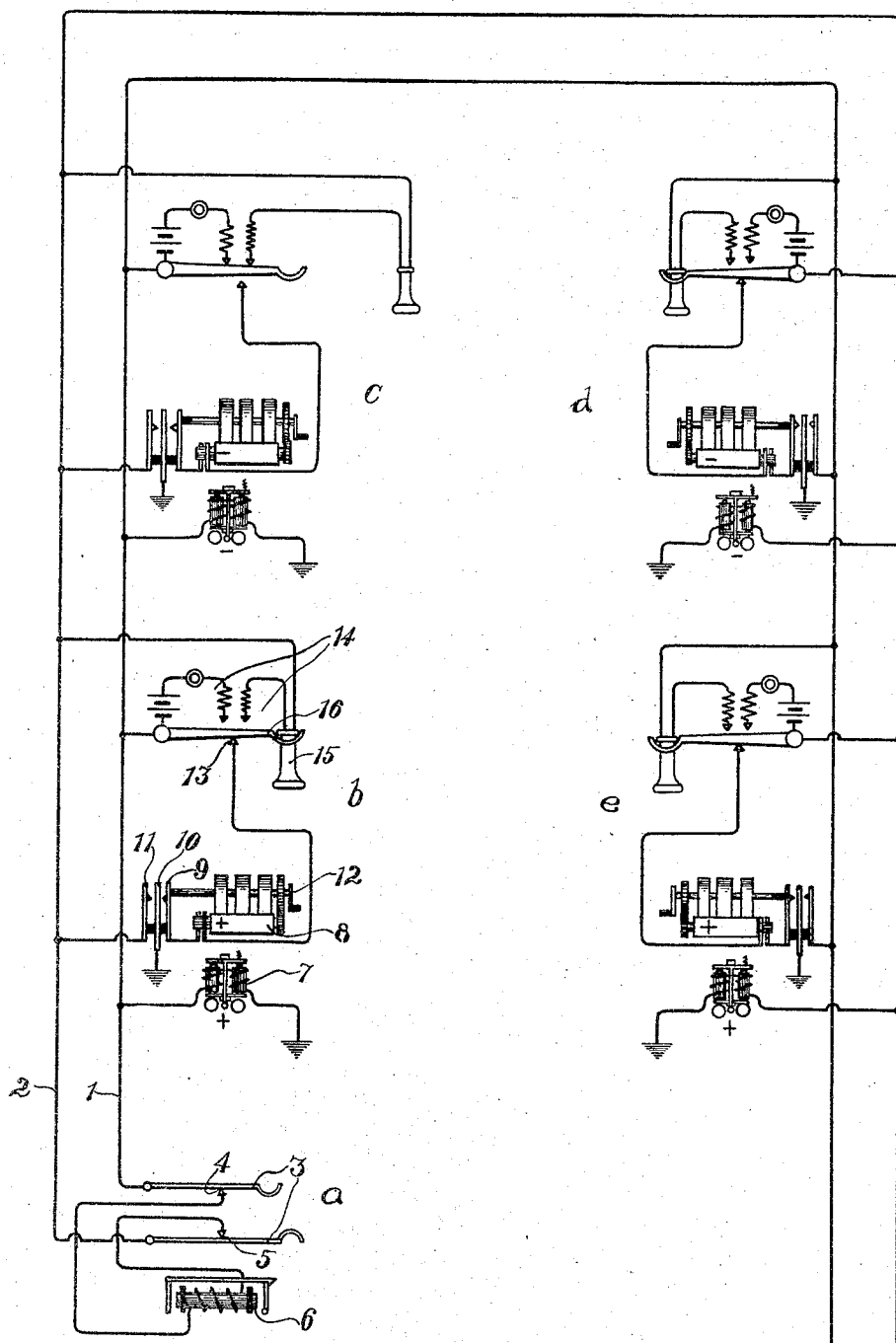


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G. BABCOCK.
FOUR PARTY LINE TELEPHONE SYSTEM.
APPLICATION FILED NOV. 14, 1903.



Witnesses

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FOUR-PARTY-LINE TELEPHONE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 782,376, dated February 14, 1905.

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To all whom it may concern:

Be it known that I, GARRISON BABCOCK, 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 Four-Party-Line Telephone Systems, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

My invention relates to telephone systems, and particularly to multiparty telephone-lines and the apparatus associated therewith.

My invention is particularly applicable to a form of four-party telephone-line, which will be hereinafter more fully described.

