(No Model.)

C. E. SCRIBNER.

ELECTROMAGNET.

No. 584,416. Patented June 15, 1897.

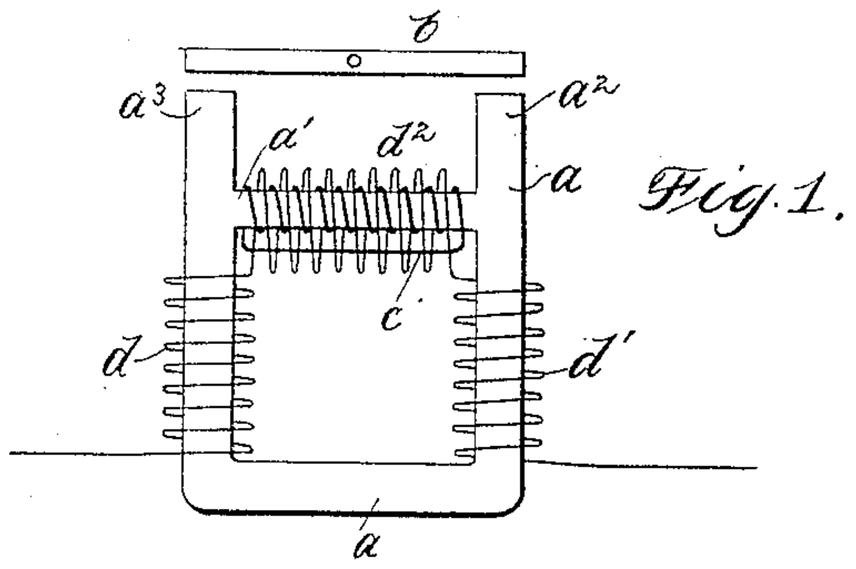


Fig. 1.

Fig. 2.

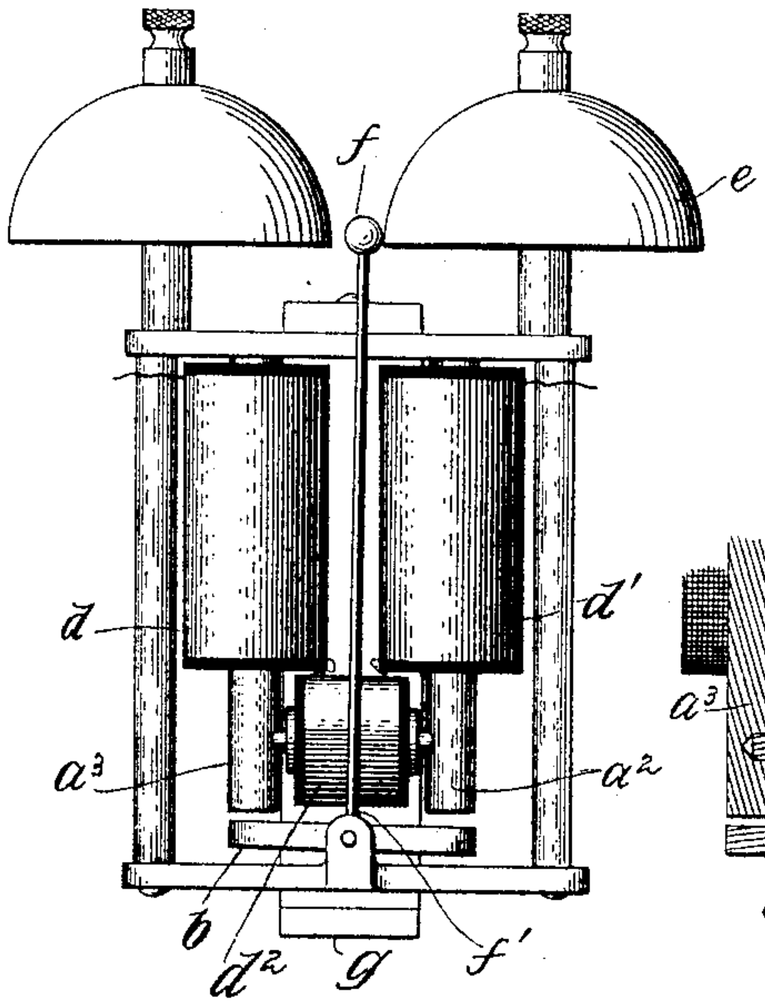


Fig. 3.

