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S. D. WILBURN

TELEGRAPH SIGNALING SYSTEM

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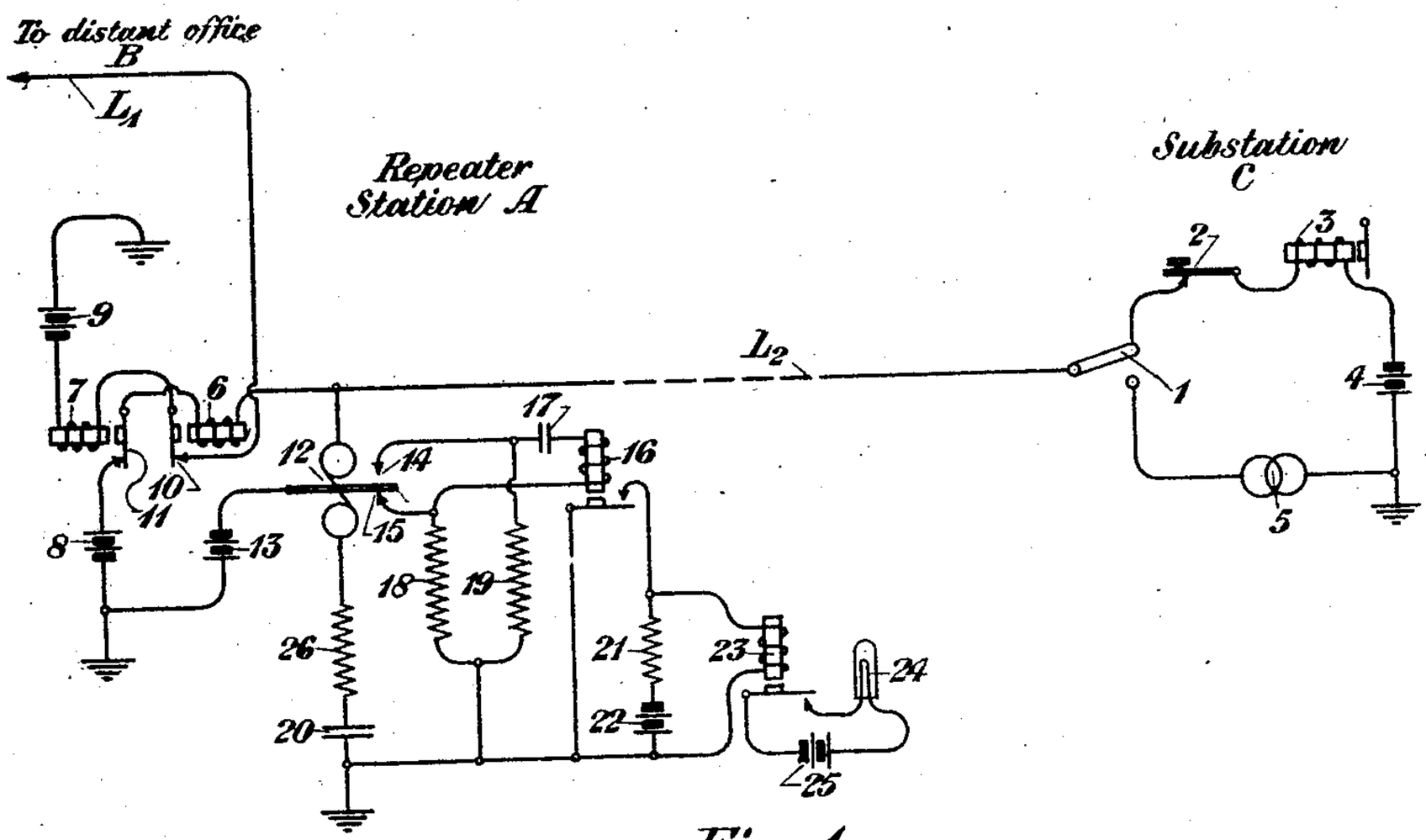

