No. 695,539. Patented Mar. 18, 1902.

F. B. COOK.

ELECTROMAGNETIC APPARATUS.

(Application filed Aug. 29, 1899.)

(No Model.)

Fig. 1.

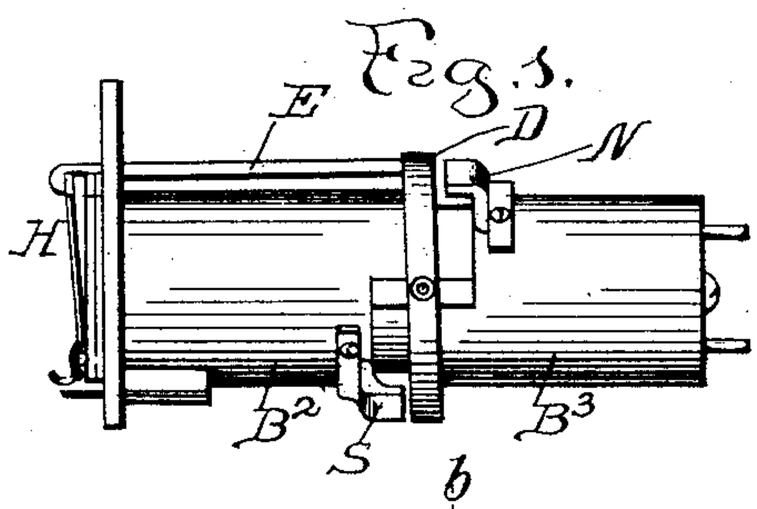


Fig. 2.

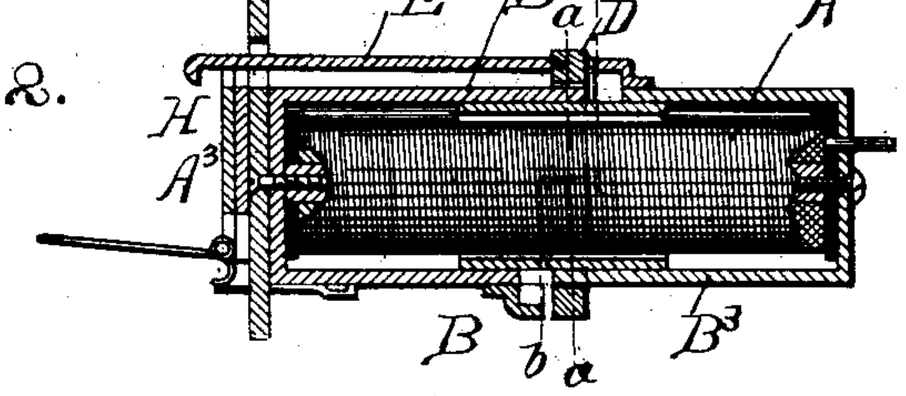


Fig. 3.

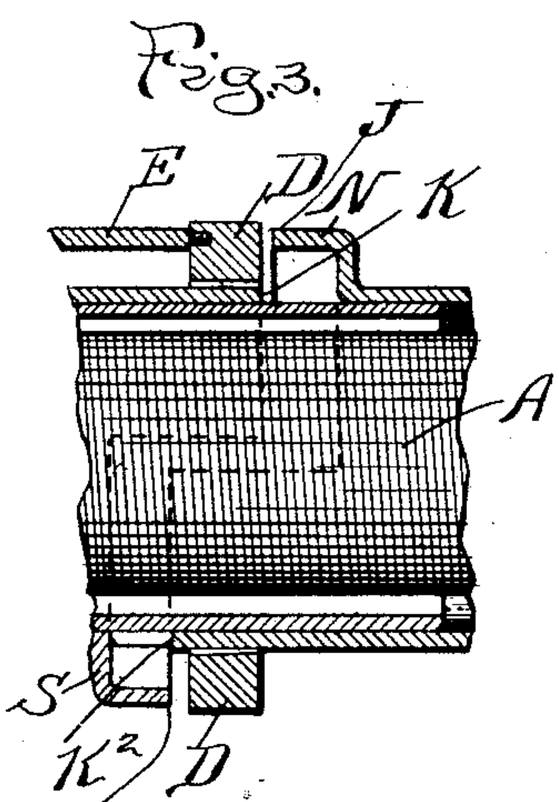


Fig. 4.

