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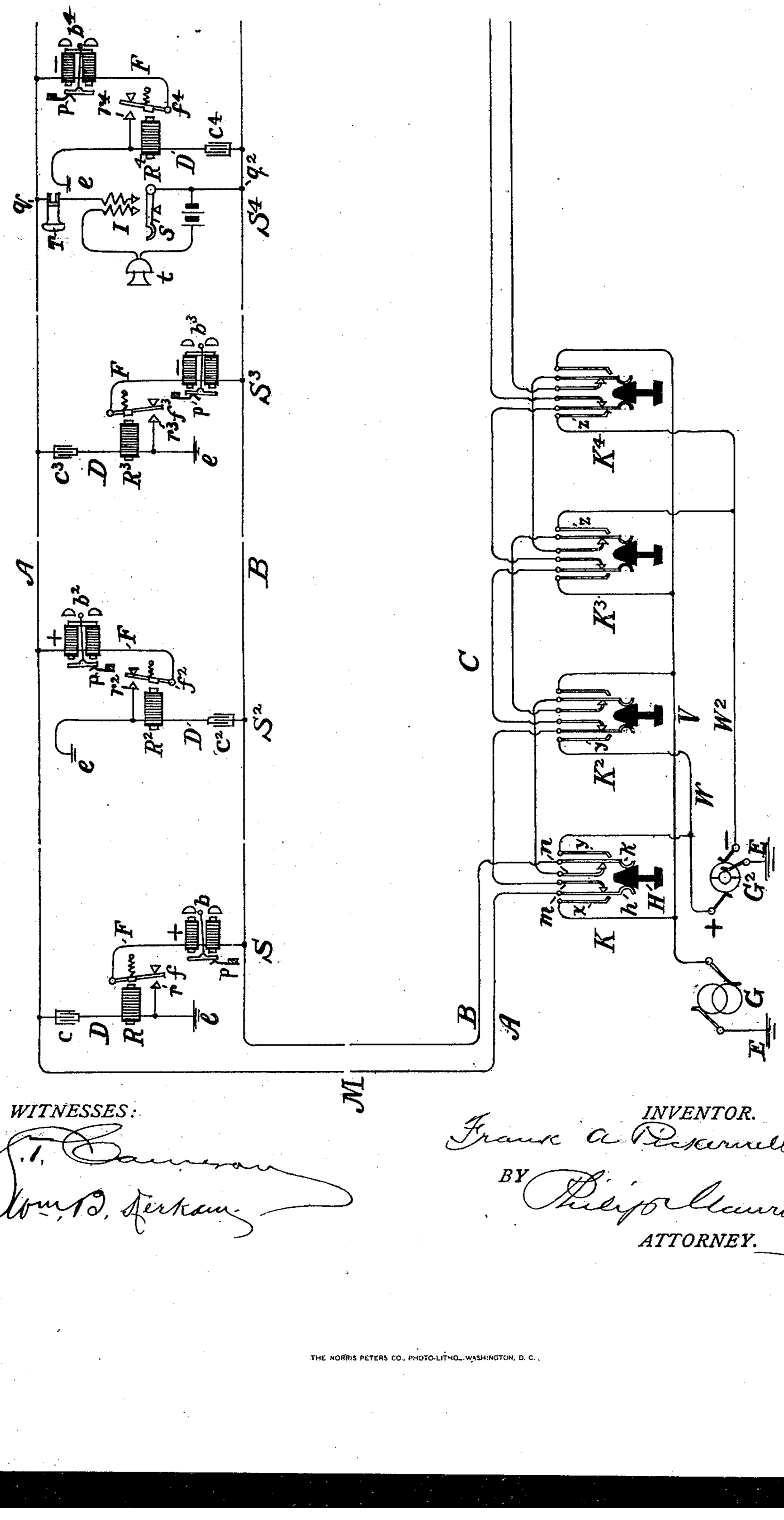
F. A. PICKERNELL.

SELECTIVE SIGNAL SYSTEM.

(Application filed Aug. 14, 1900.)

(No Model.)



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SELECTIVE-SIGNAL SYSTEM.

