W. A. FRICKE.

TELEPHONY.

APPLICATION FILED NOV. 24, 1909.

987,129.

Patented Mar. 21, 1911.

2 SHEETS—SHEET 1.

Fig. 1.

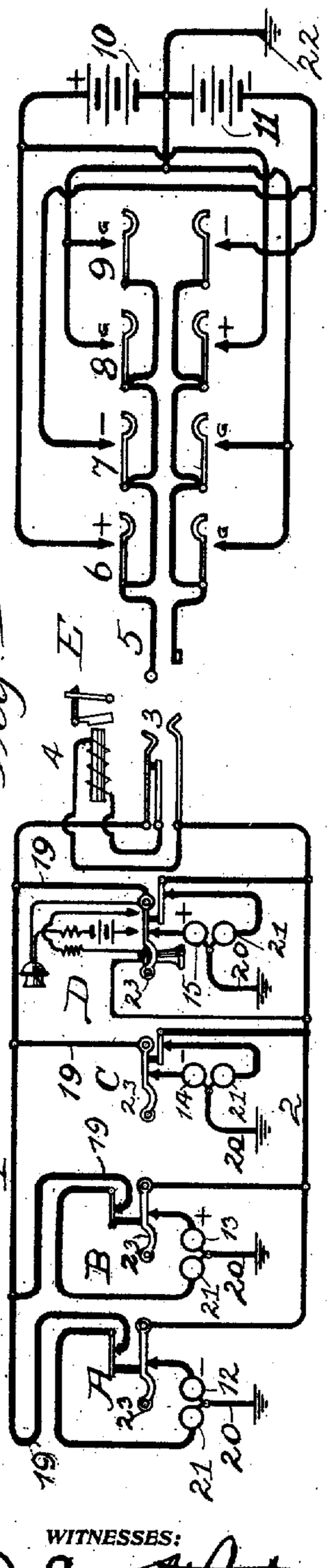


Fig. 2.

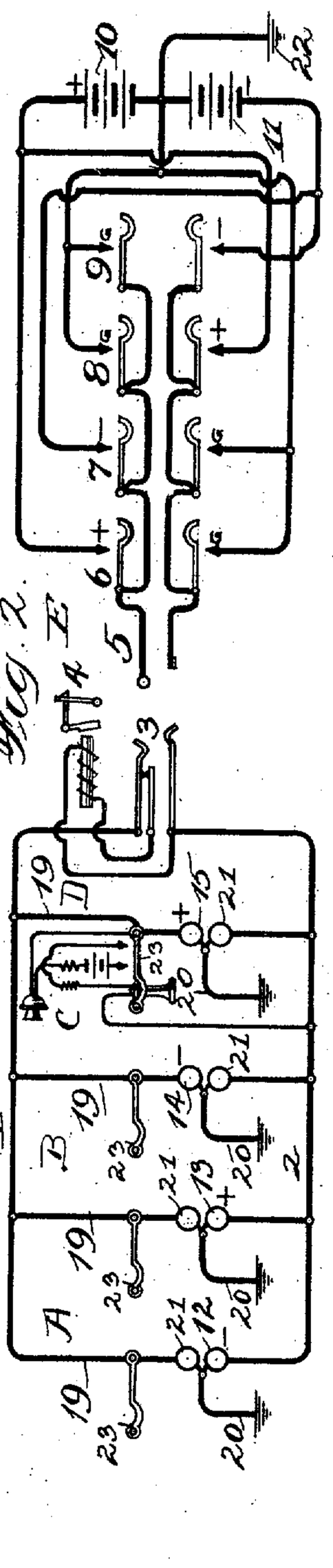
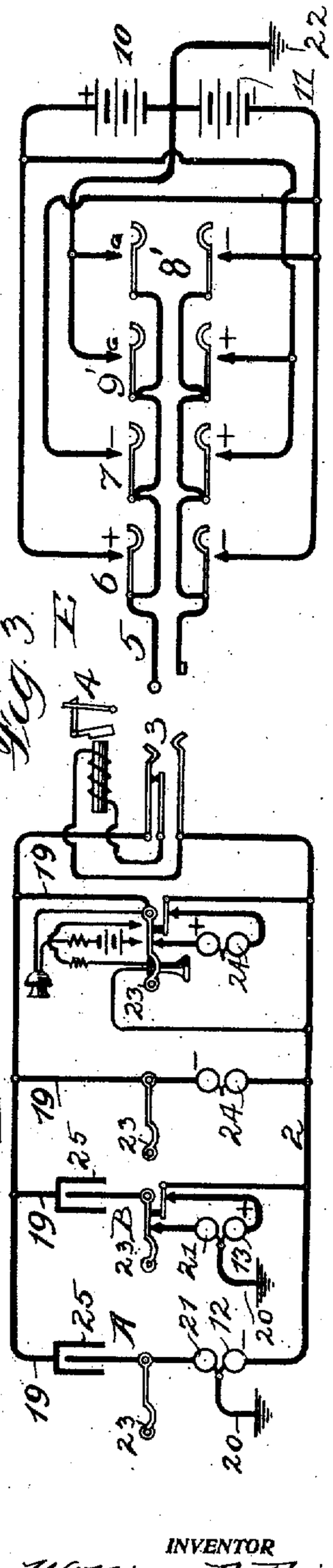


