

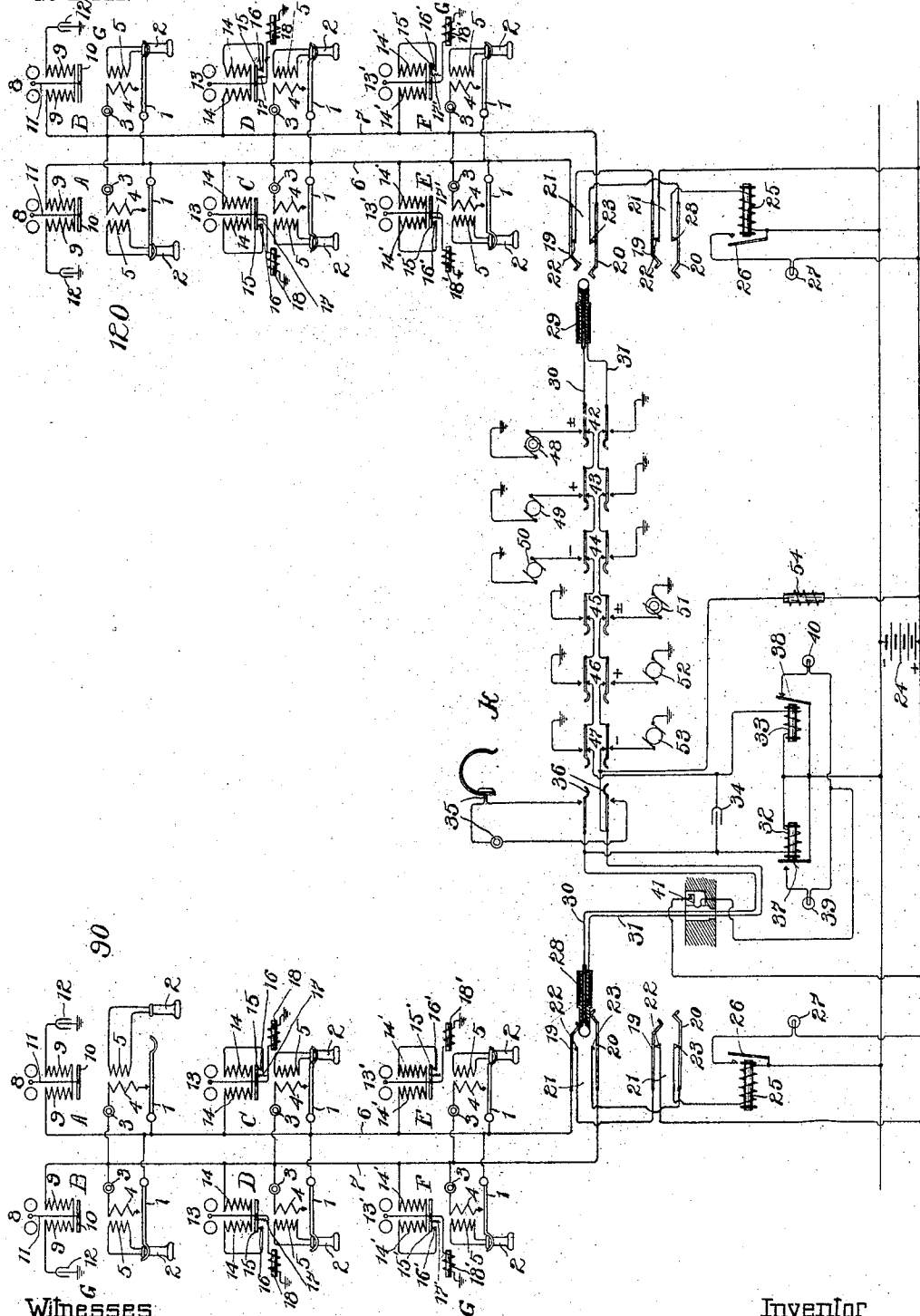
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W. M. DAVIS.
SELECTIVE SIGNALING SYSTEM.

APPLICATION FILED MAR. 27, 1903.

NO MODEL.



Witnesses,

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UNITED STATES PATENT OFFICE.

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SELECTIVE SIGNALING SYSTEM.

SPECIFICATION forming part of Letters Patent No. 765,461, dated July 19, 1904.