Fig. 1

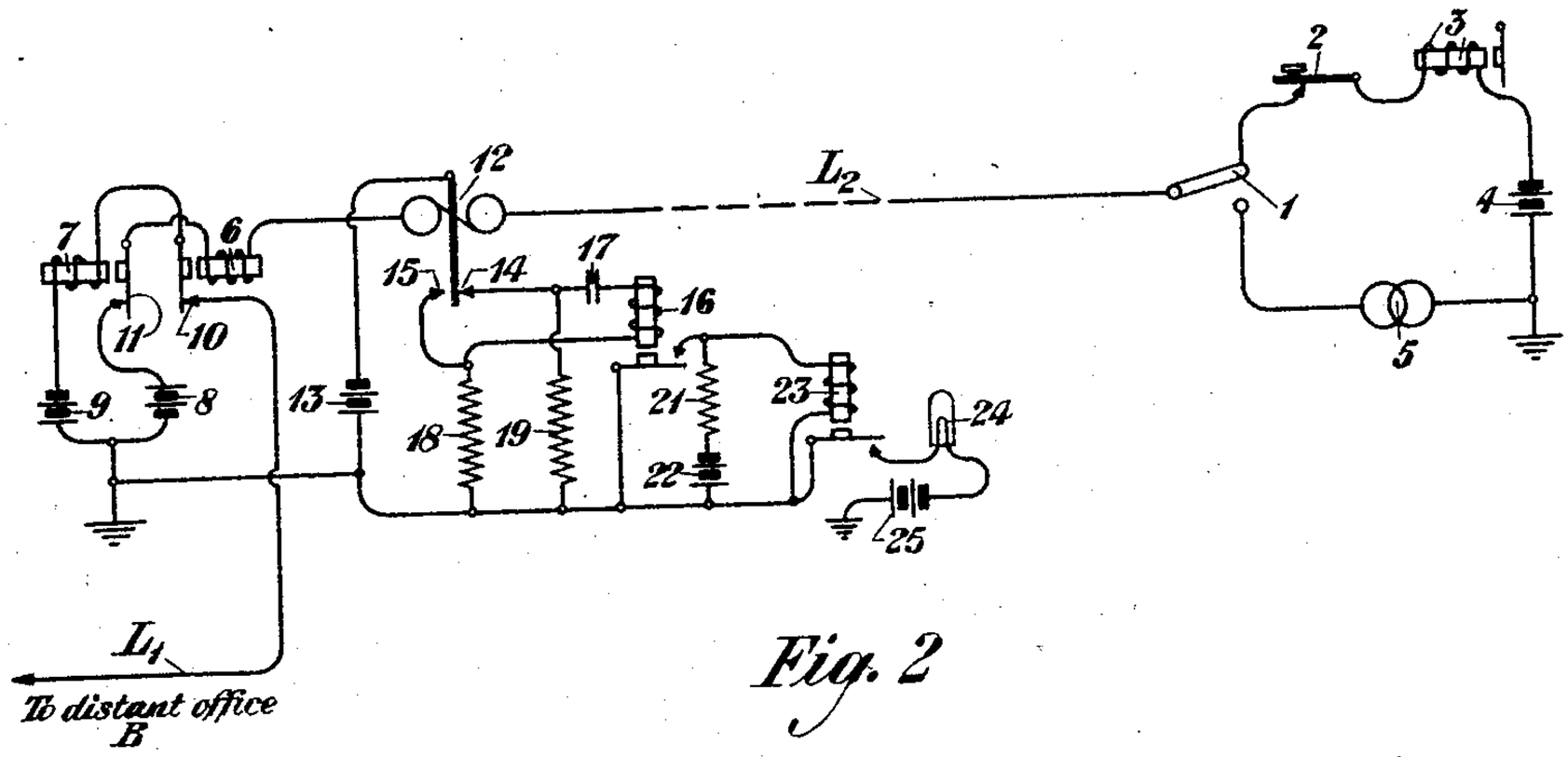

Fig. 2

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TELEGRAPH SIGNALING SYSTEM.

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This invention relates to telegraph signaling systems and particularly to an arrangement for facilitating the calling of the attendant at a repeater station by the operator of a subscriber's line connected with the said repeater station.

