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SIGNALING SYSTEM

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FIG. 1

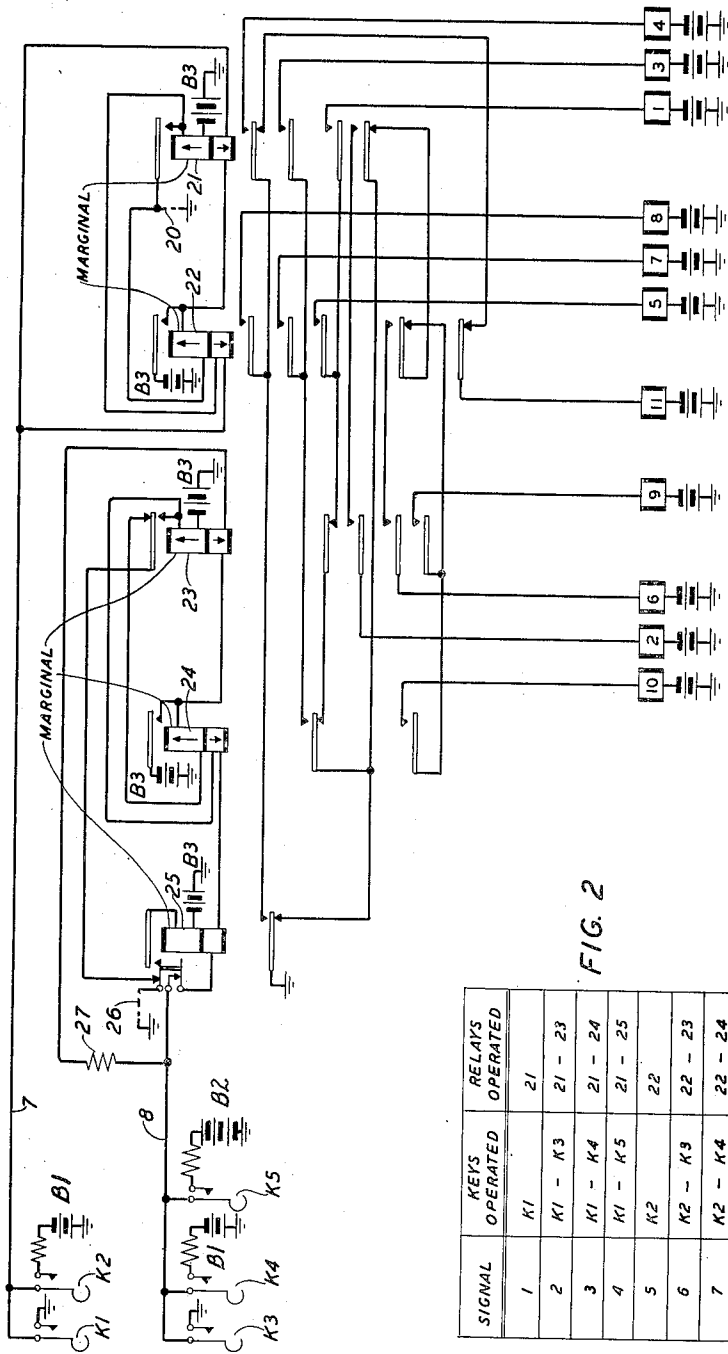


FIG. 2

SIGNAL	KEYS OPERATED	RELAYS OPERATED
1	K1	21
2	K1 - K3	21 - 23
3	K1 - K4	21 - 24
4	K1 - K5	21 - 25
5	K2	22
6	K2 - K3	22 - 23
7	K2 - K4	22 - 24
8	K2 - K5	22 - 25
9	K3	23
10	K4	24
11	K5	25

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SIGNALING SYSTEM

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This invention relates to relay circuits and signaling systems and particularly to selective signaling and has for its objects increased reliability and efficiency of selective signaling systems and the simplification and improvement of such systems.

Heretofore selective signals have been transmitted by impulses of current which differ in amplitude and polarity, the signal receiving means comprising both marginal and polarized relays. By transmitting different combinations of such pulses simultaneously and separately over each of a plurality of conductors, a desired plurality of different signals have been provided as in the systems disclosed in the patent to Carpenter 1,780,906, November 11, 1930, and in the patent to Henry 1,916,760, July 4, 1934.

This invention is a signaling system in which selective signals are transmitted by positive and negative current impulses, the signal receiving means for selectively responding to these impulses being non-polarized relays.

A feature of the invention is the transmission of any one of a plurality of selective signals by current impulses which differ in amplitude and direction, the signal receiving means consisting of a like plurality of non-polarized relays. According to a further feature, a desired plurality of selective signals are transmitted by different combinations of current impulses simultaneously and separately over each of a plurality of conductors, the signal receiving means for selectively responding to the impulses being non-polarized relays.