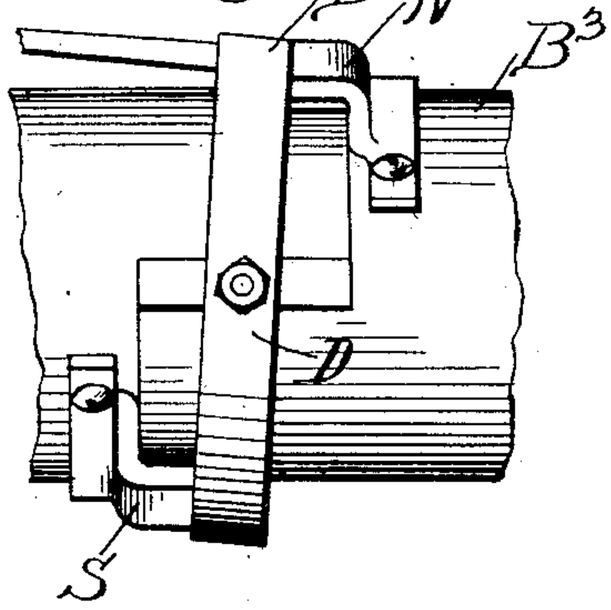


Fig. 5.

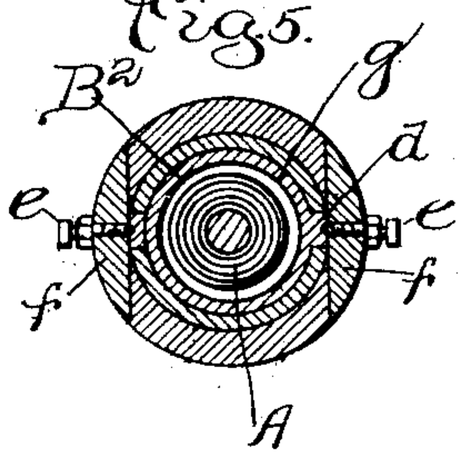


Fig. 6.

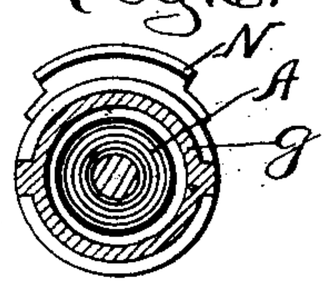


Fig. 7.

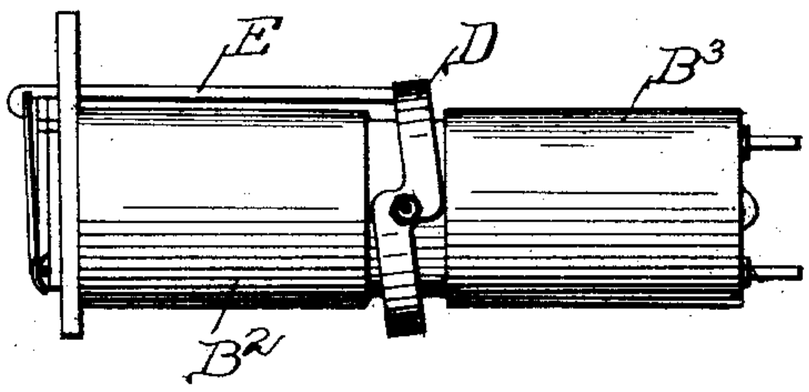
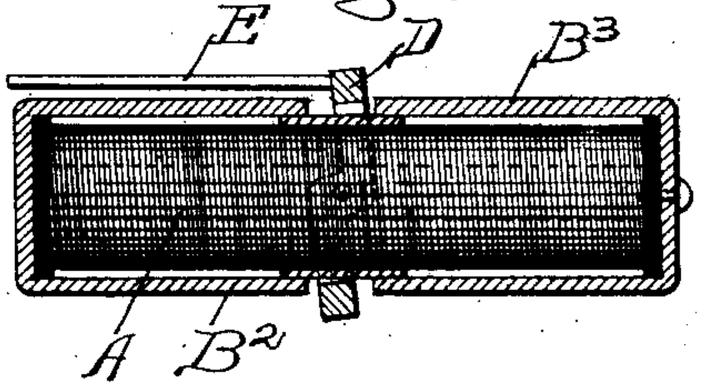


Fig. 8.



