No. 637,846. Patented Nov. 28, 1899.

J. A. BARRETT.

ELECTRICAL AND SELECTIVE SIGNALING.

(Application filed June 8, 1899.)

(No Model.)

Fig. 1.

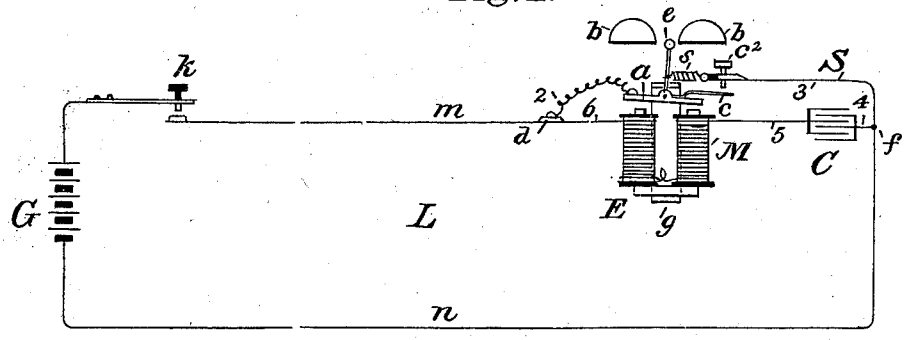


Fig. 2.

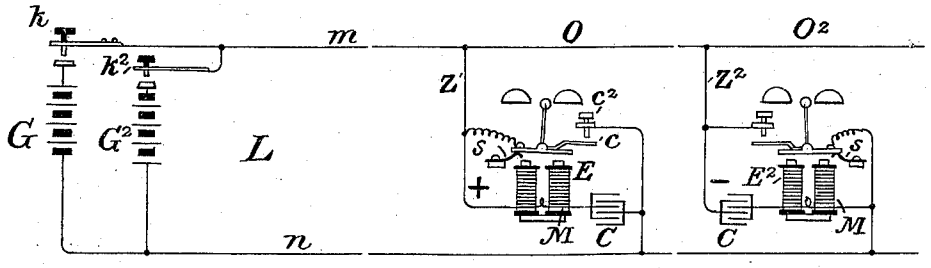
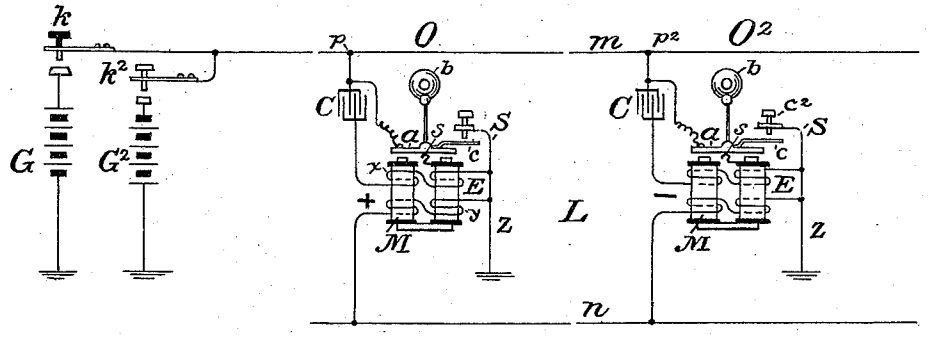


Fig. 3.



Attest,
Geo. Lewis
W. R. Edelen.

Inventor;
John A. Barrett
by Philip Mauro
his Atty.

UNITED STATES PATENT OFFICE.

JOHN A. BARRETT, OF SUMMIT, NEW JERSEY, ASSIGNOR TO THE AMERICAN TELEPHONE AND TELEGRAPH COMPANY, OF NEW YORK, N. Y.

ELECTRICAL AND SELECTIVE SIGNALING.

SPECIFICATION forming part of Letters Patent No. 637,846, dated November 28, 1899.

Application filed June 8, 1899. Serial No. 719,748. (No model.)

To all whom it may concern:

Be it known that I, JOHN A. BARRETT, residing at Summit, in the county of Union and State of New Jersey, have invented certain Improvements in Electrical and Selective Signaling, of which the following is a specification.

