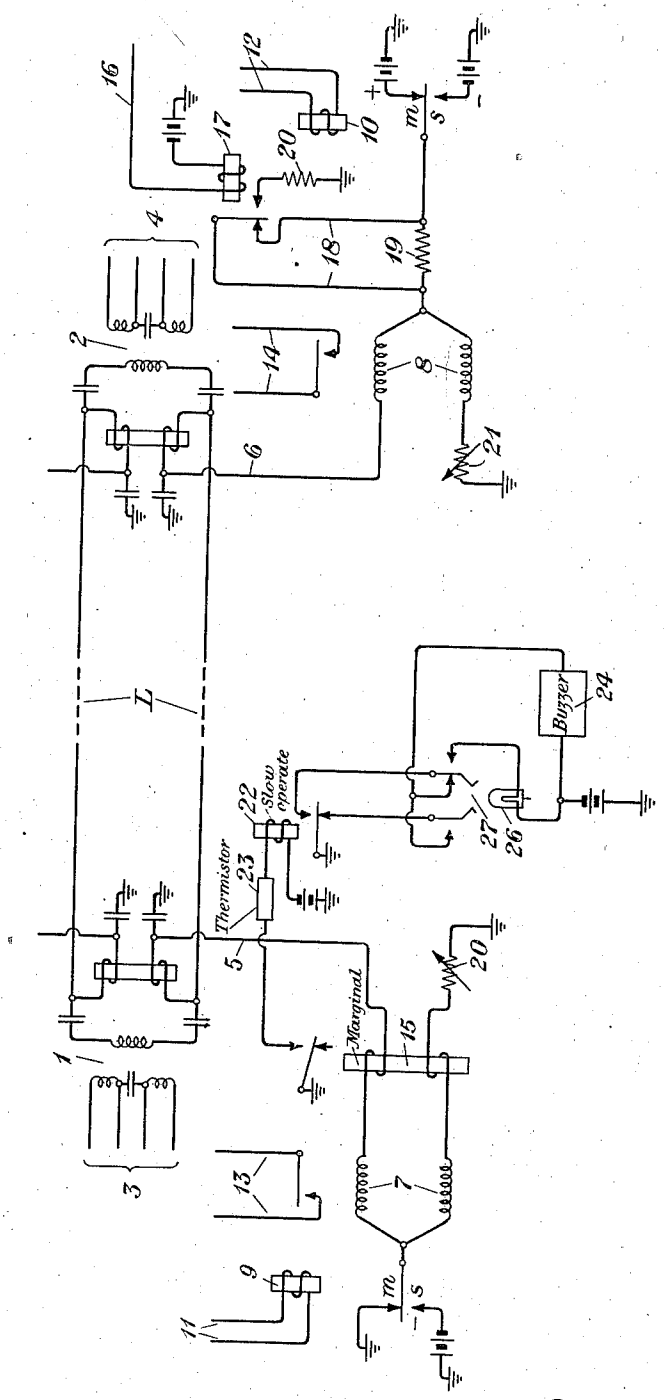
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SIGNALING SYSTEM

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SIGNALING SYSTEM

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This invention relates to transmission systems and more particularly to improved arrangements for signaling over such systems.

In certain types of transmission systems, such for example as telephone systems, it is often desirable to transmit various types of signals over a line interconnecting two offices. One of the methods of accomplishing such signaling is to connect telegraph apparatus to one side of a telephone line at each of the interconnected offices and to use such telegraph apparatus for the transmission of signals, such for example as supervisory signals, while the line itself is used for telephone signals. One type of telegraph system, which might be used in connection with such a composited line, would be a duplex polar telegraph system having a sending relay and a polar receiving relay at each end of the line and means controlled by the armature of each sending relay for connecting either ground or one polarity of battery to either end of the line to control the receiving relay at the other end. The arrangement of the invention constitutes an improvement in signaling systems of this type in that it provides arrangements whereby the telegraph system may be utilized for the sending of additional signals, such for example as alarm signals, without any interference with its normal use in transmitting telegraph signals. Hence with the arrangements of the invention it is possible to provide an additional communication channel between two offices with very little change in existing equipment. Other objects and features of the invention will appear more fully from the detailed description thereof hereinafter given.

The invention may be more fully understood from the following description together with the accompanying drawing in the figure of which is shown a circuit diagram embodying a preferred form of the invention.

