

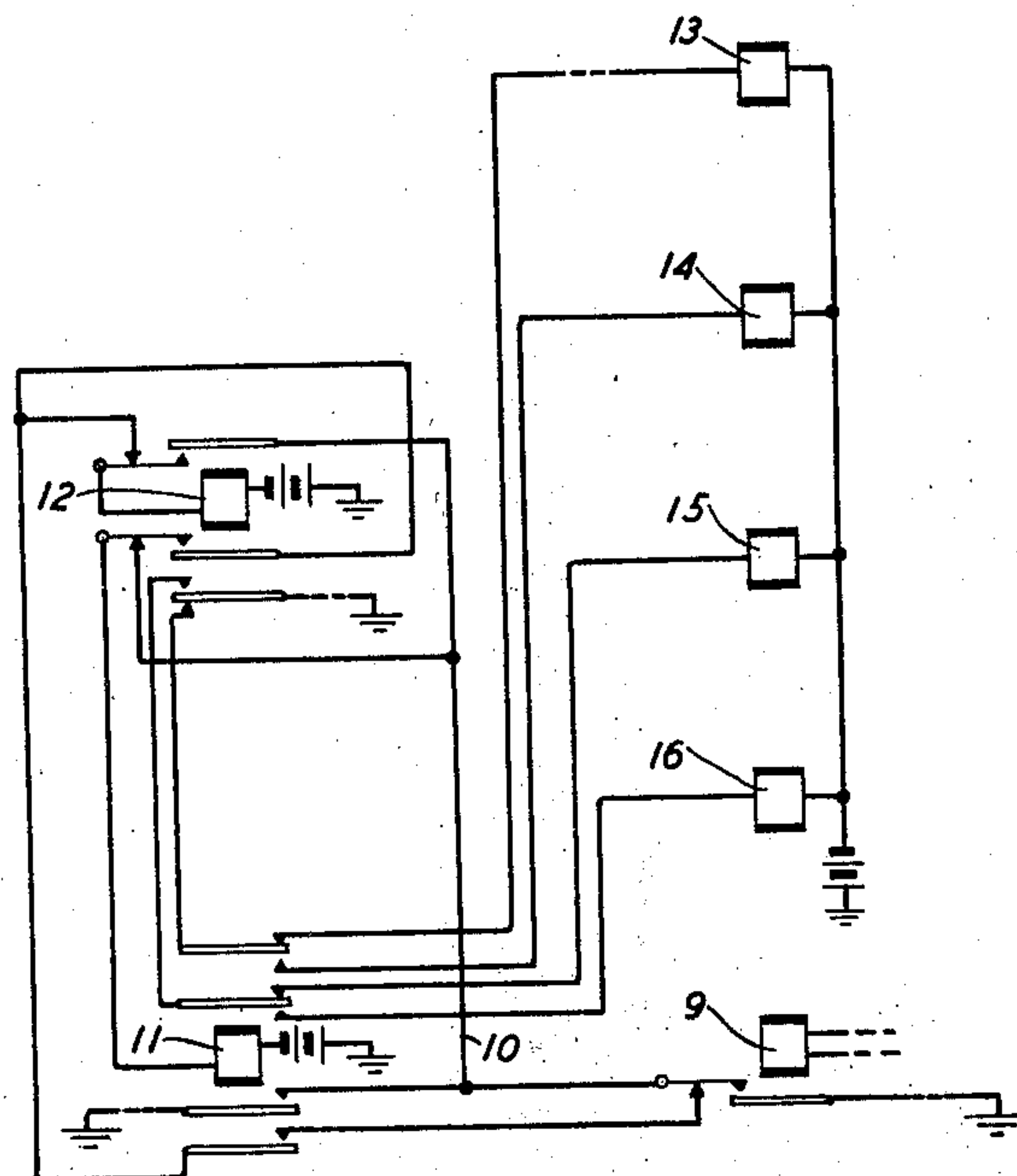
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SWITCHING SYSTEM

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SWITCHING SYSTEM

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This invention relates to electrical switching systems and particularly to switching systems comprising a relay combination operatively controlled by signal impulses.

Objects of the invention are the provision of circuit means adapted to respond to signal impulses received at a higher frequency than has heretofore been possible and to improve the reliability of switching means responsive to signal impulses.