Fig. 3.



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2 SHEETS—SHEET 2.

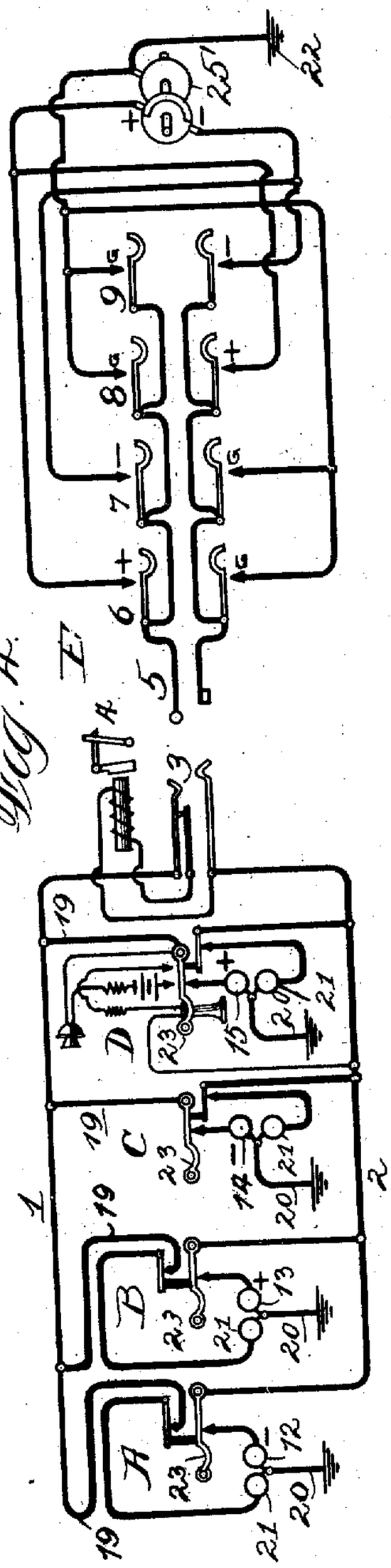

Fig. 4.

