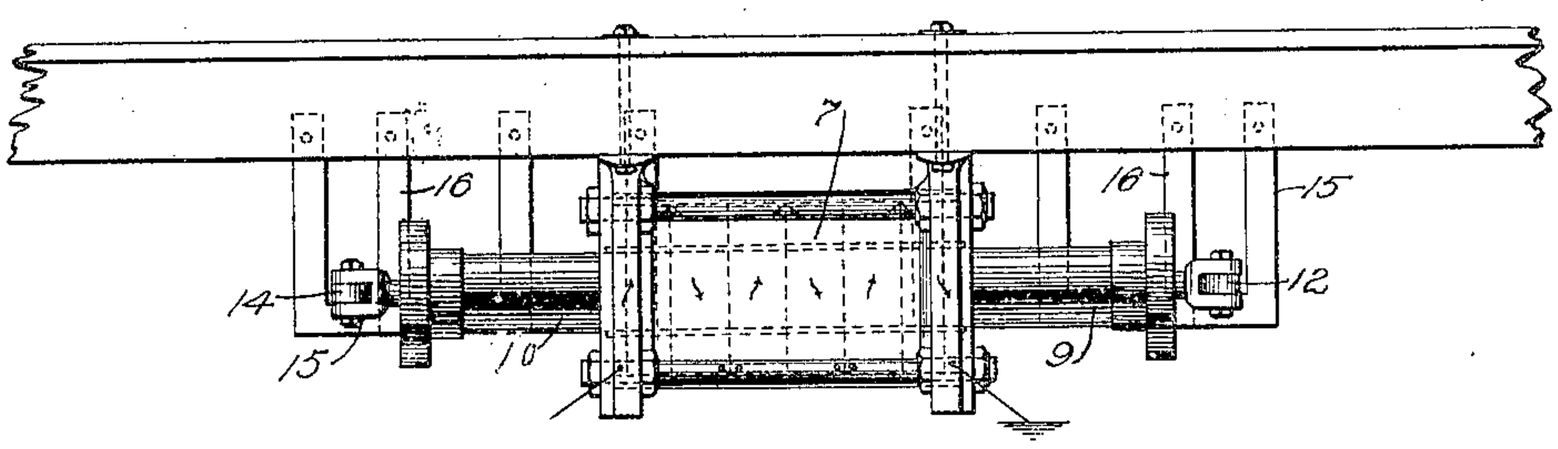

Fig. 2.

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2 SHEETS—SHEET 2.

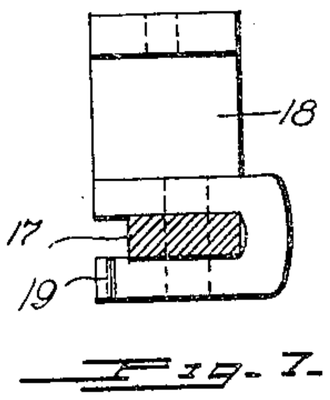

Fig. 7.

