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RELAY SELECTING CIRCUIT

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FIG. 1

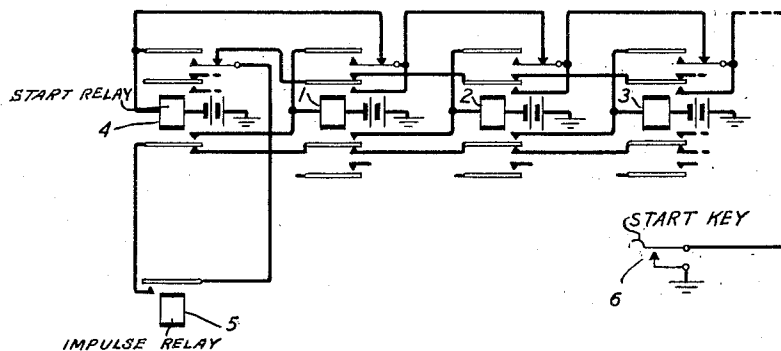
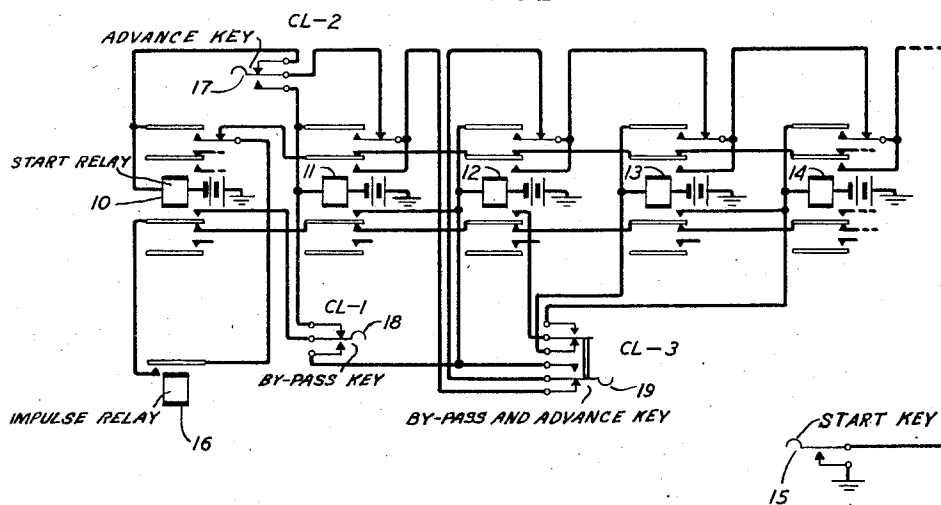


FIG. 2



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2,281,396

RELAY SELECTING CIRCUIT

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7 Claims. (Cl. 177—353)

This invention relates to relay circuits and has for its object to increase the reliability and flexibility of their operation.

More specifically it relates to selecting circuits employing a series of relays, which relays are operated individually and successively to control other circuits.

In order to insure the effective operation of a single relay, in accordance with the present invention, the relays of the series are operated and locked over circuits which include contacts of all of the relays in the series.

According to a modification of the invention means is also provided for starting the operation of the series at any point or for omitting a desired relay from the series.

In the drawing, Fig. 1 shows a simple series of relays while Fig. 2 shows the relay series modified to permit control of the starting point, and to skip certain relays when desired.

In Fig. 1 a series of three relays, 1 to 3, has been shown together with a start relay 4 and a pulse control relay 5. In addition, a circuit closer is indicated by key 6 although any other form may be used. Each of the relays 1 to 3 has three operating armatures and one or more selecting armatures.

When key 6 is operated a circuit is completed over normal contacts of relays 3, 2 and 1 to the winding of start relay 4 and battery. Relay 4 prepares the pulsing circuit which may be traced from ground on key 6, over the normal contacts of relays 3, 2 and 1, alternate contact of relay 4, pulsing contact controlled by relay 5, lower front contact of relay 4 to the winding of relay 1 and battery.

When relay 5 closes its contact, relay 1 operates and locks over its alternate contact and the normal contacts of relays 2 and 3 to ground over key 6. The operation of relay 1 opens the circuit of relay 4 but closes a secondary holding circuit for that relay under the control of the pulsing contact from battery through the winding and upper alternate contact of relay 4, contact of relay 5, lower front contact of relay 4, over the locking circuit of relay 1 to ground. When the pulse terminates, relay 4 releases to prepare the operating circuit for the remaining relays.

The second closure of the contact of relay 5 completes a circuit from battery through the winding of relay 2, lower front contact of relay 1, lower back contact of relay 4, contact of relay 5, upper normal contact of relay 4, upper front contact of relay 1, normal contacts of relays 2 and 3 to ground over key 6.