In signaling and switching systems and particularly in dial telephone systems it is well known to employ relay means controlled by an impulse relay for operating or controlling the operation of register or selector mechanism. Relay means of such a character are disclosed in Patent 1,438,743 granted to E. H. Clark, December 12, 1922, and in Patent 1,751,263 granted to O. Cesareo, March 18, 1930. The relay combination disclosed in the Clark patent involves a marginal operation and the relay combination disclosed in the Cesareo patent involves the use of non-inductive resistors to shunt the windings of the relays; and consequently these combinations are not capable of responding to impulses at as high a frequency as might otherwise be employed in impulse-controlled systems. Another relay combination of similar character is disclosed in the patent to C. R. Gray 2,033,283, March 10, 1936, but the Gray arrangement requires three relays in place of the two relays which comprise the relay combinations of the Clark and Cesareo patents.

This invention is a circuit arrangement comprising an impulse relay and only two controlled relays without shunting resistors and arranged for positive operation without marginal limitations. According to one feature of the invention, two relays each having a single winding are connected for control by an impulse relay in such a manner that a first operation of the impulse relay closes a circuit for operating a first one of the controlled relays, the release of the impulse relay closes a circuit for operating the other of the controlled relays, a second operation of the impulse relay opens the operating circuit of said first controlled relay and the release of said impulse relay opens the operating circuit of the other of the controlled relays, this sequence of operations being effected without marginal adjustment and without providing shunting resistors for the windings of the controlled relays.

A feature of the invention is the use of continuity spring combinations for controlling the desired sequence of operations so as to maintain the continuous energization of each of the two

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controlled relays as required during each cycle of operation.

A better and more complete understanding of the invention may be obtained by considering the specific embodiment of the invention shown in the drawing which forms a part of this specification. The invention is, in general, applicable to any signaling system in which selective signals are created by the opening and closing of signaling circuits.

Referring to the drawing, relay 9 is an impulse receiving relay and relays 11 and 12 are controlled by relay 9. Impulse registers or other controlled mechanisms are represented by electromagnets 13, 14, 15 and 16. When the arrangement is placed in condition for operation, ground is connected to the armature of the impulse relay 9, to the inner lower armature of relay 11, and to the outer lower armature of relay 12. Assuming relays 11 and 12 to be non-operated, the operation of relay 9 closes a circuit including conductor 10 and the lower continuity back contact of relay 12 for operating relay 11. Relay 11 connects ground to conductor 10 thereby to hold relay 11 operated under the control of relay 9, independent of the front contact of relay 9. When relay 9 releases at the end of the first impulse, relay 11 is held operated; and relay 12 is operatively energized in a circuit traced from its winding through its upper continuity back contact, the outer lower front contact of relay 11, the continuity back contact of relay 9, conductor 10 and the inner lower front contact of relay 11. The operation of relay 12 opens its operating circuit after closing a locking circuit through its upper continuity front contact, conductor 10 and the inner lower front contact of relay 11; and opens the hereinbefore traced holding circuit of relay 11 after closing another circuit for holding relay 11, the last-mentioned circuit being traced from the winding of relay 11 through the front contact of the lower continuity springs of relay 12, the outer lower front contact of relay 11, the continuity back contact of relay 9, conductor 10, and inner lower front contact of relay 11.

When relay 9 reoperates, with relays 11 and 12 operated, relay 11 releases due to the opening of its holding circuit at the continuity back contact of relay 9. The release of relay 11 opens the above-mentioned locking circuit of relay 12, but relay 12 is held operated through the continuity front contact of relay 9. After relay 11 has released, the release of relay 9 opens the holding circuit of relay 12 and relay 12 releases.

Thus a first operation of relay 9 causes the

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operation of relay 11 whereby a circuit is closed for energizing electromagnet 14; release of relay 9 following a first operation causes the operation of relay 12 and the continued operation of relay 11, whereby a circuit is closed for energizing electromagnet 15; the reoperation of relay 9 causes the release of relay 11 and the continued operation of relay 12 whereby a circuit is closed for energizing electromagnet 15; and the release of relay 9 causes the release of relay 12 and the continued release of relay 11 whereby a circuit is closed for energizing electromagnet 13. To prevent the energization of electromagnet 13 after ground is connected to the armatures of relays 9 and 12 but prior to the operation and release of both of relays 11 and 12, the operating circuit of electromagnet 13 may include a contact closed responsive to the operation of any one or more of electromagnets 14, 15 and 16. Thus relays 11 and 12 effect a desired register or selective operation responsive to signals received by relay 9.

