No. 737,720. PATENTED SEPT. 1, 1903.

# J. DUNCAN.

## ELECTROMAGNET.

APPLICATION FILED JUNE 1, 1903.

NO MODEL.

Fig. 1.

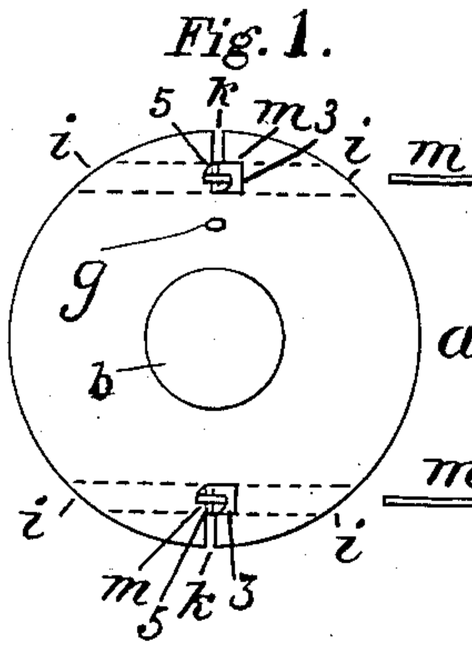



Fig. 2.

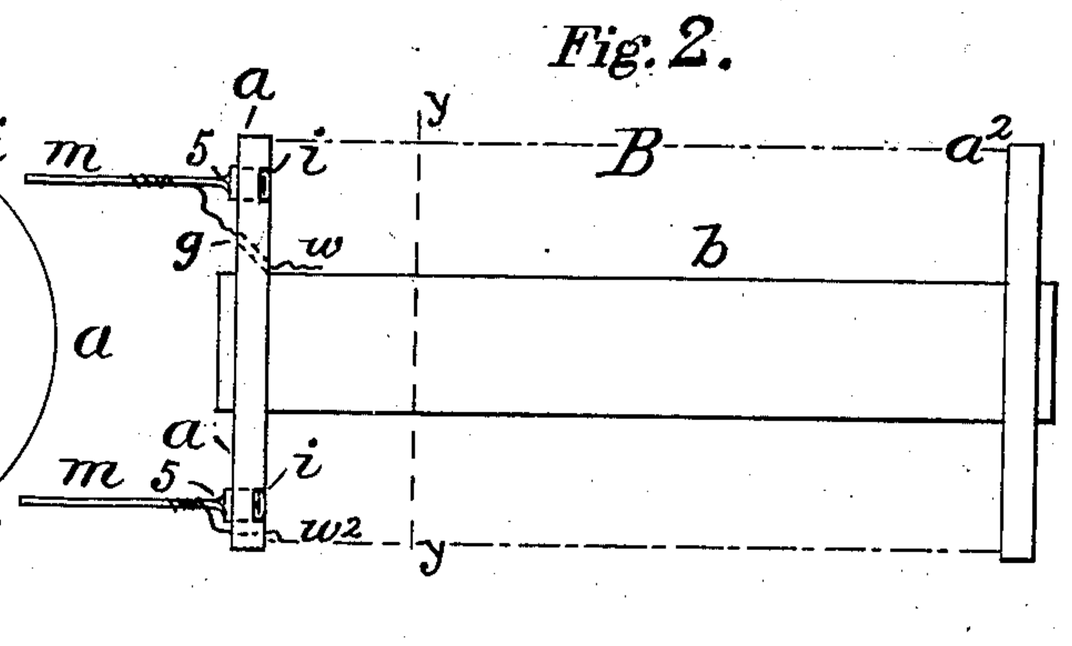



Fig. 3.

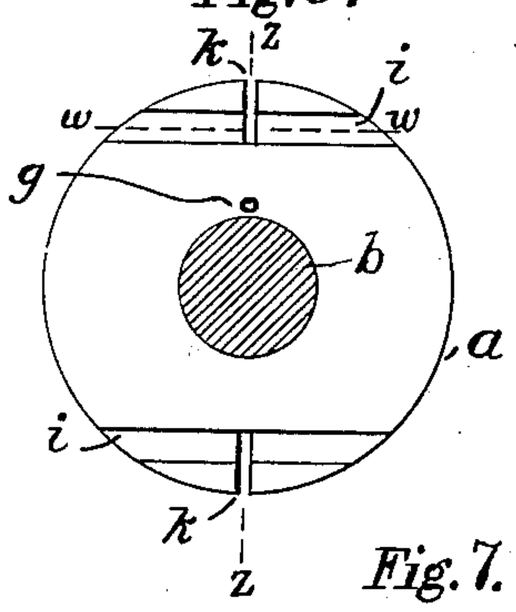



Fig. 4.