Application filed March 27, 1903. Serial No. 149,786. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM M. DAVIS, 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 Selective Signaling 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 a selective signaling system, and is particularly well adapted for use in connection with so-called "party-line" telephone systems.

My system is of that type in which selective apparatus at a number of stations is permanently and at all times similarly connected with an electric circuit. There have heretofore been employed telephone party-lines in which a bell or other signaling device at each of a number of substations has been connected with an electric circuit. In the use of these systems it has been the practice to operate all the bells at all the substations when it has been desired to signal any one substation. A subscriber at the first substation will be signaled by two rings of the bell, the subscriber at the second substation is notified by three rings of the bell, and so on, there being provided a code of signals adapted to indicate which of the connected substations it is desired to call. As distinguished from such systems my invention provides means whereby a number of substations are connected with a single line-circuit, while at the same time the signaling apparatus at any one of the substations may be actuated independently of the signaling apparatus at all of the other substations connected with the same line.

The objects of my invention are accomplished by providing signaling devices adapted to be actuated each by electric currents of a certain given peculiar nature. Thus I provide one signaling device adapted to be actuated only by an alternating current. A second signaling device is provided which is adapted to be actuated only by a direct current in one direction—for instance, the posi-

tive direction. A third signaling device is provided adapted to be actuated only by a direct current in the reverse or negative direction. Thus upon a single electric circuit there may be connected three signaling devices, each of which may be actuated by a suitable electric current independently of the other signaling devices connected with the same circuit.

A preferred embodiment of my invention comprises an arrangement in which the first signaling device consists of a polarized telephone-ringer serially connected with a condenser in bridge of the electric circuit employed. The second signaling device desirably consists of a polarized ringer in which a back contact of the armature forms a part of the circuit. Thus upon the attraction of the armature due to the passage through the associated electromagnet of a direct current in the proper direction the armature is attracted to break the connection with the back contact, and thus to interrupt the flow of current through the electromagnet, whereby the same is deenergized to permit the retraction of the armature, whereupon the circuit is again established. The operation is similar to that of the well-known house-bell, except that in addition I find it desirable to so polarize the armature that it will be subject to attraction only upon the passage of currents in one direction. Serially connected with this signal-bell in bridge of the line-circuit there is provided an impedance-coil adapted to check and largely prevent the flow of alternating currents through this signal-bell. It will be seen that the condenser associated with the first aforesaid signaling device prevents the passage of direct currents through its associated bell-coils. The third signaling device comprises apparatus similar to that described for the second signaling device, except that in the case of the third instrument the armature is oppositely polarized, whereby the third signal-bell is actuated only by currents in the opposite direction to those adapted to operate the second signaling device. It is now common practice in telephone installa-

tions to provide bimetallic circuits to each of the subscribers' substations. In connection with the use of the bimetallic telephone-lines I find it desirable to connect between each of the telephone-line limbs and the ground three sets of signaling apparatus such as previously described. Thus an operator at the central station by connecting between either of the line-limbs and the ground the terminals of a source of current adapted to supply either an alternating current or a direct current in either of two directions may signal any one of six substations connected with a single bimetallic line, and, furthermore, in signaling any one of these substations the apparatus at the other substations will not be affected to produce a signal.

My invention will be more clearly understood by reference to the accompanying drawing, in which I have illustrated two bimetallic telephone-lines 90 and 120, to each of which there is connected the substation apparatus A, B, C, D, E, and F. At each of the substations there is provided a telephone switch-hook 1, which when relieved of the weight of the receiver 2 causes the closure in bridge of the telephone-line of a circuit through a battery-transmitter 3 and the primary 4 of an induction-coil whose secondary 5 is connected with the receiver 2. In addition to the telephone instruments each substation is provided with signaling apparatus, the signaling apparatus at substations A and B being identical, except that the signaling apparatus at substation A is connected between the line-limb 6 and the ground G and that the signaling apparatus at substation B is connected between the line-limb 7 and the ground G. The signaling apparatus at substation A comprises a well-known telephone-ringer 8, the alternate energization of whose electromagnet-coils 9 9, due to the passage of an alternating current therethrough, causes the vibration of the polarized armature 10 and the attached bell-clapper 11. There is included in the circuit through the coils 9 9 a condenser 12. This condenser is for the purpose of preventing the passage of direct currents through the electromagnet-coils 9 9. At the substation C in addition to the telephone apparatus there is provided a call-bell 13, which comprises electromagnet-coils 14 14 and a polarized armature 15, adapted to be actuated thereby. The circuit through the coils 14 14 includes the armature 15 and a back contact 16 therefor. A retracting-spring 17 serves normally to retain the armature 15 in contact with the back contact 16. This circuit also serially includes an impedance-coil 18, adapted to check and prevent the passage of alternating currents through the ringer 13. The polarization of the armature 15 prevents its attraction by the electromagnet-coils 14 14 except upon the passage of a current in one of the two directions. Thus the bell 13 may be supposed to be actuated