What is claimed is:

1. In combination, a control relay and two controlled relays each of said control relays having a single winding, means for operatively energizing one of said controlled relays responsive to a first operation of said control relay, means including a front contact of said one relay for holding said one relay operated after said control relay releases after said first operation, means including a front contact of said one relay for operating the other of said controlled relays when said control relay releases after said first operation, means including a back contact of said control relay and a front contact of said other relay for holding said one relay operated after the operation of said other relay, means including a front contact of said one relay for holding said other relay operated, and means including a front contact of said control relay for holding said other relay operated after said one relay releases.

2. In combination, an impulse receiving relay having a set of continuity springs, first and second relays controlled by said set of continuity springs, each of said first and second relays having a single winding, means including the front contact of said set of continuity springs for operating said first relay responsive to a first operation of said impulse relay, means rendered effective by the operation of said first relay and the release of said impulse relay following said first operation of said impulse relay for operating said second relay, means comprising the back contact of said set of continuity springs for holding said first relay operated until said impulse relay operates a second time and for then opening the holding circuit of said first relay to cause the release of said first relay, and means comprising the front contact of said set of continuity springs for holding said second relay operated until said impulse relay releases after said second operation and for then opening the holding circuit of said second relay to cause the release of said second relay.

3. In combination, an impulse receiving relay having a set of continuity springs, first and second relays controlled by said set of continuity springs, means including the front contact of said set of continuity springs for operating said first relay responsive to a first operation of said impulse relay, means including the back contact of said set of continuity springs for holding said first relay and operating said second relay responsive to the release of said impulse relay fol-

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lowing said first operation, means comprising said set of continuity springs for causing the release of said first relay and for holding said second relay responsive to the reoperation of said impulse relay following said first operation and release of said impulse relay, and means for causing the release of said second relay and maintaining the release of said first relay responsive to the release of said impulse relay following said reoperation of said impulse relay.

4. In a relay combination consisting of an impulse receiving relay having a set of continuity springs and first and second relays, each of said first and second relays having a single winding, means including the front contact of said set of continuity springs for operating said first relay responsive to a first operation of said impulse relay, means for locking said first relay operated under the control of said second relay but independent of said impulse relay, means including the back contact of said set of continuity springs for operating said second relay responsive to the release of said impulse relay following its first operation, means for holding said first relay operated after the operation of said second relay under the joint control of said impulse and second relays, means comprising said set of continuity springs responsive to the reoperation of said impulse relay following the operation of said second relay for causing the release of said first relay and for holding said second relay after said first relay releases, and means comprising said set of continuity springs responsive to the release of said impulse relay following the release of said first relay for causing the release of said second relay.

5. In combination, an impulse receiving relay, first and second relays each of said first and second relays having a single winding, a battery, conductors connecting the windings and contacts of said relays and said battery whereby a first operation of said impulse relay closes a circuit for operating said first relay, the operation of said first relay closes a first circuit for holding said first relay, the release of said impulse relay following the operation of said first relay opens the operating circuit of said first relay and closes a circuit for operating said second relay, the operation of said second relay closes a first circuit for holding said second relay, opens the operating circuit of said second relay, closes a second circuit for holding said first relay and opens said first circuit for holding said first relay, the reoperation of said impulse relay following the operation of said second relay opens said second circuit for holding said first relay to cause the release of said first relay and closes a second circuit for holding said second relay, the release of said first relay opens said first circuit for holding said second relay, and the release of said impulse relay following the release of said first relay opens said second circuit for holding said second relay to cause the release of said second relay.

6. In combination, an impulse receiving relay having a set of continuity springs, first and second relays controlled by said impulse relay, each of said first and second relays having a single winding, said second relay having a first set and a second set of continuity springs, a circuit for operating said first relay including the back contact of said first set of continuity springs of said second relay and the front contact of the continuity springs of the impulse relay, a circuit for holding said first relay operated after the im-

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pulse relay releases until said second relay operates comprising the back contact of said first set of continuity springs of said second relay and a first front contact of said first relay, a circuit for operating said second relay when said impulse relay releases following the operation of said first relay comprising a back contact of said second set of continuity springs of said second relay, a second front contact of said first relay, the back contact of the continuity springs of said impulse relay and said first front contact of said first relay, a circuit for holding said first relay operated after said second relay has operated until said impulse relay reoperates comprising the front contact of said first set of continuity springs of said second relay, said second front contact of said first relay, the back contact of the continuity springs of the impulse relay and said first front contact of said first relay, a circuit for holding said second relay operated un-

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til said first relay releases comprising the front contact of said second set of continuity springs of said second relay and said first front contact of said first relay, and a circuit for holding said second relay operated after said first relay has released until said impulse relay releases comprising the front contact of said second set of continuity springs of said second relay and the front contact of the continuity springs of said impulse relay.

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