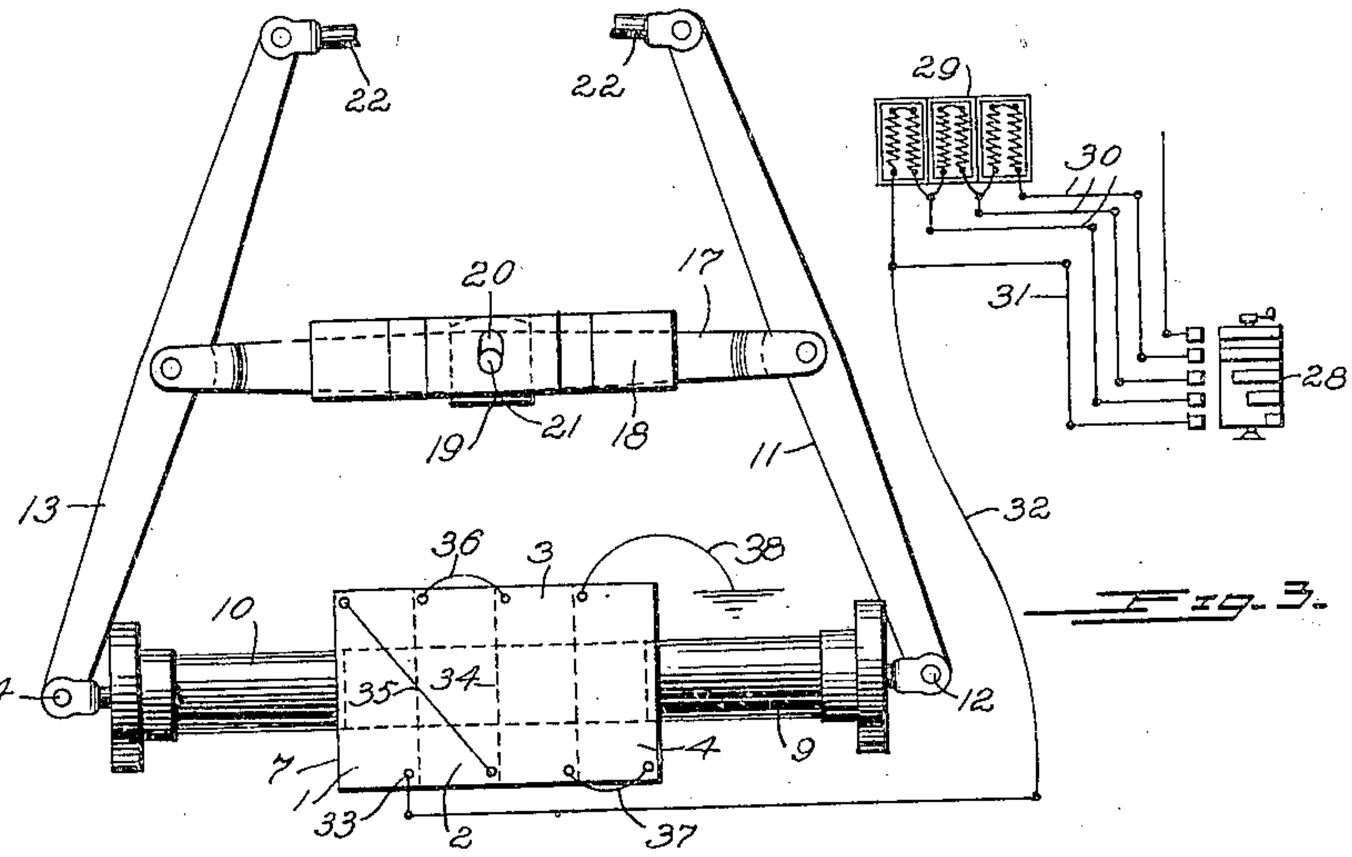

Fig. 3.

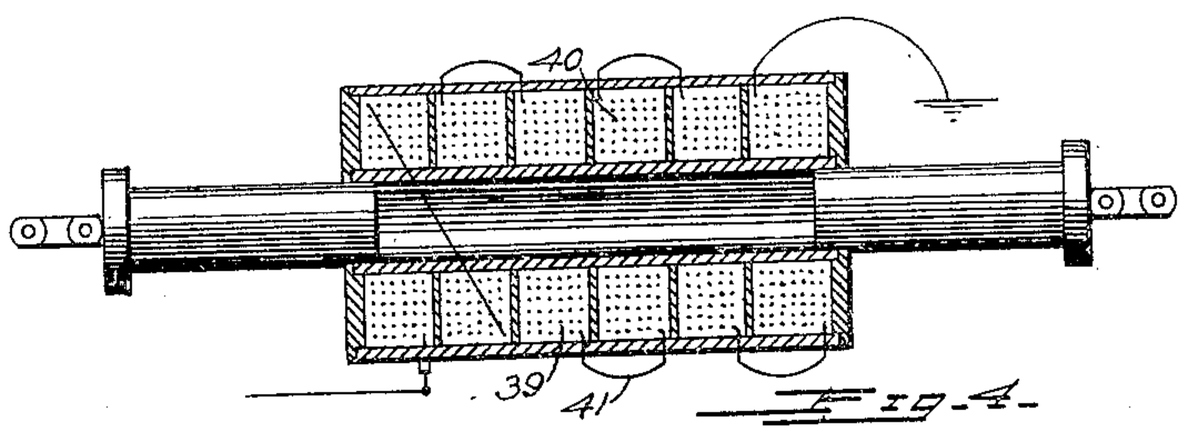

Fig. 4.

