(No Model.)

I. A. TIMMIS.

ELECTRO MAGNET.

No. 506,282. Patented Oct. 10, 1893.

Fig. 1.

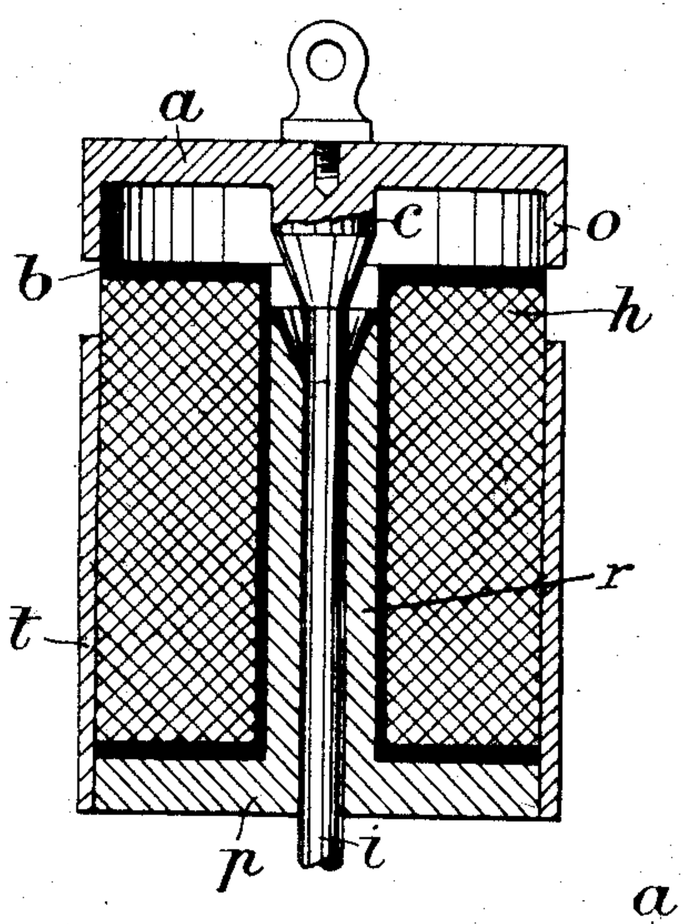


Fig. 2.

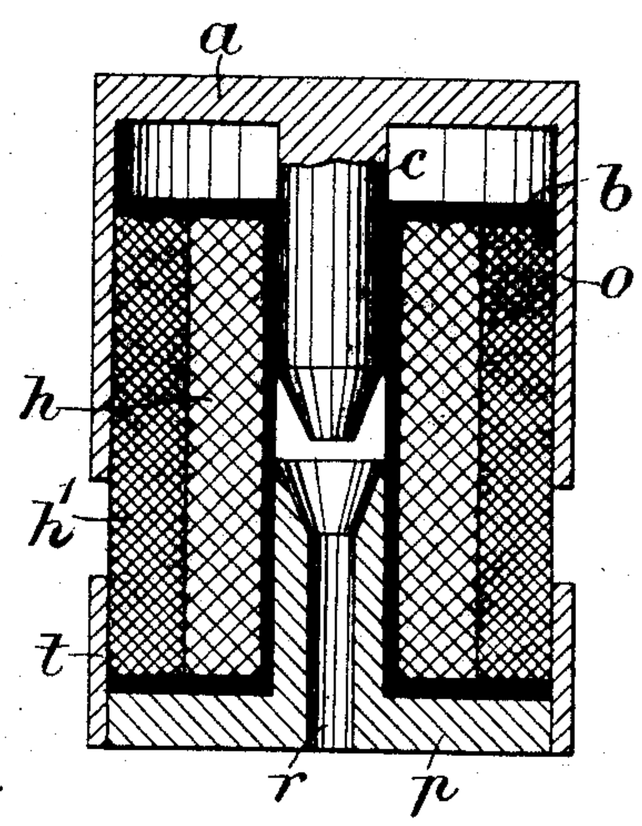


Fig. 3.

