(No Model.)

A. STROMBERG & A. CARLSON.

TELEPHONE APPARATUS.

No. 504,636. Patented Sept. 5, 1893.

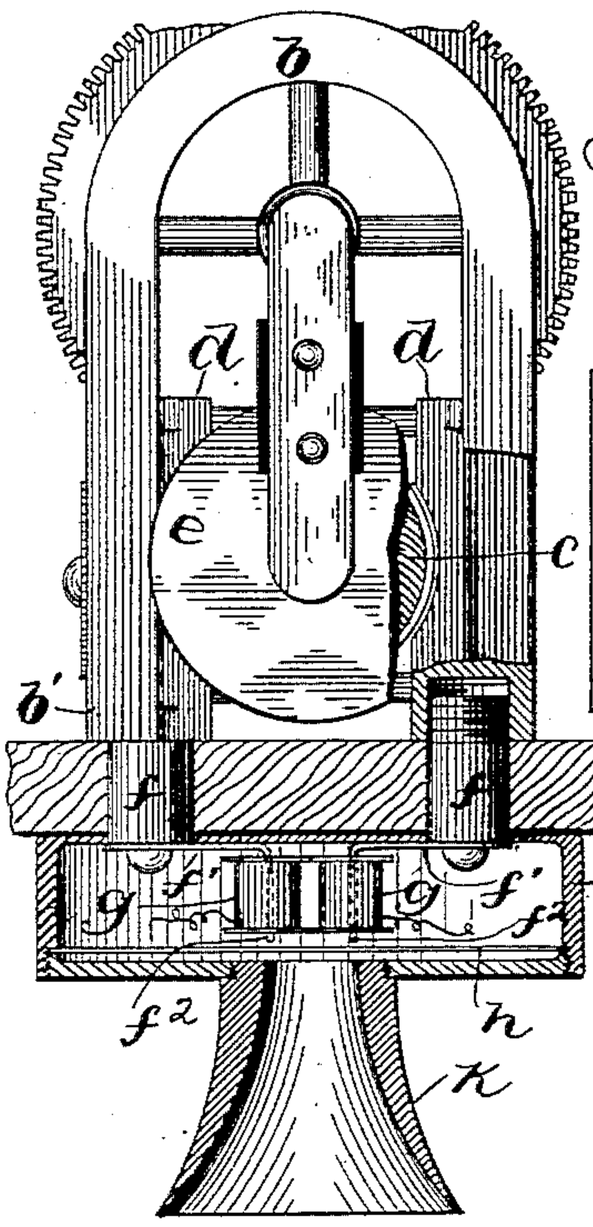

Fig. 1

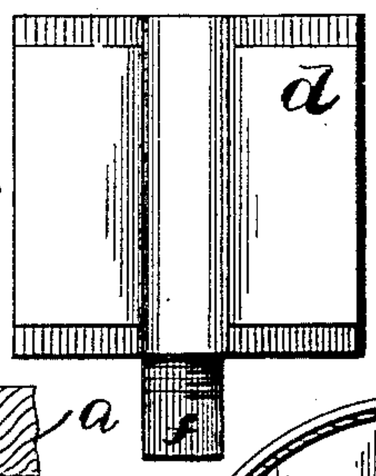

Fig 2

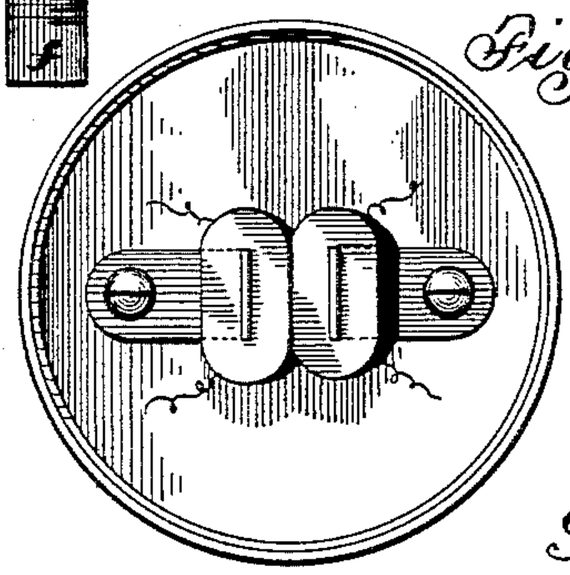

Fig. 3

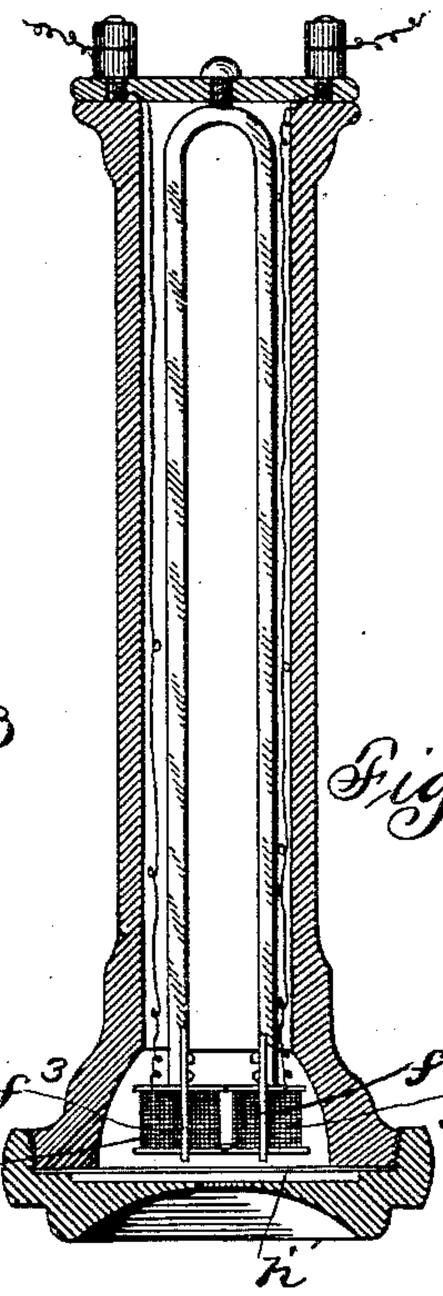

Fig. 4

Fig. 5

To Exchange

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UNITED STATES PATENT OFFICE.

ALFRED STROMBERG AND ANDREW CARLSON, OF CHICAGO, ILLINOIS.

TELEPHONE APPARATUS.

SPECIFICATION forming part of Letters Patent No. 504,636, dated September 5, 1893.

Application filed April 3, 1893. Serial No. 468,849. (No model.)

To all whom it may concern:

Be it known that we, ALFRED STROMBERG and ANDREW CARLSON, citizens of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Telephone Apparatus, (Case No. 9,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

Our invention relates to telephone apparatus, and its object is to provide a magneto telephone of increased power which may be used for a transmitter.

A further object of our invention is to simplify the construction of the signaling bell and the telephone, and to utilize the permanent magnets of the magneto ringer for the telephone.

Our invention consists in so forming the poles of the magneto generator that they are brought into proximity to a diaphragm, and providing these poles with helices so connected as to permit the flow of the undulations of the current caused by the vibration of the diaphragm in proximity to the poles of the electro-magnet, and in the arrangement of the magneto telephone as a transmitter, and a receiving instrument connected therewith in a circuit in such a manner as to secure the greatest effect.