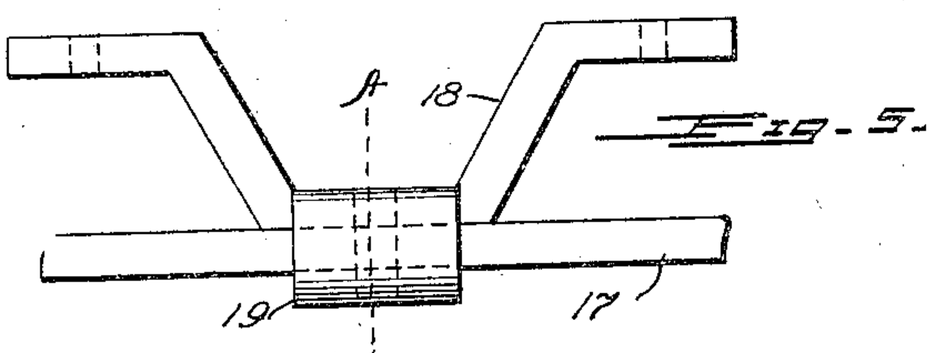

Fig. 5.

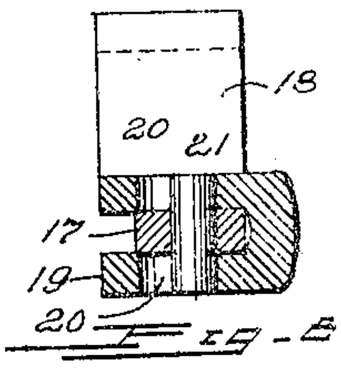

Fig. 6.

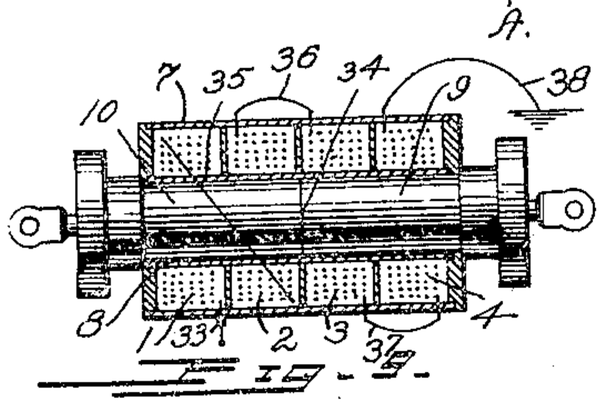

Fig. 9.