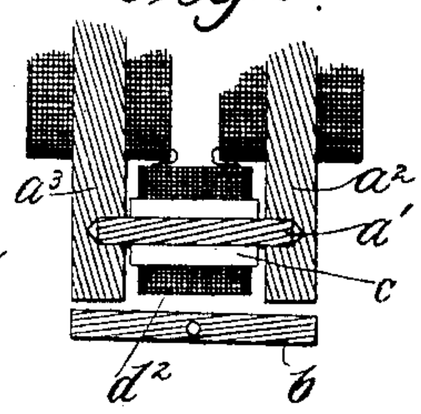


Fig. 4.

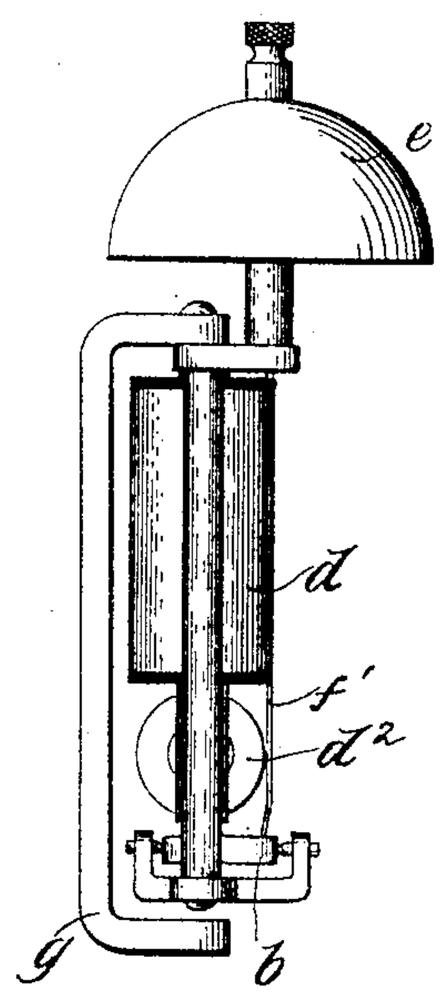
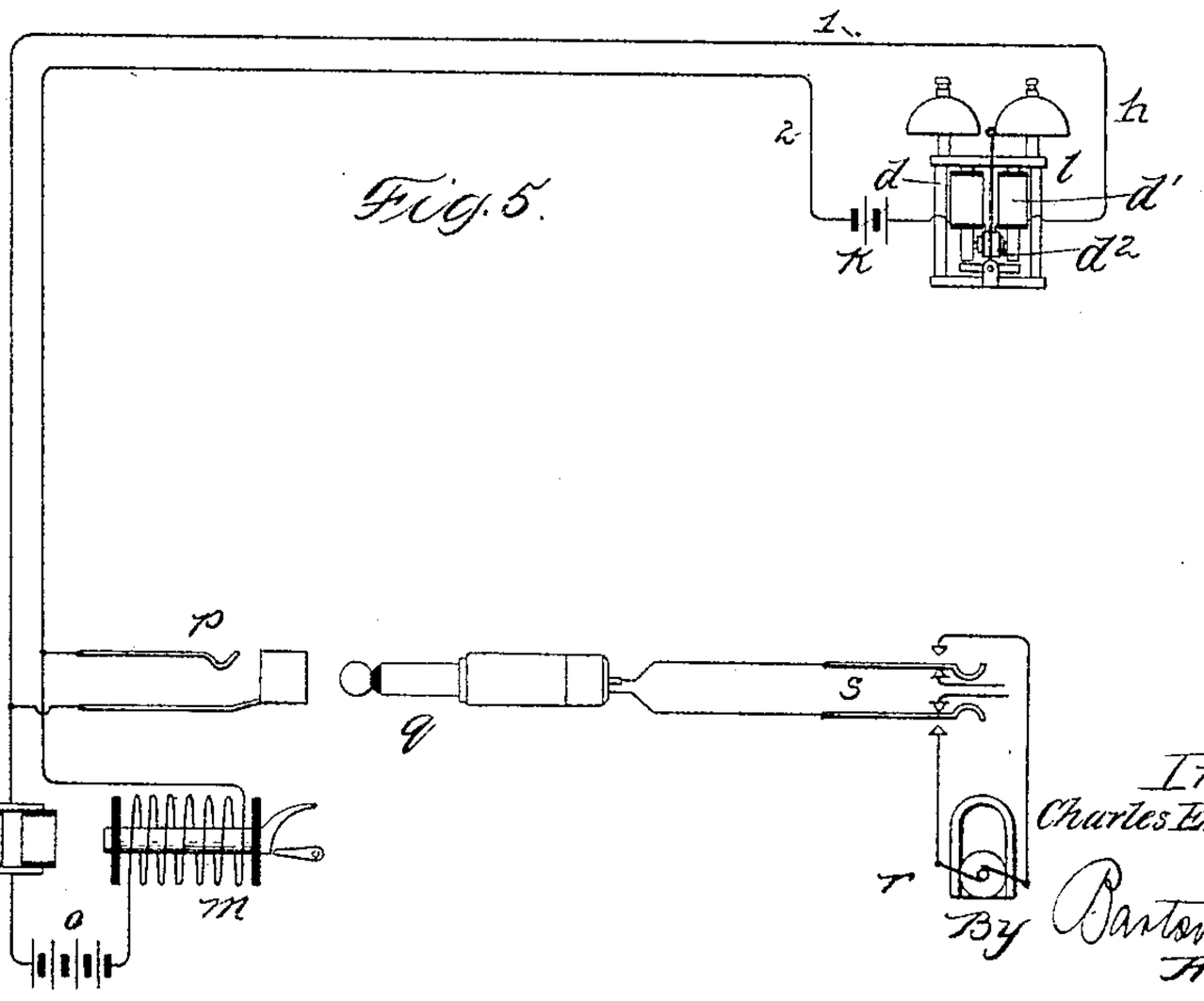