Another feature of the invention is a relay circuit consisting of two like non-polarized relays each having two windings, one winding of each relay having twice the number of turns that the other winding has, the windings of each relay being normally, differentially energized in a circuit including in the order named one winding of one relay, the unlike winding of the other relay, the other winding of the one relay and the other winding of the other relay, a control conductor being connected to the junction between said unlike winding of the other relay and said other winding of the one relay whereby operation of the one relay is effected by connecting a current source of one polarity to the control conductor and the operation of the other relay is effected by connecting a current source of opposite polarity to the control conductor.

A clear and complete understanding of the invention will be facilitated by a consideration of

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the circuit arrangement shown in the drawing, which arrangement constitutes one embodiment of the invention and its features. The invention is not limited to the specific arrangement shown in the drawing but is generally applicable to relay and signaling systems.

Referring to the drawing:

Fig. 1 shows a selective signaling system; and Fig. 2 lists the different signal conditions.

The signaling arrangement shown in the drawing comprises two key contacts K1 and K2 for transmitting signals over a signaling conductor 7 to effect the selective operation of signal relays 21 and 22, and three key contacts K3, K4 and K5 for transmitting signals over a signaling conductor 8 to effect the selective operation of signal relays 23, 24 and 25. The actuation of key contact K1 connects ground to conductor 7; the actuation of key contact K2 connects to conductor 7 battery B1 of the same voltage and polarity as the battery B3 connected to the windings of relays 21 and 22; the actuation of key contact K3 connects ground to conductor 8; the actuation of key contact K4 connects to conductor 8 battery B1 of the same voltage as the battery B3 connected to the windings of relays 23 and 24; and the actuation of key contact K5 connects to conductor 8 a battery B2 of the same voltage as, or higher voltage than that of battery B3 but of opposite polarity. Only one of contacts K1 and K2 can be operated at the same time and only one of contacts K3, K4 and K5 can be operated at one time; so that there are eleven different signals which may be transmitted responsive to the actuation of one of contacts K1 and K2, the actuation of one of contacts K3, K4 and K5, or the simultaneous actuation of one of contacts K1 and K2 and one of contacts K3, K4 and K5. The eleven different combinations of the five key contacts and the corresponding eleven different combinations of the signal relays are listed in Fig. 2 of the drawing. The signal relays control eleven signal registers or relays such as those numbered 1 to 11 in the drawing, one for each of the eleven distinctive combinations of the five signal relays 21 to 25. Each of the relays 21, 22, 23 and 24 is a non-polarized relay having two windings one of which has twice the number of turns that the other winding has. Relay 25 is also a non-polarized relay having two windings which may or may not be similar to those of the other four signal relays.

Assume the key contacts K1 through K5 to have been associated with the signal relays 21 through 25 in any known manner, whereupon

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ground is connected to conductors 20 and 26 to prepare the relays for operation responsive to signals transmitted over conductors 7 and 8. For instance, in an automatic telephone system in which the keys K1, K2, K3, K4 and K5 constitute an operator's key set for transmitting digits, and relays 21, 22, 23 and 24 are part of a register-sender which is connected to conductors 7, 8 responsive to the initiation of a call from the operator's position at which the key set is located, ground is connected to conductors 20 and 26 when the register-sender is ready to receive each digit of the called number, and is disconnected from these conductors after each digit is registered. Reference may be had to Patent No. 1,780,906, granted to W. W. Carpenter and R. E. Hersey November 11, 1930, for disclosure of an automatic telephone system in which a register-sender is connected to an operator key set and in which a set of signal relays are selectively operated under the control of the calling station to effect the registration of each digit of a called subscriber's number. With neither of the key contacts K1 and K2 actuated, the windings of relays 21 and 22 are energized in a circuit traced from grounded conductor 20, through the upper winding of relay 22, lower winding of relay 21, lower winding of relay 22 and upper winding of relay 21, to battery B3. The windings of each of relays 21 and 22 are differentially energized by the current in this circuit as indicated by the arrows. Although the upper winding of each relay has twice as many turns as the lower winding, these relays are adjusted so that they do not operate when their windings are differentially energized by the same current. With none of keys K3, K4 and K5 operated, the windings of relays 23, 24 and 25 are energized in a circuit traced from grounded conductor 26, through the continuity back contact of relay 25, upper back contact of relay 23, upper winding of relay 24, lower winding of relay 23, resistor 27, inner upper back contact of relay 25, lower winding of relay 25, lower winding of relay 24, and upper winding of relay 23, to battery B3. The windings of each of relays 23 and 24 are differentially energized by the current in this circuit as indicated by the arrows; and, although the upper winding of each has twice as many turns as the lower winding, the adjustment of each relay is such that it is not operated when its windings are differentially energized by the same current. Relay 25 is also adjusted so as not to be operated by the energization of its lower winding in series with both windings of both of relays 23 and 24 and resistor 27.

