No. 750,132. PATENTED JAN. 19, 1904.

I. A. & E. W. TIMMIS.

ELECTROMAGNET.

APPLICATION FILED JUNE 19, 1903.

NO MODEL.

Fig. 1

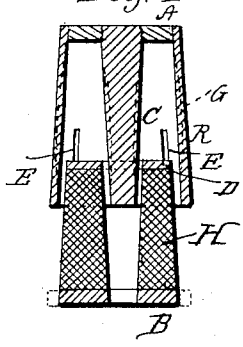


Fig. 2

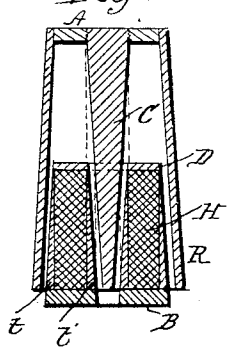


Fig. 3

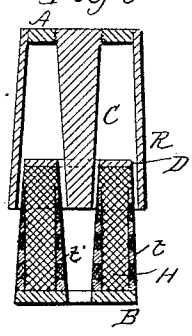


Fig. 4

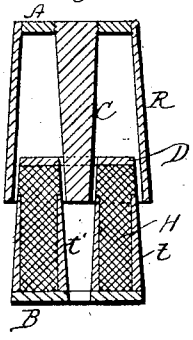
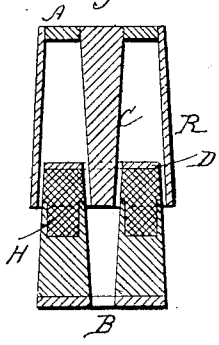


Fig. 5



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No. 750,132. Patented January 19, 1904.

UNITED STATES PATENT OFFICE.

ILLIUS AUGUSTUS TIMMIS AND EDGAR WILLIAM TIMMIS, OF LONDON, ENGLAND.

ELECTROMAGNET.

SPECIFICATION forming part of Letters Patent No. 750,132, dated January 19, 1904.

Application filed June 19, 1903. Serial No. 162,374. (No model.)

To all whom it may concern:

Be it known that we, ILLIUS AUGUSTUS TIMMIS and EDGAR WILLIAM TIMMIS, subjects of the King of Great Britain, residing at London, in the county of Middlesex, England, have invented new and useful Improvements in Electromagnets, of which the following is a specification.

Our invention has relation to electromagnets, and has for its object the provision of means whereby the range and power of an electromagnet may be increased without a corresponding increase in the quantity of wire with which the magnet is wrapped or in the electric current by which the magnet is energized.

In Letters Patent of the United States granted to Illius A. Timmis October 10, 1893, No. 506,282, an electromagnet is shown and described in which a helix is lined and partly covered with magnetizable metal and has an armature provided with a core that enters the helix and a depending lip that when the core is nearly home in the helix comes down over the uncovered part of the latter. In this electromagnet the wire of the helix, its hollow core and covering, and the core and depending lip of the armature have parallel sides.

In carrying our present invention into effect we make the helix of tapering form exteriorly and interiorly, either or both, and the core and depending lip of the armature of corresponding form, so that as the armature is attracted its surfaces adjacent to the surfaces of the helix will gradually approach the latter until in contact therewith. By this construction we give to the magnet greater power and longer range of motion than has been attained in magnets of the ordinary construction.

Our invention consists in the novel constructions, combinations, and arrangements of parts hereinafter described and claimed.

Referring to the accompanying drawings, Figure 1 is a vertical sectional view of an electromagnet constructed according to our invention, and Figs. 2, 3, 4, and 5 similar views of modified forms of the same.

H designates the helix, which is composed of suitably-insulated wire and is mounted on a bottom plate B of magnetizable material.

A designates the armature, which is formed with a tapering core C and a tapering depending lip or rim R. The interior and exterior surfaces of the helix are tapered on lines parallel with the adjacent surfaces of the core and rim of the armature, and while the parallelism of the adjacent surfaces of the helix and core is maintained throughout the entire range of motion of the armature these surfaces will constantly approach one another or draw closer together during the entire range of motion of the armature toward the helix.

