No. 677,359. Patented July 2, 1901.

J. D. IHLDER.

ELECTROMAGNET.

(Application filed Apr. 17, 1900.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

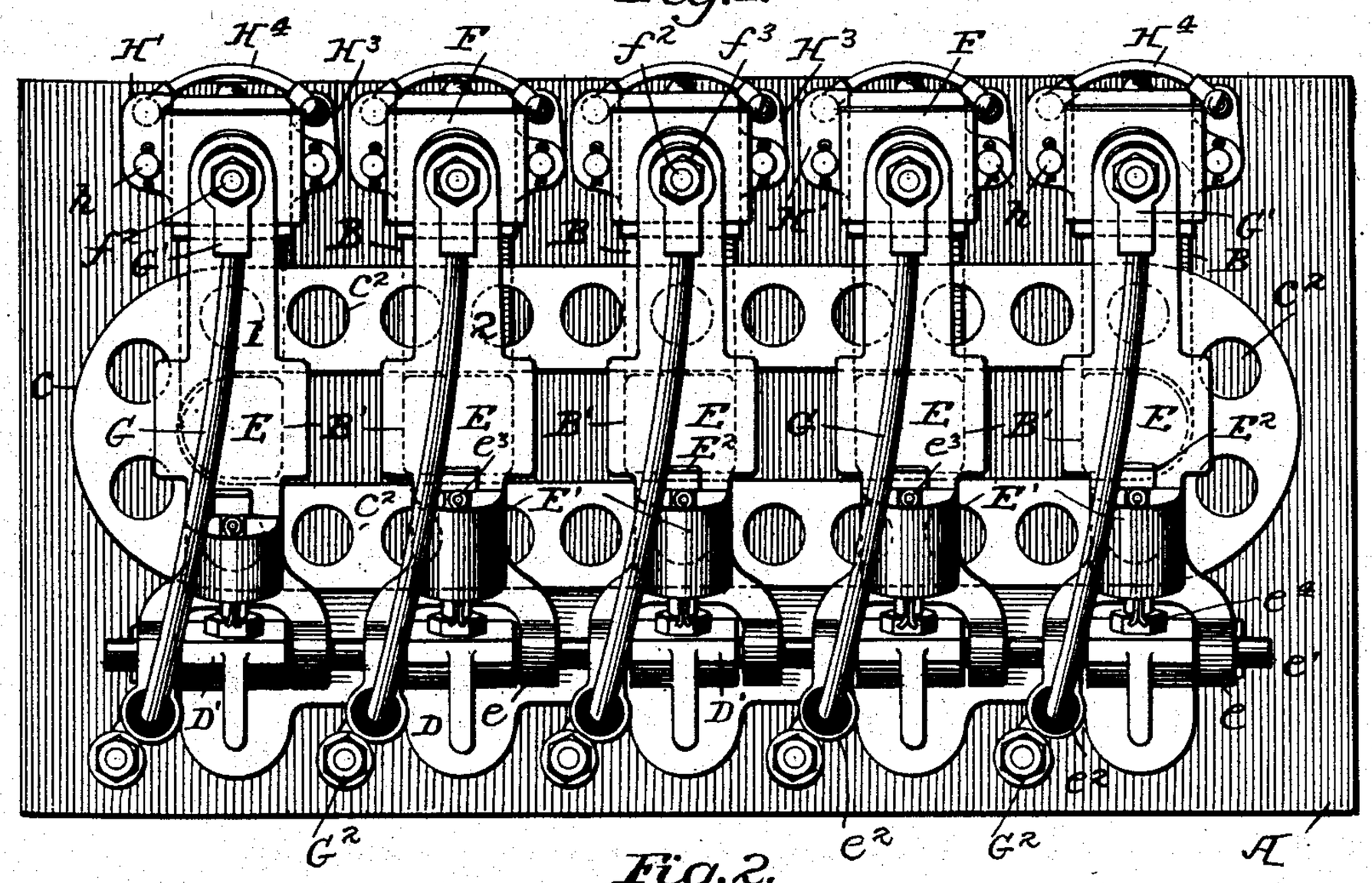

Fig. 2.