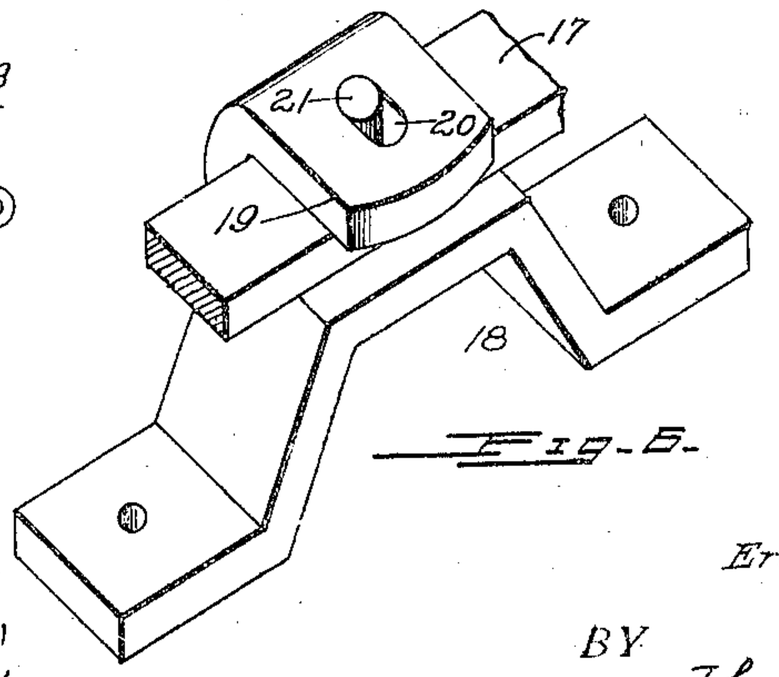

Fig. 8.

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ELECTROMAGNET.

No. 812,511. Specification of Letters Patent. Patented Feb. 13, 1906.

Application filed April 25, 1904. Serial No. 204,692.

To all whom it may concern:

Be it known that I, ERNEST H. MILLER, a citizen of the United States, residing at Lancaster, in the county of Lancaster and State of Pennsylvania, have invented certain new and useful Improvements in Electromagnets, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to electromagnets, and more particularly to an improved solenoid which I have devised especially for operating the brakes of street and railway cars, though it is capable of and designed for general application.

The primary object of the invention is to provide an improved electromagnet or solenoid possessing great power, the described embodiment having two oppositely-movable cores and two or more coils at each side of its center, whereby the lines of force are concentrated and a powerful magnetic field produced, with the center of attraction at the center of the solenoid, so that when it is energized its cores will be drawn inward with great force or power for operating the brake mechanism or other appliances in connection with which it is used.

The invention consists, first, in the novel construction of the solenoid and core; second, in the manner of wiring the solenoid, and, lastly, in the construction and combination of various details of construction, as will hereinafter be fully described and then pointed out in the claims.

In the accompanying drawings, which form a part of this specification, Figure 1 is a top plan view of a solenoid and of a lever system illustrating one application of my invention, and Fig. 2 a side elevation thereof. Fig. 3 is a plan view of the solenoid, of the connections with the controller, and of the wiring; and Fig. 4, a longitudinal section of a modified construction of the solenoid, showing the cores drawn out. Fig. 5 is a side view of the hanger supporting the link connecting the brake-levers; Fig. 6, a bottom perspective view of said hanger; Fig. 7, an end view thereof, and Fig. 8 a transverse section on broken line A A of Fig. 5. Fig. 9 is a longitudinal section of the solenoid illustrated in Fig. 3, the cores being drawn in.

Similar numerals indicate like parts throughout the several views.

In the drawings, 7 indicates the solenoid, consisting of a cylinder 8, open at both ends and having coils 1, 2, 3, and 4 arranged, as it were, in two series and so as to throw the center of attraction in the center of the solenoid, as will be more fully described. The core adapted to be operated in said cylinder 8 when the solenoid is energized by the electric current is divided into two sections, or rather there are two cores 9 and 10, which engage opposite ends of cylinder 8, and when the solenoid is energized these cores are drawn toward the center.

11 indicates a brake-lever pivoted to core 9 at 12, and 13 a brake-lever pivoted to core 10 at 14, said brake-levers being supported by stirrups 15 and 16. These brake-levers are connected at or near their centers by a pivoted strut 17, supported by a hanger 18. The hanger 18 has on its under side a horizontally-disposed jaw 19, and in said jaw and in the bottom of the hanger are slots or elongated openings 20, lying in the same general direction as the brake-levers. Strut 17 is engaged in the groove formed by jaw 19 and the bottom of the hanger, and it has a pin 21 passing through it and rigidly secured therein, the ends of which pin engage in said openings 20, wherein they are adapted to move.

22 indicates the rods connecting the brake-beams (not shown) with the ends of the brake-levers opposite the ends pivoted to the cores of the solenoid.

23 is a floating lever supported by stirrups 16 and 24 and having pivoted to the ends thereof brake-rods 25, connecting it with the brake-staffs at opposite ends of the car. Floating lever 23 on opposite sides of its center is attached to rods 22 through chains 27 and spur 26 of said rods.

