C. O. HARRINGTON.

MAGNETIC DEVICE.

APPLICATION FILED JUNE 13, 1916.

1,298,701. Patented Apr. 1, 1919.

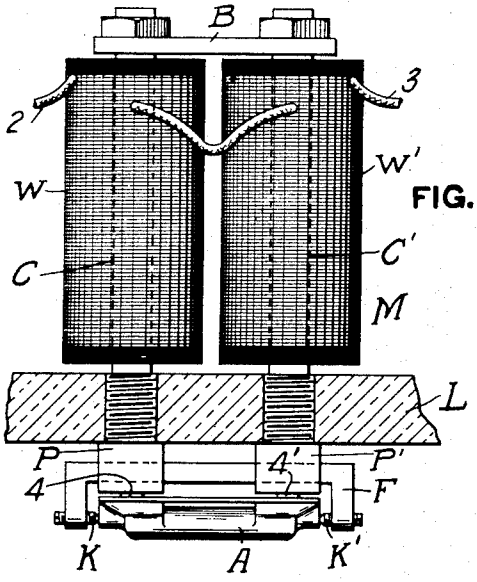


FIG. 1

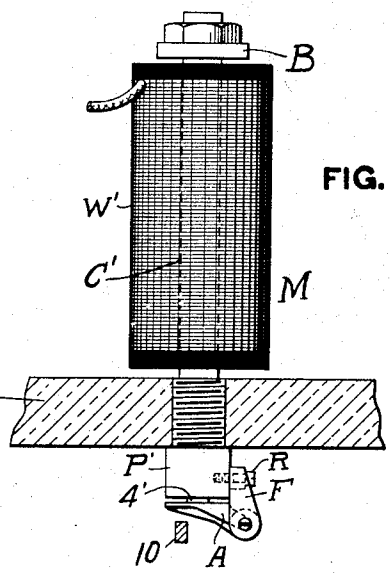


FIG. 2

FIG. 3

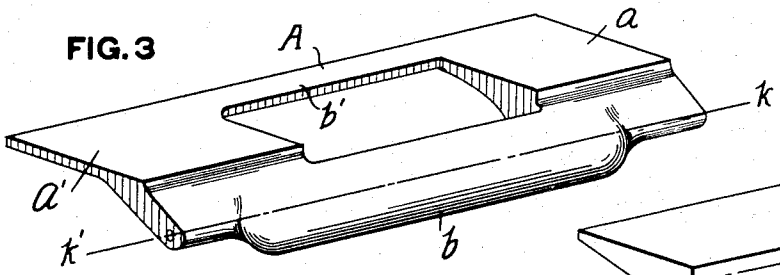


FIG. 5

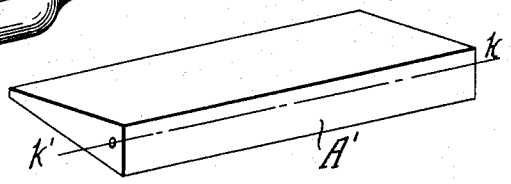


FIG. 4

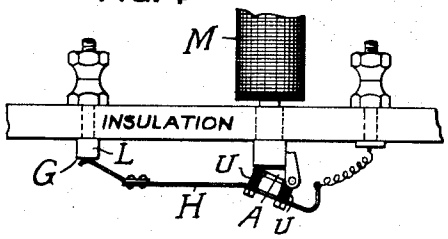


FIG. 6

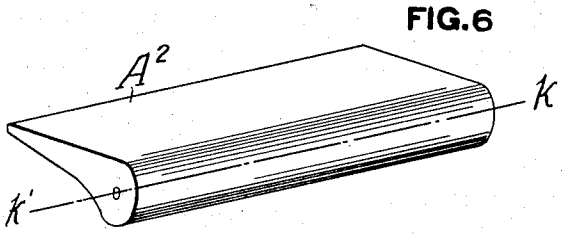
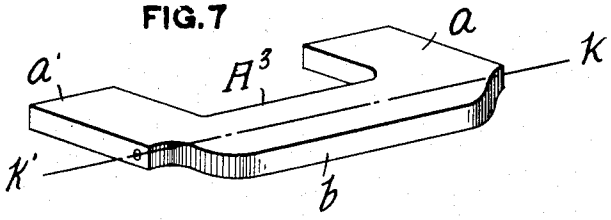


FIG. 7



WITNESSES

A. L. Vencill

A. C. Holte

INVENTOR

Clinton O. Harrington

By Geo. E. Crum

His atty.

