(No Model.) 2 Sheets—Sheet 1

I. H. FARNHAM.

ELECTRIC SIGNALING APPARATUS.

No. 328,578. Patented Oct. 20, 1885.

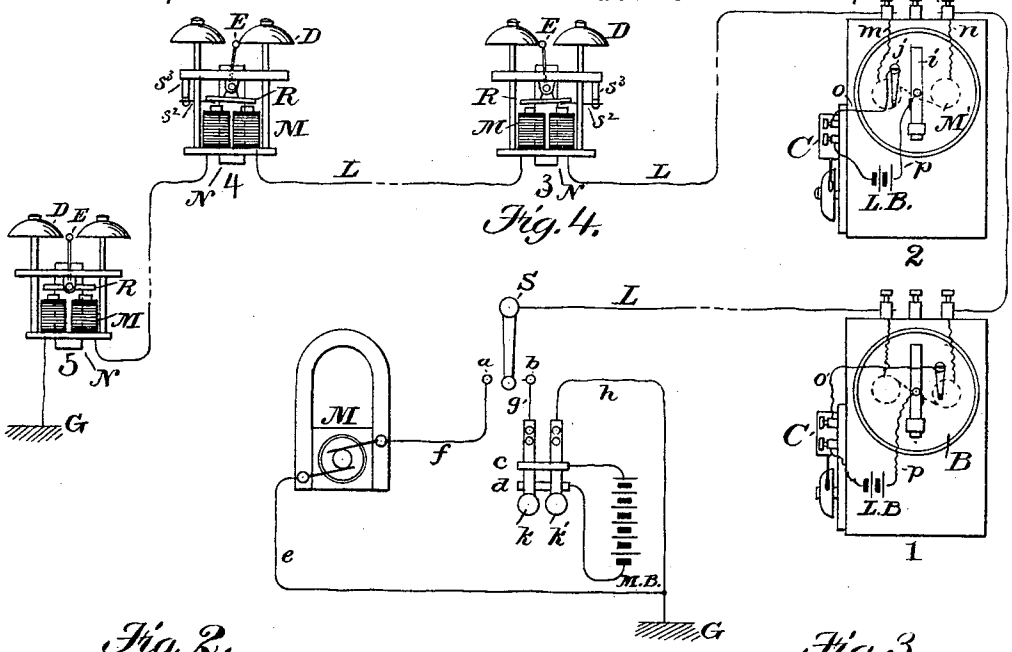

Fig. 4.

Fig. 2.

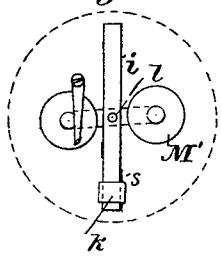

Fig. 1.

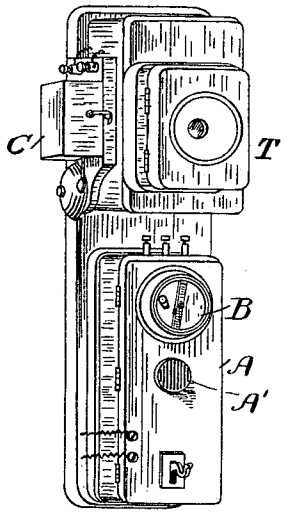

Fig. 3.

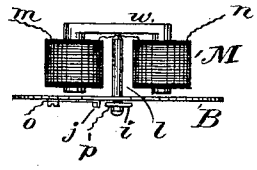

Fig. 5.

Witnesses.
Harry L. Amer.
Ira R. Steward.

Inventor.
Isaac H. Farnham
by A. Bolock
his attorney.

(No Model.) 2 Sheets—Sheet 2

I. H. FARNHAM.

ELECTRIC SIGNALING APPARATUS.

No. 328,578. Patented Oct. 20, 1885.