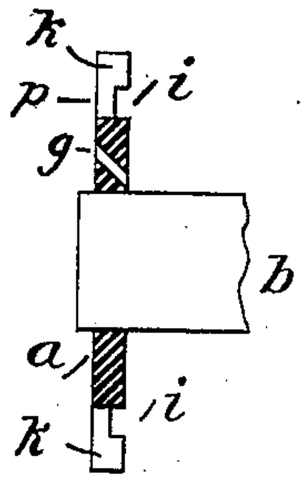



Fig. 7.

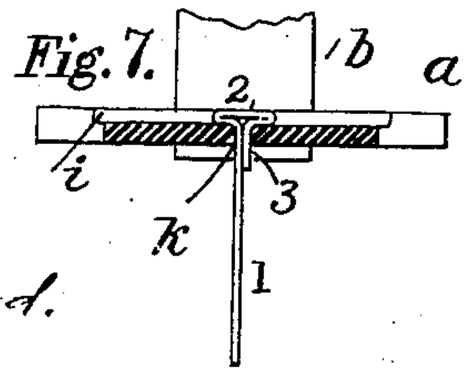



Fig. 9.

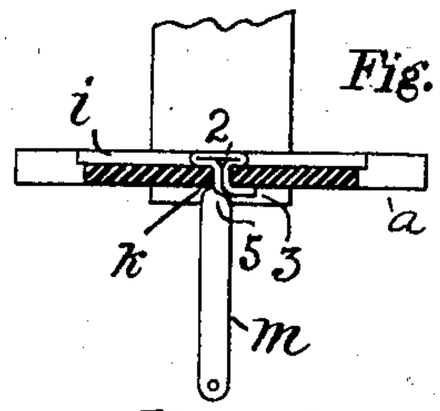



Fig. 5.

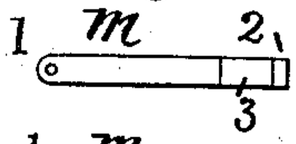



Fig. 6.

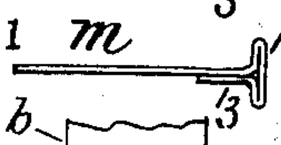
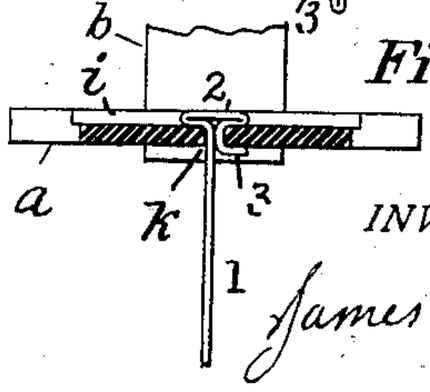



Fig. 8.




WITNESSES:

Frank C. Lockwood.

Joseph A. Fately

INVENTOR.

James Duncan

No. 737,720. Patented September 1, 1903.

# UNITED STATES PATENT OFFICE.

JAMES DUNCAN, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

## ELECTROMAGNET.

SPECIFICATION forming part of Letters Patent No. 737,720, dated September 1, 1903.

Application filed June 1, 1903. Serial No. 159,663. (No model.)

*To all whom it may concern:*

Be it known that I, JAMES DUNCAN, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in Electromagnets, of which the following is a specification.

It is well known that electromagnets are frequently composed of a metal core upon the ends of which are snugly-fitting disks of some insulating material, such as hard rubber or some insulating fiber, the space between the disks being filled with several layers of fine insulated wire wound tightly over each other. The core, with the disks, constitute what is commonly called the "spool," and terminal means are provided in one disk, to which the inner and outer ends of the windings of insulated wire are led and attached usually by soldering and to which the external conductors are connected. The common terminal means for this purpose in electromagnets employed in connection with telephone-circuits is to insert two pins into one of the disks diametrically opposite to each other and parallel with the core, holes being bored through the disk and counterbored on the inner face of the disk to receive the pins. Nuts are placed in the counterbores on the inner ends of the pins, and other nuts upon the pins bear upon the outer face of the disk, which is thus held between them. The inner end of the coil-windings is led through a small inclined hole in the disk to its outer side and soldered to one of the pins, while the outer end of the windings may be led through a second hole in the disk and soldered to the second pin. The principal objection to terminal connections of this character is that the nuts become loose, and the pin is then liable to be turned and break the wire of the winding at the pin or inside the disk and render the coil useless. The pins are frequently loosened when the winding wires or the circuit-conductors are soldered thereto, as the heat of the soldering operation may soften that portion of the disk in the vicinity of the two nuts, which hold the pin in position.

The present invention provides a terminal of such construction that it is easily attached and detached from the disk, and should it when in place become loosened it cannot be turned around and may be easily retightened without breaking the wire from the coil in any case.

In the drawings accompanying this specification, Figures 1 and 2 are respectively end and side elevations of a magnet-spool provided with coil-winding terminals as devised by me. Fig. 3 is a view on line *y y* of Fig. 4 of the inner surface of the spool-disk to which the terminals are connected, and Fig. 4 is a section on line *z z* on Fig. 3. Figs. 5 and 6 are respectively side and edge views of the terminal clip detached, and Figs. 7, 8, and 9 are sections on line *w w* on Fig. 3 to illustrate the method of inserting and securing the terminal clip in place in the head or disk of the spool.