In the operation of a telegraph system furnishing service to a plurality of subscribers it is desirable that the operator of any subscriber's line may be able to immediately get the attention of the attendant at the repeater station from which his loop circuit is operated. This is necessary in order that the operator can notify the attendant when the signals are unsatisfactory. In a system in which the subscriber's loop circuits are full metallic circuits it is customary to connect the metallic circuit with duplicate windings of a neutral relay, which are in turn connected with a source of current supply. In such an arrangement the currents in both windings are substantially equal and their magnetic effects are opposed, so that the armature of such relay is normally unaffected. If, however, one side of the subscriber's loop is intentionally grounded at the subscriber's station by the operation of a push button or equivalent device, the relay will be unbalanced, and, when it operates, it closes a circuit through a signaling device, either visual or audible or both, the object of which is to attract the attention of the attendant at the repeater station. When a subscriber's circuit is connected with the repeater station by a single wire grounded circuit, as distinguished from the full metallic circuit referred to above, it will, or course, be apparent that the use of a balanced relay is not practicable for the operation of a calling-in signal.

In such cases if the single wire grounded circuit be comparatively short, a signal to the repeater station may be effected by the subscriber by means of a single winding relay included in the subscriber's circuit at the repeater station. This relay would have to be non-operative on the normal current in the subscriber's circuit and operative on an increase of current obtained by the shunting out of a resistance at the subscriber's station when he wishes to signal. Thus the operation of the calling-in relay at the repeater station is marginal and in the case of a long subscriber's circuit operated over a single wire to ground, the resistance of the circuit may be such that sufficient margin of current is not obtainable. In addition, if such a single wire grounded circuit of considerable length be operated over open wire lines, leakage will further tend to make this method inefficient.

It is accordingly the object of this invention to provide a calling-in signal for long subscriber's circuits or lines operated by the single Morse method. This invention will be clearly understood from the following description when read in connection with the attached drawing, of which Figure 1 shows a form of embodiment of the invention in which the polar relay controlling the system is connected in shunt to ground and Fig. 2 shows an embodiment of the invention in which the said polar relay is connected in series with the line.

In Fig. 1, L_1 represents a line extending from the repeater station A to a distant office B. L_2 represents a subscriber's line circuit extending from the repeater station A to the substation C, terminating there upon the movable arm of the switch 1. When this arm is moved to its upper contact the line L_2 will be connected through the key 2, the line relay 3 and the battery 4 to ground. In practice, the relay 3, would, of course, control a sounder or other similar device but it is not deemed necessary to show this additional equipment to describe the invention. When the arm 1 is moved to its lower contact the line L_2 will be connected through the 16 cycle generator to ground. The invention is not limited to the particular frequency mentioned or to any particular form of apparatus. At the repeater station A the line L_2 is connected through the winding 6 of the repeater with the armature 11, controlled by winding 7 of the same repeater. Sources of potential 8 and 9 are connected with the contact and with the winding of relay 7 in the manner shown. Connected with the line L_2 in shunt to ground is a polar relay 12 in series with a condenser 20 and a resistance 26. The armature of this polar relay is connected with a source of potential 13. The upper contact 14 of this relay is connected through the condenser 17 with the winding of the relay 16 and the lower contact 15 is connected directly with the winding of the relay 16. Bridged across these two contacts to ground are equal resistances 18 and 19. The armature of relay

16 is grounded and the contact thereof is connected through the resistance 21 and the source of potential 22 to ground. Connected in series with the said resistance and source of potential is the winding of relay 23, which when deenergized in a manner that will be apparent from subsequent description, will close the circuit from the battery 25 through a signaling device, which is represented by the lamp 24.

Having in mind the foregoing description of the apparatus connected with the circuit in which this invention is embodied, the manner in which the circuit operates to effect the purposes of the invention will now be made clear.