In operation it being desired to apply the brakes the solenoid is energized, as will be described, when cores 9 and 10 are retracted, throwing outward the ends of the brake-levers pivoted to the rods connecting them with the brake-beams. As the fulcrum-pin 21 of strut 17 is engaged with and free to move in elongated slots 20, such movement compensates for any variation in the distance between the pivotal supports of the equalizing-levers and the ends of the reciprocating cores in different positions of the latter.

Referring to Fig. 3, 28 indicates a controller; 29, a rheostat located between the con-

troller and the solenoid; 30, the conductors from the controller to the rheostat, and 31 a branch conductor directly from the controller to the main conductor 32, connected with the "start" of the coil 1 of solenoid 7, as shown at 33. The coils of this solenoid are so wired that the center of attraction is at the center. 34 of the solenoid. In this wiring the "finish" of coil 1 is connected with the start of coil 2, as shown by conductor 35. The finish of coil 2 is connected with the finish of coil 3 by conductor 36, and the start of coil 3 is connected with the start of coil 4 by conductor 37, while the finish of coil 4 is grounded through conductor 38. The result of this mode of wiring the coils of the solenoid is that any matter subject to magnetic influence when placed at either end of cylinder 8 will be drawn to its center and there held, or an iron rod will be drawn in from either end and will be centered at the center of said cylinder. So, also, the cores 9 and 10, occupying the positions illustrated in Fig. 3, when the solenoid is energized said cores will be drawn toward the center of said solenoid, as shown in Fig. 9. In the magnet thus constructed the lines of force are concentrated, and a powerful magnetic field is produced, the power of the magnet being much greater with the two cores than with a single core, as demonstrated by the fact that with but one division-core introduced into the end of cylinder 8 and the solenoid being sufficiently energized to draw the core into the cylinder when one man can withdraw said core against the attraction of the solenoid with the same amount of electrical energy, and with both divisions of the core drawn into said cylinder it is impossible for the strength of two men, one at the outer end of each division of the core, to produce any effect on said divisions as against the attraction of the solenoid. This attraction is as fully exerted if one of the cores is altogether in the tube before the solenoid is energized to draw the other core in.

Fig. 4 illustrates the wiring of a core having six coils. The adjacent center coils 39 and 40 have their starts connected by a conductor 41.

I do not restrict myself to the manner of wiring the solenoid, or to other details of construction herein shown and described, as it is obvious that many alterations may be made therein without departing from the principle and scope of my invention.

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

1. A solenoid having two or more coils at each side of its center, similar terminals of the center coils being electrically connected and the opposite terminal of one of said center coils being electrically connected with a dissimilar terminal of an outer coil, the latter having its other terminal connected with the feed-wire.

2. A solenoid having two or more coils at each side of its center with similar terminals of its center coils electrically connected, the opposite terminal of one of said center coils being electrically connected with a dissimilar terminal of an outer coil, and the latter having its other terminal connected with the feed-wire; the center and outer coil at the opposite side of the magnet also having similar terminals electrically connected.

3. A solenoid comprising a series of coils with electrical connections between similar terminals of the center coils and oppositely-movable reciprocating cores working in an opening through the centers of the coils.

4. A solenoid having a series of coils arranged in corresponding groups at each side of the center of the magnet with similar terminals of the center coils electrically connected together, and oppositely-movable reciprocating cores fitted in an opening through the centers of the coils.

5. A solenoid having a series of coils encircling a central opening, a pair of oppositely-movable reciprocating cores fitted in said opening, and electrical connections between similar terminals of successive coils for completing a circuit through the several coils.

6. A solenoid comprising a plurality of coils at each side of its center, and a core in two parts adapted to approach each other when the solenoid is energized, the center coils having similar terminals connected and an opposite terminal of one of said center coils connected with a similar terminal of one of the outer coils, dissimilar terminals of the opposite center and outer coils being connected, and the opposite terminal of the latter coil being connected with the feed-wire, substantially as described.

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Witnesses:
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WM. R. GERHART.