To obviate the various defects heretofore referred to, I have devised the invention disclosed in the accompanying drawings, wherein—

B represents the spool of an electromagnet, consisting of a suitable metal core *b*, having the heads or disks *a* $a^2$ secured at each end, the core ends extending beyond the disks a proper distance. Across the inner face of one of the heads or disks *a* of the electromagnet B, I form two parallel depressions or channels *i i*, one on each side of the core *b*, and near the periphery of the disk of a suitable width and depth and at right angles to the channels and central with the disk are cut the two radial slits *k k*, one extending across each channel. An inclined hole *g* is drilled in the disk in the usual manner, through which the inner end of the coil-winding is threaded.

Figs. 5 and 6 show a clip *m*, made from thin narrow sheet metal bent upon itself, having a T-shaped upset end 2, with a long single extension 1 and a shorter extension 3, laid close to and double with the part 1. This constitutes the terminal to which the ends of the coil-windings are soldered, as I will now proceed to describe. To attach the clip *m* to either side of the disk *a*, its extension 1 is held outside and above the slit *k* and the doubled part is passed down as far as it can go and then drawn forward, so that the head 2 will come into the channel *i*, as shown in Fig. 7. Then the short extension 3 is bent

over onto the outer face of the disk, as shown in Fig. 8, and firmly pressed down. This secures the clip on its short-extension side. Then a pair of pincers is placed upon the long extension close down to the face of the disk and the said extension given a one-quarter turn in either direction, which makes a lock or obstruction 5, which secures the clip on the long-extension side. The clip is held from turning about, as the head fits closely in the channel and its extensions fill the slit tightly, and it cannot be forced inward or become loosened endwise because it is held to the disk on one side by a projection from the head and the bent-over part 3 and on the other side by the other head projection and the obstruction 5, produced by the twist given to the part 1, so that there can be no loosening of the terminal from any ordinary cause. As represented in Fig. 2, the ends of the coil-windings $w$ $w^2$ are soldered to the respective clips $m$ $m$, the inner end $w$ passing through the hole $g$, while the outer end $w^2$ may be brought through the slit. Should the portion $p$ become softened from heat conducted thereto by the extension 1 and thereby loosen the clip, it can be tightened again by giving another twist to the extension, and if for any cause it becomes necessary to remove the clip this can be easily done by untwisting the extension, lifting up the part 3, and pushing the clip inward the thickness of its head and drawing it out from the slit $k$.

Having thus fully described the invention, I claim—

1. The combination in an electromagnet, of a core, a coil of wire, and a disk of insulating material on each end of the core, one of the disks having a radial slit from its periphery into an enlarged depression on the inner side thereof, with a metal terminal extending outward from said disk and provided with an enlarged head adapted to rest in said depression, with means integral with the terminal for holding its head in the depression, as set forth.

2. The combination in an electromagnet, of a core, a coil of wire, and an insulating-disk on each end of the core, one disk having a channel across its inner face bisected by a radial slit, with a terminal clip composed of a narrow metal strip bent upon itself into irregular lengths and its head upset, the head of the clip resting in said channel and its extensions in the slit, one of which is bent over onto the outer face of the disk, while the other is twisted around to form an obstruction, as set forth.

3. The combination in an electromagnet, of a core, a coil of wire, and an insulating-disk on each end of the core, one disk having two channels across its inner face on opposite sides thereof, each bisected by a radial slit, with terminal clips composed of a narrow metal strip bent upon itself into irregular lengths and its head upset, the head of each clip resting in its channel, both extensions passing through the slit, one being bent over onto the outer face of the disk and the other twisted around to form an obstruction, as set forth.

4. The combination in an electromagnet of a core, a coil of insulated wire, and a disk of insulating material on each end of the core, one disk having a channel across its inner face bisected by a radial slit, with a terminal clip composed of a narrow metal strip bent upon itself into irregular lengths and its head upset, the head of the clip resting in said channel, both extensions passing through the slit, one being bent over onto the outer face of the disk and the other twisted around to form an obstruction, the inner end of the coil extending through a hole into the disk and soldered to the twisted extension, as set forth.

5. The combination in an electromagnet, of a core, a coil of wire, and disks of insulating material on each end of the core, one disk having two channels across its inner face on opposite sides thereof each bisected by a radial slit, with terminal clips composed of a narrow metal strip bent upon itself into irregular lengths and its head upset, the head of each clip resting in its channel, both extensions passing through the slit, one being bent over onto the outer face of the disk and the other twisted around to form an obstruction, the inner end of the coil extending through a hole into the disk, the outer end of the coil passing through the slit, and both ends of the coil soldered to their terminals, as set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 26th day of May, 1903.

JAMES DUNCAN.

Witnesses:
GEO. WILLIS PIERCE,
FRANK C. LOCKWOOD.