Witnesses

F. G. Hinkel

Wm. Gillman, Jr.

Inventor

John D. Ihlder

by Howson & Howson

Attorneys

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Fig. 3.

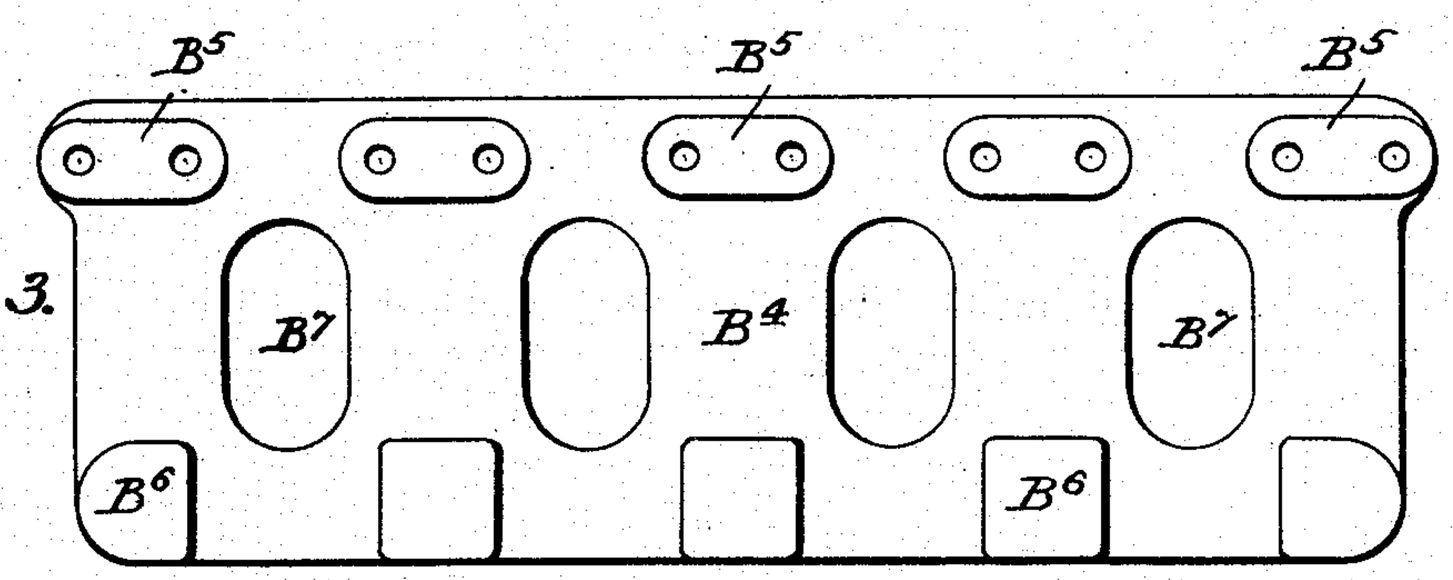


Fig. 4.

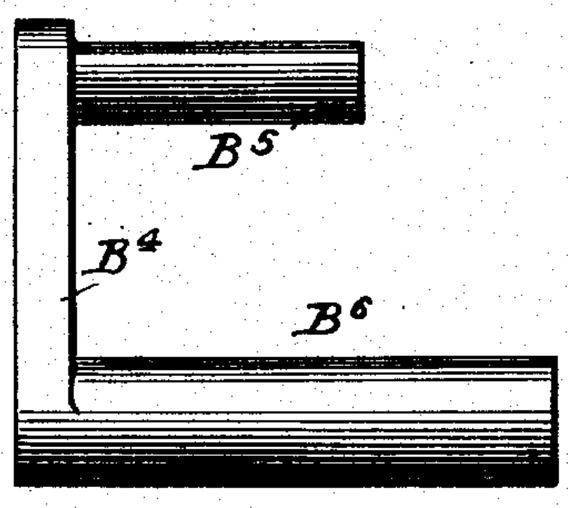


Fig. 6.

