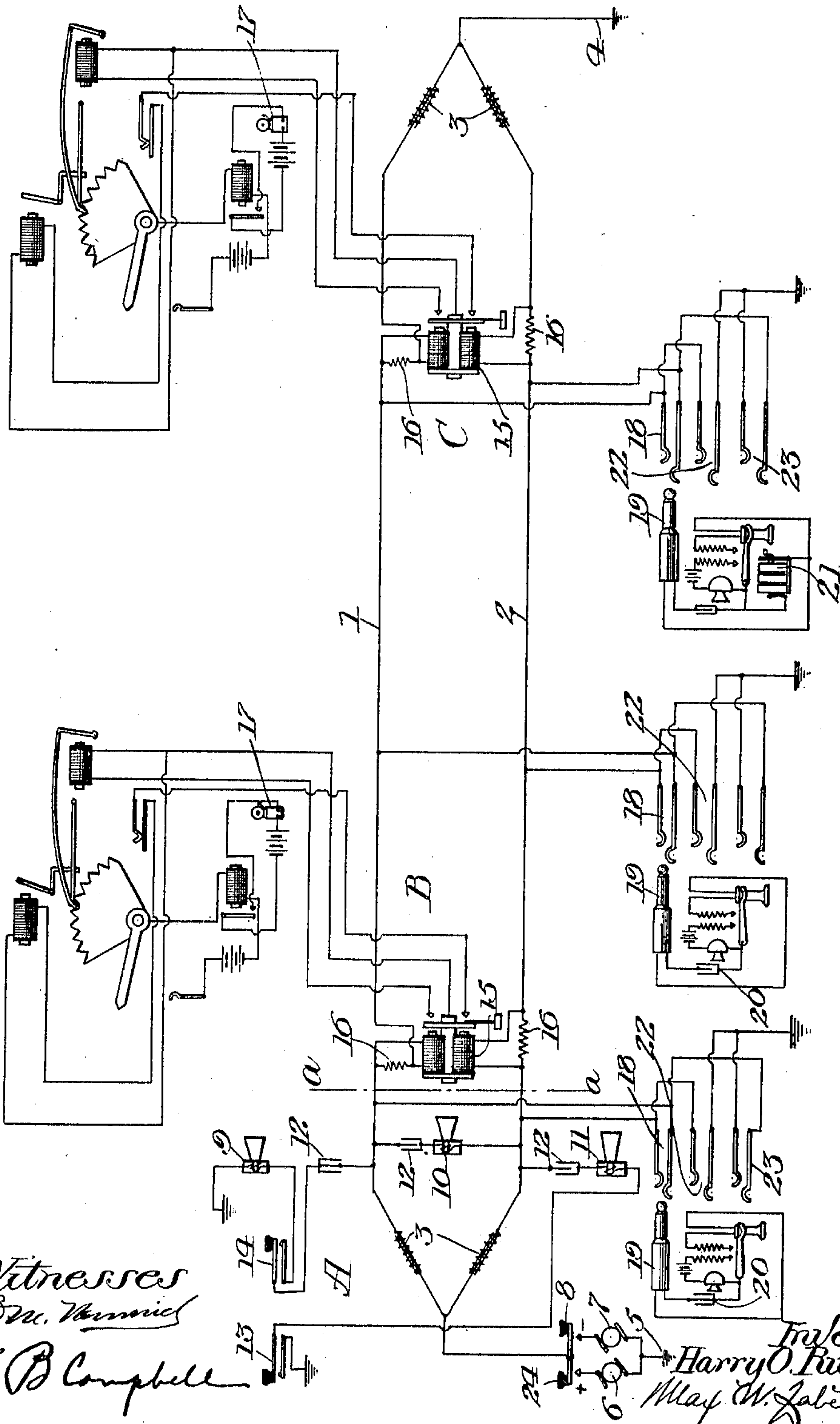


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 SIGNALING SYSTEM.
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To all whom it may concern:

Be it known that I, HARRY O. RUGH, citizen of the United States, residing at Sandwich, in the county of Dekalb and State of Illinois, have invented a certain new and useful Improvement in Signaling Systems, 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 signaling systems, and finds its application more particularly along railway systems, and although my invention is not so limited, I will describe it in this application as so applied.

