

(No Model.)

A. D. AYRES.
ELECTRO MAGNET.

No. 476,236.

Patented June 7, 1892.

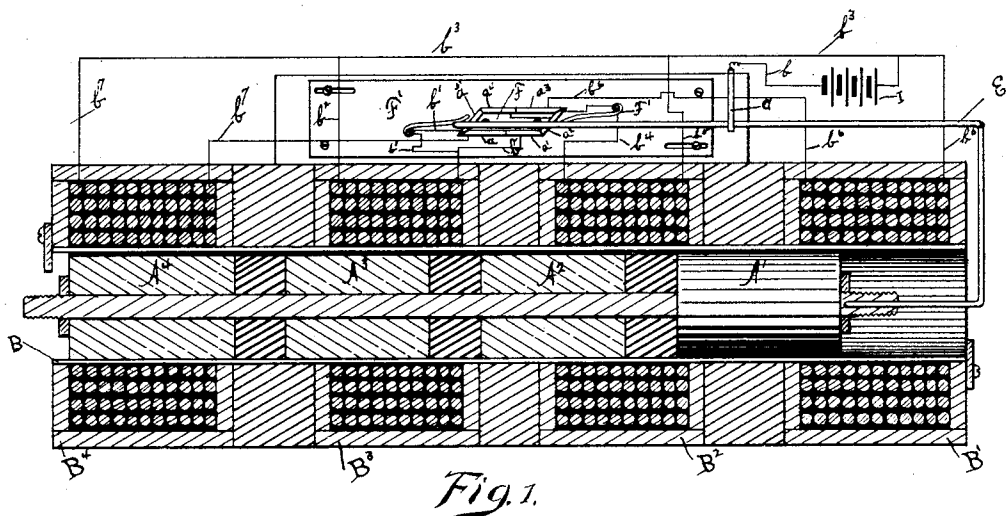
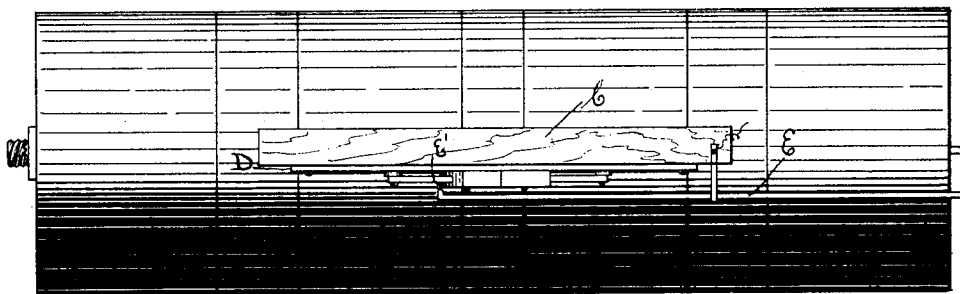


Fig. 2.



Witnesses.

Clare A. Williams,
Julius Schuster

Inventor.

Andrew Q. Ayres.
Hawes *Lucy*
his attys.

UNITED STATES PATENT OFFICE.

ANDRUS D. AYRES, OF KALAMAZOO, MICHIGAN.

ELECTRO-MAGNET.

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Application filed September 15, 1891. Serial No. 405,767. (No model.)

To all whom it may concern:

Be it known that I, ANDRUS D. AYRES, a citizen of the United States, residing at the city of Kalamazoo, in the county of Kalamazoo and State of Michigan, have invented a certain new and useful Improvement in Electro-Magnets, of which the following is a specification.

The object of my invention is to secure a long pull from electro-magnets. I attain this end by means of the arrangement and combination of a series of iron-clad or paramagnetically-incased coils consisting of separate and independent incased coils having movable cores, said cores being the armatures and so arranged and constructed that the current will pass from one coil or magnet to the others consecutively, energizing one after another, thereby causing the armatures to move, each coil drawing the armatures a predetermined distance, thereby forming a complete or nearly-complete magnetic circuit between the armature and incasement, at which instant the current changes into another coil where the armature of the coil to which the current changes is in an operative position, causing the armatures to travel a certain other predetermined distance, and so on to the end of the series, thence by proper commutation back again, if desired. By this means the armatures are caused to move any desired distance, said distance being regulated by the construction and arrangement of the magnets and armatures. It is not in all arrangements necessary that it should be the magnet or coil immediately next following to which the current changes or that but one magnet should be energized at a time, for the construction can be such that it will change to any coil in the series or so built that any desired number of coils will be simultaneously excited. In this construction of the magnets it is highly important that the cores or magnets (which ever are constructed to move) should be arranged in such a position relatively to each other and to the stationary portions that when one coil shall have performed its function the case and core and the coil or coils next energized will bear to each other such a relation that the same action will take place as in the ones preceding it—that is, the configuration of the two must be such that as mem-

bers of a magnetic circuit they will be susceptible of a change in form or position. The construction can be best facilitated by employing separate cores and incasements with coils therein, incased coils and cores being magnetically separated but bound together, as shown in the drawings, wherein similar letters refer to like parts throughout the figures.