only upon the passage of a direct current in the positive direction therethrough. The signaling apparatus at substation D may be identical with that at substation C, except that it should be connected between the line-limb 7 and ground rather than between the line-limb 6 and ground, as is the signaling apparatus at substation C. The signaling apparatus at substation E may be connected between the line-limb 6 and ground, while that at substation F is connected between the line-limb 7 and ground. The signaling apparatus at these two substations may be otherwise identical. The apparatus at substation E comprises a bell 13', whose electromagnet-coils 14' are serially included in a circuit through the back contact 16' and the polarized armature 15', the armature being provided with a retracting-spring 17'. The circuit through the electromagnet-coils also includes an impedance-winding 18'. It will be seen that the signaling apparatus at substation E is identical with that at substation C, except that the armature 15' is oppositely polarized, whereby the apparatus at substation E is subject to actuation only upon the passage of a current in the reverse or negative direction. It will be apparent that by connecting the terminals of a source of alternating current between the line-limb 6 and ground G the call-bell 8 at substation A will be actuated. The bells 13 and 13' at substations C and E, respectively, will not be actuated, however, due to the prevention of the flow of the alternating current therethrough, due to the impedance of the coils 18 and 18'. The connection of the terminals of a source of direct current between the line-limb 6 and ground will when connected in one direction—for instance, the positive direction—cause the actuation of the signaling-bell 13 at substation C. The connection of a source of direct current between the line-limb 6 and the ground in the reverse direction will similarly cause the actuation of the signal-bell at substation E. The connection of a source of direct current between the line-limb 6 and the ground will not cause the passage of any current through the bell 8 at substation A, due to the interruption of the continuous circuit through the coils 9 9 by the condenser 12. In the same manner the connection of a source of alternating current between the line-limb 7 and ground will cause the actuation of the signal-bell at substation B, the bells at substations D and F being prevented from operation by the impedance of their associated coils 18 and 18'. The connection of a source of direct current between the line-limb 7 and ground, if in one direction, will cause the actuation of the signal-bell at substation D alone and if connected in the reverse direction will cause the actuation of the signal-bell at substation F alone. When employed in connection with a telephone system, I find it desirable to provide at the central station means

for connecting the terminals of a source of alternating current between ground and either the line-limb 6 or 7 and for connecting the terminals in either direction of a source of direct current between ground and either the line-limb 6 or the line-limb 7. Aside from the provision of means whereby the signaling-currents of proper character may be connected with the line-circuits the central-station apparatus may be identical with that employed in a great many systems now well-known to those skilled in the art, and herein lies one of the principal advantages of my selective signaling system—that it may be employed in connection with any of the well-known exchange systems now in use. In order to illustrate the method of associating my improved selective signaling system with a telephone system, I have shown the line-limbs 6 and 7 for each of the telephone-lines 90 and 120 leading to the central exchange K, where they are respectively connected with tip and sleeve springs 19 and 20 of the line-jacks 21. Contacts 22 and 23 normally make connection with the jack-springs 19 and 20 and through suitable conductors connect the line-limb 6 directly with the positive pole of a common battery 24. The line-limb 7 is connected through a line-relay 25 with the negative pole of the common battery 24. This line-relay controls by its armature 26 a local circuit through the line signaling-lamp 27, the operation of which will be well understood by those skilled in the art. The operator's cord-circuit may comprise the usual answering-plug 28 and the calling-plug 29, whose tip-contacts are normally connected through the tip-strand 30 and whose sleeve-contacts are normally connected through the sleeve-strand 31. There are preferably included in the tip-strand circuit the supervisory signaling-relays 32 and 33, these relays being shunted by the condenser 34, whereby the transmission of voice-currents is improved. The usual operator's telephone set 35 may be included in bridge of the cord-circuit by manipulation of the listening-key 36. The supervisory relays 32 and 33 control, respectively, the armatures 37 and 38, which in turn control local circuits through the supervisory signaling-lamps 39 and 40. The continuity of the local circuits for the lamps 39 and 40 is controlled by a plug-seat switch 41, adapted upon the removal of the plug 28 from its seat to connect the positive pole of the battery 24 with one of the terminals of each of the lamps 39 and 40. The common terminal of the relays 32 and 33 is connected, as shown, with the negative pole of the battery 24. I have illustrated a series of six ringing-keys 42, 43, 44, 45, 46, and 47, each adapted to connect the terminal of a suitable source of current with one of the line-limbs 6 or 7 within the jack 21, associated with which the plug 29 has been inserted. The manipulation of the key 42 serves to con-