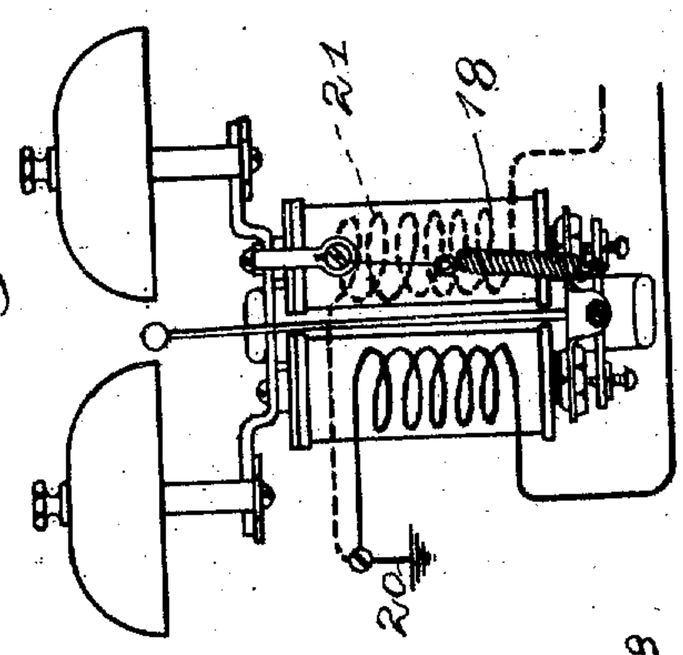

Fig. 6.

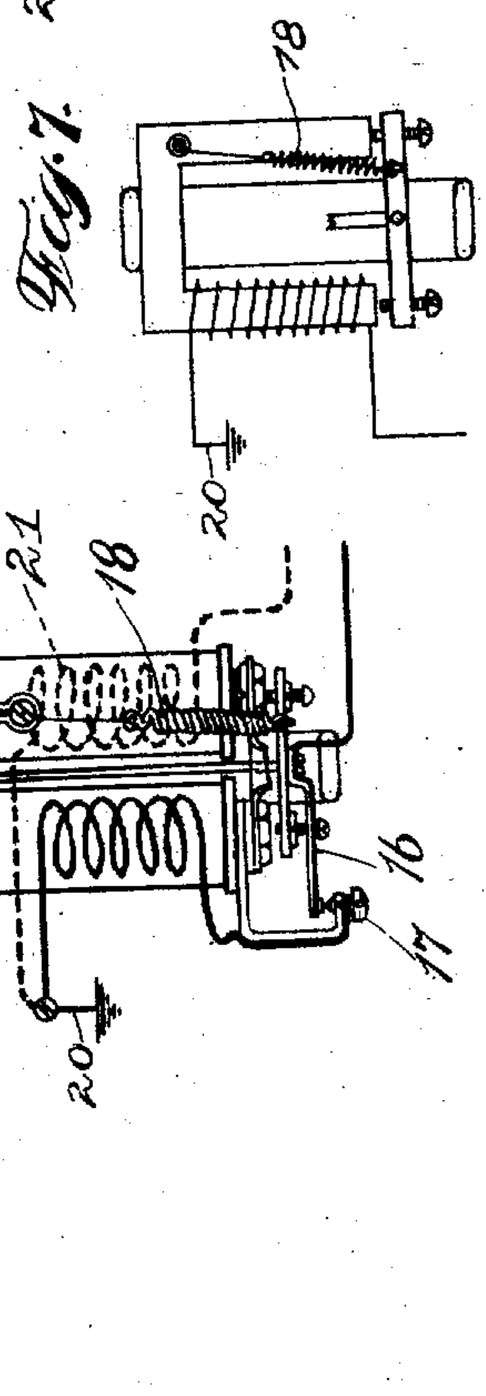

Fig. 7.

Fig. 5.

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TELEPHONY.

987,129. Specification of Letters Patent. **Patented Mar. 21, 1911.**

Application filed November 24, 1909. Serial No. 529,837.

To all whom it may concern:

Be it known that I, WILLIAM A. FRICKE, 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 Telephony, 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 relates to electro-magnetic signal receiving appliances and to systems in which signal receiving appliances are employed.