This invention relates to electrical signaling and is founded upon the fact that I have found and practically demonstrated that under certain conditions the armature of a polarized electromagnetic mechanism may be caused to oscillate or vibrate and that this oscillation may be sustained continuously when the said electromagnetic apparatus joined up in a circuit in series with a condenser is submitted to the action of a steady unbroken electrical current of unchanging direction or polarity. In carrying out the invention the armature of such a polarized electromagnetic signaling instrument, instead of moving to one pole or the other of the magnet with which it is associated and remaining there when the said magnet is placed in circuit with a source of steady current, such as a battery, is enabled to rapidly vibrate or oscillate, and if the said instrument be an electric bell (in which case a bell-hammer is attached to or actuated by the armature) it is, by means of such vibrations, enabled to produce a continuous or protracted ring.

The characteristic features of my invention consist in connecting up a polarized electromagnet and a condenser in series in the circuit of a generator of steady or direct current, such as a battery, so that the circuit shall be in the said condenser inductively closed but conductively open or incomplete, in arranging a normally open or discontinuous shunt around the said magnet and condenser, and in so combining with the armature of the said magnet means for closing the said shunt-circuit that when the said armature actuated by its magnet moves from its normal or resting position to a new position in the magnetic field the shunt-circuit is closed, while on the return of the armature the shunt-circuit is once more opened or broken. The passage through the coils of the electromagnet of a steady electrical current or impulse of appropriate direction excites the magnet, which thereupon causes the armature to assume a position tending more nearly to perfect the magnetic circuit of which it forms a part, and means, such as a spring, is associated with the said armature, tending to maintain the normal position thereof and acting on the cessation of the exciting current or impulse or on the passage of an impulse of reversed direction to facilitate or accelerate its return movement.

Since the circuit, so far as conduction is concerned, is normally open in the condenser, the action of the battery when brought into connection with the said circuit by closing a key, pressing a button, or otherwise is not in the first place to establish a current, but to impress upon the circuit an electromotive force of plus or minus sign, according to the way in which the generator-poles are presented to the circuit-conductors, and the said electromotive force charges the condenser and the intervening line; but in charging the condenser the wave or impulse traverses the electromagnet and imparts to the same the polarity and strength requisite for the movement of the armature against or in opposition to the spring or equivalent retaining force.

This movement of the armature causes it to engage a limiting contact-stop, and the shunt-circuit, which includes the said stop and the substance of the armature, is thus closed, and not only constitutes a discharging-circuit for the condenser, but also a path through which the main circuit is made transiently complete. The condenser promptly discharges itself through the local or shunt circuit thus constituted, the discharge-current therefrom passing though the magnet-coil reversely, tending to restore and emphasize the normal magnetic condition thereof, and coöperating with the accelerating-spring to cause the prompt return movement of the armature and as a consequence the equally prompt reopening of the shunt-circuit. This action is automatically repeated as long as the transmitting-key remains closed or as long as the steady electromotive force or current is maintained in connection with the circuit, and an electric-bell constructed and operated in accordance with these principles when

properly adjusted rings vigorously and continuously.

It is to be observed that the instrument automatically transforms the main direct electromotive forces or currents, so far as the electromagnet is concerned, into impulses of alternating direction.

The spring, or such other mode of biasing the armature as may be adopted, besides facilitating the prompt return movement of the armature operates to insure the opening of the shunt-circuit at its separable contact-points when the appliance is in a state of disuse. Together with the fixed and movable contacts the armature and its actuating-spring constitute an intermittent or vibratory circuit-controller.

In the accompanying drawings, Figure 1 is a diagram of a simple circuit, illustrating the principles of the invention. Fig. 2 is a diagram illustrating the application of my invention to two bells to be rung selectively; and Fig. 3, a diagram showing its application to the system of selective signaling shown and described by me in Letters Patent of the United States No. 626,131, dated May 30, 1899.