In the drawing is shown a line L. For the purpose of illustrating this invention the line L will be assumed to be a telephone line interconnecting two offices. At the left end of the line is a transformer 1 connecting the line to the circuits 3 which might extend to a master office. At the other end of the line is shown a transformer 2 connecting the line to the circuits 4 which might extend to apparatus in a community dial office. To transmit supervisory signals between two offices of this type, it has been the practice to connect a telegraph circuit to one side of the line L. In the drawing, the telegraph circuit is shown connected to the ring side of the line by means of the conductors 5 and 6. At the master office there would be provided a polar receiving relay 7 and a sending relay 9. The polar receiving relay 7 would have its windings differentially arranged and one of them would be connected to a balancing artificial line 20. At the community dial office there would be provided a polar receiving relay 8 and a sending relay 10. The polar receiving relay 8 would have its windings differentially arranged and one of them would be connected to a balancing artificial line 21. In the arrangements heretofore utilized, the marking and spacing contacts of the sending relays 9 and 10 would be connected, respectively, to ground and to negative battery. Such an arrangement would constitute a form of duplex polar telegraph system in which the operation of either of the sending relays would cause a reversal in the direction of current flow over the line to operate the polar receiving relay at the other end of the line. In such an arrangement, when the telegraph circuit was idle, ground would be connected to both of the marking contacts of the sending relays and no current would flow over the system. Systems of this type utilized in the past to transmit supervisory signals between a manual office and a community dial office are well known in the art. For example, if an operator at the master office wanted to establish a connection to a subscriber in the community dial office she would insert a cord in a trunk jack, not shown, which, by means of circuit 11, would operate the sending relay 9. This would connect negative battery to the line and operate the polar receiving relay 8 at the community dial office. This would cause equipment in the community dial office to connect trunk equipment to the trunk the manual office operator has plugged in on, and would send dial tone to the manual office operator. The manual office operator would then plug in to a dialing jack and proceed to dial the number wanted at the community dial office. This operation would cause the relay 9 to function in response to the dialing impulses and send the dial signals over the line to operate the polar receiving relay 8 which, by means of circuit 14, would cause the connection to the desired line to be completed. When the subscriber at the community dial office answers, equipment in the community dial office would cause the sending relay 10 to operate to connect negative battery to the line to operate the polar receiving relay 7 at the master office. This, by means of the circuit 13, would indicate to the manual office operator that the customer

has answered. The telegraph system would also be used for supervisory signals initiated at the community dial office. It is pointed out that in the system just described which has been utilized in the past, the marking contacts of each of the sending relays would be connected to ground when the line was idle and accordingly, under such conditions there would be no current flow over the line.

In the arrangements of the invention, the marking contact of the sending relay 10 at the community dial office is not connected to ground but is connected to positive battery. Under such conditions, when the line is idle, there will be a flow of current over the line from the positive battery connected to the marking contact of relay 10 to ground connected to the marking contact of relay 9 at the master office. This current will not be in the proper direction to operate the polar relay 7. It will not operate the polar relay 8 because the currents through its differentially arranged windings will neutralize each other. When the sending relay 9 at the master office operates, this will connect the negative battery connected to its spacing contact to the line. As positive battery is connected to the line at the other end, the current through the upper winding of relay 8 will be doubled with respect to the current flowing through its lower winding. Accordingly, the polar relay 8 will be operated by the operation of sending relay 9. When sending relay 10 operates to move its armature to its spacing contact, negative battery is connected to the line and ground connected to the line at its other end. This will reverse the normal direction of current flow over the line and will cause the polar relay 7 to be operated by the sending relay 10. With such an arrangement current will flow over the line at all times whether it is idle or whether it is being used to send telegraph signals. At one of the offices, such as the master office, there would be provided a neutral relay 15 which would be connected in the line and artificial line portions of the telegraph equipment, as shown. The relay 15 is a marginal relay and is so adjusted that it will be held operated by the normal current flowing on the line either when in an idle condition or in use for signaling. At the other office, namely, the community dial office, there would be provided a resistance 19 connected in circuit with the armature of the sending relay 10. A normally closed short-circuit 18 around this resistance would be provided. A relay 17 would be provided connected in a circuit 16. The circuit 16 might be connected to alarm apparatus which would complete it in the event of equipment failure at the office, or the circuit might be closed by any desired means, such as a telegraph key. When the circuit 16 is closed and the relay 17 operated, the short-circuit about resistance 19 is removed and a connection to ground through a resistance 20 is established from the armature of the sending relay 10. This will reduce the value of the current normally flowing over the line to a value sufficient to allow the marginal relay 15 to release. The polar receiving relays 7 and 8, however, are adjusted so that they will function with this reduced current and accordingly, the inclusion of these resistances 19 and 20 in the circuit will not affect the normal operation of the arrangements for transmitting telegraph signals. When relay 15 releases it closes a circuit through the thermistor 23 and the slow operating relay 22. A thermistor 23 is provided and the relay 22 is made slow to operate so that the momentary release of relay 15 when the armatures of the sending relays are in mid-air, will have no effect. The operation of relay 22 will close a circuit over the right-hand contact of key 27 for the buzzer 24 to indicate to the operator at the master office that the alarm circuit 16 at the community dial office has functioned. The operator may then, through the key 27, operate the lamp 26 and short-circuit the buzzer. When circuit 16 releases and relay 15 again operates, a circuit will be closed over the left-hand contact of key 27 for the buzzer.