nect a terminal of the alternating-current generator 48 with the tip-strand of the cord-circuit leading to plug 29. The manipulation of the key 43 connects a terminal—for instance, the positive terminal—of the direct-current generator 49 with the tip-strand. The manipulation of the key 44 serves to connect the negative terminal of the generator 50 with the tip-strand. The manipulation of the key 45 connects one terminal of the alternating-current generator 51 with the sleeve-strand 31, leading to the plug 29. The manipulation of the key 46 connects the positive terminal of a direct-current generator 52 with the sleeve-strand, and a manipulation of the key 47 connects the negative terminal of the direct-current generator 53 with the sleeve-strand. The other terminals of these various sources of current may be permanently connected with the ground, as shown. I find it desirable also to provide contacts on the ringing-keys, whereby the limb of the line which is not utilized for the transmission of a signaling-current may be connected with the ground. Thus the lower contacts for the keys 42, 43, and 44 are connected with ground, while the upper contacts of the keys 45, 46, and 47 are connected with ground. An impedance-coil 54 is connected between the positive pole of the battery 24 and the sleeve-strand 31.

The operation of a telephone system employing my invention may be described as follows: Any one of the subscribers—for instance, the subscriber at substation A on line 90—upon removing his receiver from the switch-hook causes the closure of a circuit, which may be traced as follows: from the positive pole of the battery 24, through the line-limb 6, switch-hook 1 at the station A, primary coil 4, transmitter 3, to the line 7, and through the line-relay 25 to the negative pole of the battery 24. The consequent energization of the relay 25 causes the attraction of its armature 26, whereby a local circuit is established to illuminate the line signal-lamp 27. The central operator answers the line-signal by the insertion of her answering-plug 28 within a line-jack 21, associated with the line 90. The insertion of the plug 28 within the jack causes a spreading of the springs 19 and 20, whereby the circuit through the line-relay 25 is interrupted to cause its deenergization and the consequent extinction of the line signal-lamp 17. It will be seen that the removal of the answering-plug 28 from its seat will have caused the closure of the plug-seat switch 41, whereby the positive pole of the battery will be connected with terminals of the lamps 39 and 40. The armature 37 will have been attracted, however, by the energization of the supervisory relay 32, due to the flow of current through a circuit which may be traced as follows: from the negative pole of the battery 24, through the supervisory relay 32, the tip-strand 30 of the cord connecting appara-