UNITED STATES PATENT OFFICE.

CLINTON O. HARRINGTON, OF EDGEWOOD BOROUGH, PENNSYLVANIA, ASSIGNOR TO THE UNION SWITCH & SIGNAL COMPANY, OF SWISSVALE, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

MAGNETIC DEVICE.

1,298,701. Specification of Letters Patent. Patented Apr. 1, 1919.

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To all whom it may concern:

Be it known that I, CLINTON O. HARRINGTON, a citizen of the United States, residing at Edgewood Borough, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Magnetic Devices, of which the following is a specification.

My invention relates to magnetic devices, and more particularly to armatures for such devices.

One object of my invention is to improve the present shape of armatures for magnets in such manner as to diminish their dead weight torque and moment of inertia while retaining the same flux carrying capacity. Other objects of my invention will appear in the following description.

I will describe several forms of magnetic devices embodying my invention and then point out the novel features thereof in claims.

In the accompanying drawings, Figure 1 is a view showing in front elevation an electromagnet comprising one form of armature embodying my invention. Fig. 2 is a view showing in side elevation the apparatus shown in Fig. 1. Fig. 3 is a perspective view of the armature A shown in Figs. 1 and 2. Fig. 4 is a view showing a portion of a relay comprising an armature embodying my invention. Figs. 5, 6 and 7 are perspective views showing modified forms of armatures embodying my invention.

Similar reference characters refer to similar parts in each of the several views.

With reference to Figs. 1 and 2, M designates an electromagnet which in the present construction comprises iron cores C and C′, enveloped by energizing windings W and W′. At their upper ends the cores C and C′ are bridged by an iron backstrap B for conducting flux from one core to the other. Adjacent their lower ends the cores are mounted in a plate L of porcelain or other non-magnetic material used for the support of the electromagnet. The cores terminate in pole-pieces P and P′ adapted to co-act with an armature A. This armature is pivoted on trunnions K and K′ in a non-magnetic yoke F which is attached to the pole-pieces by screws R. When windings W and W′ are deënergized, the armature A is held by force of gravity against a back-stop 10. When windings W and W′ are energized by electric current, magnetic flux is set up in cores C and C′. This flux flows into the armature A and attracts it into engagement with the pins 4 and 4′ in the faces of pole-pieces P and P′. The rapidity of this movement and the force with which the armature is held against the poles of the magnet depend upon the moment of inertia of the armature and the torque with which gravity counteracts the magnetic pull, which torque if often referred to as the dead weight torque. The weight of the armature cannot be reduced below a minimum which is necessary to furnish sufficient cross-sectional area for the armature flux. I therefore distribute the iron in the armature in such manner that a large part of its weight is at the pivotal axis of the armature, where its moment of inertia and dead weight torque are small.

This is best shown in the perspective view of the armature (Fig. 3) wherein line *k k′* designates the pivotal axis. The armature is preferably constructed from a single piece of iron so that it has low reluctance to the passage of flux. The form of armature shown in Fig. 3 comprises essentially three members, designated *a*, *a′* and *b*. Of these, members *a* and *a′* engage the faces of poles P and P′, and have a corresponding shape, and member *b* conducts the armature flux from one of these pole-engaging members to the other. Members *a* and *a′* are thin at their edges, and the thickness increases gradually to a maximum adjacent member *b*, so that the thickness of the armature iron increases substantially in proportion to the increase of flux in the armature. Thus these members are reduced to the lowest desirable weight and have their center of gravity as near to axis *k k′* as practical, so that these members have a low dead weight torque and a low moment of inertia about their axis. The member *b* is of a cross section sufficient to conduct the armature flux from one end to the other at the desired flux density. As here shown it is round in cross section and concentric with the pivotal axis *k k′*, so that it has no dead weight torque and the smallest possible moment of inertia about axis *k k′*. The whole armature is therefore constructed so that its weight is as small as practical and its center of gravity is as near to the pivotal axis as possible, so that its dead weight torque and moment of inertia about its pivotal axis *k k′* are a minimum.