One feature of my invention relates particularly to the class of signal receiving appliances employing polarized signal presenting or signal causing armatures and soft iron cores having windings adapted for inclusion in circuit with suitable sources of current for the purpose of so magnetizing the said soft iron cores as to cause them to coöperate with the permanently magnetized armatures to occasion signals. This feature of my invention finds much utility in the construction of signal bells. Hitherto, signal receiving bells of the type to which my invention particularly relates included horse shoe shaped soft iron cores, both limbs of each core being provided with coils included in serial relation in circuit with some suitable source of current, and cumulatively wound so that one pole of a core would attract one end of the polarized armature, which was centrally pivoted, and the other pole would repel the other end of the polarized armature, whereby the two poles exerted turning efforts upon the polarized armature in the same circular direction. I have observed that the pole which repelled the armature also would have a demagnetizing effect upon the armature, so that in time the armature would become deënergized to such an extent as to materially reduce the effect of the signal receiver of which it formed a part. By means of one feature of my present invention, the signal receiver is so constructed as materially to reduce, if not altogether to eliminate, the objectionable demagnetizing effect upon the permanently polarized armature. I accomplish this result by so distributing the winding about the soft iron core that the magnetizing effect thereof upon the soft iron core will be considerably less at the pole of the core that repels the armature as compared with the magnetizing effect of the pole of the soft iron core where the armature is attracted. I have obtained very good results by disposing all the winding about that limb of the horse shoe core which carries the pole that has attraction for the armature. In order that the advantages which I secure by this arrangement may not be lost, I cause the current which is to operate the signal receiver to pass through the winding of the signal receiver in one direction only and at intervals, means being employed, operating independently of the signal receiver, winding, for restoring the armature to its initial position when the energizing current ceases to flow. In the preferred embodiment of the invention, this means resides in a spring connected with the armature so as to be placed under increased tension by the armature when magnetically attracted, the spring restoring the armature when magnetic pull thereupon is removed. While I prefer to use a horse shoe core, I do not wish to be limited to a core having two branches, since certain of the advantages of my invention may otherwise be secured.

Another feature of my invention relates to party telephone line systems employing metallic line circuits, and has for its general object such an association of signal receivers therewith that the sides of the telephone lines will always be in balance, irrespective of the number, odd or even, of the signal receivers that are connected with each line. According to present practice, the signal receivers will not in themselves effect balance between the sides of a party line unless an even number thereof are properly connected with the line in a manner which is well understood by those skilled in the art. By means of my invention, it is immaterial whether an odd or even number of signal receivers are connected with the party line, as the balance may always be maintained by means of the connections and arrangements which I employ. In practicing the present feature of my invention, I provide a bridge conductor at each station of the party line which is connected to ground or common return at an intermediate portion. Each bridge conductor contains a signal receiver upon one side of the ground connection, the other side of the

bridge conductor containing the winding that is sufficient to balance the winding of the signal receiver. In a four party line, for example, two signal receivers are included in the bridge conductors between one side of the party line and the ground connection for the bridge conductors, and two more signal receivers at the remaining stations are connected between the other side of the telephone line and the ground connections for the bridge conductors at these latter stations. The signal receivers interposed between each side of the telephone line and the ground connections are adapted to respond to positive and negative current respectively, and the sides of the telephone lines form, independently of each other, parts of signaling circuits that are completed through the grounded connections, by all of which arrangement, signal receivers at the party line stations may be selected for operation.

By means of the characteristics of the present features of my invention, which have been generally outlined, it will be very apparent that it is immaterial how many stations are connected with the party line, since the balance between the sides of the party line is always maintained when the circuit arrangements of my invention are employed.