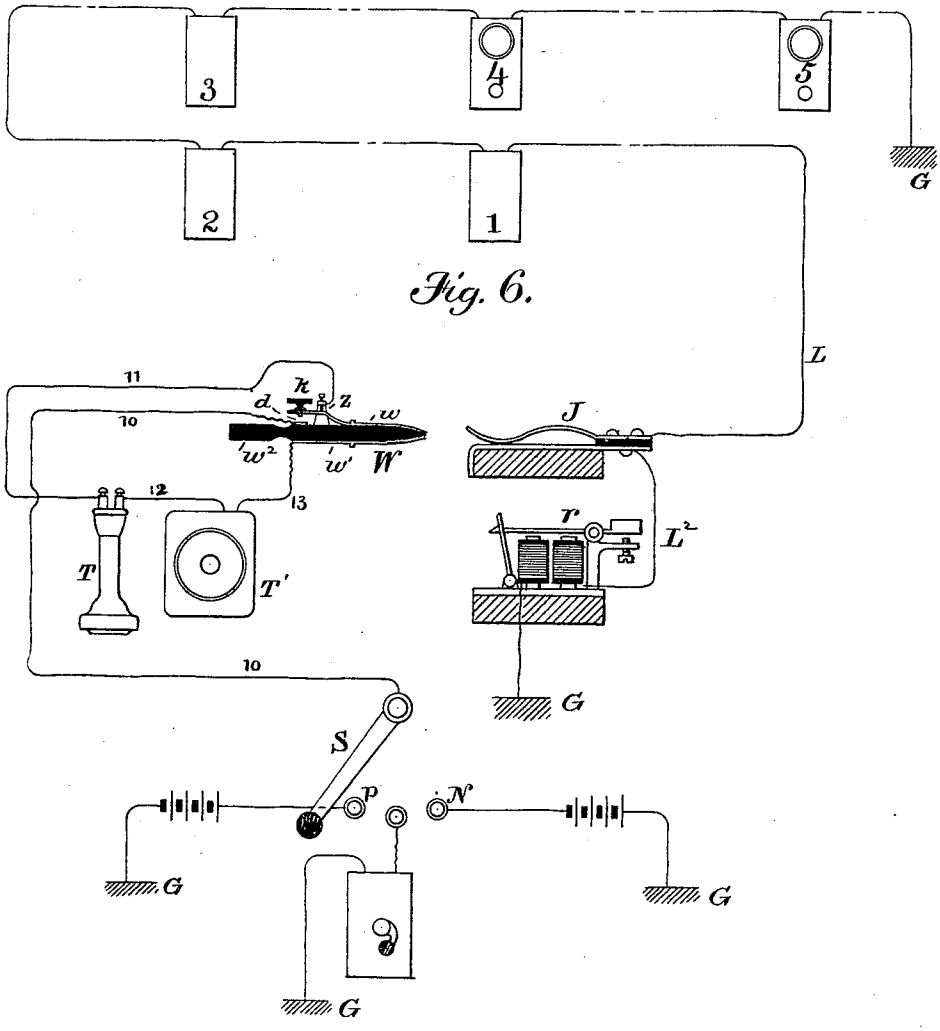

Fig. 6.

Witnesses,
Harry L. Amer.
Ira R. Steward.

Inventor:
Josiah H. Farnham
by A. Pollok
his attorney

UNITED STATES PATENT OFFICE.

ISAIAH H. FARNHAM, OF DEERING, MAINE, ASSIGNOR TO THE AMERICAN BELL TELEPHONE COMPANY, OF BOSTON, MASSACHUSETTS.

ELECTRIC SIGNALING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 328,578, dated October 20, 1885.

Application filed August 16, 1884. Serial No. 140,722. (No model.)

To all whom it may concern:

Be it known that I, ISAIAH H. FARNHAM, a citizen of the United States, residing at Deering, in the county of Cumberland and State of Maine, have invented certain Improvements in Electric Signaling Apparatus, of which the following is a specification.

My present invention relates to an improved method of and apparatus for signaling upon telephone and telegraph lines or other electric circuits, in cases where it is necessary to place a number of stations upon the same line or circuit. Since the commercial introduction of the speaking-telephone, and prior to my invention, many devices have been invented to accomplish this end, some of which have proved efficient. Nearly all, however, involve the use of special apparatus which is more or less expensive and complicated.