The features of my invention are the provision of means to render circuits more infallible than they are at present constituted by providing appliances so that should a circuit become defective under service conditions temporarily that auxiliary though less efficient working circuits may be opened from the aforesaid defective circuit.

I will describe my invention more in detail in connection with the accompanying drawing, illustrative of one embodiment thereof.

In carrying out my invention I use two line wires, 1 and 2, which unite various stations, the station A, which I prefer as the sending station, likewise the stations B and C. All of that portion of the circuit and apparatus lying to the left of the line *a*, *a* constitutes equipment at station A. The line wires 1 and 2 are united at either end by means of impedance coils, 3, 3, which impedance coils, of course, are of sufficient impedance to prevent interference of the use of line wires 1 and 2 as a metallic circuit. The union of the impedance coils 3, 3 is connected to ground at 4 at one end of the circuit, and is connected to ground 5 at the other end of the circuit, through generators 6, 7, which are in position to provide either negative or positive currents respectively, through the operation of the keys 8 and 24.

When the key 8 is operated negative impulses are sent in parallel over the line wires 1 and 2, and when the key 24 is operated positive impulses flow in parallel over the line wires 1 and 2 respectively from the generators 6 and 7.

At the station A I provide a suitable form of howler circuit, comprising the howlers 10 and 11 in series with suitable condensers

12. The howler 10 is in bridge of the two conductors 1 and 2. The howler 11 is adapted for connection between line wire 2 and the ground, through the agency of the key 13, and the key 14 is used to connect howler 9, when desired, between the line wire 1 and the ground. It will thus be seen that howlers can be actuated either by metallic impulses received over the line wires 1 and 2, or by grounded impulses received either over the line wire 1 or the line wire 2.

The metallic circuit through the wires 1 and 2 has its continuity broken at the various stations B and C by the interposition of polarized relays 15. The relays 15 are what may be called "three-position relays," in that their armatures are adapted to occupy either one of three positions, namely, the normal position in which no contact is made, and two alternative positions in which unlike contacts are established. The polarized relay has two windings, and one winding is included in each said line wire. The windings of course are reversed, in order to have a cumulative effect of the currents sent in parallel over the line wires 1 and 2 from the generators 6 and 7. Non-inductive resistances 16 bridge the coils of the polarized relays 15, so that telephonic continuity remains in the line wires 1 and 2. The polarized relay 15 operates suitable step-by-step mechanism by the use of positive or negative battery impulses, thus to operate a signal 17. Details of this selective mechanism are unnecessary, as it is described in my Patent No. 927,602, dated July 13, 1909. From the station A signals can be sent to call either station B or C through the polarized relays 15, and as many more stations can be added as the construction of the selector mechanism associated with the polarized relay 15 will permit.

The circuit comprising wires 1 and 2 is adapted for telephonic communication between the various stations. To this end I have provided a jack 18, having the usual springs, which are connected metallically to the line wires 1 and 2. In association with the jack is a plug 19, to which is connected through a condenser 20 a usual magneto telephone set, adapted for metallic communication through the jack 18, over line wires 1 and 2. At the various stations B and C, I likewise provide a jack 18, metal-

lically connected in association with the plug and telephone set, the same as at station A, except that a generator 21 is added, so as to actuate the howlers, either 9 or 10 or 11, as desired.

It frequently happens in the operation of systems over railway lines or otherwise, that circuits consisting of line wires 1 and 2 either become closed, or one or both conductors become grounded. In the first case, the circuit is not satisfactory for metallic communication, and in the second place depending upon the character of the ground, one or the other wire is unserviceable and the other must be used over a ground connection. To provide for such operation, I have in the first place, as already explained, added to the equipment at Station A, in addition to the howler 10, supplemental howlers 9 and 11, which can receive signals over either line wire and the ground. Of course it will be apparent that the howler circuit need not be duplicate or triplicate, if not so desired, but on the other hand a single circuit can be used, which with the suitable agency of a key can be connected either in parallel or over either line wire and the ground.