tus, the tip-spring 19 of a line-jack 21, the line-limb 6, the subscriber's telephone apparatus, the line-limb 7, the sleeve-spring 20 and sleeve-strand 31 and the impedance-coil 54 to the positive pole of the battery 24. The attraction of the armature 37 interrupts the otherwise completed local circuit through the supervisory signal-lamp 39, whereby the same is not illuminated. The supervisory signal-lamp 40, however, is illuminated, due to the flow of current through the armature 38, which has not been attracted by its relay 33. The operator communicates with the subscriber at substation A on line 90 and ascertains the number of the subscriber's substation with which he desires communication. Assuming this to be substation C on line 120, she inserts her calling-plug 29 within one of the line-jacks 21 associated with line 120. She thereupon manipulates her ringing-key 43 to connect the terminals of the direct-current generator 49 with a circuit including the line-limb 6 and the ground-return. Current then flows from this generator over the line-limb 6 to ground, there being one path through the signaling apparatus at substation E, this apparatus, however, being polarized in such a direction that the positive current from the generator 49 does not effect the actuation of the signal-bell 13'. The inclusion of the condenser 12 in circuit with the bell 8 prevents the passage of direct current from the line-limb 6 to ground through this bell. There is another path for the current from the generator 49 through the bell 13 at substation C to ground. This bell, it will be remembered, was polarized in such a direction that the passage of a positive current causes the attraction of the armature 15. Thus the signaling apparatus at substation C on line 120 is actuated to call the subscriber to his phone. Answering the call, the subscriber removes his receiver from the switch-hook, thereby establishing a circuit through the supervisory relay 33 to cause the attraction of the armature 38, whereupon the supervisory signaling-lamp 40 is extinguished. The replacement of the receivers either at substation B on line 90 or at substation C on line 120 causes an interruption of the circuit through the supervisory relay 32 or 33, respectively, whereby the associated supervisory signaling-lamp is illuminated to indicate to the operator that the connected subscribers have finished with their conversation. She thereupon removes the cord-connecting plugs from the line-jacks, whereupon the apparatus is restored to its normal condition. It will be apparent that if any other of the subscribers connected with line 120 had been desired by the calling subscriber the manipulation of the proper ringing-key as hereinbefore described would have caused a signal at the proper substation.

The signal-bells which I have described as being adapted for actuation by a direct cur-

rent, some in the positive direction and some in the negative direction, may be described as "rheotome" signal-bells, it being understood by this descriptive term that in connection with the bell there is associated means for automatically interrupting the circuit which traverses the electromagnet-coils and the bell-magnets.

While I have herein shown and described a preferred embodiment of my invention, it will be apparent to those skilled in the art that many modifications may be employed without departing from the spirit thereof. I do not, therefore, wish to limit myself to the precise disclosure herein set forth; but,

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

1. In a selective signaling system, the combination with a central station of a line conductor leading therefrom, a return-path to the central station, a polarized signal-bell and a serially-connected condenser connected between said line conductor and said return-path, a rheotome signal-bell in a circuit of high impedance connected between said line conductor and said return-path, and means located at the central station adapted to connect the terminals of a source of alternating current or the terminals of a source of direct current between said line conductor and said return-path.

2. In a selective signaling system, the combination with a central station of a line conductor leading therefrom, a return-path to the central station, a polarized signal-bell and a serially-connected condenser connected between said line conductor and said return-path, a polarized rheotome signal-bell adapted to be operated by a direct current in the positive direction in a circuit of high impedance connected between said line conductor and said return-path, a polarized rheotome signal-bell adapted to be actuated by a direct current in a negative direction in a circuit of high impedance connected between said line conductor and said return-path, and means located at the central station adapted to connect the terminals of a source of alternating current or the terminals of a source of direct current in either direction between said line conductor and said return-path.

3. In a selective signaling system, the combination with a central station of a line conductor leading therefrom, a return-path to the central station, a polarized signal-bell and a serially-connected condenser connected between said line conductor and said return-path, a rheotome signal-bell and a serially-connected impedance-coil connected between said line conductor and said return-path, and means adapted to connect the terminals of a source of alternating current or the terminals of the source of direct current between said line conductor and said return-path.

4. In a selective signaling system, the com-

5 bination with a central station of a line conductor leading therefrom, a return-path to the central station, a polarized signal-bell and a serially-connected condenser connected between said line conductor and said return-path, a polarized rheotome signal-bell adapted to be actuated by a direct current in a positive direction, and a serially-connected impedance-coil connected between said line conductor and said return-path, a polarized rheotome signal-bell adapted to be actuated by a current in a negative direction, and a serially-connected impedance-coil connected between said line conductor and said return-path, and means adapted to connect the terminals of a source of alternating current or the terminals of a source of direct current in either direction between said line conductor and said return-path.