I will explain my invention more fully by reference to the accompanying drawings, showing preferred embodiments thereof, in which—

Figures 1, 2, 3 and 4 illustrate different party line equipments coming within the scope of the invention and sufficient of telephone exchange apparatus to illustrate the manner in which the signal receivers at the party line stations may be selected for operation and operated. Fig. 5 is a view in elevation of a signal receiving bell constructed in accordance with my invention, the circuit connections being somewhat diagrammatically indicated, the mechanism of the bell itself serving to interrupt the circuit therethrough, thereby requiring the use of uninterrupted direct current for signaling purposes. Fig. 6 is a view showing a construction generally similar to the construction shown in Fig. 5, with the exception that the signal device of Fig. 6 is not provided with a switch for making and breaking the circuit through the winding. Fig. 7 is a view that is somewhat diagrammatic to illustrate my improved signal receiving magnet structure.

Like parts are indicated by similar characters of reference throughout the different figures.

Referring first more particularly to Fig. 1, I have there shown a metallic party line extending by its sides 1 and 2 from a plurality of party line stations, A, B, C and D, to a telephone exchange E, where I have indicated a spring jack 3 whose tip and sleeve springs are connected with the sides 1 and 2 of the telephone line respectively. There is indicated at the exchange a suitable form of line signal 4 which need not be described and enough of a cord circuit equipment to complete the disclosure of my invention, the cord circuit equipment indicated including a calling plug 5 having tip and sleeve strands which are caused to become continuations of the sides of the telephone line when the plug 5 is inserted within the jack 3. As there are four party telephone line stations in the system shown in Fig. 1, there are four calling keys, 6, 7, 8 and 9, that are individual to the party telephone line stations. Each calling key includes a pair of springs permanently connected with the cord strands and each calling key further includes a contact for each spring, the springs of a key engaging the contacts of such key when the key is operated by some suitable means, as, for example, a plunger, as is well understood by those skilled in the art. Keys 6 and 7 are adapted to impress direct current of positive sign and direct current of negative sign respectively upon the side 1 of the party telephone line, while keys 8 and 9 are adapted to impress current of positive and negative sign respectively upon the side 2 of the party telephone line. The source of current illustrated in Fig. 1 includes one set of batteries 10 that is adapted to furnish current of positive sign by way of keys 6 and 8 to the limbs 1 and 2 of the party telephone line and another set of batteries 11 adapted to furnish current of negative sign to the sides 1 and 2 of the party telephone line by way of keys 7 and 9. When batteries or other forms of current sources are employed which are not interrupted at the exchange, the signal receivers 12, 13, 14 and 15, at the party line stations are constructed to break their own circuits, and to this end may be made as indicated in Fig. 5, wherein the heavy unbroken helical line indicates the single energizing winding to which each signal receiver is preferably limited, the helical dotted line constituting a balancing coil, as will more clearly appear, this balancing coil being for the sake of convenience physically a part of the signal receiver structure but not an operating part of such structure. The armature of the signal receiver illustrated in Fig. 5 is pivoted between its ends and carries a switch arm 16 which is normally held against a contact 17 by a retractile spring 18, the contact elements 16 and 17 being in serial relation with the operating winding of the signal receiver. When the operating winding of the signal receiver is energized the switch armature 16 is elevated against the force of the