In a large number of four-party telephone-lines which have heretofore been employed it has been necessary to provide a marginal adjustment between telephone-bells located at subscribers' substations and the line signal or drop at the central telephone-exchange. In the use of such a system it has been customary to provide a source of comparatively strong currents at the central office adapted when sent over the telephone-line to ring the bell at some one of the four substations connected with a bimetallic line, these currents usually returning to the signal-station by way of the ground. Each of the four subscribers' substations has been provided with a generator adapted to send the current over the line to throw the drop or actuate the signal at the central office. In order that the currents generated at the substations shall not actuate the bells, or any of them, at the substations, the currents generated by the substation-generators have been comparatively weak. To correspond with these weak currents set up by the substation-generators the drop or signal at the central office has been adjusted so as to be actuated by weak currents not sufficiently strong to actuate bells at the substations. In order that any one of the four subscribers connected to the bimetallic line may be signaled, it has been customary to polarize the apparatus at each of the substations, two of the substation signaling devices, such as bells,

being connected between one limb of the line and ground, and these two signaling devices being oppositely polarized, so that one will be actuated upon the passage of currents of one polarity, while the other is actuated only upon the passage of currents of opposite polarity. The other two substation signaling devices have been connected between the other line-limb and ground, and these two signaling devices have also been oppositely polarized, so as to be each actuated by currents of opposite polarity. My invention is applicable to such a system.

The principal objects of my invention are to provide means whereby strong signaling-currents may be generated at the substations without causing an improper actuation of the signaling devices at any of the substations.

By means of my invention I am enabled to do away with marginal adjustment or difference of adjustment between the substation and central-office signaling devices.

By means of my invention a four-party line of the character described may be extended to a much greater length than has heretofore been possible. A slight leakage of the line will not injuriously affect the proper operation thereof.

A system constructed in accordance with my invention is absolutely selective, and no effect whatever is produced upon substation signaling apparatus upon the operation of the signaling-generator at any one of the substations.

My invention has another advantage in that it may readily and cheaply be applied to almost any of the well-known telephone line-circuits or signaling-circuits employed at central exchanges.

In accordance with my invention I provide signaling devices at the substations as above described—that is, two bells legged between each line-limb and the ground and the two bells of each pair oppositely polarized, so that one may be actuated by impulses in one direction and the other actuated by impulses in the opposite direction. A signal-generator is provided at each of the substations, each

adapted to generate currents of one polarity, the polarity of the current generated at any one substation corresponding with the polarization of the signal-bell at that substation.

5 Each generator is adapted to be connected in bridge of the telephone-line limbs in signaling the central office. Automatic or manual means is also provided in conjunction with each generator whereby the opposite line-

10 limb from that to which the associated signal-bell is connected may be short-circuited to ground. The current set up by the generator at each substation is direct, so far as possible, as distinguished from pulsating or alternating currents. The ground connection,

15 which is made at the generator at the time of signaling the central office, produces a path through the associated signal-bell, whereby the actuation of the generator causes this bell to produce a single tap. The generator will

20 not cause an actuation of the other bell at any substation which is legged to the same line-limb, for the reason that this bell will be oppositely polarized, and no current will find its

25 way to and through the signal-bells connected with the other line-limb, for the reason that one line-limb is short-circuited to ground, whereby the bells connected to that line-limb are short-circuited, and thereby prevented

30 from operating.

My invention will be more clearly understood by reference to the accompanying drawing.

I have illustrated the telephone-line comprising limbs 1 and 2, which lead from the central station to the substations *b*, *c*, *d* and *e*. At the central exchange the line-limbs 1 and 2 terminate in the tip and sleeve springs of the jack 3, with which the contacts 4 and 5

40 normally make connection, these contacts being connected with a drop 6 or other suitable form of signal. I have not illustrated the cord connecting apparatus used for the purpose of connecting this line with others, as such apparatus is well known and understood by those skilled in the art. The apparatus is intended to operate in such a way that any one of the subscribers may signal

45 an operator at the central exchange without causing an actuation of the signaling apparatus at any of the other substations and also in such a way that the operator may signal any one of the subscribers without calling any other subscriber to his phone. At substation

50 *b* there is provided a polarized bell or signal 7, which we may assume is positively polarized. At the same substation there is a direct-current generator 8, adapted to set up current of the polarity corresponding with the polarization of the bell 7. In conjunction

55 with the generator there is a set of contact-springs 9, 10, and 11, adapted to be automatically actuated upon the operation of the generator. Such a form of switching apparatus

60 is well known and understood by those skilled

in the art, and it will be understood that upon turning the crank 12 of the generator the springs 9, 10, and 11 are automatically connected together. The spring 9 is connected with one terminal of the generator, while the other terminal of the generator leads to the normal contact 13 of the hook-switch mechanism. The contact-spring 10 is connected with the ground. The contact-spring 11 is connected with the line-limb 2.