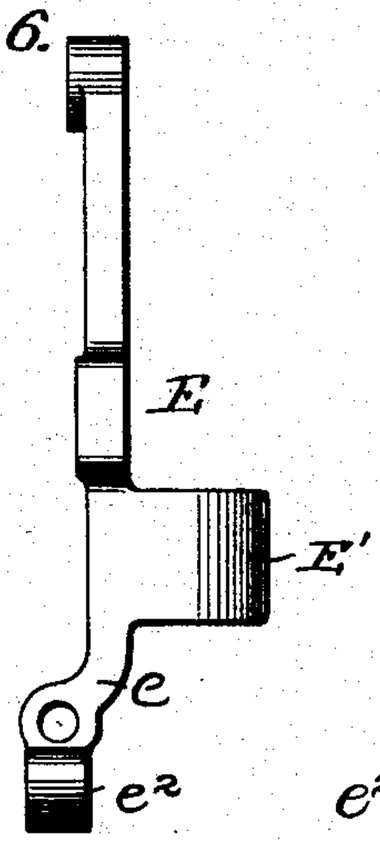


Fig. 5

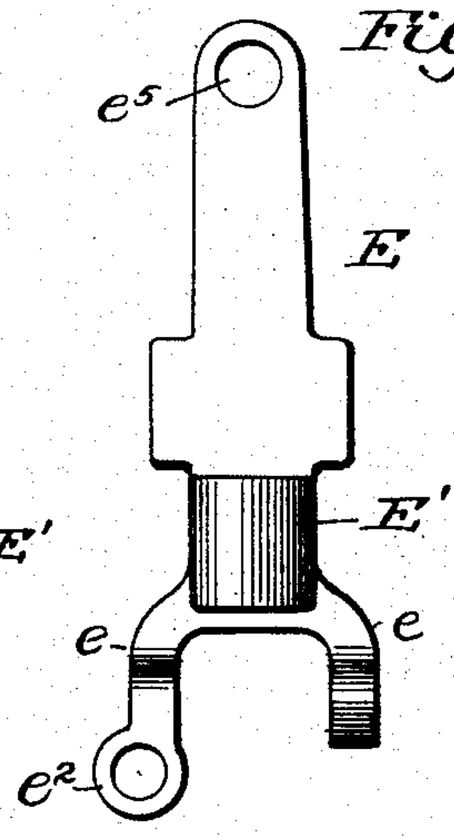


Fig. 7.

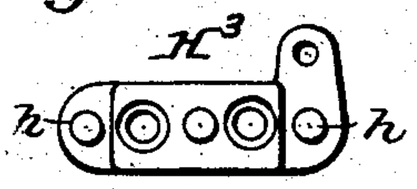


Fig. 8.

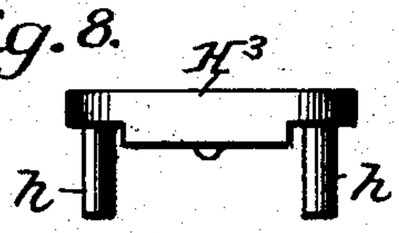


Fig. 9.

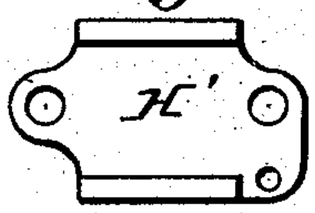


Fig. 10.

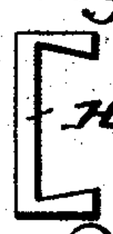


Fig. 12.