Our invention will be more readily understood by reference to the accompanying drawings, in which—

Figure 1 is a side elevation of a magneto ringer with one of the permanent magnets and one of the pole pieces partially broken away, and the transmitter of our invention in section. Fig. 2 is a top view of one of the pole pieces which surround the armature of the magneto generator. Fig. 3 is a front view of the transmitter of our invention with the cover removed. Fig. 4 is a sectional view of the receiver which we preferably use, in connection with the transmitter of our invention. Fig. 5 is a diagram showing the arrangement of circuits in which the transmitter and receiving telephone of our invention are connected.

Similar letters of reference are used to indicate similar parts throughout the different views.

The magneto generator may be of the well known type ordinarily used for signaling bells on telephone lines. We preferably mount the generator upon the front of the box so that the magnets extend in a horizontal position in the inside of the box, though this arrangement is not essential to the use of our invention.

Fig. 1 represents such an arrangement, the door *a* of the box being partially shown. The permanent magnets *b* of the magneto generator are placed with their poles *b'* against the door or front of the inclosing case. The armature *c* of the generator is surrounded, as in the usual construction of generator, with soft iron pole pieces *d d* forming a cylinder in which the armature is adapted to rotate. The disk *e*, preferably of non-magnetic material, is adapted to cover the armature and to support the axis upon which the armature rotates.

Connected with the soft iron pole pieces of the magneto generator are soft iron extensions thereof, *f f*, extending through the cover of the case, and to these extensions are attached the angular soft iron pieces *f' f'* upon the ends of which we wind the helices *g g*. The angular pieces *f' f'* are thus in magnetic connection with the permanent magnets *b* of the magneto ringer, and will be polarized by the permanent magnets *b*, one of said pieces being north and the other south. The ends f^2 f^2 of the angular pieces *f' f'* preferably project through the helices and in close proximity with the diaphragm *h*, which is rigidly supported at its periphery in the case *i*, which is provided with the mouth piece *k* of any desired construction. The diaphragm is of the usual construction of soft iron, and, as is well known, the vibration of the diaphragm in close proximity to the poles f^2 f^2 causes an undulatory current to be set up in the helices surrounding the poles *f' f'*.

The receiver is of ordinary construction, but instead of using the straight bar magnet we prefer to use a magnet of horseshoe form. To the ends of this horseshoe magnet are screwed or riveted soft iron extensions f^3 f^3 about which are wound the helices of fine wire *g' g'*. The ends of these soft iron pieces

are brought into close proximity to the diaphragm h'. We have found that a receiver so constructed, and connected up, as shown in Fig. 5, with our transmitter, produces most satisfactory results. As will be seen from this diagram, the line from the subscriber's outfit, or from one station of a private line, starting from ground l passes through the contact point m when the switch is down, as it normally is when the telephone is not in use, thence through the ringer and out to the line n and to ground at the exchange or the other station, or back again to the point l in case of a metallic circuit. When the telephone is taken off the hook o contact is made with the point p, as is shown in Fig. 5, when the circuit is through the two coils g g of the transmitter, thence through the coils g' g' of the receiver, thence by line q to the exchange, or through station and back, as before.

We have found the connection of the two coils of the receiver in multiple arc, as shown, to produce the best results, and our construction of telephone is such that it not only utilizes the permanent magnets of the ringer, which are usually powerful, thus resulting in saving in the cost of the instrument, but accomplishes practically the same result as an ordinary battery transmitter in much more compact, convenient and less expensive form.

As shown in Fig. 5, the coils of the transmitter are connected in circuit in series, so that double the voltage of the voice currents is secured that would be obtained were but a single coil used, or were the coils connected in multiple. This may be explained by the fact that for a given coil and magnetic field any movement of the diaphragm induces a current of a definite voltage, while if the diaphragm be moved in proximity to two such coils currents of the same definite voltage will be induced in each. If these two coils be connected together in series the voltages will be added, while if they be connected in multiple the voltage will be that of one of the coils only. Thus it is seen that for the transmitting instrument it is desirable to connect the coils in series. By placing extensions upon the pole pieces of the magneto generator, therefore, we are enabled to secure a strong magnetic field, while by bringing the extensions into close proximity to one another and to the diaphragm we are enabled to secure a magnetic field of minimum reluctance; furthermore, by placing a coil upon each extension and connecting the coils in series we are enabled to secure a maximum voltage for the voice currents. It has been proposed heretofore to place a diaphragm in close proximity to a polar extension upon a magneto generator, but we are not aware that it has ever been proposed before to bring polar extensions from both poles opposite a common diaphragm and to connect coils placed upon each in series.