A well-known type of local-battery telephone set is shown at 14, this telephone set being adapted to be connected in bridge of the line by the removal of receiver 15 from the switch-hook 16, the removal of the receiver at the same time causing a break in the bridging-circuit through the generator 8. There is provided at each of the substations similar signaling mechanism, that at substation *c*, which is connected with the line-

85 limbs in the same way as that at substation *b*, being, however, of opposite polarity, as indicated by the negative signs upon the bell and generator. The apparatus at substations *d* and *e* is oppositely polarized, as indicated by the plus and minus signs, and it will be noted that the connections of the signaling-bells and generators with the line-limbs are just the reverse of what they are at substations *b* and *c*. A subscriber, for instance, at substation *b* in

90 signaling central office operates his direct-current generator 8, whereby the terminals of the generator are connected across the line-limbs 1 and 2. Circuit can thereupon be traced from the generator through contact 13, switch-hook 16, line-limb 1, tip-spring of the jack 3, contact 4, line-drop 6, contact 5, the sleeve-spring of the jack 3, line-limb 2, spring 11, spring 10, and from spring 9 back to the generator. Currents traversing this circuit

95 cause an actuation of the drop 6 to notify the central-station operator that a connection is desired. A circuit from this generator at substation *b* can also be traced through the contact 13 to switch-hook 16, to line-limb 1, thence through the electromagnet-coils of the polarized signal-bell 7 at the same substation to ground and thence through springs 10 and 9 back to the generator. The bell 7 is adapted to be actuated by a pulsating current of one

100 polarity, that polarity corresponding with the direction of the direct current set up by the generator 8 at the same substation. As the current set up by the substation-generator is direct rather than pulsating, there will be only one stroke of the bell 7, which is not objectionable, and indeed has some advantages. If it were not for the fact that the line-limb 2 is grounded at substation

105 *b* upon the actuation of the generator 8, the current might be traced from the generator 8 to line-limb 2, thence to substations *d* and *e*, and through the signal-bells at these stations to ground, thence through the ground to the signal-bells at substations *b* and *c*, and thus

back to line-limb 1, which is at that time connected with the other terminal of the generator 8. The bell at substation *c* is negatively polarized, and therefore would not be actuated by this current, nor would the bell located at substation *d*, as these bells are actuated only upon the passage of the currents in the negative direction. The positively-polarized bell at substation *e*, however, would be actuated by operation of the generator at substation *b*, thereby notifying the subscriber at substation *e* that a call was being made. This actuation of another subscriber's bell is of course undesirable, for the reason that it might call him to his phone as in the act of answering a signal intended for him, or it might serve to apprise him of the fact that a call is being initiated, whereupon he might remove his telephone-receiver from the switch-hook and listen to the conversation taking place. The actuation of the call bell or bells at substations *d* and *e* is absolutely prevented, however, by grounding the line-limb 2 at substation *b* when a call is being initiated from this substation. This ground connected to line-limb 2 serves to short-circuit the path from line-limb 2 to the call-bells at substations *d* and *e* and thence through the call-bells at substations *b* and *c* to line-limb 1 and thence to the other terminal of the generator. It will be seen that connections of the switching mechanism associated with each of the generators at the various substations are arranged so that the call-bells which are connected with the other line-limb than that to which the associated call-bell is connected will be short-circuited and their operation thus prevented.

As will be well understood by those skilled in the art, there is provided at the central station means whereby a series of pulsating currents of either polarity may be connected between ground and either line-limb upon inserting a cord connecting-plug within the jack 3. Thus the connection of a source of pulsating current between the ground and line-limb 1 at the central station will cause the actuation of the call-bell at either substation *b* or substation *c*, depending upon the polarity of the signaling-current. The signals at substations *d* and *e* will neither of them be actuated, for the reason that they are connected with the other line-limb. In connecting up the apparatus the polarization of the generator may be reversed by reversing the position of the permanent magnets which form a part of the type of generator commonly employed for this purpose. For the reason that there is no tendency for the calling-currents set up at a substation to cause the actuation of signaling-bells at other substations the strength of these calling-currents may be made as great as is desirable, whereby the system may be employed over lines having considerable length.

As will be understood by those skilled in the art, a manually-operated switch or push-but-

ton may be substituted in place of the automatic generator-switch, as shown.

Other modifications of my invention may occur to those skilled in the art, and while I have shown the preferred form of my invention I do not wish to be limited to the precise construction herein set forth.