spring 18, thereby to open the circuit through said winding, whereafter the spring 18 will operate to reverse the movement of the armature to restore the connection between the contacts 16 and 17, whereupon current may again flow through the operating winding, the armature thus being caused to vibrate as long as the operating winding is connected with a source of direct current. This operating winding, in each of the signal receivers at the party line stations in the system shown in Fig. 1, is indicated at 12, 13, 14 and 15. At each party line telephone station a bridge conductor 19 is employed, from an intermediate portion of which a grounded connection 20 is taken. The signal receivers at stations A and B are included between the side 2 of the telephone line and the grounded connections 20. The signal receivers at stations C and D are included between the side 1 of the telephone line and the grounded connections 20. Each bridge conductor 19 includes a balancing coil 21 on a side of the associated grounded connection 20 opposite to that on which the associated signal receiver is located. This balancing coil 21, although forming no operating part of the signal receiver, is contained within the structure of the signal receiver for the sake of convenience as indicated in Fig. 5. It is apparent that it is immaterial whether there be 4, 3, 2 or 1 stations connected with the party line so far as the balance of the line is concerned, since there is provided at each party line station the means to balance the line so that the equipment at one party line station does not have to coöperate with the equipment at another party line station to balance the line, my invention thus being an important improvement over the prior art in this respect. Each calling key has one spring and one contact that is adapted to close circuit through the selected signal receiver, these springs and contacts being indicated in the diagram by the signs +, —. Each key desirably has an extra spring and contact indicated by the letter G for the purpose of grounding the limb of the line which is companion to the limb over which signaling current is caused to flow, whereby the side of the line which is not to carry current is provided with a short circuiting grounded connection indicated at 22 to prevent unintentional ringing of any of the signal receivers connected with this latter line side. As illustrated in Fig. 1, the bridge conductors 19 are governed in their continuity by switch hooks 23 which cause the completion of the bridge conductors when they support the telephone receivers and which cause the exclusion of the signal receivers and the balancing coils together with the grounded connections between the same from the bridge conductors when the telephone receivers are removed from the switch hooks.

The system illustrated in Fig. 2 is similar to the system illustrated in Fig. 1 with the exception that the switch hooks 23 have no control over the bridge conductors 19 which are permanently connected between the sides of the telephone line.

There are many features in the system shown in Fig. 3 that are also present in the systems shown in Figs. 1 and 2. In the system shown in Fig. 3, however, only the two outermost party line stations, A, B, correspond in circuit arrangement to these stations, A, B, of Figs. 1 and 2, the inner party line stations of Fig. 3 having their signal receivers 24 unprovided with grounded connections, keys 8′, 9′, serving to operate the signal receivers 24 by including battery 10 or 11 in bridge of the telephone line in a manner well understood by those skilled in the art. In order to prevent battery 10 or battery 11 from operating the signal receivers at stations A, B, when such battery is to operate a signal receiver 24, I include condensers 25 in the bridge conductors 19 at stations A, B, and on the same side of the grounded connections 20 on which the balancing coils 21 are disposed. It is to be understood that, in the arrangement of Fig. 3, the ringing circuit is completed through the lower coil 12 of each signal receiver at stations A, B, the upper coil 21 of each signal receiver at such stations being the balancing coil and having connection with the telephone line through the condenser 25. When the station A in the system of Fig. 3 is to be signaled, grounded circuit including battery 11 is brought into circuit with side 2 of the telephone line and thereby into circuit with the coil 12 of the signal receiver at said station. When station B of the system of Fig. 3 is to be signaled, battery 10 is included in circuit with the side 2 of the telephone line and thereby in circuit with the operating coil of the signal receiver at station B. It is to be understood that though the operating coils of both of the signal receivers are included in circuit with each battery when it is brought into connection with the side 2 of the telephone line, but one bell, suited to the polarity of the battery, will respond.

The system illustrated in Fig. 4 is generally similar to the system illustrated in Fig. 1. The signal receivers in the system illustrated in Fig. 4, however, do not cause the interruption of direct current but are of the circuit arrangement illustrated in Fig. 6, the operating coil which is shown in the full helical line in Fig. 6 being permanently connected with the adjacent side of the telephone line. In other respects, the structure shown in Fig. 6 is similar in construction and function to the structure

shown in Fig. 5 and similar parts are given similar characters of reference. Inasmuch as the current is not interrupted at the substations in the system shown in Fig. 4, I employ suitable means for furnishing positive interrupted current and negative interrupted current, indicated diagrammatically at 25′, the keys 6 and 7 connecting positive and negative interrupted current with one side of the telephone line and the keys 8 and 9 connecting positive and negative interrupted current with the other side of the telephone line.

