

(No Model.)

I. A. TIMMIS & S. C. C. CURRIE.

ELECTRO MAGNET AND ARMATURE.

No. 293,116.

Patented Feb. 5, 1884.

Fig. 1

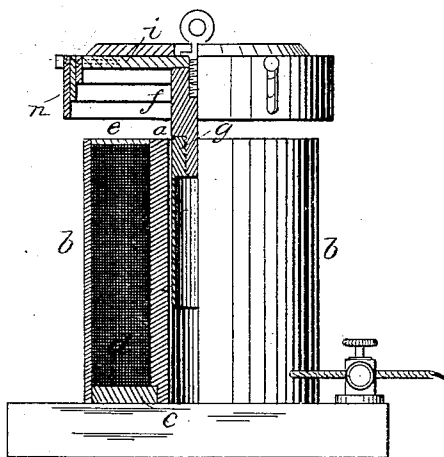


Fig. 2

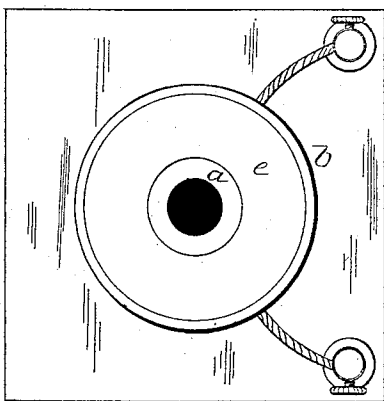


Fig. 3

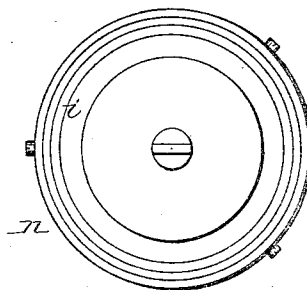


Fig. 4

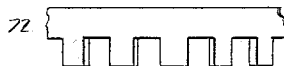
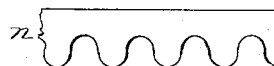


Fig. 5



Witnesses

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UNITED STATES PATENT OFFICE.

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ELECTRO-MAGNET AND ARMATURE.

SPECIFICATION forming part of Letters Patent No. 293,116, dated February 5, 1884.

Application filed December 7, 1883. (No model.) Patented in England August 4, 1882, No. 3,712.

To all whom it may concern:

Be it known that we, ILLIUS AUGUSTUS TIMMIS and STANLEY CHARLES CUTHBERT CURRIE, subjects of the Queen of Great Britain, residing at London, in the county of Middlesex, England, have invented certain new and useful improvements in Electro-Magnets and Armatures; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, in which—

Figure 1 is a half-sectional elevation of a magnet and armature embodying our invention. Fig. 2 is a top or plan view of the magnet. Figs. 3, 4, and 5 are details.

In electro-magnets as heretofore constructed the ratio of decrease between the attractive power of the field and the armature attracted thereby has been very violent, and of such a nature that where a long stroke is required the working-current has necessarily been altogether disproportionate to and beyond its requirements for effecting a powerful attraction as the armature approaches the magnetic poles; hence the force of magnetic attraction has been in no wise economized, but, while powerful enough to overcome a resistance at one point of the armature-stroke, has been necessarily much greater, in order to effect a sufficient pull at the extremity of such stroke, where the resistance is the same. To perfectly economize this force, the ratio or relation of the attraction to the distance through which the field operates must be changed, so that while the resistance which the armature imposes remains equal throughout the stroke the distribution of attractive force shall not be so unequal as under ordinary construction of electro-magnets it is found to be. If, then, such a change in the relation of the attractive force through the distance in which it is intended to be operative is accomplished, it follows that a small current may be advantageously utilized in effecting a long stroke of the armature, and accordingly producing a greater amount of mechanical work, because the greater the distance to which the attractive force can be projected the more equal will be the distribu-

tion of the magnetic attraction, and the force required to pull the armature when close to the poles economically proportioned to the force required to overcome the initial resistance.

The object of our invention is, briefly, to provide an electro-magnet that shall have a maximum of power proportionate to its size and the amount of current employed in energizing it and an extensive magnetic field, wherein the inequality of attractive power is reduced to a minimum and the field of force correspondingly extended.

A further object of our invention is to produce an electro-magnet which shall have a low resistance, and which shall be powerfully energized by a current of considerable electromotive force and but little quantity, whereby a large number of electro-magnets may be placed in series over a long length of conducting-wire effectively operated.

A still further object of our invention is to provide an electro-magnet in which the shock due to the impact of the armature against the poles, caused by the rapidly-increasing power of the magnet as the armature approaches, shall be avoided, and the injury to the mechanism which may be connected to the armature, necessarily ensuing from such shock, shall be prevented.