20 5. In a selective signaling system, the combination with a central station of a line conductor leading therefrom, a return-path to the central station, a signal-receiving instrument connected between said line conductor and said return-path, said signal-receiving instrument being responsive to alternating currents and irresponsive to a direct current, a rheotome signal-bell in a circuit of high impedance connected between said line conductor and said return-path, and means adapted to connect the terminals of a source of alternating current or the terminals of a source of direct current between said line conductor and said return-path.

35 6. In a selective signaling system, the combination with a central station of a line conductor leading therefrom, a return-path to the central station, a polarized signal-bell and a serially-connected condenser connected between said line conductor and said return-path, a second signal-receiving instrument responsive to a direct current but irresponsive to an alternating current, connected between said line conductor and said return-path, and means adapted to connect the terminals of a source of alternating current between said line conductor and said return-path, and means adapted to connect the terminals of a source of direct current between said line conductor and said return-path.

50 7. In a selective signaling system, the combination with a central station of a line conductor leading therefrom, a return-path to the central station, a signal-receiving instrument responsive to an alternating current and irresponsive to a direct current connected between said line conductor and said return-path, a polarized rheotome signal-bell adapted to be actuated by a direct current in a positive direction in a circuit of high impedance connected between said line conductor and said return-path, a polarized rheotome signal-bell adapted to be actuated by a direct current in a negative direction in a circuit of high impedance connected between said line conductor

and said return-path, and means adapted to connect the terminals of a source of alternating current or the terminals of a source of direct current in either direction between said line conductor and said return-path.

70 8. In a party-line telephone-exchange system, the combination with a central station of a bimetallic telephone-line extending from said central station to a series of substations, subscribers' telephone instruments at each of said substations adapted to be connected in bridge of said metallic line-limbs, a common return-path to the central station, a signal-receiving instrument connected between each of said line conductors and said return-path, and a second signal-receiving instrument connected between each of said line conductors and said return-path, said first signal-receiving instruments being responsive to alternating currents and irresponsive to direct currents, and the second signal-receiving instruments being responsive to direct currents and irresponsive to alternating currents.

90 9. In a party-line telephone-exchange system, the combination with a central station of a bimetallic telephone-line extending from said central station to a series of substations, subscribers' telephone instruments at each of said substations, adapted to be connected in bridge of said metallic line-limbs, a common return-path to the central station, a signal-receiving instrument connected between each of said line conductors and said return-path, a second signal-receiving instrument connected between one of said line conductors and said return-path, said first signal-receiving instruments being responsive to alternating currents and irresponsive to direct currents, and the second signal-receiving instrument being responsive to a direct current and irresponsive to an alternating current.

100 10. In a party-line telephone-exchange system, the combination with a central station of a bimetallic telephone-line extending from said central station to a series of substations, subscribers' telephone instruments at each of said substations, adapted to be connected in bridge of said metallic line-limbs, a common return-path to the central station, a signal-receiving instrument connected between each of said line conductors and said return-path, a second signal-receiving instrument connected between one of said line conductors and said return-path, and a third signal-receiving instrument connected between the same line conductor and said return-path; the said first signal-receiving instruments being responsive to alternating currents and irresponsive to direct currents, the second signal-receiving instrument being responsive to a direct current in a positive direction and irresponsive to a direct current in a negative direction and irresponsive to an alternating current, and the third signal-receiving instrument being responsive to a direct current in a negative

direction and irresponsive to a direct current in a positive direction, and irresponsive to an alternating current.

11. In a party-line telephone-exchange system, the combination with a central station of a bimetallic telephone-line extending from said central station to a series of substations, subscribers' telephone instruments at each of said substations, adapted to be connected in bridge of said metallic line-limbs, a common return-path to the central station, a signal-receiving instrument connected between one of said line conductors and said return-path, and other signal-receiving instruments connected between each of said line conductors and said return-path, the said first signal-receiving instrument being responsive to an alternating current and irresponsive to a direct current, and the second signal-receiving instruments being responsive to direct currents and irresponsive to alternating currents.

12. In a party-line telephone-exchange system, the combination with a central station of a bimetallic telephone-line extending from said central station to a series of substations, subscribers' telephone instruments at each of said substations, adapted to be connected in bridge of said metallic line-limbs, a common return-path to the central station, a polarized signal-bell and a serially-connected condenser connected between each of said line conductors and said return-path, a rheotome signal-bell in a circuit of high impedance connected between each of said line conductors and said return-path, and means located at the central station adapted to connect the terminals of a source of alternating current or the terminals of a source of direct current between either of said line conductors and said return-path.