The object of my invention is to enable the operator at the central or principal station of such a line as I have mentioned to sound a call or alarm at any particular station required without putting in operation any of the other alarms upon the line, and to effect this result with apparatus of the most ordinary and cheaply-constructed character at the way-stations, and with no other apparatus at the central station than would otherwise be employed.

I have found by practical experience that a series of five stations upon a single circuit is as large a number as can profitably be operated, and that there is little or no demand for a larger number, and I have devised my method to provide for that number. The method I adopt is to operate one call of the series by intermittent pulsations of electricity of definite direction—say positive—a second by intermittent pulsations of negative direction, a third by successive pulsations of rapidly-alternating direction or character, a fourth by a constant and steady current of positive direction, and the fifth by a constant and steady current of negative direction.

To this end my invention further consists of mechanism and electrical-circuit arrangement whereby different modes of operating the same signal-transmitting apparatus at the central station are enabled to effectuate results differing in character at the sub-stations.

In the accompanying drawings, Figure 1 is a perspective view of the station apparatus at two of the stations. Fig. 2 is a front view showing a detail thereof and indicating the relative position of some of the working parts. Fig. 3 is a plan of the same detail, looking down. Fig. 4 is a diagram of the electrical circuit with the signal transmitting and receiving instruments. Fig. 5 is a detail showing the weight with which I regulate the needle-circuit closer, and Fig. 6 is a diagrammatic drawing of a modification of the electrical connections at the central station.

In Letters Patent issued to me February 26, 1884, No. 294,212, is described an annunciator comprising a pivoted magnetic needle supported vertically between the two cores of an electro-magnet and adapted to deflect in either direction, according to the direction of an electric current passing through the coils of said electro-magnet. In Letters Patent issued to Geo. L. Anders and Theo. N. Vail, May 31, 1881, No. 242,408, a system of signaling is shown wherein continuous currents of electricity varying not only in direction, but also in strength, are used in combination with constantly-alternating pulsations. Suitable instruments adapted to respond to these differing currents are also therein described and claimed. Moreover, in Letters Patent issued to Geo. L. Anders, March 22, 1881, No. 239,134, an arrangement of two signaling-instruments is described, comprising two polarized bells the armatures of which are each biased normally in opposite directions, so that one of the said bells responds to intermittent pulsations of electricity of positive direction while the other responds to like pulsations of negative direction.

My present invention is based upon the subject-matter of my former patent, hereinbefore cited, combined with a portion of the invention described in the patent of Anders and Vail, and with the subject-matter of the patent of Anders, both previously referred to herein, and it constitutes an improvement and extension of all of the said patents, which are here cited as representing the state of the art prior to my invention.

My invention will be readily comprehended by an examination of the diagram shown at Fig. 4 of the drawings, where there is shown a central-station apparatus consisting of a

battery, a magneto-generator, a switch, and a system of reversing-keys connected with a main line and a series of five sub-stations, numbered consecutively from one to five. The signal apparatus at station No. 1 gives the signal in consequence of the deflection of a pivoted magnetized needle normally poised in a vertical plane to a given angle, where it is adapted to close a local circuit, and thus to ring a bell included in such circuit. The apparatus at station No. 2 gives the signal in a similar manner, but is adapted to close its local by a deflection of the needle in a direction opposite to that of No. 1. Stations Nos. 3 and 4 are provided with ordinary polarized bells fitted with centrally-pivoted armatures biased oppositely with respect to one another by springs, so that where No. 3 will ring when a series of successive positive pulsations are sent, while No. 4 will remain inert, No. 4 will respond to a similar succession of negative pulsations, No. 3 remaining quiescent. The bell at station 5 is, as shown, a polarized bell of ordinary construction, and is adapted to respond to currents of rapidly-alternating direction. Being well known, this instrument requires no further description.

I will now describe more particularly the instruments at stations No. 1 to No. 4.