SPECIFICATION forming part of Letters Patent No. 663,783, dated December 11, 1900.

Application filed August 14, 1900. Serial No. 26,880. (No model.)

To all whom it may concern:

Be it known that I, FRANK A. PICKERNELL, residing at Newark, in the county of Essex and State of New Jersey, have invented certain Improvements in Selective-Signal Systems, of which the following is a specification.

This invention relates to selective signaling, and in particular to that branch of the subject which involves the combined employment of a plurality of main conductors and both directions of current. Its object is to provide a convenient and trustworthy selective-signaling system well adapted for use in connection with metallic telephone-circuits of the central-battery type extending between a central station and four substations, which system, moreover, shall be simple in structure and operation, requiring no mechanism of special character, and shall be capable of operating through a very considerable range of line resistance and under varying conditions of balance. It is of advantage in the operation of any such signaling system to be provided with and utilize substation earth branches, and while my invention involves the employment of two such branches or earth connections at each substation these are both without any conductive connection with the line conductors, both when the circuit is out of use and while it is being used for conversation, one of them at each station being at all times conductively separated from its main conductor by a condenser which, however, also serves to establish an inductive relation between the main and branch, while the other is normally without either conductive or inductive connection.

In pursuance of the above-stated object the invention consists in combining the two main conductors, a dissimilar branch from both main conductors at each substation, and an electromagnetic call-bell at each substation, two in the normally-dissociated earth branches from one main and two in the similar earth branches of the other, with a relay at each substation, two in the condenser-containing branches of one main conductor and two in those of the other, each station-relay having the bell branch at its own station led through its circuit-closing points, so that the continuity of each bell branch is controlled by the relay in the condenser branch at the same station, and four keys at the central station corresponding with the call apparatus at the four substations, respectively, each key when operated being adapted to simultaneously transmit an alternating current over a predetermined one of the main conductors, and an intermittent or pulsatory current of predetermined direction over the other main conductor for the operation of the relay and bell at the corresponding substation.

The station-bells associated by their normally open branches with each main are in any preferred way organized to respectively respond to pulsatory or intermittent currents of diverse direction—that is, one responds to plus currents only and the other to minus currents only—and a convenient plan is to oppositely bias their armatures by springs in the manner disclosed by the United States Patent No. 239,134, granted March 22, 1881, to George L. Anders.

The station-relays are adapted to respond by the steady attraction of their armatures to alternating currents transmitted over the main to which their branches are respectively united, and when the relay at any station is excited by the action of the alternating currents transmitted over its own line conductor and attracts its armature it operates to close the circuit of the bell branch at the same station, so as to bring the bell there into operative relation to the pulsatory current of appropriate direction which is being simultaneously transmitted over the other line conductor—viz., that with which the bell branch thus closed is associated, and operating also by the retraction of its armature to again open the said bell branch when the manipulation at the central station of the corresponding key is discontinued. The drawing accompanying this specification is a conventional diagram of a four-station telephone-circuit to which my present invention is applied.

Referring to the said diagram, A and B are main or line conductors, which may be those of a metallic telephone circuit M and extend between a central station C and four substations S, S^2, S^3, and S^4. Branches D, one at each substation, extend from one or the other

of the mains to earth, those at two of the substations branching from conductor A and at the other two from conductor B. Earth branches F, one at each substation, also extend from the two main conductors, two of them leading from main conductor A and the other two from conductor B; but at each substation the branches D and F extend from different mains. Thus at stations S and S^3 the branches D lead to ground from the line conductor A and the branches F from line conductor B, while at substations S^2 and S^4 this order is reversed.

R, R^2, R^3, and R^4 are alternating-current relays connected in the branches D, respectively, one at each station, and c, c^2, c^3, and c^4 are condensers also included in said branches in series with said relays. These relays are all so designed that they will respond to alternating currents, such as those developed by a ringing-generator transmitted over their main conductors, and will attract their armatures and steadily maintain such attraction when and as long as the transmission of the said alternating currents is continued. By means of the condensers c, &c., the relays R, &c., are kept out of conductive association with their respective main conductors, while at the same time and by the same means an inductive association between each branch D and including the relay and the appropriate line conductor is maintained. The relays R R^2 R^3 R^4 have armatures f, f^2, f^3, and f^4, adapted to oscillate between back and front limit-stops in a manner well understood. In each case the armature f and its front stop r constitute movable and fixed electrical contact-points.