Our invention accordingly consists, first, in the novel construction of an electro-magnet and its armature, whereby the field of force is extended and a more equally distributed attractive power is obtained; secondly, in the novel construction of an electro-magnet and its armature, whereby the movement of the armature is rendered comparatively constant and even throughout its stroke; thirdly, in the novel construction of an electro-magnet and its armature, whereby a longer working-stroke of the armature is secured with a given amount of current than has heretofore been attainable.

Having in view the objects heretofore mentioned, and in order to provide a magnet which will accomplish these objects, we will now proceed to describe in detail the best form and method of carrying out our invention.

In the construction of our electro-magnet

we make an inner cylindrical core, *a*, of soft iron of any suitable thickness, diameter, or length, and at any suitable distance outside it we put another cylinder, *b*, of the same length and of such a thickness that the ratio of the sectional area of one to the sectional area of the other may be such that the magnetic influence of the two shall be equal. These two cylinders rest upon a circular soft-iron plate, *c*. The space between the inner and outer cylinders, described above, is filled in with one or more coils of wire, *d*, which may be formed of insulated wire of one system or split up into two or more systems, according to the particular purpose for which the magnet is required. At one or both ends, if necessary, we put a disk of brass, *e*, or other diamagnetic substance, to keep the coils in place. The reason for putting a cylinder outside the coil or coils, as well as inside, is that both are magnetized by the one coil and further strengthened by their opposite poles being connected by the circular plate on which they rest, the plate itself also being acted upon by the current in coil. There may be two or more cylinders, each being separated by a coil of suitable thickness. Within the inner core or cylinder we put a rod of soft iron, *f*, incased in brass or other diamagnetic substance, *g*, (to prevent its sticking to the inner cylinder,) so that it slides easily but not too loosely or too tightly therein. This rod is screwed or fastened to or made a part of and the same piece with a circular plate of soft iron, *i*, which is of course at the opposite end of the magnet to the circular soft-iron plate mentioned above, and the whole acts as an armature. The object of this center rod of iron sliding within the inner cylinder is that being acted upon by the current in coil and polarized longitudinally thereby it polarizes the circular plate *i*, to which it is attached radially and in such a way that the attraction is increased between the plate (which acts as an armature) and the outer cylinder, thus increasing the total pull on the armature.

Round the outside of the circular plate, which is attached to the center rod, we put a thin ring of iron, or other suitable metal, *n*, of such a depth as to project round the plate toward the outer cylinder, (though it may be made to project toward one of the other cylinders,) above mentioned, and is, by preference, of such a diameter that it will just slip over the latter without touching it. This rim may have a plain or serrated edge, the object of which is that its edge is nearer the cylinder than the plate to which it is attached is to that cylinder, and it is therefore drawn toward the latter, and thereby brings the plate with it until it (the plate) is acted upon by the cylinders, and hence the total pull is lengthened. Of course, the size, depth, shape, and quality

of the ring depend upon the nature of pull required. This outer rim may be attached directly to the circular plate, or with a thin ring of brass or other diamagnetic substance between, this depending upon the strength and distribution of pull required. Of course, the ring may consist of one or more pieces or sheets of metal, with or without diamagnetic layers between them.

The rim *n* may be attached to the circular plate directly, or it can be screwed thereto, and it may be slotted to allow of adjustment, and there may be two or any number of rims of any convenient shape or size.

Instead of soft iron, as specified herein, soft steel or other suitable metal may be used, because, we would remark, that it is possible to make a metal other than iron, which, when magnetized, can be quickly demagnetized; and where one sheet or ring of metal is described herein, the sheet or ring may be made of one, two, or more pieces or sheets of iron or other suitable metal without interfering with the objects of this invention.

What we claim as our invention is—

1. An electro-magnet comprising a tubular core of magnetic material constituting one of the poles, a cylindrical shell of similar material constituting the other pole, a plate of magnetic material connecting the pole-pieces, and an insulating conducting-helix surrounding the central core, in combination with an armature consisting of a disk having a central projection adapted to slide within the tubular core, substantially as described.

2. The combination, with an electro-magnet having a tubular core, a surrounding helix, and an inclosing-shell of magnetic material, and a connecting-yoke, of an armature consisting of a disk provided at its center with a projection adapted to enter the tubular core, and at its edge a depending flange adapted to slip over the edge of the outer shell, substantially as described.

3. In an electro-magnet, the combination of a central core, a surrounding helix, and an inclosing-shell of magnetic material, with an armature consisting of a disk provided with a depending flange, substantially as described.

4. The combination, with an electro-magnet, of an armature having an adjustable depending flange.

In testimony that we claim the foregoing we hereto affix our signatures.

ILLIUS AUGUSTUS TIMMIS.

STANLEY CHARLES CUTHBERT CURRIE.

Witnesses to signature of I. A. Timmis:

THOS. A. CONNOLLY,

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Witnesses to signature of S. C. C. Currie:

WM. HY. JORDAN,

SAML. A. PRATT.