Referring now more particularly to the signal receiving apparatus at a given station, and also referring to Fig. 7, it will be seen that I have provided a signaling system including a signal receiver that has a permanently polarized armature swingingly mounted between its ends and an energizing winding the effect of whose field preponderates upon one side of the armature mounting, means for impressing intermittent current upon said winding, said winding having a core which, in addition to the attracting pole on one side of the armature mounting, also presents to said armature an opposite pole upon the other side of said mounting to repel the armature in the same circular direction in which it is attracted, and mechanical means operating to restore the armature from its magnetically altered position when said winding is deënergized. The energizing winding of the signal receiver is alone shown in Fig. 7, the balancing coil 21 being omitted. This balancing coil is, for the sake of economy and convenience, disposed upon the limb of the core which is companion to the limb which carries the energizing winding.

The signal receiver herein disclosed forms the subject matter of a division of this application filed July 18, 1910, Serial No. 572518. My co-pending application, Serial No. 495,104, filed May 10, 1909, discloses some of the characteristics herein set forth.

While I herein refer to grounded connections and grounded sources of current, it is of course to be understood that I consider common returns to be the equivalent of the grounded connections illustrated.

While I have herein shown and particularly described preferred circuit arrangements and structural features, I do not wish to be limited to the precise details of construction and circuit arrangement shown, as changes may be made without departing from the spirit of my invention, but,

Having thus described my invention, I claim as new and desire to secure by Letters Patent, the following:—

1. A metallic telephone line extending from a telephone exchange to four party line telephone stations, a conductor in bridge of the telephone line at each of the party line stations, a grounded connection extending from an intermediate portion of each bridge conductor, signal receivers at the party line telephone stations included in the bridge conductors, two of said signal receivers being interposed between the same side of the telephone line and the grounded connections of the bridge conductors containing these two signal receivers, one of these two signal receivers responding to positive current and the other of these two signal receivers responding to negative current, the two remaining signal receivers being interposed between the remaining side of the telephone line and the grounded connections of the bridge conductors that contain these latter two signal receivers, one of these latter two signal receivers responding to positive current and the other of these latter two signal receivers responding to negative current, and means governed at the exchange for including each side of a metallic telephone line in grounded circuit with positive current and in grounded circuit with negative current whereby each of the signal receivers may be operated to the exclusion of the remaining signal receivers, the signal receivers each including a switching device governed by its armature for opening circuit through its winding and means operating to restore the armature from its magnetically altered position when the signal receiver winding is deënergized, thereby to reëstablish the circuit through the signal receiver.

2. A metallic telephone line extending from a telephone exchange to two party line telephone stations, a conductor in bridge of the telephone line at each of the party line stations, a grounded connection extending from an intermediate portion of each bridge conductor, signal receivers at the party line telephone stations included in the bridge conductors between their grounded connections and the same side of the telephone line, one of said signal receivers responding to positive current and the other to negative current, means governed at the exchange for including the side of the telephone line that is directly connected with said receivers in grounded circuit with current of positive sign or in circuit with current of negative sign to operate the selected signal receiver, a third party line station, a conductor in bridge of the telephone line at the third station, a grounded connection extending from an intermediate portion of the bridge conductor at the third station, a signal receiver included in this latter bridge conductor between its grounded connection and the side of the telephone line opposite the sides with which the signal receivers at the first two party line stations are directly connected, a balancing device included in the bridge conductor at the third station on

the other side of its grounded connection, and means at the telephone exchange for closing circuit through the signal receiver at the third station and the side of the telephone line directly connected therewith, the signal receivers each including a switching device governed by its armature for opening circuit through its winding and means operating to restore the armature from its magnectically altered position when the signal receiver winding is deënergized, thereby to reestablish the circuit through the signal receiver.