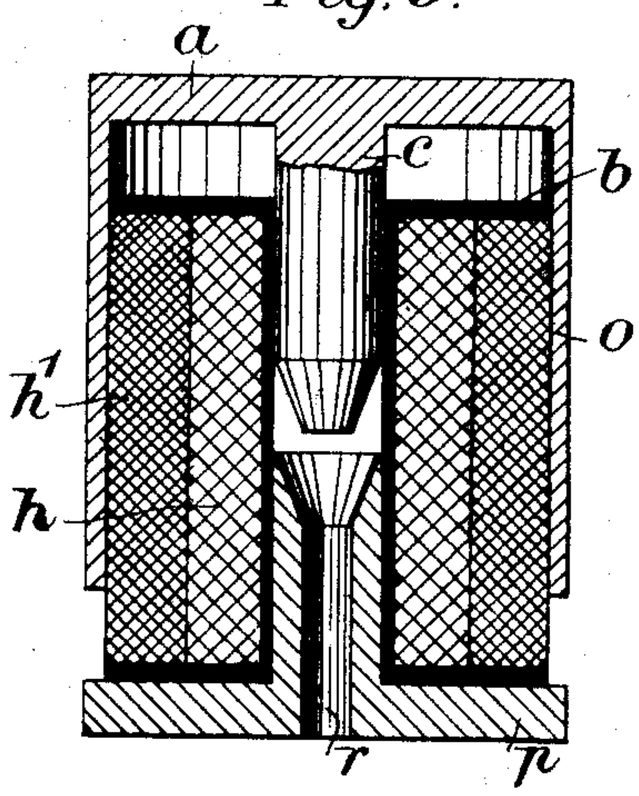


Fig. 4.

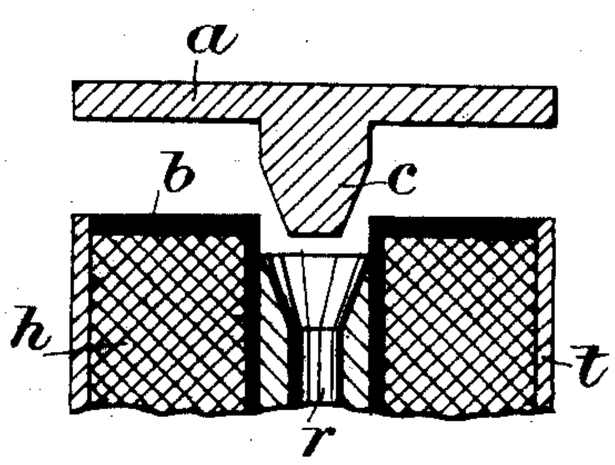


Fig. 5.

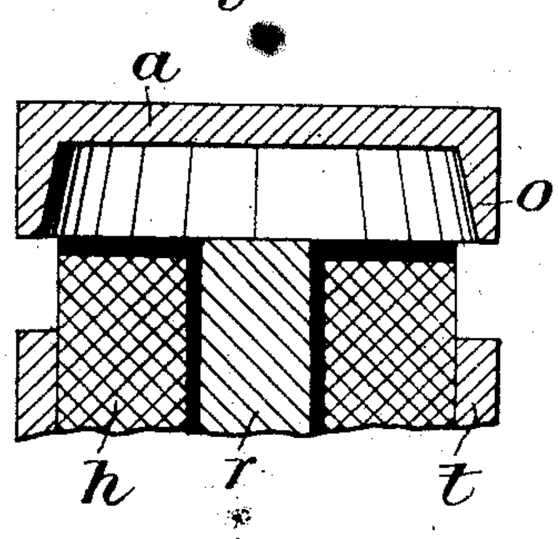


Fig. 6.

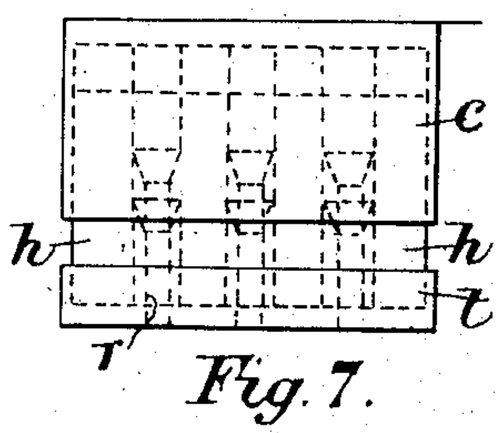
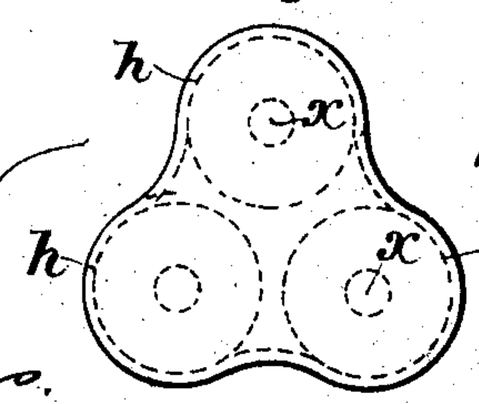


Fig. 7.