Fig. 5.



Witnesses: i
G. L. Cragg.
J. W. Sinclair

Inventor:
Charles E. Scribner.
By Barton & Brown
Attorneys.

UNITED STATES PATENT OFFICE.

CHARLES E. SCRIBNER, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE WESTERN ELECTRIC COMPANY, OF SAME PLACE.

ELECTROMAGNET.

SPECIFICATION forming part of Letters Patent No. 584,416, dated June 15, 1897.

Application filed November 4, 1895. Serial No. 567,837. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. SCRIBNER, a citizen 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 Electromagnets, (Case No. 405,) 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.

My invention concerns, broadly, the construction of electromagnets, its aim being to produce an electromagnet which shall respond to alternating or pulsating electric currents, but which shall remain inert when traversed by undulating or continuous currents.

The immediate object of the invention is to provide a polarized signal-bell for telephone-lines which shall remain undisturbed by current continuously flowing through it, but shall be sensitive to alternating signaling-currents.

The essential novelty of my invention consists in the combination, with an electromagnet and its armature, of a bridge or magnetic shunt of magnetic material between the poles of the electromagnet and a magnetizing-helix upon the bridge, adapted to nullify the polarity of the magnet-poles, or, in other words, to create a condition of no difference of magnetic potential between the poles. The armature is by this device perfectly shunted by the bridge while continuous currents traverse the magnet-helices. For the purpose of making the magnet responsive to alternating currents this bridge is surrounded by a closed conducting-circuit, as by a tube of copper, by which rapid fluctuations of the induction in the bridge are obstructed, so that when the magnet-coils are traversed by rapidly-varying currents the null condition of the magnet-poles is not attained, and the poles act upon the armature in the usual way to effect its movement. In utilizing this contrivance in a polarized electric bell a constant polarity is imparted to the electromagnet by means of a permanent magnet in proper relation to it. The armature is centrally pivoted in the manner shown in Patent No. 210,886, dated December 17, 1878, to T. A. Watson, and carries a tongue oscillating between gongs. A bell thus organized will remain unaffected when traversed by an unvarying or constant current of any strength, but will respond to fluctuations or alternations in the current through it, such as are produced by the action of a generator of signaling-current, with an efficiency substantially as great as that of the ordinary polarized signal-bell.

The invention is shown in the accompanying drawings.

Figure 1 of the drawings represents the elements of the electromagnet in a diagrammatic manner. Fig. 2 is a front elevation of the polarized signal-bell. Fig. 3 is a section of a portion of the bell through the magnetic bridge and its surrounding tube and magnetizing-helix. Fig. 4 is a side elevation of the bell. Fig. 5 is a diagram illustrating the use of the bell in a telephone-line in which a current circulates constantly for the purpose of charging a storage battery at the substation.

The essential and novel features of the invention may be described with reference to Fig. 1.