Having disclosed my invention, I claim as new and desire to secure by Letters Patent—

1. In a telephone system, the combination with a telephone-line comprising two metallic limbs leading from an exchange to a series of substations, of a signal-bell at one substation connected between one line-limb and a third conductor, a signal-bell at a second substation connected between the second line-limb and said third conductor, an electrically-operated signal device at the central exchange normally connected between said line-limbs, a source of current at the first said substation adapted when connected in bridge of the line-limbs to cause an actuation of the central-station signal device, and automatic means for closing a low-resistance path between the third conductor and the second line-limb when said source supplies current to said line.

2. In a telephone system, the combination with a telephone-line comprising two metallic line-limbs leading from an exchange to a series of substations, a signal-bell at one substation connected between one line-limb and a third conductor, a signal-bell at a second substation connected between the second line-limb and said third conductor, an electrically-operated signal device normally connected in bridge of the line-limbs, a source of current at the first said substation, adapted when connected in bridge of the line-limbs to cause an actuation of the signal device, and means for closing a low-resistance path between the third conductor and the second line-limb when said source supplies current to said line.

3. In a telephone system, the combination with a telephone-line comprising two metallic limbs leading from an exchange to a series of substations, of an electrically-operated signal device at one of said substations connected between one line-limb and a third conductor, an electrically-operated signal device at the second substation connected between the second line-limb and said third conductor, an electrically-operated signal device at the central station normally connected in bridge of said line-limbs, a source of current at the first said substation adapted when connected in bridge of the line-limbs to cause an actuation of the central-station signal device, and automatic means for closing a low-resistance path between the third conductor and the second line-limb when said source is connected to cause an actuation of the central-station signal device.

4. In a telephone system, the combination with a telephone-line comprising two metallic limbs leading from a series of substations to

an exchange, of a signal-bell at one substation adapted to be actuated by pulsating direct currents, said signal-bell being connected between one line-limb and a third conductor, a second signal-bell at the second substation adapted to be actuated by pulsating currents of opposite polarity, said second bell being connected between the second line-limb and said third conductor, an electrically-operated signal device at the central exchange adapted for connection between the line-limbs, a direct-current signaling-generator at one of said substations adapted to be connected in bridge of the line-limbs to cause an actuation of the signal device at the central exchange, and automatic means for closing a short-circuit path in shunt of one of said signal-bells when said generator is connected in bridge of the line-limbs for signaling purposes.

5. In a telephone system, the combination with a bimetallic line extending by its limbs from a central exchange to a series of substations, of a positively-polarized signal-bell and a negatively-polarized signal-bell connected between a third conductor and one of said line-limbs, a source of direct current adapted to be connected in bridge of the line-limbs, and means whereby the connection of said source of current in bridge of said line-limbs automatically connects each signal-bell in a direct shunt-path about said source.

6. In a telephone system, the combination with a bimetallic line extending by its limbs from a central exchange to a series of substations, of a signal-bell at one substation connected between a third conductor and one of said line-limbs, a source of current at another substation adapted to be connected in bridge of the line-limbs, and means whereby the connection of said source of current in bridge of said line-limbs automatically closes a low-resistance path between said third conductor and that line-limb to which said signal-bell is connected to prevent actuation of said signal-bell.

7. In a telephone system, the combination with a bimetallic line extending by its limbs from a central exchange to a series of substations, of a positively-polarized signal-bell and a negatively-polarized signal-bell connected between a third conductor and one of said line-limbs, a positively-polarized signal-bell and a negatively-polarized signal-bell connected between said third conductor and the second line-limb, a source of current of one polarity at one substation adapted to be connected in bridge of the line-limbs, and means whereby the connection of said source of current in bridge of the line-limbs automatically closes a short-circuit shunt-path about the signal-bells connected between one of the line-limbs and said third conductor at another substation to prevent actuation of said signal-bells.

8. In a telephone system, the combination with a bimetallic line extending by its limbs

from a central exchange to a series of substations, of a positively-polarized, electrically-operated signal device and a negatively-polarized, electrically-operated signal device, both connected between a third conductor and one of said line-limbs, a positively-polarized, electrically-operated signal device and a negatively-polarized, electrically-operated signal device connected between said third conductor and the second line-limb, a direct-current signaling-generator associated with one of said signaling devices at one of said substations, and means whereby the actuation of said generator automatically closes a low-resistance path between one of the line-limbs and said third conductor.

9. In a telephone system, the combination with a bimetallic line extending by its limbs from a central exchange to a series of substations, of a positively-polarized, electrically-operated signal device and a negatively-polarized, electrically-operated signal device, both connected between a third conductor and one of said line-limbs, a positively-polarized, electrically-operated signal device and a negatively-polarized, electrically-operated signal device connected between said third conductor and the second line-limb, a direct-current signaling-generator associated with one of said signaling devices at one of said substations, and means whereby the actuation of said generator automatically closes a low-resistance path between that line-limb to which the associated signaling device is not connected and said third conductor.