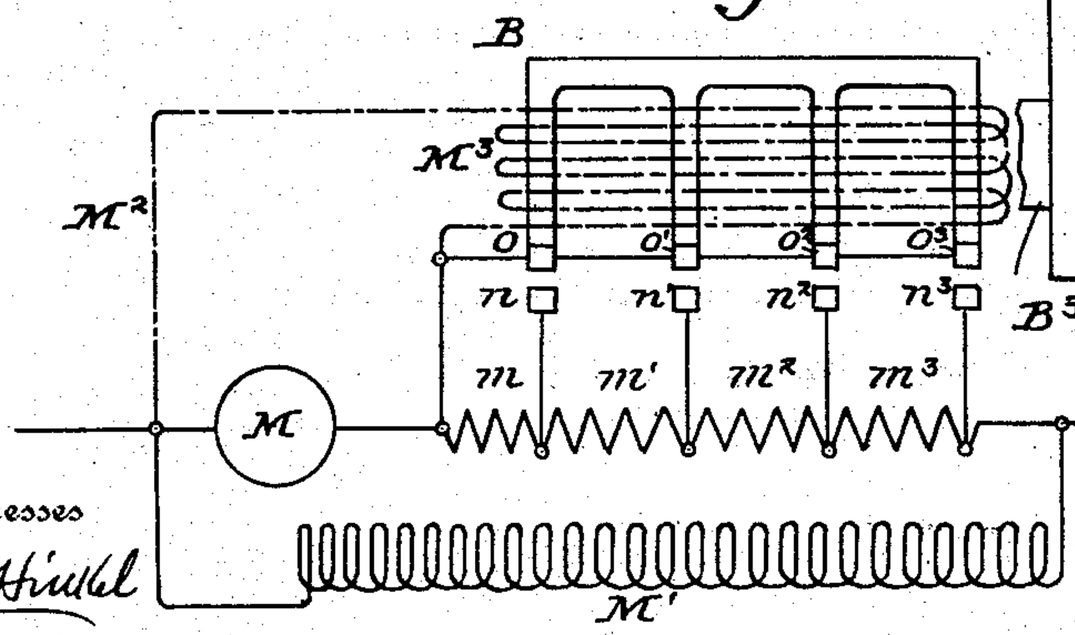
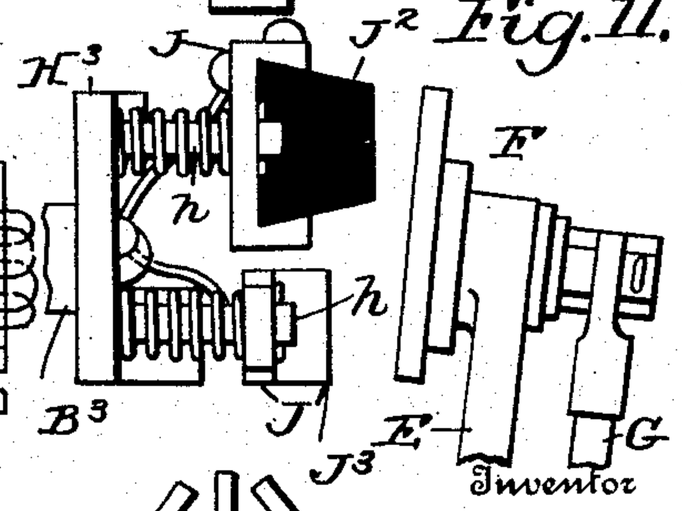


Fig. 11.



Inventor
John D Ihlder

Witnesses
J. J. Hinkel
Wm. Gillman, Jr.

S

by Foster Freeman

Attorneys

UNITED STATES PATENT OFFICE.

JOHN D. IHLDER, OF YONKERS, NEW YORK, ASSIGNOR TO THE OTIS ELEVATOR COMPANY, OF EAST ORANGE, NEW JERSEY.

ELECTROMAGNET.

SPECIFICATION forming part of Letters Patent No. 677,359, dated July 2, 1901.

Application filed April 17, 1900. Serial No. 13,260. (No model.)

To all whom it may concern:

Be it known that I, JOHN D. IHLDER, a citizen of the United States, residing at Yonkers, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Electromagnets, of which the following is a specification.

My invention relates to improvements in electromagnets, and has for its object to provide what may be termed a "multiple" electromagnet; and to these ends my invention consists in the various features of construction and arrangement of parts having the general mode of operation substantially as hereinafter more particularly set forth.

Referring to the accompanying drawings, wherein I have illustrated a preferred form of my invention, Figure 1 is a front elevation of a device embodying my invention. Fig. 2 is an end elevation. Fig. 3 is an elevation of a magnet-core frame. Fig. 4 is an end elevation of the same. Figs. 5 and 6 are respectively front and side views of the armature. Figs. 7 and 8 are plan and side views, respectively, of the plate supporting the contacts. Figs. 9 and 10 are similar views of the contacts. Fig. 11 is a side view showing a modification of the contacts, and Fig. 12 is a diagram showing one manner of using my invention.