The usual U-shaped core a of the electromagnet is provided with a bridge a' integral with it, the pole-pieces a^2 a^3 projecting beyond the bridge and being presented to the armature b. Upon the bridge a' is placed a closed conducting-circuit c, represented as a short-circuited coil of low resistance, which may in practice be a tube of non-magnetic metal. Helices d and d' are wound upon two limbs of the core a, and a third helix d^2 is wound upon the bridge a' outside the coil or winding c. Coils d, d^2, and d' are connected in series. The coils d and d' may be of the usual size and resistance—say of one thousand ohms. Coil d^2 may be of any suitable resistance, but should have a magnetizing effect with relation to coils d and d' such that it may produce in the bridge a' an induction equal to that produced by coils d and d' in the core a, and in the same direction in the circuit. Under this condition when the three helices are traversed by a steady current there will be a condition of no difference of magnetic potential between the extremities of the bridge a', or, in other words,

this bridge will be a perfect short circuit of the magnet and will prevent the magnetizing of pole-pieces a^2 and a^3. The armature b will therefore not be attracted. When, however, the current through these helices is caused to vary quickly, corresponding fluctuations of the induction through the bridge a' are obstructed or largely prevented by the currents induced in the short-circuited coil or tube c in a manner well known. The short-circuited conductor c thus both directly impairs the efficiency of the bridge a' as a magnetic shunt and shields this bridge from the action of the helix d^2, the effect being substantially equivalent to the removal or interruption of the bridge a' during the passage of the varying current. Hence the armature b is attracted and brought into motion when the magnet is traversed by alternating or other rapidly-varying currents.

The magnetic bridge surrounded by the closed conducting-circuit (the copper tube) is of course alone effective to a certain extent in reducing the difference of magnetic potential at the poles when the magnet is excited by continuous currents. Hence the bell is operative in a degree when the winding d^2 is omitted. The best effect is, however, obtained with the complete device as described.

Figs. 2, 3, and 4 illustrate the application of this contrivance in a polarized electric bell of well-known type. The electromagnet is carried in a frame, at one extremity of which, opposite the pole-pieces a^2 a^3 of the magnet, the armature b is carried by trunnions at its center. The same frame carries upon posts a pair of gongs e, between which oscillates a hammer f, carried by a tongue f', secured to the armature b. A bent permanent magnet g has one extremity fixed to the yoke of the electromagnet and the other presented to the armature b, so that the latter is permanently magnetized by induction with like poles at its extremities. The bridge a' may be a small bar of iron let into the pole-pieces a^2 a^3. It is surrounded by a cylinder or tube c of copper, which is provided with flanges or heads near its extremities, the space between the heads being filled by the coil d^2. While a steady current is flowing through the coils of this bell the electromagnet exerts no attraction upon its armature b, and since the latter is magnetized by permanent magnet g with consequent poles at its center it lies indifferently at either side. When, however, an alternating signaling-current finds circuit through the bell, the magnetic bridge and the coil d^2 cease to perform their function, the pole-pieces are alternately magnetized in opposite directions through the agency of helices d and d', and the armature is thrown into vibration. Obviously if the signaling-current were not actually reversed, but only raised above and depressed below a certain average or normal value, the effect upon the armature would be the same as that produced by an alternating current.