If key contact K1 is actuated, a circuit is closed from ground, through contact K1, conductor 7, lower winding of relay 22, upper winding of relay 21, and battery B3; so that the lower winding of relay 21 and upper winding of relay 22 are shunted by conductor 7 and key K1. The resistance of conductor 7 is low so that there will be substantially no current through the lower winding of relay 21 and upper winding of relay 22 while key K1 is operated. Thus the energization of the lower winding of relay 21 is decreased and the opposing energization of the upper winding of relay 21 is increased sufficiently to effect the operation of relay 21; and, although the energization of the upper winding of relay 22 is decreased, the opposing energization of the lower winding of relay 22 is not increased sufficiently to effect the operation of relay 22. Relay 21 closes a locking circuit through its upper

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winding and front contact so as to remain operated after key contact K1 is restored to normal, the other windings of relays 21 and 22 being thereby short-circuited.

If key contact K2 is actuated, a circuit is closed from battery B1, through contact K2, conductor 7, lower winding of relay 21, and upper winding of relay 22, to grounded conductor 20; so that battery B3, the upper winding of relay 21 and lower winding of relay 22 are shunted by battery B1, key K2 and conductor 7. Thus the energization of the lower winding of relay 22 is decreased and the opposing energization of the upper winding of relay 22 is increased sufficiently to effect the operation of relay 22; and, although the energization of the upper winding of relay 21 is decreased, the opposing energization of the lower winding of relay 21 is not increased sufficiently to effect the operation of relay 21. Relay 22 closes a locking circuit through its upper winding and front contact so as to remain operated after key contact K2 is restored to normal, the other windings of relays 21 and 22 being thereby short-circuited.

If key contact K3 is actuated, a circuit is closed from ground, through contact K3, conductor 8, inner upper back contact and lower winding of relay 25, lower winding of relay 24, and upper winding of relay 23, to battery B3; so that resistor 27 and the lower winding of relay 23 and upper winding of relay 24 are shunted by conductor 8 and key K3. The resistance of conductor 8 is low so that there will be substantially no current through the lower winding of relay 23 and upper winding of relay 24, while key K3 is operated. Thus the energization of the lower winding of relay 23 is decreased and the opposing energization of the upper winding of relay 23 increased sufficiently to effect the operation of relay 23. Although the energization of the upper winding of relay 24 is decreased, the opposing energization of the lower winding of relay 24 is not increased sufficiently to effect the operation of relay 24; and although the energization of the lower winding of relay 25 is increased, the increase is insufficient to effect the operation of relay 25.

If key contact K4 is actuated, a circuit is closed from battery B1, through contact K4, conductor 8, resistor 27, lower winding of relay 23, upper winding of relay 24, upper back contact of relay 23, and continuity back contact of relay 25 to grounded conductor 26; so that the lower winding of relay 25, lower winding of relay 24, upper winding of relay 23 and battery B3 are shunted by conductor 8, key K4 and battery B1. Thus the energization of the lower winding of relay 24 is decreased and the opposing energization of the upper winding of relay 24 increased sufficiently to effect the operation of relay 24. Although the energization of the upper winding of relay 23 is decreased, the opposing energization of the lower winding of relay 23 is not increased sufficiently to effect the operation of relay 23; and since the energization of the lower winding of relay 25 is decreased, relay 25 does not operate.

If key contact K5 is actuated, a circuit is closed from battery B2, through contact K5, conductor 8, thence through two branches in parallel; one branch of which is traced through the inner upper back contact and lower winding of relay 25, lower winding of relay 24, upper winding of relay 23 and battery B3; and the other branch of which is traced through resistor 27, lower winding of relay 23, upper winding of relay 24, upper back contact

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of relay 23, continuity back contact of relay 25 to grounded conductor 26. The current through the upper winding of relay 23 and lower windings of relays 24 and 25 is thus increased since batteries B2 and B3 are connected therethrough in series aiding; and the current through the upper winding of relay 24 and lower winding of relay 23 is reversed in direction. The increased current through the lower winding of relay 25; effects the operation of relay 25 and, since both windings of each of relays 23 and 24 are now energized in the same direction, both of relays 23 and 24 also operate. Relay 25 closes a locking circuit through its upper winding and thus opens the circuit through its lower winding and causes the immediate release of both of relays 23 and 24.

