(No Model.)

R. EICKEMEYER.

ELECTRO MAGNET.

No. 422,512. Patented Mar. 4, 1890.

Fig. 1.

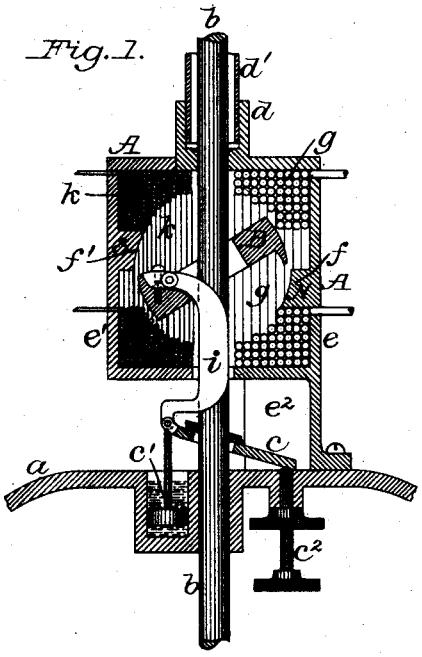


Fig. 2.

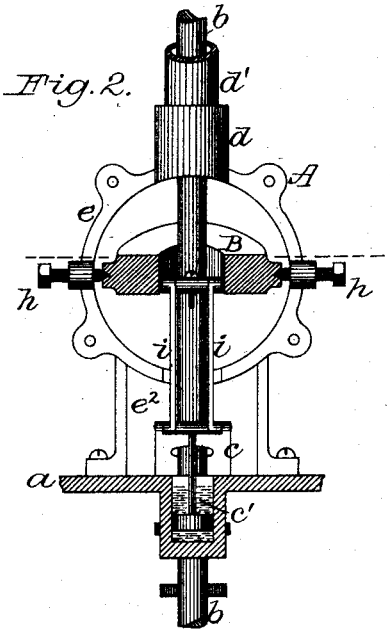


Fig. 3.

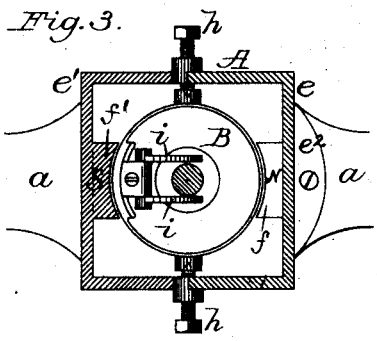
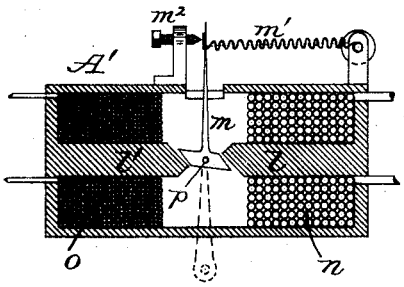


Fig. 4.



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UNITED STATES PATENT OFFICE.

RUDOLF EICKEMEYER, OF YONKERS, NEW YORK.

ELECTRO-MAGNET.

SPECIFICATION forming part of Letters Patent No. 422,512, dated March 4, 1890.

Application filed August 18, 1887. Serial No. 247,281. (No model.)

To all whom it may concern:

Be it known that I, RUDOLF EICKEMEYER, of Yonkers, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Electro-Magnets; and I do hereby declare that the following specification, taken in connection with the drawings furnished and forming a part thereof, is a clear, true, and complete description of the several features of my invention.

My electro-magnets are specially valuable and effective when employed in all connections where vibratory armatures are relied upon to perform such mechanical duty as tripping heavily-locked detents or lifting and lowering considerable weights, or imparting motion to a train of light gearing, as by a lever, cord, and wheel, or in gong and bell striking, and also in such connections as involve extreme sensitiveness in operation and rapid vibratory movements. My electro-magnets are also specially valuable in electrical organizations wherein a vibratory armature is either desirably or essentially inclosed in metallic structures or chambers, inasmuch as I am enabled to convert such structures into effective portions of the electro-magnet.