The bell at No. 4 consists, as shown, of an electro-magnet, M, and centrally-pivoted armature R therefor, both polarized by a horseshoe permanent magnet, N. The said armature is fitted with a bell-hammer, E, adapted to vibrate the gongs D. So far the description corresponds to the bell of No. 5. To prevent the bells 4 and 3 from responding to currents of the same class that actuate No. 5, and also to individualize them with respect to one another, I attach a flat spring, s^2, to a standard, s^3, affixed to the frame of the bell, the free end of said spring being arranged to bear upon one end of the armature R. The springs s^2 of the two bells are fixed to press upon the opposite ends of the two armatures, as shown, and the armature of the bell No. 4 is thus biased to hold the bell-hammer normally against the right-hand gong, while the armature of No. 4 holds its bell-hammer normally biased against the left-hand gong. The armature of No. 3 is thus actuated to ring by currents of given direction, while that of No. 4 is actuated by currents of opposite direction, as fully shown and described in the patent of Anders, hereinbefore cited. Being thus oppositely biased with respect to one another, it is clear that rapidly-alternating currents—such as those adapted to ring No. 5—will not cause them to respond, since the transitions in such alternations are too quick for biased armatures to follow. On the other hand, the bell No. 5 can never make but a single stroke when either of the two bells, No. 3 or No. 4, are rung, because it is only energized by currents of successively-alternate direction.

Referring now to the instruments Nos. 1 and 2, which are also separately shown in Figs. 2 and 3, they consist of an electro-magnet, M′, included by wires *m* and *n* in the line-circuit, and fixed horizontally behind the dial B, so that its cores approach close to the inner side of said dial. The cores of the magnet are attached to a yoke or back piece, *u*, of such a length as to bring the cores of the magnet-spools a distance apart approximately equal to the length of a permanently-magnetized bar or needle, *i*, which is pivoted at *l* in the center of the dial, and which is made heavier at one end, so that it will hang vertically between the magnet-cores, although in front thereof. The weight of this lower end may be made adjustable by the attachment of the sliding sleeve *k*, made of any suitable metal, and adapted to fit firmly upon the end of the magnetized bar, while it is capable of being slid to any position thereon. It may be made to clasp the bar or needle by means of the friction-spring *s*.

A vibrating electro-magnet bell, *c*, is provided and is connected with one pole of the local battery L B, which, if preferred, may be used also to energize the transmitting-telephone. The other pole of the battery is connected by wire *p* with the magnetized needle or its axis, and another wire is run from the remaining binding-screw of the bell to a fixed contact-arm, *j*, which by a screw, *o*, is attached to the dial; or, if preferred, it may be fixed to the frame in the rear of the dial, and in that case the contact-point of the arm is caused to protrude through dial and to stand in position to engage the pivoted needle when deflected. The contact-arms of the instrument at No. 1 and at No. 2 are placed upon opposite sides of the needle, and thus contact is made and the local circuit closed through the bell C, in one case, with a steady and non-intermitting positive current and in the other with a steady non-intermitting negative current. When the local circuits of either are closed, the corresponding bell rings. I have found by practical experience that these needles will not deflect, except to an inconsiderable amount in either direction when the intermittent currents adapted to actuate the bells Nos. 3 and 4, or when the rapid alternations necessary to ring 5 are passing through the line, and that, *per contra*, when the steady current required to deflect the needle is sent, no effect, except occasionally a light single stroke is manifested at the other three instruments in circuit. In the perspective view, Fig. 1, I have shown this arrangement combined in a telephonic outfit with a magneto-electric generator operated by the forcible detachment from a pair of electro-magnets included in the line-circuit and attached to the poles of a permanent magnet, the whole being inclosed in a case, A. B is the pivoted needle, and A′ the push-button, which detaches the armature. The transmitting-telephone T is mounted on the upper part of the case and the call-bell C on one side thereof. I may, however, if I so elect, attach the magnetized

needle and its connections equally well to the ordinary crank-operated magneto-generator, and in many cases this form would be preferred.