In Fig. 1, L is the main circuit, having conductors *m n*. G is a source of steady current of unchanging direction. *k* is a key or circuit-closer for connecting the said source with the circuit. E is a polarized electromagnetic appliance or mechanism of any desired type, as a polarized relay or bell. (Shown, however, as a bell.) C is a condenser, and S is a normally-open shunt. The electromagnetic mechanism E has an electromagnet M, which is connected in series with the condenser in the circuit L; an armature *a*, (shown as the centrally-pivoted armature of a standard polarized bell,) the polarization being initially imparted to the magnet or armature, or both, by a permanent magnet *g* or in any other well-known manner; the usual gongs *b*; a bell-hammer *e*, attached to the armature; a retracting or accelerating spring *s* permanently biasing the armature and holding the same in a normal position; a contact-spring *c*, carried by the armature, and a fixed contact or stop c^2, normally separated from the armature-contact, but adapted to engage the same and to establish conductive electrical continuity therewith when the armature influenced by the electromagnet oscillates on its center and moves into a new position. The shunt S is formed of the conductor 2, the armature *a*, or, of course, any conductor carried thereby, the movable point or spring *c*, the fixed point c^2, and the conductor 3, and as it connects with the main-circuit conductor at points *d* and *f* is extended around the electromagnet and condenser. The contacts *c* c^2 being normally separated, the shunt in the resting position of the armature is open. When the armature oscillates into its other position, the points *c* c^2 are brought into contact and the shunt is closed. When this occurs, a local electrostatic circuit is formed, including the shunt-circuit and that portion of the main circuit bounded by the points *f* and *d*—viz., the conductor-sections 4, 5, and 6—and the condenser C and electromagnet M are contained in the said local circuit. The operation of such an electromagnetic appliance has already been indicated in a general way. When an electromotive force, due to the generator G, is impressed upon the circuit by closing the key *k*, the condenser C is charged, and the charging impulse surges through the magnet-coil, exciting the magnet and causing its influence to be exerted on the armature in opposition to the spring *s*. The armature rocks on its pivot into a new position, where it closes the shunt between the points *c* and c^2. The condenser instantly distributes its charge through the local electrostatic circuit thus closed, the impulse thereof passing through the magnet-coils in a direction opposite to that of the initial impulse, and this, together with the new way through the shunt for the main-line current and the action of the spring *s*, promptly restores the armature to its initial position and again opens the shunt, this cycle of operations being continuously recurrent as long as the key *k* remains closed.

In Fig. 2 I have shown two electromagnetic instruments E and E^2, placed at different stations or points O O^2 of the main circuit L in parallel bridges Z Z^2 thereof. They are identical in structure and arrangement, except that their magnets are so wound or connected as to be respectively responsive by the movement of their armatures to currents or impulses of opposite direction, one being responsive to impulses of plus sign only and the other to impulses of minus sign only. Each, however, possesses the characteristic features of the electromagnet M and condenser C serially connected in the main circuit, the normally-open shunt S around the said magnet and condenser, and the retaining and accelerating spring *s*. As means for impressing the required oppositely-directed electromotive forces or transmitting the appropriately-directed currents for the selective operation of the said mechanism, I show two independent batteries G and G^2, whose connection with the main circuit is controlled by their respective keys *k* and k^2, the first of which is arranged to transmit the positive impulses required for the operation of mechanism E, while the latter transmits the negative impulses required for the operation of mechanism E^2. Obviously instead of employing separate batteries a single generator of any preferred suitable type might be employed in connection with keys of any well-known form adapted to connect the generator-poles with the line-terminals in such a way as to send from the same source impulses of either direction, as required.

In Letters Patent of the United States granted to me May 30, 1899, No. 626,131, I

have described a form of selective signal and a system for its efficient operation wherein the polarized bell-magnets each have two cores normally and permanently magnetized to like initial polarity and a permanently-magnetized armature polarized oppositely and normally attracted to the said poles and adapted to be repelled therefrom when currents of such character as to reverse the polarity of both core-poles simultaneously are passed through the winding of both of the said cores. When such armatures are thus repelled, a bell is struck by an attached hammer and the stroke is made to repeat itself and to develop into a continuous ring, in several ways fully described in the said patent. Moreover, a number of such bells may in the system of the said patent be selectively rung by associating their magnet-windings with the two conductors of a metallic circuit and with a ground-return or third conductor, and with means for directing plus and minus currents to the required bells over both conductors severally, jointly in series, or jointly in parallel at will.

Fig. 3 sufficiently indicates the convenience with which my present invention may be applied to such polarized bells and associated with such a system of combination signaling-currents. Two polarized bell mechanisms only are shown—viz., those organized to respectively become operative with plus and minus electromotive forces impressed upon the main-circuit conductor m only. The line conductors m and n of the main circuit L, the generators G and G^2, and the keys k and k^2 are similar to the same devices in Fig. 2. At each station the electromagnet has two windings x and y. In each the winding y has no function with respect to the ringing of the two bell mechanisms shown, but is present as part of the means to maintain the quiescence of those particular mechanisms when other current combinations traverse the same line-wires to operate bell mechanisms at other stations. The windings x of the magnets M at both stations O and O^2 are alone active. The winding x of the electromagnetic bell E is placed in an earth branch between the point p on conductor m and the station ground connection z and includes the condenser C. Assuming the normal polarities of both magnet-cores to be S, the said winding is of such direction that when by depressing key k a plus current from battery G passes through it the said polarity is neutralized and the armature a is repelled from the cores and the bell-hammer strikes the gong b, the ring being made continuous by the action of the condenser-shunt and spring s in the manner already described. The plus current, however, merely tends to reinforce the polarity of the magnet M at station O^2, which therefore does not operate. If, however, the key k^2 be manipulated and a minus current passes to the line, it will act to neutralize the polarity of the magnet M at O^2, and the bell there will ring continuously, that at O remaining silent. Obviously two other bell mechanisms to be operated in the same way by plus and minus impulses can be similarly associated with conductor n, and it is equally manifest that four other bells embodying my present invention can be operated by connecting two of them operatively in bridges between the conductors m and n, to be rung by currents or impulses passing outward over conductor m and back by conductor n for one of them and reversely for the other, and by connecting the remaining two in branches between the two main conductors in parallel and earth connections and transmitting plus and minus impulses over such parallel circuit for their respective operation. Reference is made to the said patent No. 626,131 for the details of such circuit connections, current combinations, and keys for their operation.