10. In a telephone-exchange system, the combination with a bimetallic telephone-line extending by its limbs from an exchange to a series of substations, of a signal-bell adapted to be actuated by pulsating currents in a positive direction located at one substation and connected between one line-limb and a third conductor, a second signal-bell adapted to be actuated by pulsating currents in a negative direction located at a second substation and connected between the same line-limb and said third conductor, a third signal-bell adapted to be actuated by pulsating currents in a positive direction located at a third substation connected between said third conductor and the second line-limb, a fourth signal-bell adapted to be actuated by pulsating currents in a negative direction located at a fourth substation and connected between said third conductor and said second line-limb, a direct-current generator at each substation adapted for connection in bridge of the line-limbs, means whereby the actuation of each generator automatically closes a low-resistance path between said third conductor and that line-limb to which the signal-bell at the same substation is not connected, the generator at each substation being of such polarity as to cause an actuation of the signal-bell at the same substation, and an electrically-operated signal device at

the central exchange, normally connected in bridge of said line-limbs.

11. In a telephone-exchange system, the combination with a bimetallic telephone-line
5 extending by its limbs from an exchange to a series of substations, of a signal-bell adapted to be actuated by currents in a positive direction located at one substation and connected between one line-limb and a third conductor,
10 a second signal-bell adapted to be actuated by currents in a negative direction located at a second substation and connected between the same line-limb and said third conductor, a third signal-bell adapted to be actuated by currents in a positive direction located at a third
15 substation connected between said third conductor and the second line-limb, a fourth signal-bell adapted to be actuated by currents in a negative direction located at a fourth substation and connected between said third conductor and said second line-limb, a direct-current generator at each substation adapted for
20 connection in bridge of the line-limbs, means whereby the actuation of each generator automatically closes a low-resistance path between said third conductor and that line-limb to which the signal-bell at the same substation is not connected, the generator at each substation being of such polarity as to cause an actuation
25 of the signal-bell at the same substation, and an electrically-operated signal device at the central exchange, normally connected in bridge of said line-limbs.

12. In a telephone-exchange system, the combination with a bimetallic telephone-line
35 extending by its limbs from an exchange to a series of substations, of a signal-bell adapted to be actuated by currents in a positive direction located at one substation and connected between one line-limb and a third conductor,
40 a second signal-bell adapted to be actuated by currents in a negative direction located at a second substation and connected between the same line-limb and said third conductor, a third signal-bell adapted to be actuated by currents in a positive direction located at a third substation and connected between said third conductor and the second line-limb, a fourth signal-bell adapted to be actuated by currents in a negative direction located at a fourth
45 substation and connected between said third conductor and said second line-limb, a direct-current generator at each substation adapted for

connection in bridge of the line-limbs, means whereby the actuation of each generator automatically closes a low-resistance path between
55 said third conductor and one line-limb, and an electrically-operated signal device at the central exchange normally connected to said line-limbs.

13. In a telephone-exchange system, the combination with a bimetallic telephone-line
60 extending by its limbs from an exchange to a series of substations, of a signal-bell adapted to be actuated by pulsating currents located at one substation and connected between one line-limb and the third conductor, a second signal-bell adapted to be actuated by pulsating currents located at a second substation and connected between said third conductor and the
65 second line-limb, a direct-current generator at each of said substations adapted for connection in bridge of the line-limbs, and means whereby the actuation of each generator automatically closes a low-resistance path between
70 said third conductor and that line-limb to which the associated signal-bell is not connected.

14. In a telephone-exchange system, the combination with a bimetallic telephone-line
80 extending by its limbs from an exchange to a series of substations, of a signal-bell adapted to be actuated by pulsating currents located at one substation and connected between one line-limb and the third conductor, a second signal-bell adapted to be actuated by pulsating currents located at a second substation and connected between said third conductor and
85 the second line-limb, a direct-current generator at each of said substations adapted for connection in bridge of the line-limbs, means whereby the actuation of each generator automatically closes a low-resistance path between said third conductor and that line-limb
90 to which the associated signal-bell is not connected, and an electrically-operated signal device at the central exchange normally connected in bridge of said line-limbs and adapted to be actuated by currents from either of said
95 generators.

In witness whereof I hereunto subscribe my name this 4th day of November, A. D. 1903.

GARRISON BABCOCK.

Witnesses:

HARVEY L. HANSON,
JOHN STAHR.