In telephone-exchange practice it has sometimes been found desirable to provide at the substation of a line a storage battery for operating the station-transmitter, the battery being charged by a current constantly flowing in the line from a central source, but it has been found that such steadily-flowing current interfered with the operation of the ordinary type of polarized bell. Fig. 5 represents such an organization of circuits, including my improved bell at the substation.

Telephone-line 1 2 extends from a substation h to a central station i. At the substation the circuit includes serially a storage battery k of two cells and three windings d, d', and d^2 of the bell l. At the central station the line includes an annunciator m and an impedance-coil n and is led to the terminals of the central charging-battery o. The line is connected with the usual spring-jack p. A plug q is represented, which, when introduced into spring-jack p, serves to connect a source r of alternating signaling-current in a bridge of the line-circuit 1 2 at the exchange, the continuity of this circuit being controlled, however, by the usual ringing-key s.

The circulation of the charging-current in the line leaves the bell l normally inert. When the source r of signaling-current is connected with the line, fluctuations are produced in the line-circuit 1 2 which effect the operation of the bell. If the source r of signaling-current be of sufficient strength with relation to battery o, it may create an alternating current in the line-circuit, but if the electromotive force of the source of signaling-current be less than that of battery o clearly the resulting signaling-current would be only a pulsating or undulating current. In either case the bell may be efficiently actuated without disconnecting the battery o.

I claim as new and desire to secure by Letters Patent—

1. The combination with an electromagnet, of a bridge of magnetic material between its poles, a coil encircling the bridge, and means for producing current in the coil, said coil being adapted to create a condition of no difference of magnetic potential between the poles of the magnet, substantially as described.

2. The combination with an electromagnet, of a bridge of magnetic material uniting its poles, a closed conducting-circuit and a coil encircling the bridge, and a source of current in circuit with said coil, the coil being adapted to produce a condition of no difference of magnetic potential between the magnet-poles, as described.

3. The combination in an electromagnet, of a core terminating in pole-pieces, windings on the core, a bridge of magnetic material uniting the pole-pieces, a closed conducting-circuit and a winding encircling the said bridge, all of said windings being connected

in the same electrical circuit, the last-mentioned winding being adapted to neutralize the effect of the other two windings upon the pole-pieces, substantially as described.

4. In an electric bell the combination with the electromagnet and the centrally-pivoted polarized armature thereof, of a bridge of magnetic material uniting the poles of the magnet, and a closed conducting-circuit encircling the bridge, as described.

5. The combination in an electric bell, of the electromagnet and the centrally-pivoted polarized armature thereof, a bridge of magnetic material uniting the poles of the electromagnet, a closed conducting-circuit and a winding encircling the said bridge, the said winding being in a circuit with the windings of the electromagnet and being adapted to neutralize the effect of the said magnet-windings upon the poles of the magnet, substantially as described.

6. In an electric circuit, the combination of a source of charging-current, a storage battery, a polarized signal-bell having its electromagnet provided with a bridge of magnetic material uniting its poles, a winding in the charging-circuit and a closed conducting-circuit encircling the said bridge, and means for producing variations in the current through the charging-circuit, substantially as described.

In witness whereof I hereunto subscribe my name this 17th day of September, A. D. 1895.

CHARLES E. SCRIBNER.

Witnesses:
ELLA EDLER,
LUCILE RUSSELL.