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UNITED STATES PATENT OFFICE.

FRANK B. COOK, OF CHICAGO, ILLINOIS.

ELECTROMAGNETIC APPARATUS.

SPECIFICATION forming part of Letters Patent No. 695,539, dated March 18, 1902.

Application filed August 29, 1899. Serial No. 728,820. (No model.)

To all whom it may concern:

Be it known that I, FRANK B. COOK, a citizen of the United States of America, and a resident of Chicago, Cook county, Illinois, have invented a certain new and useful Improvement in Electromagnetic Apparatus, of which the following is a specification.

My invention relates to certain improvements in an electromagnetic apparatus which is especially adapted, although not exclusively, for use in connection with telephone apparatus, and I shall therefore describe and illustrate my invention in connection with such apparatus.

In the central office of a telephone system a switchboard is provided at and by which operators establish connection between the various circuits of the subscribers as and when called upon by any subscriber desiring to be coupled for conversation with some other subscriber. In order to attract the attention of the operator at the switchboard to the circuit of any given subscriber, annunciators or visual indicators are provided, one for each subscriber's circuit, which are operated to display or give a signal by a current generated at the subscriber's station extending the call, which current acting upon an electromagnet of the annunciator operates it to display the signal. It is desirable that the annunciator or drop be capable of sensitive and invariable operation by currents of minimum strength, as the conditions which prevail in telephonic systems tend to impair and reduce the strength of the currents in generation and when generated.

The object of my invention is to provide an electromagnetic apparatus which shall be capable of sensitive action to invariably operate the annunciator by currents of a much less strength than has been possible heretofore.

My invention has certain other objects in view; and it consists in certain features, which will be fully described, and pointed out in my claims, reference being now had to the accompanying drawings, in which—

Figure 1 is a side elevation of my improved annunciator. Fig. 2 is a central longitudinal section. Fig. 3 is an enlarged central longitudinal section of the central portion of the annunciator, showing the armature-lever and armature away from the magnet-poles in a position to be attracted thereby. Fig. 4 is an exterior view of said central portion of the annunciator, also enlarged. Fig. 5 is a cross-section on the line *a a* of Fig. 2. Fig. 6 is a like view on the line *b b* of Fig. 2. Fig. 7 is an exterior view of a modified form. Fig. 8 is a central longitudinal section of the same.

My invention broadly consists in an electromagnetic apparatus comprising substantially in construction an inclosing magnetic shell surrounding the electromagnet and formed in two parts, together with an armature acted upon by the magnetic poles of said shell, whereby the poles of the magnetic shell are presented in such close proximity to the armature as to obtain the maximum pull with a minimum current.

My invention also consists in disposing the armature in such relation to the pole or poles of the electromagnet that said armature is permitted to have a greater range of movement and yet remain always within the field of force of the magnet, whereby the armature is invariably operated and permitted and given a wider or greater range of movement, and this is accomplished by an operating-current of less strength.

I shall proceed to describe my improvements in connection with the annunciator of a telephone-exchange.

In annunciators as now usually constructed the one end of one pole of the electromagnet acts upon a pivoted armature, which in turn operates a pivoted latching-lever engaging a pivoted shutter, whereby the armature when attracted by one end or one pole of the magnet operates the lever to release the shutter, which then drops or falls and in so doing indicates or gives the signal to the operator.

The electromagnet A is disposed within the tubular magnetic shell B, which latter is made in two parts B^2 and B^3, each secured to the end of the core A^2 of the electromagnet by the screws A^3 and A^4. The armature D is ring-shaped, surrounds the electromagnet A and its shell B, and is pivoted approximately at the center D^2 to diamagnetic pivot-pieces *d d*; the pivot-screws *e e*, Fig. 5, passing through diamagnetic pieces *f f* on the arma-