Returning to Fig. 4, I have shown the main line L as terminating in a button-switch, S, which may be turned on either of the two buttons *a* and *b*. When turned onto the button *a*, the line is continued to ground through the magneto-machine M and the wires *f* and *e*. The bell No. 5 may now be rung by the said machine, the four other bells remaining irresponsive. When the switch is turned onto the button *b*, the line is normally continued to the ground *via* button *b*, wire *g'*, key *k*, back contact-bar, *c*, key *k'*, and ground-wire *h*. When key *k* is tapped successively a number of times a corresponding series of negative currents are transmitted to line by the following route: ground-wire *h*, key *k'*, back contact-bar, *c*, battery M B, anvil-contact *d*, key *k*, wire *g*, and button *b*, to line, ringing one of the two bells 3 or 4—say 4. Tapping in a similar way upon key *k'* has the effect of reversing the battery, and will ring bell 3. A steady pressure upon either key will send a continuous and unbroken current to line of direction depending upon the key pressed. This current will in either case deflect both needles of instruments 1 and 2, but in one case will bring the needle of No. 1 into contact with the contact-point, deflecting the needle of No. 2 farther away from its point, and in the other case the opposite result will be achieved. The whole five bells may thus be individually operated.

Although I have shown but one line, and so far have but indirectly indicated that my invention may be efficiently utilized in combination with a telephone-exchange, it is evident that any number of lines may be worked equally well from the same central-station apparatus. I have accordingly shown in Fig. 6 an arrangement of the central-station instrumentalities which I have found very effectual in actual use.

L represents a subscriber's line, and 1, 2, 3, 4, and 5, the several stations located thereon. The line terminates at the distant end, as usual, at the earth, while at the central-station end it is led through a spring-jack, J, and by the wire L^2 to the annunciator *r* and then to ground. Any number of lines may be so connected and arranged in a switch-board common to the series in a manner well understood.

W is a wedge adapted for insertion into the spring-jack, and controlling an instrument-loop, which, when the wedge is thrust into the spring-jack, becomes virtually a part of the line. The wedge W consists of a block of insulating material, w^2, carrying on its upper side a metal spring-plate, *w*, provided at the spring end with a press-knob, *k*.

Immediately under the press-knob a contact-point, *d*, is affixed to the insulating-block, and when the knob is pressed a contact-point on its lower surface is brought into connection with the point *d*. Normally, however, the spring *w* presses upward against the back limit, *z*, this being also an electrical contact leading to the office-telephones T and T' by the wires 11 and 12, and thence by wire 13 to the plate *w'*, which is fixed to the lower side of the wedge. When the wedge is thrust into the spring-jack and the knob *k* left unpressed, the effect is simply to introduce the telephones into the line-circuit. A button-switch, S, is provided which has three positions, as shown. One of the buttons on which it may be placed may be marked *p*, and is connected with the positive pole of a calling-battery whose negative pole is to earth. A second button is marked N, and is connected with the negative pole of a second battery equal to the first, but with positive pole to earth. The third button is connected with a magneto-generator. The switch-lever S is united by a wire, 10, with the contact-anvil. When, now, the wedge W is inserted in any spring-jack and the switch S is placed on the button P, the key *k* may be pressed steadily on the anvil *d*, to send a steady and continuous positive current to line, or it may be tapped repeatedly to send intermittent currents to line. When the switch is placed on the button N, the same operations will send continuous and intermittent negative currents to line; and, finally, when the switch is placed on the third button and the key steadily pressed, magneto-electric currents which are of alternate direction are sent to line. The magneto-generator may of course be driven either by power or hand, as may be found convenient.

Wherever in this specification I have referred to a generator as an instrument for sending currents of rapidly-alternating direction, it must be understood that I may, without prejudice to my invention, use a battery and pole-changer.

I claim—

The combination, with a subscriber's line of a telephone-exchange system, said line comprising five signaling-instruments, each located at a different sub-station, and each adapted to give an individual signal, of a spring-jack forming a part of said line, and a looping-wedge adapted for insertion in said spring-jack, together with a single key affixed to said wedge, a button-switch connected with the contact-anvil of said key, a series of contact-buttons for said switch, separate batteries with opposite poles to ground connected with two of the said buttons, and a generator or current-reverser connected with the other button, substantially as set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 1st day of August, A. D. 1884.

ISAIAH H. FARNHAM.

Witnesses:
A. W. COOMBS,
C. H. TOLMAN.