13. In a party-line telephone-exchange system, the combination with a central station of a bimetallic telephone-line extending from said central station to a series of substations, subscribers' telephone instruments at each of said substations, adapted to be connected in bridge of said metallic line-limbs, a common return-path to the central station, a polarized signal-bell and a serially-connected condenser, connected between each of said line conductors and said return-path, a rheotome signal-bell in a circuit of high impedance connected between one of said line conductors and said return-path, and means located at the central station, adapted to connect the terminals of a source of alternating current between either of said line conductors and said return-path, and adapted to connect the terminals of a source of direct current between the return-path and that line conductor to which said rheotome signal-bell is connected.

14. In a party-line telephone-exchange system, the combination with a central station of a bimetallic telephone-line extending from said central station to a series of substations, subscribers' telephone instruments at each of

said substations, adapted to be connected in bridge of said metallic line-limbs, a common return-path to the central station, a polarized signal-bell and a serially-connected condenser connected between one of said line conductors and said return-path, a rheotome signal-bell in a circuit of high impedance connected between each of said line conductors and said return-path, and means adapted to connect the terminals of a source of alternating current between the return-path and that line conductor to which said polarized signal-bell is connected, and adapted to connect the terminals of a source of direct current between said return-path and either of said line conductors.

15. In a party-line telephone-exchange system, the combination with a central station of a bimetallic telephone-line extending from said central station to a series of substations, subscribers' telephone instruments at each of said substations, adapted to be connected in bridge of said metallic line-limbs, a common return-path to the central station, a polarized signal-bell and a serially-connected condenser connected between each of said line conductors and said return-path, a polarized rheotome signal-bell adapted to be actuated by a direct current connected between each of said line conductors and said return-path, and means adapted to connect the terminals of a source of alternating current between either of said line conductors and said return-path, or to connect the terminals of a source of direct current between either of said line conductors and said return-path.

16. In a party-line telephone-exchange system, the combination with a central station of a bimetallic telephone-line extending from said central station to a series of substations, subscribers' telephone instruments at each of said substations, adapted to be connected in bridge of said metallic line-limbs, a common return-path to the central station, a polarized signal-bell, and a serially-connected condenser connected between each of said line conductors and said return-path, a polarized rheotome signal-bell in a circuit of high impedance adapted to be actuated by a direct current in a positive direction connected between one of said line conductors and said return-path, a polarized rheotome signal-bell adapted to be actuated by a negative current in a circuit of high impedance connected between the same line conductor and said return-path, means adapted to connect the terminals of a source of alternating current between either of said line conductors and said return-path, and means adapted to connect the terminals of a source of direct current in either direction between said return-path and that line-limb to which said polarized rheotome signal-bells are connected.

17. In a party-line telephone-exchange system, the combination with a central station, of a bimetallic telephone-line extending from

said central station to a series of substations, subscribers' telephone instruments at each of said substations adapted to be connected in bridge of said metallic line-limbs, a signal-bell at one substation connected between one line-limb and ground through a condenser and responsive only to alternating current, a positively-polarized rheotome-bell at another substation connected from the same line-limb to ground through a high-impedance circuit, and a negatively-polarized rheotome-bell at a third substation connected from the same line-limb to ground through a high-impedance circuit, said polarized rheotome-bells being responsive to direct currents and not to alternating currents, all said bells being excluded from the talking-circuit over said metallic line-limbs.

18. In a party-line telephone-exchange system, the combination with a central station, of

a bimetallic telephone-line extending therefrom, a signal-bell connected from each line-limb to ground through a condenser responsive only to alternating currents, a positively-polarized rheotome-bell connected from each line-limb through a circuit of high impedance, a negatively-polarized rheotome-bell connected from each line-limb to ground through a circuit of high impedance, and substation telephonic apparatus for each bell adapted for connection in bridge of the line-limbs, all the bells being excluded from the talking-circuit over said metallic line-limbs.

In witness whereof I hereunto subscribe my name this 23d day of March, A. D. 1903.

WILLIAM M. DAVIS.

Witnesses:

LYNN A. WILLIAMS,
HARVEY L. HANSON.