Figure 1 is a longitudinal section of the device taken through the center. Fig. 2 is a top view of the complete device and shows the contact between the brush and commutator.

A¹, A², A³, and A⁴ represent the core-armatures.

B¹, B², B³, and B⁴ represent shells in which the coils are placed on the brass tube B, and are preferably made of soft iron.

B represents the brass tube separating the coils from the armatures.

C is a piece of ebonite.

D is an adjustable ebonite plate.

E is a commutator-brush.

E' is a platinum point on the brush shown in Fig. 2.

F is a commutator.

F' represents two guide-springs.

a, a', a², a³, a⁴, and a⁵ represent different sections of the commutator F.

I represents the source of electricity.

b, b', b², b³, b⁴, b⁵, b⁶, and b' represent current-wires.

G is a light spring-brush resting on the arm E.

My device operates as follows, particular reference being had to Fig. 1: In this figure the cores are represented in such a position that a magnetic circuit is completed between the armature A⁴ and the casing or magnet B⁴. In this position the brush E has shifted to the guide-spring F' the point E', resting on the spring F', the spring-brush so adjusted that it seeks an equilibrium, and will spring to F' from a. Now should a circuit be made through the battery I, the current will follow b through G and E to spring F', and a⁵ b' to the helix around B³, thence by b² and b³ to the battery I, completing the circuit. This energizes B³ and draws A³ toward the right end, moving all the cores until the magnetic circuit between A³ and B³ is nearly completed, at which instant the brush E passes to a⁴ another sec-

tion of the commutator, and the core A^2 will have reached, with reference to the magnet B^2 , an operative position. The current will then, passing from the brush E, complete the circuit through a^4 , the wire connecting with $a^3 b^4$, helix of B^2 , and b^5 and b^3 to the battery I, energizing B^2 , and by drawing A^2 nearly close the magnetic circuit between B^2 and A^2 , at which instant E will have passed to a^3 and A^1 will have reached an operative position with reference to B^1 , when the current, again passing from E, will complete the circuit through $a^3 b^6$, helix of B^1 , and b^6 to the battery I, energizing the magnet B^1 and inductively the armature A^1 and drawing A^1 till the magnetic circuit between B^1 and A^1 will have been nearly or quite completed, at which instant E will spring to F' , A^2 being in an operative position with reference to B^2 , completing the circuit through G, E, spring F' , b^4 , helix of B^2 , and b^5 to the battery I, energizing B^2 and drawing A^2 to the left till it shall have nearly completed a magnetic circuit, at which instant E will have passed to a' and A^3 , being brought by such action to an operative position with reference to B^3 , the circuit being completed through G, E, a' , b' , helix of B^3 , b^2 , and b^3 . This energizes B^3 and draws A^3 to the left till a magnetic circuit shall have been nearly completed between B^3 and A^3 , at which instant E will pass to the next section a of the commutator, and A^4 will have been brought to an operative position with reference to B^4 , when the circuit will be completed through G, E, a , b' , helix of B^4 , b' , and b^3 and will energize B^4 and draw A^4 to the left till a magnetic circuit shall have been nearly or quite completed between B^4 and A^4 , when E will spring to F' , leaving the magnets and armatures in the original position. This action will continue as long as a sufficient current continues. It will be seen that that section of the commutator marked a^5 is connected by b' with F' , and that the other section marked a^2 is connected with F' at the other end and also to a^4 . The object of this is to insure a circuit through whichever one

of these points E should come in contact. It is seen from this explanation that there is always an armature in an operative position with its relative magnet. By the expression "operative position" I mean such a relative position of an armature to its magnet or a magnet to its relative armature that when a magnet is energized the armature becoming inductively magnetized, being a part of the magnetic circuit, will have a greater affinity for the pole of the magnet which is uncovered by the armature, and tend to close the gap between them; or, in other words, that the configuration of the two is such that both being magnets, the proximity of their opposite poles will tend to close the gap by the attraction between them, thus bringing them together until they form a complete or nearly-complete magnetic circuit.

While I have in this application described a particular form of commutator and a certain shape of apparatus, it must be distinctly understood that the invention is not limited to that particular means of supplying current, and is applicable to any shape where several armatures can be fastened together, magnetically separated, and each made to form parts of complete or nearly-complete magnetic circuits, so as practically to produce a long movement of the armatures or magnets.

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

The combination of a series of paramagnetically-incased coils provided with a series of magnetically-divided core-armatures, said armatures being bound together and each armature arranged to form portions of particular magnetic circuits, and a suitable commutator so arranged that the combined armatures are made to partake of the action of the series.

A. D. AYRES.

Witnesses:

CLARE A. WILLIAMS,
JULIUS SCHUSTER.