In my present electro-magnets the magnetic influence or field is wholly restricted to the interior of the shell; and I will here state that a similar restriction was long ago sought and obtained by me, and has long ago been practically applied in many forms of dynamo-electric machines heretofore devised by me and disclosed in several of my Letters Patent heretofore granted—as, for instance, in Nos. 342,504 and 358,340.

My novel electro-magnet contains a vibratory armature through which the magnetic circuit is directly completed as from core to core; but more or less valuable results will accrue if the said armature carry magnetic faces mounted upon interposed non-magnetic metal.

For performing certain lines of duty a single exciting-helix is employed, as wherein the exciting-current is to be applied and cut off at such times or intervals as may be required; but when said helix is to be continuously influenced I employ, as heretofore in other connections, an auxiliary helix for so far oppositely magnetizing the shell and cores as to reduce or modify the power of the main helix to influence the vibratory or reciprocating armature, as when the latter is in part controlled by a spring or weight.

The numerous connections in which my novel electro-magnets may be profitably employed will be promptly obvious to persons skilled in the art, and the same is true of the many variations in form which may be adopted according to the exigencies of each case without any material departure from my invention, and although I am well aware of this and could illustrate and describe such in great variety, I have deemed it necessary to specially describe and illustrate my invention only in connection with its application to an arc-light regulator and to a relay or circuit breaker, and after fully describing the same the features deemed novel will be duly specified in the several clauses of claim hereunto annexed.

Referring to the drawings, Figure 1 is a vertical cross-section of an electro-magnet embodying my invention as desirably applied to an arc-light regulator. Fig. 2 is a similar section in a plane at right angles to that in Fig. 1 without the exciting-helix. Fig. 3 is a horizontal section of the parts shown in Fig. 2. Fig. 4 is a central vertical section of one of my electro-magnets organized in a relay.

Referring now to Figs. 1, 2, and 3, it will be readily understood that the frame-bow *a*, from which the lamp (not shown) is suspended, the upper carbon *b*, its clamp-lever *c*, glycerine dash-pot and plunger *c'*, and adjusting-screw c^2 are all as heretofore. The frame *a*, in the usual manner, is suspended from an inclosing structure A, having on its top a hole for the passage of the upper carbon and a socket *d* for engaging with the tube *d'*, which constitutes the supporting-stem for the entire lamp. The inclosing structure or chambered shell A here shown incloses a portion of the arc-regulating mechanism, and that was the function of all prior chambered structures known to me in this connection, coupled with its function of a mere connecting medium between the suspending-tube *d'* and the lamp-frame *a*; but as a result of my invention this structure now for the first time

performs duty as a part of the regulating medium, in that it is composed of magnetic metal and forms a part of one form of my novel electro-magnet. This chamber A is constructed in two closely-fitting parts $e\,e'$, joining in a vertical line, and provided with lugs or ears, with which clamping-bolts are used. The tube d is integral with one of these parts e, and so, also, is a pendent foot e^2, which is bolted to the lamp-frame a. The form of this chamber may be indefinitely varied; but as here shown it is cylindrical, and it should have at its two ends appropriate pole-faces (here shown to be internally projecting portions or cores) for affording appropriate pole-faces in a desirable form, and these may be coincident or out of coincidence, but, as shown at f and f', they occupy different horizontal planes, and the pole f is surrounded eccentrically by the exciting-helix g, so that when an electrical current is applied thereto appropriate poles N S are developed at the two faces, and they will obviously influence any armature carrying magnetic metal and capable of vibrating in any manner toward and from said faces, or either of them.

The armature B here shown is novel in this connection, in that it is so formed and of magnetic metal that it completes the magnetic circuit when in proper position with relation to the pole-face; or, in other words, the magnetic circuit passes from the pole f through the armature to pole f', and thence traverses the inclosing-shell from end to end or to the pole f, thus developing in said armature appropriate opposite poles by induction. This armature is annular in form, so as to afford an interior space, which is freely occupied by the upper carbon b, and it is pivoted on trunnion-screws h, mounted in lugs on the part e of the shell, said screws being pointed to afford delicate bearings for the armature, as clearly indicated in Figs. 2 and 3.

The faces of the poles are concave and the co-operating faces of the armature are convex, thus conforming them to the arc of the circle in which the armature vibrates on its trunnions. At one side, near one of its pole-faces, the armature is coupled by means of links i with the clamp-lever c, before referred to.