In order to arrange the line wires 1 and 2 for talking purposes when the metallic continuity of said wires is destroyed, or rendered imperfect, I provide a second jack 22 at each station, connected between line wire 2 and the ground, and a third jack 23 at each station, connected between line wire 1 and the ground, thus to permit using either line wire 1 or 2 as a grounded telephone system through the agency, of course, of the associate plugs 19 and their respective telephone sets.

Normally line wires 1 and 2 are adapted for metallic communication. Now, however, if line wire 1 becomes grounded or open, I use jack 22, the one which is connected with the line wire 2, and the telephone set at such station is ready for grounded telephonic service with the other stations over the line wire 2. I thus increase the efficiency of the line circuits 1 and 2 by the interposition of means which permit the use of other, though less efficient circuits, in connection with the same line wires, one of which may be out of service temporarily. Likewise if line wire 2 is grounded or defective or open, telephonic circuit can be carried on over the line wire 1, using the ground as a return by using jack 23 between the line wire 1 and ground, through the agency of the plug 19. The relay having a coil in each line wire 1 and 2 will respond to the impulses of positive or negative current, even if one or the other of the line wires is temporarily out of service.

Having thus described the preferred em-

bodiment of my invention, what I claim as new and desire to secure by Letters Patent is:

1. A metallic circuit telephone system comprising a central station and a plurality of substations united by two line conductors and return conductor, of a substation telephone set at each station, switching instrumentalities at each station for connecting the telephone set in bridge of said line conductors so that the telephone sets can all communicate metallically, switching instrumentalities at each station for connecting the telephone set thereat between a line conductor and the return conductor, when the remaining line conductor is temporarily defective, so that the various telephone sets can communicate over this second circuit, and signal receiving devices at the central station capable of receiving a signal from the substations either metallically over the line conductors or over either line conductor and the return circuit.

2. A metallic circuit telephone system comprising a central station and a plurality of substations united by two line conductors and a return conductor, of a substation telephone set at each station, each said telephone set having a transmitter and local battery and a switch for closing a local closed circuit through said transmitter and battery, switching instrumentalities at each station for connecting the telephone set in bridge of said line conductors so that the telephone sets can all communicate metallically, switching instrumentalities at each station for connecting the telephone set thereat between a line conductor and the return conductor, when the remaining line conductor is temporarily defective, so that the various telephone sets can communicate over this second circuit, and means whereby the substations may be called over the line conductors or over a line conductor and the return circuit.

3. A metallic circuit telephone system, comprising a plurality of stations united by two line conductors, of a substation telephone set for each station, each said telephone set having a transmitter and local battery and a switch for closing a local closed circuit through said transmitter and battery, a jack for each telephone by means of which it is connected to the system aforesaid in bridge, switching means for each telephone for breaking said metallic bridge connection and connecting said telephone set between either line conductor and ground.

4. A metallic circuit telephone system, comprising a plurality of stations united by two line conductors, of a sub-station telephone set for each station, switching means at each telephone for connecting said telephone set in bridge of said line conductors,

switching means for opening the connection between said telephone set and one of the conductors, and transferring said connection to a ground, and means at one of the stations for receiving calling signals metal-

5 lically and over either line wire and ground.
 10 5. A metallic circuit telephone system, comprising a plurality of stations united by two line conductors, of a telephone sub- station set for each station, each said tele- phone set having a transmitter and local battery and a switch for closing a local closed circuit through said transmitter and battery, a jack at each substation for me-
 15 tallically connecting said telephone set to said line conductors, a second jack at each station for connecting said telephone set be- tween a line conductor and ground, a third jack at each station for connecting said tele-
 20 phone set, between the second line conductor and ground, and a plug for said telephone set.

6. A metallic circuit telephone system, comprising a plurality of stations united by
 25 two line conductors, of a telephone sub- station set for each station, a signal at each station which it is desired to call, a select- ing device for each signal, and electro-mag- netic means for operating said selecting de-
 30 vice, inserted in each line conductor at each signal receiving station, and a shunt circuit transparent to telephonic currents bridged around each electro-magnetic means.

7. A selective signaling system compris-
 35 ing a central station and a plurality of sub- stations united by two line conductors, a step-by-step selector at each substation, elec- tro-magnetic means at each selector for operating same, having two coils one in each
 40 line conductor, a shunt transparent to tele- phonic currents bridged around each coil and sources of positive and negative current at the central station for selectively operat- ing said electro-magnetic means.