ture and entering said pivot-pieces. By this means the armature is magnetically insulated from the magnetic shell B and virtually made up of two parts or pieces isolated from each other. The pivot-pieces *d d* are held by the diamagnetic shield *g*. Angular-shaped pole-pieces J and J^2 are secured on or formed, respectively, with the parts B^2 and B^3 of the shell B on the upper and lower sides thereof, and the poles of the magnet are therefore located, respectively, above and below the pivot D^2 of the armature D and presented to opposite sides and vertical ends of said armature. The end portion of each of the parts B^2 and B^3 of the magnetic shell in proximity to the armature D are cut away, as shown more clearly by the dotted lines of Fig. 3, to form the pole-pieces K and K^2, which are thus beneath or within the ring-armature D. By reason of the weight of the latch-lever E the armature D tends to remain in a vertical position away from the pole-pieces J J^2, as shown in Fig. 3. It will be observed, however, that when in this position the armature is at the same distance from the pole-pieces K and K^2, and therefore these poles exert a pull immediately upon the armature D, the poles J and J^2 also supplementing and increasing this pull. The armature always maintains the same slight relative distance from the pole-pieces K and K^2 in all its assumed positions and notwithstanding the armature is given a wide range of movement it is always immersed within the magnetic field of the pole-pieces K K^2. The armature as ordinarily used at present is pivoted at its upper or lower end in proximity to the magnet, and therefore a part of the energy of the magnet is wasted in exerting a pull upon the stationary pivot-point of the armature. Also the outer end portion of the armature in such a construction is relatively distant or remote from the pole of the magnet and cannot be given a wide range of movement, as it would then be brought without the field of force of the magnet.

In my construction as shown in connection with the annunciator the armature is preferably centrally pivoted and a pole presented above and below said pivot and on either side of the armature, certain of the pole-pieces being arranged in such relation to the armature that it always remains at the same distance from said pole-pieces, and therefore always immersed in the field of force thereof to be immediately acted upon thereby, the other pole-pieces supplementing and exerting an additional pulling force. The pole-pieces unitedly exert an influence which causes the armature to rotate on its pivot into the position shown in Figs. 1 and 3, thereby lifting the lever E to release the shutter H.

It will also be observed that I obtain a greater leverage in acting upon the armature, because the pole-pieces below the pivot exert a pull upon the lower lever-arm of the armature in one direction, and the pole-pieces above said pivot exert a pull upon the upper lever-arm of said armature in an opposite direction, the combined influence of the two sets of pole-pieces resulting in the rotation of the armature on its pivot and the lifting of the latching-lever.

In Figs. 7 and 8 I have shown a form in which the pole-pieces J and J^2 are not employed, in which case it is not necessary to divide the armature into two parts by the diamagnetic pieces *f f*, as is done with the form previously described. It will be particularly observed that by reason of this construction the armature is always in close proximity to the electromagnet-poles, and thereby a maximum pull is brought to bear upon the armature by the poles with a minimum current. Again, as the electromagnet is surrounded by a heavy metallic shell, should the coil burn out under excess of current the shell would protect the other portions of the apparatus from injury by fire.

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

1. In an electromagnetic apparatus, a two-part armature approximately centrally pivoted, an electromagnet and a plurality of pole-pieces of said magnet arranged on either side of said armature and above and below the pivot thereof, a latching-lever and a drop or shutter normally held by said lever.

2. In an electromagnetic apparatus, a two-part magnetic shell formed with pole-pieces at its proximate ends, an electromagnet connected therewith, and an armature the opposite sides of which are acted upon by the poles of said shell.

3. In an electromagnetic apparatus, a two-part magnetic shell formed with pole-pieces at its proximate ends, an electromagnet connected therewith, and an armature mounted on an axis located between the poles of said two-part shell.

4. In an electromagnetic apparatus, a two-part magnetic shell, an electromagnet connected therewith, and an armature centrally pivoted and positioned between the poles of the shell.

5. In an electric magnetic apparatus, a two-part magnetic shell, an electromagnet connected therewith and a centrally-pivoted ring-shaped armature positioned between the poles of the shell and surrounding the electromagnet.

6. In an electromagnetic apparatus, a two-part magnetic shell, an electromagnet connected therewith and a centrally-pivoted ring-shaped armature which surrounds the electromagnet and the pole-pieces of the shell whereby said armature remains within the field of force of said pole-pieces.

7. In an electromagnetic apparatus, a mag-

netic shell formed in two parts each of which is connected with the electromagnet and each having a pole-piece and a two-part armature together with supplemental pole-pieces on the ends of the magnetic shell.

8. In an electromagnetic apparatus, a two-part magnetic shell, an electromagnet connected therewith and a ring-shaped armature, suitably pivoted encircling said electromagnet and positioned between the poles of the shell.

Signed by me at Chicago, Cook county, Illinois, this 26th day of August, 1899.

FRANK B. COOK.

Witnesses:
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