The signal storing relays 1 to 11 are controlled by the contacts of relays 21, 22, 23, 24 and 25 so that a different one of the storing relays is actuated for each different signal transmitted by keys K1, K2, K3, K4 and K5 as shown in Fig. 2. The arrangement may be such that a plurality of groups of signal storing relays are provided; and, when the storing relays of one group are operated, the release of the operated one of the signal receiving relays 21, 22, 23, 24 and 25 is effected so that these relays may respond to a succession of signals which are successively effective to operate a signal storing relay in each of the signal storing groups, as in the aforementioned Carpenter-Hersey patent.

It is also apparent that a third relay may be provided in combination with relays 21 and 22 for operation by a third key contact associated with conductor 7 in the same manner that relay 25 is operated by key contact K5 over conductor 8. Such an arrangement would provide four more different signals for transmission over conductors 7 and 8.

What is claimed is:

1. A relay system comprising first and second non-polarized relays each having first and second windings, said first winding of each of said relays having twice as many turns as said second winding, first and second batteries of like voltage and each having the like pole connected to ground, means connecting said first battery in series with said first winding of said first relay, said second winding of said second relay, said second winding of said first relay and said first winding of said second relay in the order named, whereby the first and second windings of each relay are normally energized differentially, each of said relays being marginally adjusted so as not to be operatively responsive to said differential energization of its windings in series, means comprising a first signaling contact and a low resistance conductor for closing a shunt across said second winding of said first relay and said first winding of said second relay so as to deenergize these windings and increase the energization of the first winding of said first relay and the second winding of said second relay to cause the operation of said first relay without operating said second relay, and means comprising a second signaling contact and said low resistance conductor for connecting said second battery to the junction between said second windings so as to decrease the energization of said first winding of said first relay and said second winding of said second relay and increase the energization of said second winding of said first relay and said first winding of said second relay to cause the operation of said second relay without operating said first relay.

2. A relay system comprising first and second non-polarized relays each having first and sec-

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ond windings, said first winding of each of said relays having twice as many turns as said second winding, first and second batteries of like voltage and each having the like pole connected to ground, means connecting said first battery in series with said first winding of said first relay, said second winding of said second relay, said second winding of said first relay and said first winding of said second relay in the order named, whereby the first and second windings of each relay are normally energized differentially, each of said relays being marginally adjusted so as not to be operatively responsive to said differential energization of its windings in series, means comprising a first signaling contact and a low resistance conductor for closing a shunt across said second winding of said first relay and said first winding of said second relay so as to deenergize these windings and increase the energization of the first winding of said first relay and the second winding of said second relay to cause the operation of said first relay without operating said second relay, means comprising a second signaling contact and said low resistance conductor for connecting said second battery to the junction between said second windings so as to decrease the energization of said first winding of said first relay and said second winding of said second relay and increase the energization of said second winding of said first relay and said first winding of said second relay to cause the operation of said second relay without operating said first relay, and means individual to each of said relays and comprising said first winding of the relay for locking the relay operated independent of said signaling contacts.

3. A relay system comprising first, second and third non-polarized relays each of said first and second relays having first and second windings, said first winding of each of said two relays having twice as many turns as said second winding, first, second and third batteries, the voltage of said first and second batteries being substantially equal to each other and the voltage of said third battery being equal to or higher than that of each of said first and second batteries, the like pole of each of said first and second batteries and the unlike pole of said third battery being connected to ground, a resistor, means connecting said first battery in series with said first winding of said first relay, said second winding of said second relay, a winding of said third relay, said resistor, said second winding of said first relay and said first winding of said second relay in the order named, whereby said winding of said third relay is normally energized and said first and second windings of each of said first and second relays are normally energized differentially, each of said first and second relays being marginally adjusted so as to be operatively non-responsive to said differential energization of its windings in series, said third relay being marginally adjusted so as to be operatively non-responsive to the energization of its winding in said series connection with said first battery and both windings of said first and second relays, means comprising a first signaling contact and a low resistance conductor for closing a shunt across said resistor, said second winding of said first relay and said first winding of said second relay to deenergize these windings and increase the energization of the first winding of said first relay and the second winding of said second relay so as to cause the operation of said first relay without operating either of said second and third

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relays, means comprising a second signaling contact and said low resistance conductor for connecting said second battery to the junction between said winding of said third relay and said resistor to decrease the energization of said winding of said third relay, said second winding of said second relay and said first winding of said first relay and increase the energization of said second winding of said first relay and said first winding of said second relay so as to cause the operation of said second relay without operating either of said first and third relays, means comprising a third signaling contact and said low resistance conductor for connecting said third battery to the junction between said winding of said third relay and said resistor to reverse the energization of said second winding of said first relay and said first winding of said second relay and

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increase the energization of said winding of said third relay, said second winding of said second relay and said first winding of said first relay, whereby said first, second and third relays are operated, and contact means rendered effective by the operation of said third relay for causing the release of said first and second relays.

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