While my invention, which, as above indicated, I have conveniently termed a "multiple" magnet, is adapted for many and various purposes, and the details of construction and arrangement of parts can be varied to suit the particular purpose for which it is intended, the form in which I have chosen to illustrate my invention is adapted more particularly for use in connection with means for controlling the operations of electromagnets such as are described in my Patent No. 612,629, granted October 18, 1898. In this patent, broadly speaking, one of the features comprises the use of a series of electromagnets which are arranged and connected so that they control resistances in the motor-circuit, cutting the resistances in and out successively and gradually, as required, and operating automatically in accordance with the variations in the current in the circuit of the motor. Such magnets may be used in various connections with the motor, and one of the simplest and most desirable connections is to control the resistance of the armature-circuit of the motor, which resistance is included in the circuit on starting the motor and is gradually and successively cut out as the motor attains a greater speed, producing more counter electromotive force, or otherwise, and I will explain the preferred construction of my multiple electromagnet and show one mode for controlling or varying the resistance in the armature-circuit of the motor.

Referring to the drawings, A indicates a suitable base, preferably of some insulating material, as slate, marble, vulcanite, and the like, upon which the parts of the magnet are mounted. Upon this base are secured a number of magnet-cores B, which are shown in the present instance (especially in Figs. 1 and 2) of a U shape, each having a core-piece proper, B′, a yoke-piece B^2, and a standard B^3, formed in one piece, and there are mounted on the base a number of these cores, five being shown in the present instance, although, of course, this number will vary according to the requirements of any particular case. Instead of making these core-pieces separate they may be made, as indicated in Figs. 3 and 4, in one single frame or casting in which there is a plate or yoke-piece B^4, having a number of standards B^5 projecting from the upper edge and having a number of core-pieces B^6 projecting from the lower portion of the plate, the plate being cut away, as at B^7, for the purpose of lightness. Mounted on these cores is a single coil C, arranged to embrace all the cores, and while this coil may be variously constructed I have shown a spool consisting of side pieces *c c′*, preferably of brass or some other non-magnetic material and having openings c^2 for lightness, containing a suitable number of coils of wire C′ wound in the usual way, and this coil C can be secured on the cores in any desired manner, and I have shown split pins c^3 passing through the openings in the ends of the core-pieces B′. Also mounted on the base is a suitable plate D, having a number of projecting arms or standards D′, and mounted on these arms or standards are the armatures E, there being as many

armatures and standards as there are core-pieces in the multiple magnet. In the present instance these armatures are made as best shown in Figs. 5 and 6, in which the lower ends are bifurcated, forming arms *e*, embracing the standards D′ and pivoted thereto by suitable pivots *e′*, and one of the bifurcated arms *e* is provided with a projection e^2, having an opening through which can pass the conductor hereinafter described. This opening is shown at right angles to the pivot-bearings of the armature. Projecting from the front of the armature is a lug E′, which may be utilized as a weight to make a weighted armature, and which also may have a suitable stop E^2, shown in the form of a bolt passing through the lug E′, the head of the bolt normally impinging upon the extended end of the standard D′, and by means of this bolt the normal position of the armature with relation to the magnet-core can be adjusted with accuracy, and when desired some means may be provided for securing the bolt in adjustable position, and I have shown a split pin e^3 passing through an opening in the lug, with the lower end of the pin embracing the squared head e^4 of the bolt. These armatures E in the present instance are also contact-carriers, and while various forms of contacts may be used, I have shown in the present instance the free end of the armature as being provided with a perforation e^5, in which is supported a contact F, shown in Figs. 1 and 2 as consisting of a plate or disk *f* of metal, such as copper, and insulated from the armature by disks *f′*, and the disk-pin f^2, attached to the plate of copper, is also insulated from the sides of the perforation e^5, as shown, and the contact is held in place by a suitable washer and nut f^3. It is of course possible to include the armature in the circuit, and in that event contact F need not be insulated therefrom; but preferably I insulate the contact and provide a conductor G, having a connector G′ secured to the contact F by the nut f^3, and this conductor is insulated from and passes through the opening in the projection e^2 of the armature and is secured to the binding-screw G^2, mounted on the base A in the usual manner. Of course other connections between the contact and binding-screw can be used; but by arranging the conductor G in this form it maintains a practically constant relation to the armature so far as weight is concerned, and it is held in a convenient position where it is not liable to be disturbed and does not interfere with the adjustment of the armature, as hereinafter set forth.