While the arrangements of the invention have been disclosed as associated with a telephone line interconnecting two specific types of offices, it is understood that this is purely for the purposes of illustration and that the arrangements of the invention are capable of being associated with other types of lines. Furthermore, while the arrangements of the invention have been illustrated as used for sending supervisory and alarm signals, it is understood that they are capable of transmitting other varieties of signals. Accordingly, while the arrangements of the invention have been disclosed as embodied in certain specific forms which are deemed desirable, it is understood that they are capable of embodiment in many other and widely varied forms without departing from the spirit of the invention as defined by the appended claims.

What is claimed is:

1. A line, two polar receiving relays each connected to different ends of said line, one of said relays being arranged to be operated when current flows therethrough in one direction and the other being arranged to be operated when current flows there-through in the other direction, each of said relays having a pair of differentially arranged windings, two sending relays each having its armature connected to the apex of the differentially arranged windings of its associated receiving relay, positive and negative battery connected to the marking and spacing contacts respectively of the sending relay at one of said stations, ground and negative battery connected to the marking and spacing contacts respectively of the other of said sending relays whereby current will flow over said line at all times, means at either end of said line for reversing the direction of current through the polar relay at the other end to cause its operation, a relay included in one end of said line, said relay being marginal and adjusted so that it will be held operated by the normal current flow existing on said line, and means at the other end of said line for reducing the normal current flow existing on said line to release said last mentioned relay without affecting the operation of said polar relays.

2. A line, sending relays and polar receiving relays so associated with said line that current flow will exist on said line when it is in idle condition or when a polar receiving relay is being operated by a sending relay at the other end of the line, a marginal relay in one end of said line so adjusted as to be held operative by the normal currents flowing over the line when it is idle or when said polar receiving relays are operated for signaling purposes, a signaling circuit controlled by said marginal relay, and means at the other end of said line for reducing the current flow existing on said line at any time whereby said marginal relay may be released, said polar

receiving relays being adjusted so that they will operate on said reduced current.

3. A line, sending relays and polar receiving relays so associated with said line that current flow will exist on said line when it is in idle condition or when a polar receiving relay is being operated by a sending relay at the other end of the line, a marginal relay in one end of said line so adjusted as to be held operative by the normal currents flowing over the line when it is idle or when said polar receiving relays are operated for signaling purposes, a signaling circuit controlled by said marginal relay, a normally short-circuited resistance in said line at the end distant from said marginal relay, a second signaling circuit, and means controlled by said second signaling circuit for opening the short circuit around said resistance whereby the current flow on the line will be sufficiently reduced so that said marginal relay will be released but the operation of said polar receiving relays will not be affected.

4. A transmission line, a telegraph circuit connected to one side of said line at each end thereof, said telegraph circuit being so arranged that current will flow thereover when said circuit is idle or when said circuit is being utilized for the transmission of telegraph signals, a marginal relay associated with one end of said telegraph circuit, said relay being so adjusted that it will be held operated by the normal currents flowing in said telegraph circuit, a slow operate relay controlled by said marginal relay, an alarm circuit controlled by said slow operate relay, means at the end of said line distant from said marginal relay for varying the resistance of the telegraph circuit thereat whereby the current flow over the line will be reduced so that said marginal relay will be released, and an alarm circuit for controlling said last mentioned means.

5. A duplex polarential telegraph system having a neutral marginal relay connected in the line and artificial line circuits at one end thereof, said relay being adjusted to be held in operated condition by the currents normally flowing at all times over said system, and means at the other end thereof to vary the value of said currents to control said relay.

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