45 8. A metallic circuit telephone system, comprising a plurality of stations united by two line conductors, of a telephone substa- tion set for each station, each said telephone set having a transmitter and local battery
 50 and a switch for closing a local closed cir- cuit through said transmitter and battery, a jack at each substation for metallically connecting said telephone set to said line conductors, a second jack at each station for
 55 connecting said telephone set between a line conductor and a return circuit, a third jack at each station for connecting said telephone set between the second line conductor and a return circuit, and a plug for said tele-
 60 phone set.

9. A metallic circuit telephone system, comprising a central station and a plurality of substations united by two line conductors and a return circuit, of a telephone substa-
 65 tion set for each station, a signal receiving

device at each station, which it is desired to call, each of said signal receiving devices having an operating coil associated with each line conductor, so that said signal re-
 70 ceiving devices can be operated should any- one of the line conductors become defective and a step-by-step selector under the control of said signal-receiving devices.

10. A selective signaling system compris-
 75 ing a central station and a plurality of sub- stations united by two line-conductors, a step-by-step selector at each sub-station, electro-magnetic devices at each selector for controlling same having two coils, one in
 80 each line conductor, a shunt transparent to telephone currents bridged around each coil, a source of current at the central station, and switching devices at the central station for selectively operating said electro-mag-
 85 netic devices.

11. A signaling system comprising a cen-
 tral station and a plurality of substations united by two line conductors, a step-by- step selector at each substation, electro-mag- netic means at each substation for operating
 90 said selector, an impedance device at the central station bridged across said line con- ductors, current supplying devices at the central station, and switching means at the central station for transmitting current from
 95 said current-supplying devices over said line wires in parallel and a return circuit, thereby to operate said electro-magnetic means to actuate said step-by-step selectors.

12. A selective signaling system compris-
 100 ing a central station and a plurality of sub- stations united by two line conductors, a step-by-step selector at each substation, elec- tro-magnetic devices at each selector for con- trolling same having two coils, one in each
 105 line conductor, a shunt transparent to tele- phone currents bridged around each coil, a source of current at the central station, and switching devices at the central station for operating said electro-magnetic devices.
 110

13. A signaling system comprising a cen-
 tral station and a plurality of substations united by two line conductors, a step-by-step selector at each substation, serial electro- magnetic means at each station for operat-
 115 ing said selector, an impedance device at the central station bridged across said line con- ductors, current-supplying devices at the central station, and switching means at the central station for transmitting current from
 120 said current-supplying devices over said line wires in parallel and a return circuit, there- by to operate said electro-magnetic means to actuate said step-by-step selectors.

14. A signaling system comprising a cen-
 125 tral station and a plurality of substations united by two line conductors, a step-by- step selector at each substation, signals un- der the control of said selectors, serial elec- tro-magnetic means at each substation for
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operating said selector, an impedance device at the central station bridged across said line conductors, current supplying devices at the central station, and switching means at the central station for transmitting current from said current-supplying devices over said line wires in parallel and a return circuit, thereby to operate said electro-magnetic means to actuate said step-by-step selectors.

15. A selective signaling system comprising a central station and a plurality of substations united by two line conductors, a step-by-step selector at each substation, two electro-magnets at each selector for controlling same, one in each line conductor, a shunt transparent to telephone currents bridged around each electro-magnet, a source of current at the central station, and switching devices at the central station for operating said electro-magnets.

16. A telephone system comprising a plurality of stations united by two line conductors and a return conductor, of a telephone substation set for each station, each substation set including a transmitter, a local battery and a switch for establishing a local circuit through said transmitter and battery, switching means for each substation set for connecting same to the two line conductors aforesaid metallicly, or between either line conductor and the return conductor.

17. A selective signaling system comprising a central station and a plurality of substations united by the two line conductors, step-by-step selector apparatus at each substation, two electro-magnets for each selector apparatus for controlling same, one in each line conductor, means associated with said electro-magnets to permit telephone currents to flow over said line conductors substantially unimpeded by said electro-magnets, a source of current at the central station and switching devices at the central station for causing the operation of said electro-magnets.