In the simplest form of our improvement (illustrated in Fig. 1 of the drawings) the helix H is composed solely of insulated wire coiled in the form shown—that is, with its outer surface tapering inwardly from bottom to top and the cavity in its center tapering inwardly from top to bottom. The core C of the armature is tapered on lines parallel with the taper of the cavity of the helix, and the depending rim or lip R is tapered on lines parallel with the exterior surface of the same.

In Fig. 2 of the drawings we have shown a modified form of our improvement in which the helix H is cylindrical, but is provided with a lining t' of magnetizable material and a covering t of like material, the lining and covering being in magnetic contact with the bottom plate B and both being tapered toward the top, as shown, so that the surfaces of the helix in this form of our improvement are the same as in the helix shown in Fig. 1. In the magnet shown in Fig. 2 we have shown an armature having a core and a depending lip of considerably greater length than the corresponding parts of the magnet shown in Fig. 1, the range of motion of the armature shown in Fig. 2 being, however, the same as that of the armature of Fig. 1.

In Fig. 3 we have shown another modification, in which the lining t' and the covering t of the helix are made up of separate rings of magnetic material and do not extend quite up to the top of the helix, the coils of the helix

above the lining and covering being formed so as to continue the tapering lines of the two. These rings may be joined to each other and to the plate B.

In Fig. 4 we have shown a construction similar to that shown in Fig. 3, except that the lining and covering are each a single piece instead of being formed of separate rings.

In still another modification (shown in Fig. 5) the lower half of the helix is formed of magnetizable metal which is grooved on top, so as to extend part way on the interior and exterior of the coiled wire H.

If desired, the bottom plate B in any of the forms shown may extend beyond the outer surface of the helix and in under its central cavity, as shown in dotted lines in Fig. 1, so that the core C and rim R when home may rest on and adhere to the bottom plate. A top D, of non-magnetizable material, may be fitted to the helix, and in some cases in order to reduce or eliminate the effect of eddy-currents we slot the armature-rim, as shown at E E in Fig. 1.

If desired, the angle of bevel given to the surfaces of the helix and armature core and rim can be arranged at so slight a degree from parallel lines that the magnet can be arranged to work as a solenoid, with the enormous advantage that there is a holding pull at the maximum of force exercised or at any prearranged point of travel.

By means of the constructions above described we are able to obtain a long stroke with a strong pull; but it is sometimes advisable, and often imperative, to keep the force that is exercised at the commencement of the movement of the armature the same all through that movement. To effect this, the magnetizable-metal core and rim, either or both, may be extended through and beyond the bobbin, as shown in the dotted lines in Fig. 2, so as to set up a counter attractive force, and thus neutralize the excessive attractive force, or the magnetizable parts of the armature which enter or come within the attraction of the helix are beveled off or the parts of the helix which are farthest away from the armature at the commencement of the stroke are cut away or formed so that as the parts of the armature enter or are drawn over the outside of the helix there is an increasing air-gap, as shown at G, Fig. 1.

At any part or parts in either the armature or helix we may fit such a substance as paraffin or cannel-coal or an equivalent substance having the power of hindering the electric (or active magnetic) lines of force to control the pulling or attractive force between the bobbin or helix and the armature.

Having described our invention, we claim—

1. In an electromagnet, the combination with a helix having a tapering central cavity and a tapering external surface, of a naked armature having a tapering core and a tapering rim, substantially as described.

2. The combination in an electromagnet of a helix having a tapering central cavity and a tapering external surface with a naked armature having a core and a depending rim both tapered on lines parallel to the adjacent surfaces of the helix, substantially as described.

3. The combination in an electromagnet, of a helix having a lining and covering of magnetizable material, the said lining and covering being of increasing thickness from top to bottom, substantially as described, with a naked armature having a tapering core and a tapering rim, as set forth.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

ILLIUS AUGUSTUS TIMMIS.
EDGAR WILLIAM TIMMIS.

Witnesses:
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ARTHUR NIBLOCK.