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UNITED STATES PATENT OFFICE.

ILLIUS AUGUSTUS TIMMIS, OF LONDON, ENGLAND.

ELECTRO-MAGNET.

SPECIFICATION forming part of Letters Patent No. 506,282, dated October 10, 1893.

Application filed February 1, 1893. Serial No. 460,622. (No model.) Patented in England October 22, 1892, No. 18,994.

To all whom it may concern:

Be it known that I, ILLIUS AUGUSTUS TIMMIS, a subject of the Queen of Great Britain and Ireland, residing at 2 Great George Street, Westminster, London, in the county of Middlesex, England, have invented certain new and useful Improvements in Electro-Magnets, (for which I have obtained a patent in England, No. 18,994, dated October 22, 1892;) and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same, reference being made to the accompanying drawings, in which similar letters refer to similar parts in the several figures.

Figure 1 represents an electromagnet partly in cross-section. Figs. 2, 3, 4, and 5 represent modifications of my present invention. Figs. 6 and 7 represent a compound electromagnet.

My present invention has for its object to utilize the great magnetic attractive force exercised by a coil or coils of copper or other wire, having a current of electricity flowing through them, where they are not incased in, or surrounded by, magnetizable metal such as soft iron, an armature of suitable shape and metal, such that when the pull or suck is in action and the armature and bobbin are coming together the pull is increased as the magnetizable surfaces come closer, and then when these surfaces of the armature and bobbin are in contact or practically so, the holding power between the armature and bobbin is very great with a minimum consumption of electrical energy.

In Fig. 1, *a* is the armature of magnetizable metal and is composed of a top plate *a*, a center rod *c* (which may be hollow); *o* is an outer rim, *r* is an inner tube (or it may be a rod) of magnetizable metal, and *t* is an outer tube of the same metal. *t* and *r* are joined together by a base plate *p*. *i* is a rod attached to the center rod *c*, the rod *i* being of non-magnetizable metal. *b* is a casing of non-magnetizable metal which is used to keep the helix *h* in its proper place.

In Figs. 2 and 3 there is a double coil helix or bobbin *h*, *h'*; *h'* being of finer wire than *h*. In Fig. 2 the lengths of *r* and *t* are reduced. In Fig. 3 the outer tube *t* is dispensed with.

Fig. 4 shows an armature without the rim or tube *o* but *t* is extended to the top of the bobbin so that *a* may come against it.

Fig. 5 shows an armature with no center rod *c* but *r* is extended to the top so that *a* may come against it.

Figs. 6 and 7 show a compound magnet having three bobbins with three center rods and one common outside tube on the armature and also on the bobbin. There may be any number of bobbins and there may be rods placed in any of the openings *x*, *x*.

The main objects I have in view are the combination in an electromagnet of a powerful pull or suck on the center rod *c* or on the outer rim *o* or on both, by means of an electric current passing through the helix or bobbin of wire—where it is not incased in magnetizable metal—together with the extra attractive force exercised by the magnetizable metal about the bobbin when that of the armature is coming near it; then the enormous holding power exercised when the magnetizable parts of the bobbin and armature are in contact or practically so, and lastly the utilizing of the bobbin of finer wire *h'*, by switching it (automatically or otherwise) in circuit with the coil *h* and in series with it, when the bobbin and armature are together (or nearly so) to reduce and economize the expenditure of electric energy when the pull has to be maintained.

"Magnetizable metal" means any metal which is available and which readily magnetizes and demagnetizes. "Wire" means insulated wire of any suitable conductivity metal.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent of the United States, is—

1. An electro-magnet, consisting of the core *r* having a base plate *p* of magnetizable metal, and the bobbin *b* of non-magnetizable metal provided with one or more coils of wire *h* and arranged around the said core with its flanges wholly covering the ends of the wires; in combination with an armature consisting of a plate *a* provided with a rim *o* adapted to slide over the top of the said coil, and a central portion *c* adapted to slide within the said bobbin, substantially as set forth.

2. An electro-magnet, consisting of the core

r having a base plate *p*, and the outer tube *t*, all of magnetizable metal, and the bobbin *b* of non-magnetizable metal provided with one or more coils of wire *h* and arranged between the said core and tube; in combination with an armature consisting of a plate *a* provided with a rim *o* adapted to slide over the top of the said coil, a central portion *c* adapted to slide within the said bobbin, and a rod *i* adapted to pass through a vertical hole in the said core, substantially as set forth.

ILLIUS AUGUSTUS TIMMIS.

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