In order to transmit signals from substation C to the distant office B or any station connected therewith the switch 1 is maintained closed in its upper position. Upon the closing of key 2 a signaling impulse will be transmitted over a circuit comprising battery 4, relay 3, key 2, upper contact of switch 1, line L_2, winding of relay 6, contact of armature 11 and battery 8 to ground, thereby energizing relay 6 so as to attract its armature 10. Upon the closing of the contact of relay 6 a circuit will be established from grounded battery 9, winding of relay 7, contact of armature 10 of relay 6 and line L_1 to and through the receiving apparatus located at the distant office B. The polar relay 12 is adjusted so as not to respond efficiently to the impulses of Morse signaling current transmitted over the line L_2. Any operation of relay 12 due to Morse signals will be prevented from causing a false calling-in signal by the use of slow-acting relays in the circuit controlled by the relay 12. A signaling impulse transmitted from the distant office B over the line L_1 will flow through the contact of relay 6 and the winding of relay 7 and upon attracting its armature 11 will send an impulse from battery 8, over the line L_2 to the substation C. The repeater, made up of the relays 6 and 7 and the associated batteries, is shown in its simplest form without the usual holding coils ordinarily found in repeaters of this type because the repeater per se does not form a part of this invention.

If the operator at the substation C experiences any difficulty in the reception of signals or for any other reason desires to attract the attention of the attendant at repeater station A, he moves the arm of switch 1 to its downward position, thereby closing a circuit which includes the 16 cycle generator 5, lower contact of switch 1, the line L_2, polar relay 12, resistance 26 and condenser 20 to ground. The polar relay 12 will operate and its armature will move between its contacts 14 and 15 in accordance with the cyclic changes of the current flowing over the line L_2. When the armature of the polar relay 12 touches its contact 14, current will flow from the source 13 through the contact 14 of relay 12, then in two parallel paths to ground, one through condenser 17, relay winding 16 and resistance 18 to ground and the other through resistance 19 to ground. Thus, relay 16 is energized and condenser 17 is charged. When the armature of relay 12 touches the contact 15, current will flow from the source 13 through contact 15 of relay 12 and then in two parallel paths to ground, one through relay winding 16, condenser 17 and resistance 19 to ground, and the other through resistance 18 to ground. Thus, relay 16 is again energized and condenser 17 again charged. It will be noted that the charge received by condenser 17, when the armature of relay 12 was on its contact 14, is in such a direction as to aid the current flow through relay winding 16 when the armature of relay 12 touches the contact 15. The converse is also true. In addition, relay 16 is a slow release relay, providing for continued operation of the signal when once started. It will be seen that relay 23 is normally energized and its armature held up by current flowing from the source 22 through resistance 21 and the winding of relay 23. Upon the energization of relay 16 its armature touches its upper contact which establishes a shunt path around the source 22 and the resistance 21, which effects the release of relay 23 and thereby allows its armature to drop. This closes the circuit of the signaling device 24 and operates said device. Relay 23 is a slow release relay to prevent false signaling which might be caused by the operation of relay 12 by Morse signals in the line L_2

The circuit of Fig. 2, in which the same reference symbols have been used to indicate parts similar to those shown in Fig. 1, differs structurally from Fig. 1 in that the polar relay 12 is connected in series with the line L_2 instead of in shunt therewith, as shown in Fig. 1. In the transmission and reception of signals the apparatus at the repeater station A and at the substation C operates in the same manner in Fig. 2 as in Fig. 1 and needs no further explanation. When the operator at substation C of Fig. 2 desires to attract the attention of the repeater attendant he closes the switch 1 in its downward position, thereby transmitting 16 cycle current from the source 5 over the line L_2 through the windings of polar relay 12 and the winding of relay 6 of the repeater, thence through the contact 11 of relay 7 and through battery 8 to ground. This current will effect the cyclic movement of the armature of the polar relay 12. When the armature of the polar relay 12 touches its contact 14, current will flow from the source 13 through the contact 14 of relay 12, then in two parallel paths to ground,