E E represent earth connections at the central station, and e e, &c., similar earth connections for the branches D and F at the substations. The earth branches F at each station pass to earth each through the contact-points f and r of the relay at the same station, and since the said relays are normally unexcited, and their armatures therefore unattracted, it follows that the said branches F are normally discontinuous; but their circuit to earth is closed whenever by the attraction of the armatures the points f and r are brought into contact. These points thus constitute a circuit-controller governing the condition of the branch F and determining the continuity or discontinuity thereof, according as they are in contact or separated.

At each substation an electromagnetic call-bell is connected in the circuit of the branch F, the said bells being respectively indicated by the reference-letters b, b^2, b^3, and b^4. Each is organized to ring in response to the passage through its magnet-coils of a pulsatory or intermittent current of appropriate direction. None of the bells can be operated unless the earth branch containing it is closed by the action of the relay at the same station; but assuming that the earth branches F have been thus closed the bells at substations S and S^3 will be responsive to intermittent or pulsatory currents of plus and minus sign, respectively, traversing main conductor B and its substation branches F, while the bells at substations S^2 and S^4 will ring, the one in response to positive currents and the other in response to negative currents, otherwise of the same character, traversing the main conductor A and its earth branches F. The said bells may in a well-known manner have the direction of current to which they are adapted to respond determined by springs p, giving a normal bias to their armatures, and in the drawing the direction of current to which each bell is designed to respond is indicated by the plus or minus sign placed over such bell.

At the central station the main conductors A B are both associated with four signaling-keys K, K^2, K^3, and K^4, corresponding with the signal-manifesting devices at the four substations, respectively. Thus key K corresponds with and will ring the bell at substation S; key K^2 corresponds with station S^2; key K^3 with substation S^3, and key K^4 with substation S^4.

G and G^2 are two sources of current at the central station, both appropriately grounded at E, the former being adapted to deliver alternating currents to the bus-conductor V for distribution by the keys, and the latter being organized to deliver pulsatory or intermittent pulsations of current of plus or minus sign to the bus-conductors W or W^2, according as the circuit of one or the other of said conductors is closed by the keys. As is well known, such a generator may readily be arranged to deliver an impulse of either sign, as desired, during one-half of each revolution of its armature and when so employed to have the impulses of opposite sign cut off. However, I am not in the practice of the invention restricted to the forms of generator indicated, it being apparent that a battery provided in the case of generator G with a pole-changer and in the case of generator G^2 with any preferred form of intermittent or vibratory circuit-closer may readily be substituted for machine-generators, if desired.

Each key comprises a plunger H, terminal springs h and k representing the line conductors A and B, respectively, continuation contacts m n for the said terminal springs; and a terminal contact x of the alternating-current generator G branched from the bus-conductor V. Keys K and K^2 have each a terminal contact y of the plus-current conductor W of generator G^2, and keys K^3 and K^4 have each a terminal contact z of the minus bus-conductor W^2 of said generator. The main conductors A and B may readily be traced through the several keys, and it is sufficient to remark that both conductors and both sources of current have terminals in all keys, and that normally the said conductors extend through contacts in the said keys serially and have no contact with either source of current. When either of the key-plungers