This armature is of advantage in many applications, as, for example, in relays. One form of relay well known in the art is illustrated in Fig. 4. It comprises an electromagnet M, whose armature A controls a contact G through the medium of a contact finger H attached to armature A by insulating studs U, which are mounted on bossed surfaces on member *b* and a member *b'* provided mainly for this purpose on the front edge of the armature as shown in Fig. 3. The tip of the contact finger H engages a fixed contact member L when the electromagnet is energized to attract the armature against the core pins. The pressure at contact G is proportional to the difference between the force of magnetic attraction and the dead weight torque of the armature. Consequently, in a relay comprising an armature of my invention it is possible to get the desired contact pressure with a smaller amount of energy than heretofore. Again, for the same amount of energy an armature of this type will permit the use of a heavier and more rigid insulator for securing the contact finger to the armature. To attain this with the ordinary form of relay armature the armature must be partially counterbalanced. This makes the armature sluggish in response, because of its high moment of inertia, besides causing undue wear on the pivot pins because of the increased weight.

In Figs. 5 and 6 I have shown armatures A' and A^2, which accomplish similar results, although not to such high degree because they are of simpler construction. Armature A' is wedge-shaped, so that it has its center of gravity nearer to the pivotal axis *k k'* than does the ordinary flat armature. Similarly, armature C is shaped substantially like a wedge having its lower surface curved to bring the center of gravity even nearer to the pivotal axis.

In Fig. 7, I have shown a flat armature A^3 having similarly to armature A of Fig. 3, two pole-engaging members *a* and *a'* and a third member *b* for conducting flux from one member *a* to the other. As here shown, the center line of member *b* is somewhat in the rear of axis *k k'*, thus serving to counterbalance the armature partially as well as conducting the flux.

Although I have herein shown and described only a few forms of devices embodying my invention, it is understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

1. A pivoted armature of a required cross sectional area of iron for the passage of flux therethrough, so formed that the iron is largely disposed adjacent the pivotal axis of the armature, whereby the dead weight torque and the moment of inertia of the armature are minimized.

2. A pivoted magnet armature having two pole-engaging members, one for each pole of the magnet, connected by a third member for conducting flux from one pole-engaging member to the other, said third member being disposed about the pivotal axis to minimize the dead weight torque and the moment of inertia of the armature.

3. A pivoted magnet armature having two pole-engaging members, one for each pole of the magnet, connected by a third member for conducting flux from one pole-engaging member to the other, said pole-engaging members being thin toward the edge and heavy adjacent the pivotal axis and said third member being disposed about the pivotal axis to minimize the dead weight torque and the moment of inertia of the armature.

4. An electromagnet armature the thickness of which at each point is substantially proportional to the amount of flux traversing the armature at such point.

5. An electromagnet comprising a pivoted armature having two pole-engaging members, one for each pole of the magnet, connected by a third member for conducting flux from one pole-engaging member to the other, said pole-engaging members being thin toward the edge and heavy at the pivotal axis and said third member being disposed about the pivotal axis to minimize the dead weight torque and the moment of inertia of the armature.

6. A pivoted electromagnet armature tapering in thickness from a maximum value adjacent the pivotal axis to a minimum value adjacent the free edge of the armature, the thickness decreasing substantially in proportion to the decrease in the quantity of flux carried by the various parts of the armature.

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

CLINTON O. HARRINGTON.

Witnesses:

A. HERMAN WEGNER,

ELMER H. COE.