In my present invention satisfactory results have been attained by employing a condenser of two microfarads' capacity and bell-magnets having a resistance of five hundred ohms to the spool or one thousand ohms for the entire electromagnet. I do not, however, limit myself to these proportions, it being evident that they may be subjected to a wide range of variation under varying conditions of practice.

I have found electromagnetic bells embodying the above-described construction to be highly advantageous in selective telephone-signals when associated with certain classes of party-line circuits, wherein it is frequently desirable to have the call-signal apparatus in portions of the circuits which conductively are open or discontinuous.

Having thus described the invention, I claim—

1. The combination in an electromagnetic apparatus or movement, of an electromagnet and armature; a condenser in series with the said electromagnet; a normally open or discontinuous shunt around the said electromagnet and condenser; and means for closing the said shunt when the said armature actuated by the said magnet is moved from its normal or resting position in the field thereof; substantially as set forth.

2. In an electromagnetic polarized bell or alarm apparatus, the combination with the electromagnet and armature thereof; and the main-circuit conductor containing the said electromagnet; of a condenser in series with the said magnet in the said conductor; a normally open or discontinuous shunt around the said magnet and condenser; and an intermittent or vibratory circuit-controller for the said shunt actuated by the armature of said magnet; substantially as described.

3. The combination substantially as hereinbefore described, with a main circuit; and a battery or like source of direct current therefor; of an electromagnetic bell apparatus comprising a polarized electromagnet included in said main circuit, and an armature; a condenser in series with the said bell in the said

main circuit establishing the normal conductive discontinuity thereof; a normally-discontinuous shunt of the said circuit around the said magnet and condenser, adapted to be automatically closed by the movement of the armature when actuated by the said electromagnet; and means for rapidly and continuously interrupting the said shunt; whereby electric waves or impulses are caused to pass through the said electromagnet in rapidly-alternating direction, and the bell operated by said magnet to be continuously rung.

4. In a system of selective signals, the combination with a main circuit; and means for alternatively impressing thereupon electromotive forces of plus and minus sign at will; with two similar sets of electromagnetic bell apparatus associated with said main circuit, in independent branches, each comprising a polarized electromagnet and a condenser in series in its own branch of the main circuit, a movable armature for the said magnet, a contact-stop therefor with which the said armature forms contact when moved under the influence of its magnet, a normally-open shunt around the magnet and condenser, leading through the said armature and contact-stop and adapted thereby to close on the initial movement of said armature, and means for accelerating the return movement of said armature and the consequent prompt reopening of said shunt; the electromagnets of the said two sets of apparatus being wound or connected to respond respectively to the said opposite electromotive forces, substantially as specified herein.

5. In a signaling system the combination with a main circuit; and means for alternatively impressing thereupon electromotive forces of plus and minus sign at will; of two similar sets of electromagnetic signaling apparatus connected severally in branches of the main circuit, each apparatus comprising a polarized electromagnet wound or connected oppositely to that of the other, and a condenser in series in its own branch of said main circuit, a centrally-pivoted armature for the said magnet, a contact-stop therefor with which the said armature forms contact when moved under the influence of its magnet, a counter-spring holding the said armature normally away from said stop, and adapted to accelerate its return therefrom, and a normally-open shunt around the electromagnet coil and condenser, leading through the said armature and contact-stop, and adapted thereby to be rapidly closed and reopened as the said armature vibrates under the coöperative action of the shunt itself, and the condenser; substantially as set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 2d day of June, 1899.

JOHN A. BARRETT.

Witnesses:
F. F. FOWLE,
H. H. BRIGHAM.