18. A selective signaling system comprising a central station and a plurality of substations united by two line conductors, step-by-step selector apparatus at each substation, two electro-magnets for each selector apparatus for controlling same, one associated with each line conductor, means associated with said electro-magnets to permit telephonic currents to flow over said line conductors substantially unimpeded by said electro-magnets, a source of current at the central station, and switching devices at the central station for causing the operation of said electro-magnets.

19. A selective signaling system comprising a central station and a plurality of substations united by two line conductors, step-by-step selector apparatus at each substation, a three-position polar relay at each substa-

tion associated with said line conductors for controlling said step-by-step apparatus, a source of current at the central station, and switching devices at the central station for causing the operation of said polar relay.

20. A selective signaling system comprising a central station and a plurality of substations united by two line conductors, step-by-step selector apparatus at each substation, a three-position polar relay for controlling said selector apparatus, having two coils, one responsive to current in one conductor aforesaid, and the other coil responsive to current in the other conductor aforesaid, a source of current at the central station, and switching devices at the central station for causing the operation of said polar relays.

21. A selective signaling system comprising a central station and a plurality of substations united by two line conductors, step-by-step apparatus at each substation, a three-position polar relay at each substation associated with said line conductors for controlling said step-by-step apparatus, means associated with said polar relay to permit telephonic currents to flow over said line conductors substantially unimpeded by said polar relay, a source of current at the central station, and switching devices at the central station for causing the operation of said polar relay.

22. A selective signaling system comprising a central station and a plurality of substations united by two line conductors, step-by-step selector apparatus at each substation, a three-position polar relay for controlling said selector apparatus, having two coils, one responsive to current in one conductor aforesaid, and the other coil responsive to current in the other conductor aforesaid, means associated with said polar relay to permit telephonic currents to flow over said line conductors substantially unimpeded by said polar relay, a source of current at the central station, and switching devices at the central station for causing the operation of said polar relays.

23. A signaling system comprising a central station and a plurality of substations united by two line conductors, step-by-step selector apparatus at each substation, electro-magnetic means at each substation for controlling said selector apparatus associated with each line conductor, an impedance device at one extremity of the line bridged across said line conductors, current supplying means at the central station, and switching devices at the central station to supply current to said line conductors to operate said electro-magnetic means.

24. A signaling system comprising a central station and a plurality of substations united by two line conductors, step-by-step selector apparatus at each substation, elec-

tro-magnetic means at each substation for controlling said selector apparatus associated with each line conductor, an impedance device at one extremity of the line bridged across said line conductors and having its middle point grounded, current-supplying means at the central station, and switching devices at the central station to supply current to said line conductors to operate said electro-magnetic means.

25. A signaling system comprising a central station and a plurality of substations united by two line conductors, step-by-step selector apparatus at each substation, electro-magnetic means at each substation for controlling said selector apparatus associated with each line conductor, an impedance device at one extremity of the line bridged across said line conductors and having its middle point grounded, current supplying means at the central station, and switching devices at the central station to supply current to said line conductors to operate said electro-magnetic means, each electro-magnetic means being responsive only to the current in its associated conductor.

26. A signaling system comprising a central station and a plurality of substations united by two line conductors, step-by-step selector apparatus at each substation, a

three-position polar relay at each substation for controlling the selector apparatus thereat, a source of current at the central station, and switching devices at the central station for changing the polarity of current supplied to said line conductors.

27. A selective signaling system having a line conductor running from a central station through a plurality of substations, a polar relay at each substation having a coil in said conductor and a three position armature, a ground connection at one extremity of said conductor, a source of positive and negative current at the central station, switching devices at the central station to govern the connection of positive or negative current to the other extremity of said line conductor, means associated with said polar relay to permit telephonic currents to flow over said line conductor unimpeded by said polar relay, step-by-step apparatus at each substation, and a plurality of operating electro-magnets interposed between said polar relay and said step-by-step apparatus.

In witness whereof, I hereunto subscribe my name this eighth day of June A. D., 1908.

HARRY O. RUGH.

Witnesses:

E. B. CAMPBELL,
O. M. WENNICH.