one through condenser 17, relay winding 16 and resistance 18 to ground and the other through resistance 19 to ground. Thus, relay 16 is energized and condenser 17 is charged. When the armature of relay 12 touches the contact 15, current will flow from the source 13 through contact 15 of relay 12 and then in two parallel paths to ground, one through relay winding 16, condenser 17 and resistance 19 to ground, and the other through resistance 18 to ground. Thus, relay 16 is again energized and condenser 17 again charged. It will be noted that the charge received by condenser 17, when the armature of relay 12 was on its contact 14, is in such a direction as to aid the current flow through relay winding 16 when the armature of relay 12 touches the contact 15. The converse is also true. In addition, relay 16 is a slow release relay, providing for continued operation of the signal when once started. When relay 16 is energized the source 22 and the resistance 21 are shunted by a path through the contact of relay 16, whereby relay 23 is released. The releasing of this latter relay closes a circuit containing the signaling device 24, thereby operating the said device. Relay 23 is a slow release relay to prevent false signaling which might be caused by the operation of relay 12 by Morse signals in the line L_2.

While the polar relay 12 may be operated either bridged to ground, as in Fig. 1, or in series with the line, as in Fig. 2, there are certain practical advantages in connecting the polar relay in shunt to ground. With that arrangement the subscriber will be able to signal the repeater attendant even though the wire may be open at the repeater station or somewhere upon the main line L_1. The arrangement of the polar relay, which would produce the least effect upon the Morse operation of the circuit, depends upon the value of the resistance and the admittance of the condenser in series with the relay. If the operating margin of the polar relay is such as to permit the use of a resistance of high value and a condenser of sufficiently high impedance the shunt-to-ground arrangement would probably be preferable.

While this invention has been disclosed as embodied in a particular form and arrangement of parts it is to be understood that it is not so limited but is capable of embodiment in other and different forms without departing from the spirit and scope of the appended claims.

What is claimed is:

1. In a telegraph signaling system, the combination with a line, of a sub-station and a repeater station, said sub-station having connected therewith a source of alternating current, and means for connecting the said source to the said line, and the said repeater station having a polarized relay responsive to the said alternating current and arranged to control a signaling device.

2. In a telegraph signaling system, the combination with a line, of a sub-station and a repeater station, the said sub-station comprising a telegraph branch, a signaling branch having a source of alternating current connected therewith, and means to connect either of said branches to said line, and the said repeater station having a polarized relay responsive to the said alternating current and arranged to control a signaling device.

3. In a telegraph signaling system, the combination with a line, of a sub-station and a repeater station, said sub-station having connected therewith a source of alternating current, and means for connecting the said source to the said line, and the said repeater station having a signaling branch comprising a polarized relay connected between the said line and ground having means associated therewith to energize and deenergize a second relay, a third relay controlled by the said second relay, and signaling means operated by the said third relay.

4. In a single line Morse repeater, the combination with a plurality of line circuits one of which has a source of alternating current connected therewith, of repeating relays and sources of potential arranged to amplify the signals received from one line circuit and to impress them upon the other line circuit, and a signaling circuit connected with one of said line circuits comprising a polarized relay responsive to said alternating current, and means controlled by the said polarized relay to operate a signaling device.

5. In a single line Morse repeater, the combination with a plurality of line circuits one of which has a source of alternating current connected therewith, of repeating relays and sources of potential arranged to amplify the signals received from one line circuit and to impress them upon the other line circuit, a signaling circuit connected to ground from one of said line circuits having a polarized relay connected therewith, and means controlled by the said polarized relay to operate a signaling device.

6. In a single line Morse telegraph system, the combination with a repeater station, of a sub-station, a line connecting the said stations, and signaling means located at said repeater station responsive to alternating current applied to said line at said sub-station.

7. In a single line Morse telegraph system, the combination with a line circuit, of a single line Morse repeater, a Morse subscriber station having means to apply either Morse signals or alternating current to the said line, the said Morse repeater having

means responsive to the said alternating current to control the operation of a signaling device.

8. In a telegraph signaling system, the combination with a line of a sub-station having a source of telegraph current, a source of signaling current and means to connect either source to said line, and a repeater station having a signal device connected therewith, responsive to said signaling current and not to the telegraph current.

In testimony whereof, I have signed my name to this specification this 5th day of December, 1923.

SIDNEY D. WILBURN.