Coöperating with the contact F on the armature are one or more contacts H, which are mounted on the standards B^3, and while this contact may vary in construction, in Figs. 1 and 2 I have shown a plate or socket H′, receiving and holding a carbon contact-block H^2, and this socket H′ is mounted on pins *h*, projecting from a plate H^3, secured to the standard B^3, and there are suitable springs *h′* surrounding the pins and holding the plate or socket H′ under spring tension, there being split pins h^2 in the ends of the pins *h*. In order to secure good electrical connection between the standard and the contact-block H^2, I connect them by a flexible conductor H^4.

In Fig. 11 I have indicated a somewhat different construction of contacts, wherein the armature-contact is practically the same as that above described; but the contact mounted on the standard is made of two different materials, there being two plates or sockets J J′, mounted upon the pins *h* of the plate H^3, and one of these sockets, as J, contains a graphite or carbon block J^2, while the other comprises or supports a block of copper J^3, the two forming what may be termed a "double" contact. It will be seen that the carbon or graphite contact-block is thicker than the copper block and normally projects beyond the latter, so that in making contact the copper contact-plate *f* first impinges upon the carbon or graphite block J^2, compressing its spring and then completing the contact with the copper block J^3. So, too, on breaking contact it is first broken between the two copper plates, the carbon or graphite plate following the armature-contact after it has left the copper plate J^3 a certain distance before it completely breaks contact. With this construction the metallic contact-plates are brought squarely against each other when connections are made; but first the armature contact-plate impinges upon the carbon or graphite contact, and in breaking the metal plates first separate while the carbon contact is still bearing on the armature contact-plate, so that the first making and final breaking is done between the metal contact-plate of the armature and the carbon or graphite member of the other contact, thus avoiding the possibility of having the contacts fused together by producing an arc between the metal surfaces. This construction I have found exceedingly useful, especially in connection with heavy currents, where the armatures are intended to operate quickly and where it is essential to have as little resistance between the contacts as practicable, and where it is desirable to prevent any sticking or burning or arcing at the contacts, and I am enabled to utilize all the advantages of broad metallic faces between the contacts and also utilize the advantages of the use of a carbon or graphite contact in connection with a metal contact, and thus avoid all the difficulties and attain the advantages due to such construction.

In a multiple magnet such as is described one of the principal objects is to arrange the armatures so that they will be operated successively and progressively in accordance with the variations in the magnetic effect of the current passing through the coils of the magnet, and this may be accomplished in many ways. For instance, the armatures may be differently weighted, and when they are

in their normal positions (shown in Figs. 1 and 2) the difference in weight will determine which armature will operate first, and I have shown armatures 1 and 2 as having lugs E′ of different sizes, and this will accomplish the result under certain conditions. One way of getting a more refined adjustment is by manipulating the bolts E^2 so that their heads e^4 will be adjusted at different distances from the lower portions of the lugs E′ and the armatures will be normally at different distances from their individual magnet core-pieces B′, and of course they will be attracted and operated by the magnet according to the strength of the current passing through the magnet-coil or according to the lines of force produced thereby. Other ways of accomplishing this result known to electricians can also be utilized.