It will be readily seen that the lifting movement of the carbon b and its support at the point to which it may be lifted will be readily effected by the application of an electric current to the helix g, which I will now term the "main" helix, because I will next describe a second or auxiliary helix k, by means of which the lowering of the upper carbon is accomplished. This auxiliary helix k is here shown to be composed of finer wire than that in the main helix; but it is similarly arranged at the opposite end of the shell or cylinder and with proper relation to the pole f'. This helix is in a shunt-circuit, as is usual in arc-lamp regulators, so that according to the requirement at the arc the main helix will be able to move and hold the armature at just such positions as will properly locate the upper carbon, because the opposite polarity induced by the auxiliary helix will accurately reduce or modify the power of the main helix to magnetize the shell and its cores or faces, and so permit the armature to move and be maintained in such positions as will properly locate the upper carbon tip with relation to the coincident tip of the lower carbon

Now referring to Fig. 4, it will be seen that the cylindrical shell A', the two cores $l\,l'$, the armature m, the main helix n, and the auxiliary helix o correspond generally with the similar parts of the form of my magnet already described, In this case, however, they are specially organized to operate as a relay, and hence the shell has an opening in its top for the armature, which is T-shaped and is in part controlled by a spring m' and abuts against a contact-screw m^2 wherever the power of said spring is overcome by the magnet influenced by the main helix n; but said spring is in turn permitted to act whenever the auxiliary helix o is caused to modify or restrict the magnetizing power of the main helix. The armature is pivoted in this case, as at p, so as to permit its arm or tail-piece to properly vibrate.

Now it will be obvious that, although of special value in some connections, it is not essential in all cases for the armature to be pivoted within the shell, nor that the pole-faces be curved or angular—as, for instance, this armature m might be extended, as indicated in dotted lines, through another opening in the bottom or lower side of the shell and there be pivoted upon a standard; or it might at its foot be a spring to serve as a pivot, in which case magnetic metal would only be used adjacent to the pole-faces and the remainder of the armature be of diamagnetic or non-magnetic metal, and each of the pole-faces would be vertical in lieu of angular, ample space being afforded between each pole-face of the armature and the face of its coincident core to provide for requisite vibratory movements. It will be equally obvious that in many instances the armature, in lieu of swinging to and fro between the poles, will be desirably moved in a right line from either pole to the other, and, further, that in connections wherein rapid intermitting changes in polarity are desired the shell and cores, or both, may be composite or laminated in their structure. It is also to be understood that for some purposes the length of the cores can be reduced to a minimum, and even that the interior central surfaces of the ends of the shell may serve as pole-faces, because the magnetic metal of the vibratory armature in properly occupying the intervening space would complete the magnetic circuit. It will be obvious that the ends of the chambered shells are not necessarily wholly closed, inasmuch as they may in some cases be in the form of radial arms affording

central pole-faces or supporting the internal cores. It is further to be understood that the auxiliary helix may be variously located and applied without departure from certain portions of my invention, so long as the main helix is within the shell and is the vibratory armature affected in the manner described by the auxiliary helix.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The combination, substantially as hereinbefore described, of a chambered shell composed of magnetic metal affording interior pole-faces, an exciting-helix within said shell for developing opposite polarity at said faces, and a vibrative armature located between said faces and completing a magnetic circuit which traverses the wall of said shell from one end to the other, and thence internally through the armature to the opposite end of said shell.

2. The combination, substantially as hereinbefore described, of a chambered shell composed of magnetic metal affording interior pole-faces, a vibrating armature between said faces, a main exciting-helix within said shell for developing opposite polarity at said faces, and an auxiliary helix, also within said shell for variably controlling the armature by modifying or reducing the magnetizing power of the main helix.

3. The combination, substantially as hereinbefore described, of a chambered shell composed of magnetic metal and affording interior pole-faces, an exciting-helix within said shell for developing opposite polarity at said faces, and an armature having faces which vibrate toward and from said pole-faces and is pivoted between said faces within said shell.

RUDOLF EICKEMEYER.

Witnesses:
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R. D. SAWYER.