is depressed, a new relation is established between the conductor and source terminals, the relation being different for each key; but in each instance an alternating current adapted for the operation of the substation-relays is transmitted over one or the other of the two main conductors, and a pulsatory or intermittent current of either plus or minus sign is simultaneously transmitted over the other main conductor to ring the bell at the corresponding substation. In operation if key K is manipulated the bell of substation S and no other will ring, for when the plunger H is depressed the line-terminal springs *h* and *k* are forced away from their normal contacts *m* and *n* and are pressed into contact with the source terminals *x* and *y*, respectively; but *h* is a terminal of main conductor A and *k* is a terminal of main conductor B. Hence the alternating current of generator G is transmitted over line A and a pulsatory current of positive direction or plus sign over main or line conductor B. The bells at stations S^2 and S^4 cannot ring, because such a current combination cannot operate their relays R^2 and R^4, so that their bell branches F are not closed, and the bell at station S^3 cannot respond, because though the alternating current in main conductor operates its relay R^3 and closes its bell branch F the current in said bell branch is of plus direction, and thus has no tendency to operate the bell b^3, which accordingly remains quiescent. In a similar way the manipulation of key K^2 rings the bell at substation S^2, and that only because such operation sends an alternating current over main conductor B and a pulsatory current of plus sign over conductor A, the relays at stations S and S^3 remaining passive and the current in A being of direction to sustain the inaction of the bell at S^4. Key K^3 sends an alternating current over main conductor A and a ringing current of minus sign over B, operating the bell at substation S^3 only, and key K^4 sends an alternating current over B and a ringing current of minus sign over A, ringing the bell of substation S^4 only.

The most obvious application of this system of selective signaling is to serve as calling apparatus for poly station telephone-circuits, and this application is indicated by the representation of substation telephone connection at substation S^4, the same for the sake of clearness having been (in the drawing) dispensed with as concerns the other substations. The telephones at station S^4 may of course be connected in any preferred way and are shown as being connected with a bridge-wire between point *q* on conductor A and point q^2 on conductor B, controlled by a hook-switch *s*, the transmitter *t* being in a local-battery circuit acting upon the line through an induction-coil I, the secondary of which is shown as being connected in series with the receiver T in the said bridge-wire.

Having thus described my invention, I claim—

1. A selective-signal circuit connecting a central station with four substations, and comprising two main or line conductors A and B; two earth branches at each substation, extending from the said main conductors respectively; an electromagnetic bell in the branch from conductor A at two of said stations, and in the branch from conductor B at the other two stations, the said two bells associated with each main conductor being organized to respond to pulsatory or intermittent current of opposite direction respectively; an alternating-current relay in the remaining branch at each station, the said relay being arranged to control the continuity of the bell branch at the same station; and four signal-transmitting keys at the central station, corresponding to the relay and bell branches at the said substations respectively, and each adapted to simultaneously transmit an alternating current over one of the main conductors for the operation of the relays connected therewith, and pulsatory or intermittent current of appropriate direction over the other main conductor to ring the desired one of the two bells brought into connection therewith by the operation of said relays, substantially as set forth.

2. The combination in a system of selective signaling with two main conductors of a telephone-circuit connecting four substations with a central station; a source of alternating current; and a source of pulsatory or intermittent current; of an electromagnetic bell at each of the said substations, two connected in normally open earth branches of one main conductor, and two in similar branches of the other main conductor, the two bells of each set being respectively organized or adjusted to respond to pulsatory or intermittent currents of diverse direction; an alternating-current relay at each station connected in an earth branch independent of that containing the said bell, the said relay branch at each substation being associated with the main conductor which at such substation is not associated with the bell branch, and the said relays being each arranged to close, through the attraction of its armature, the normally open branch at its own station; and four keys or switches, all at the central station, each controlling a different relation of the terminals of the said main conductors and sources of current, in such manner as to transmit an alternating current over a determinate one of said main conductors, and a pulsatory or intermittent current of determinate direction simultaneously over the other main conductor; substantially as and for the purposes specified.

3. In combination with a metallic telephone-circuit leading from a central station to four substations, each conductor whereof has four earth branches, one at each substation; a condenser, and a relay responsive by the steady attraction of its armature to alternating currents in each of two of the said branches from

each main conductor, all at different substations; and an electromagnetic call-bell in each of the said other branches all at different stations; the relay and the bell branches at each station being associated with different main conductors; the bell branch at each station being led through the relay-points at said station; and the two station-bells directly associated with each main being adapted to respond to pulsatory currents of plus and minus sign respectively, transmitted over said main, when the branches including them have been closed by their respective relays actuated by the passage of alternating currents in the other main; substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 9th day of August, 1900.

FRANK A. PICKERNELL.

Witnesses:
EDWARD W. BELL,
LUTHER B. WYMAN.