3. A metallic telephone line extending from a telephone exchange to two party line telephone stations, a conductor in bridge of the telephone line at each of the party line stations, a grounded connection extending from an intermediate portion of each bridge conductor, signal receivers at the party line telephone stations included in the bridge conductors between their grounded connections and the same side of the telephone line, one of said signal receivers responding to positive current and the other to negative current, and means governed at the exchange for including the side of the telephone line that is directly connected with said receivers in grounded circuit with current of positive sign or in circuit with current of negative sign to operate the selected signal receiver, the signal receivers each including a switching device governed by its armature for opening circuit through its winding and means operating to restore the armature from its magnetically altered position when the signal receiver winding is deënergized, thereby to reëstablish the circuit through the signal receiver.

4. A metallic telephone line extending from a telephone exchange to two party line telephone stations, a conductor in bridge of the telephone line at each of the party line stations, a grounded connection extending from an intermediate portion of each bridge conductor, signal receivers at the party line telephone stations included in the bridge conductors between their grounded connections and the same side of the telephone line, one of said signal receivers responding to positive interrupted current and the other to negative interrupted current, and means governed at the exchange for including the side of the telephone line that is directly connected with said receivers in grounded circuit with interrupted current of positive sign or in circuit with interrupted current of negative sign to operate the selected signal receiver.

5. A metallic party telephone line extending from a telephone exchange to a plurality of party line telephone stations, a conductor in bridge of the telephone line at each of the party line stations, a grounded connection extending from an intermediate portion of each bridge conductor, a signal receiver at one party line station included in the bridge conductor thereat between one side of the line and the associate grounded connection, a signal receiver at another party line station included in the bridge conductor thereat between the other side of the line and the associate grounded connection, balancing devices included in said bridge conductors on those sides of the grounded connections that are opposite to the sides containing the signal receivers, and means at the exchange for including one or the other of the telephone line sides in grounded circuit to operate the selected signal receiver, the signal receivers each including a switching device governed by its armature for opening circuit through its winding and means operating to restore the armature from its magnetically altered position when the signal receiver winding is deenergized, thereby to reëstablish the circuit through the signal receiver.

6. A metallic party telephone line extending from a telephone exchange to a plurality of party line telephone stations, a conductor in bridge of the telephone line at each of the party line stations, a grounded connection extending from an intermediate portion of each bridge conductor, a signal receiver at one party line station included in the bridge conductor thereat between one side of the line and the associate grounded connection, a signal receiver at another party line station included in the bridge conductor thereat between the other side of the line and the associate grounded connection, balancing devices included in said bridge conductors on those sides of the grounded connections that are opposite to the sides containing the signal receivers, and means at the exchange for including one or the other of the telephone line sides in grounded circuit to operate the selected signal receiver, the signal receivers each including a switching device governed by its armature for opening circuit through its winding and means operating to restore the armature from its magnetically altered position when the signal receiver winding is deenergized, thereby to reëstablish the circuit through the signal receiver.

7. A metallic telephone line extending from a telephone exchange to a telephone substation, a conductor in bridge of the telephone line at the substation, a grounded connection extending from an intermediate portion of said conductor, a signal receiver included in said bridge conductor on one side of its grounded connection, a balancing device included in said bridge conductor on the other side of its grounded connection, a grounded source of current, and means at the telephone exchange for including said grounded source of current in circuit with said signal receiver and grounded connection, the signal receiver including a switching device governed by its armature for opening circuit through its winding and means operating to restore the armature from its magnetically altered position when

the signal receiver winding is deënergized, thereby to reëstablish the circuit through the signal receiver.

8. A metallic telephone line extending from a telephone exchange to a telepnone substation, a conductor in bridge of the telephone line at the substation, a grounded connection extending from an intermediate portion of said conductor, a signal receiver included in said bridge conductor on one side of its grounded connection, a balancing device included in said bridge conductor on the other side of its grounded connection, a grounded source of current, and means at the telephone exchange for including said grounded source of current in circuit with said signal receiver and grounded connection.

In witness whereof, I hereunto subscribe my name this 22nd day of November A. D., 1909.

WILLIAM A. FRICKE.

Witnesses:
G. L. Crogg,
R. E. Atherton.