In Fig. 12 I have shown one circuit wherein my multiple magnet can be used for the purpose of controlling the armature resistance of the motor, and in this diagram M is the armature of a motor, M′ the shunt field-magnet coils, and $m\ m'\ m^2\ m^3$ sections of an accelerating armature resistance normally included in the armature-circuit. Connected to these sections are the armatures E of the magnet represented by the sections $n\ n'\ n^2\ n^3$, and the pole-pieces of the magnet B are represented by the parts $o\ o'\ o^2\ o^3$. There is a shunt M^2 around the motor-armature, including the coil M^3, surrounding the poles of the magnet. In this diagram the squares $n\ n'\ n^2\ n^3$, representing the armatures, are shown as arranged at varying distances from the pole-pieces $o\ o'\ o^2\ o^3$, and it is evident that when the switch S is closed the current passes through the accelerating resistance-sections $m\ m'\ m^2\ m^3$ and thence passes through the windings of the motor-armature M, while a certain amount of current will flow through the shunt-circuit M^2, energizing the magnet B to a certain extent, and as soon as this is sufficient to attract the square n, representing one armature, the resistance m is cut out and more current flows through the armature. This in turn causes more current to flow through the shunt M^2, and the magnet is further energized and the square n', representing the second armature, is attracted, cutting out the resistance m', and so on, the sections of accelerating resistance being cut out more or less, according to the amount of current which flows through the shunt M^2. So, of course, if the amount of current flowing through the shunt falls the various armatures will assume their normal positions successively, cutting in the sections $m\ m'\ m^2\ m^3$ of the resistance. In this way I provide a very delicate as well as simple means of controlling the armature resistance which is entirely automatic and subject to varying requirements. Of course while I have shown this particular application of my invention, it may be applied in various positions and under various conditions to accomplish different results without departing from the general principle of the invention.

I do not herein claim the construction and arrangement of circuits described in connection with an electric motor, (more particularly illustrated in Fig. 12,) as the same is held to constitute a separate invention and will be made the subject-matter of a separate application.

What I claim is—

1. A multiple magnet comprising a base, a plurality of cores mounted on the base, a coil embracing all the cores, and a plurality of armatures coöperating with the cores, substantially as described.

2. A multiple magnet comprising a base, a plurality of cores mounted on the base, a coil embracing all the cores, a plurality of standards, and an armature mounted on each standard, substantially as described.

3. A multiple magnet comprising a base, a plurality of cores mounted on the base, a coil embracing all the cores, a plurality of standards, an armature pivoted to each standard, and means for independently adjusting the armatures with relation to the cores, substantially as described.

4. A multiple magnet comprising a base, a plurality of cores mounted on the base, a coil embracing all the cores, standards, and armatures pivoted to the standards the armatures being provided with lugs, substantially as described.

5. A multiple magnet comprising a base, a plurality of cores mounted on the base, a coil embracing all the cores, standards, armatures pivoted to the standards the armatures being provided with lugs, and adjustable bolts connected to the lugs and bearing on the standards, substantially as described.

6. The combination with a base, a plurality of U-shaped pieces each forming a core, a yoke, and a standard, of a coil embracing the cores, and contacts supported on the standards, substantially as described.

7. The combination with a base, a plurality of U-shaped pieces each forming a core, a yoke, and a standard, of a coil embracing the cores, contacts supported on the standards, a series of arms, and an armature mounted on each arm carrying a contact, substantially as described.

8. The combination with a base, of a plurality of cores, a coil embracing all the cores, a plurality of standards carrying contacts, a plurality of arms, an armature carrying a contact mounted on each arm, and means for independently adjusting the armatures, substantially as described.

9. The combination with an armature provided with a lug and carrying a contact, of a conductor connected to the contact, and a projection connected to the armature for supporting the conductor, substantially as described.

10. The combination with a pivoted armature provided with a lug, of an adjustable bolt

in the lug, means for securing the bolt in position, a contact on the armature, a conductor connected to the contact, and a projection supporting the conductor, substantially as described.

11. The combination with a contact comprising a plate carrying pins, of a socket mounted on the pins, a contact-block carried by the socket, and springs interposed between the plate and socket, substantially as described.

12. The combination with an armature carrying a metallic contact-plate, of two spring-controlled contacts one of which is of metal and the other of carbon, the contacts being arranged substantially as described so that the armature-plate first impinges on the carbon contact and then on the metallic contact, substantially as set forth.

13. The combination with an armature having a flat-faced metallic contact, of two flat-faced spring-controlled contacts one of which is of carbon and the other of metal, the carbon projecting beyond the metal contact, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN D. IHLDER.

Witnesses:
FRED. W. NEWELL,
E. W. YEARSLEY.