In the receiving instrument we have found by experiment that better effects are produced by connecting the two coils in multiple. This is due to the fact that when the coils are so connected the magnetizations of both cores rise in unison so that the vibration of the diaphragm, which must be proportional to the combined effect of the two magnetizations, is directly proportional to the change in current strength. When, however, the two coils are connected in series, the magnetization in one core rises in advance of that in the other since the current traverses one coil in advance of the other, with the consequence that the diaphragm does not vibrate directly in response to the changes in current strength on the line, but in response to changes of a magnetization due to both coils, which magnetization is not directly proportional to the changes of current strength on the line as it is compounded of two waves of magnetization having different phases. It will thus be observed that when the coils are connected in multiple the diaphragm responds directly to the changes of the voice currents, and, consequently, the proper sounds are reproduced by the receiver, while when the coils are connected in series the lag of the magnetization in one core renders the vibration of the diaphragm disproportionate to the changes of the voice currents. As an incidental advantage of this construction the resistance of the line is greatly reduced by thus placing the coils in multiple.

While we have shown a receiver and transmitter in circuit with a telephone switch, we do not desire to limit ourselves to this combination, since it is obvious that by the addition of a flexible tube to the mouth piece k, the transmitter may be made to serve as both transmitter and a receiver, thus dispensing with the receiver of the usual type.

While we have shown the soft iron extensions of the pole pieces as being separate from and inserted in the same, we do not desire to limit ourselves to this construction, since in practice it may be found preferable to construct this soft iron extension of the pole piece and the pole piece in one.

We do not desire to limit ourselves to the precise location of the helices g g with relation to the magneto generator, as shown, but

Having described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In a telephone, the combination of the pole pieces b' b' with the extensions f f, the angular pieces of iron f' f' attached thereto, the helices g g surrounding the ends of said angular pieces, and the diaphragm h adapted to vibrate in proximity to said angular pieces of iron, substantially as described.

2. In a telephone, the combination with a magneto generator, of extensions from the poles thereof, the ends of said extensions being placed in proximity, a diaphragm opposite the ends of said extensions, and coils mounted upon said extensions, said coils being connected together in series; whereby the

permanent magnetism of the magneto generator is utilized in producing voice currents and the voltage of said currents is the result of the added effect of the two coils, substantially as described.

3. In a telephone apparatus, the combination with a magneto generator, of soft iron extensions of the poles thereof, the ends of said extensions being brought into close proximity, a diaphragm opposite the ends of said extensions, and coils provided upon said extensions; whereby a completed magnetic field of minimum reluctance is provided for the telephone, the same being in shunt with the magnetic field of the generator, substantially as described.

4. In a telephone receiver, the combination with a diaphragm, of an electro-magnet having its ends brought into proximity to said diaphragm, a coil surrounding each of the limbs of said magnet, said coils being connected in circuit in parallel; whereby both coils exert their maximum influence upon the diaphragm at the same time, substantially as described.

5. In a magneto telephone receiver, the combination with a plurality of magnetic cores having their ends placed in proximity and opposed to a common diaphragm, of coils surrounding said magnetic cores and connected in multiple in such a manner that no two of said coils may be included in series, substantially as described.

In witness whereof we hereunto subscribe our names this 30th day of March, A. D. 1893.

ALFRED STROMBERG.
ANDREW CARLSON.

Witnesses:
GEORGE L. CRAGG,
CHARLES A. BROWN.