Relay 2 opens the previously traced locking circuit for relay 1, but, to prevent the premature release of relay 1, closes a secondary locking circuit for relay 1 under the control of relay 5 which may be traced from battery through the winding

of relay 1, alternate contact of relay 1, upper front contact of relay 1, normal contact of relay 4, contact of relay 5, lower back contact of relay 4, lower front contact of relay 1, upper alternate contact of relay 2, normal contact of relay 3 to ground at key 6. When relay 5 opens its contact, relay 1 releases.

The third closure of the contact of relay 5 operates relay 3 over the lower front contact of relay 2, lower back contact of relay 1, contacts of relays 4 and 5, back contact of relay 1, front contact of relay 2, normal contact of relay 3 and ground on key 6. Relay 3 locks to key 6 and holds relay 2 over the two upper contacts of relay 2, upper back contact of relay 1, contacts of relays 4 and 5, lower back contact of relay 1, lower front contact of relay 2 over the locking circuit of relay 3.

Other relays of the series (not shown) operate in a similar fashion. It will be apparent that each relay of the series has an operating circuit including one of its own armatures and contacts on all of the relays of the series and a secondary locking circuit including three of its own armatures and contacts on all of the relays of the series. Each relay operates at the beginning of one pulse and releases at the termination of the next pulse.

Such a series of relays may be used to advantage in a circuit for making tests on a series of pieces of equipment such as is disclosed in U. S. Patent No. 2,225,688, granted December 24, 1940, to J. W. Dehn.

Fig. 2 shows a similar chain of relays as they might be used to set up a plurality of tests. When, in accordance with the class of circuit under test, it might be desirable to omit certain tests, the tests might be omitted by starting the operation of the chain at an intermediate point or by by-passing one of the relays.

The circuit of Fig. 2 includes four chain relays 11 to 14, start relay 10, pulse control relay 16, start key 15 and class keys 17, 18 and 19. It is obvious that relay contacts may be substituted for the keys shown. Generally speaking, it will appear that the class keys are inserted in the relay circuits and when normal the series operates exactly as the series of Fig. 1.

Key 17 illustrates the manner in which the starting point may be advanced, key 18 illustrates the manner of by-passing a relay and key 19 illustrates a combination of these features.

With key 17 operated, the preparatory circuit closed by the operation of key 15 extends over the normal contacts of relays 14, 13 and 12, key 19, and relay 11, operated contact of key 17 to the winding of relay 11. Relay 11 locks over its upper alternate contact and the normal contacts of key 19 and the normal contacts at relays 12, 13 and 14 to ground at key 15 and closes the

pulsing circuit to relay 12. Relay 12 in operating from the closure of the contact of relay 16 locks over the normal contacts of relays 13 and 14, and closes the holding circuit for relay 11 under the control of relay 16. These circuits are independent of key 19.

With key 18 operated, the closure of key 15 operates relay 10 in the usual manner, the circuit including normal contacts of keys 17 and 19. Since key 18 is operated, relay 10 in operating extends the pulsing circuit over the operated contact of key 18 to the winding of relay 12 so that relay 11 is by-passed and any test controlled by it would be omitted.

With key 19 operated the start circuit is extended over the lower operated contact of key 19 to the winding of relay 12, and neither relay 10 nor relay 11 is operated. In addition, the operation of key 19 transfers the pulsing circuit as closed by relay 12 from the winding of relay 13 to the winding of relay 14, by-passing relay 13.

Keys 17, 18 and 19 are merely examples of the manner in which the operation of the series of relays may be varied. In any specific circuit keys or relay contacts would be employed as dictated by the requirements of the associated equipment.

What is claimed is:

1. A selecting circuit comprising a series of relays, impulsing means, circuits interconnecting said relays and said impulsing means for operating said relays in succession in response to successive operations of said impulsing means, the operating circuit for each relay including a back contact of that relay, a front contact of the immediately preceding relay and a back contact of each of the remaining relays.

2. A selecting circuit comprising a series of relays, each relay having a plurality of armature springs, impulsing means, and means for operating said relays in succession in response to successive operations of said impulsing means comprising a circuit leading to said impulsing means over a contact of each relay of the series and an operating circuit for said relays leading from said impulsing means and extended by each relay to the next relay of the series, said circuits leading to said impulsing means extending over the back contact of one armature spring of a relay before said relay is operated, over the front contact of another armature spring while said relay is operated, and over the back contact of said other armature spring after said relay has been released.

3. A selecting circuit comprising a series of relays, impulsing means, circuits interconnecting said relays and said impulsing means for operating said relays in succession in response to successive operations of said impulsing means, each relay having a primary locking circuit over one of its front contacts and a back contact of the next succeeding relay and a secondary locking circuit over a plurality of its front contacts, said secondary locking circuit including at least one front contact of the next succeeding relay of the series and at least one back contact of each of the other relays of the series, means for preventing the operation of predetermined relays, the secondary locking circuit for the operating relays including contacts of said predetermined relays.

4. A selecting circuit comprising a series of relays, impulsing means, means for operating a particular one of said relays in response to a

predetermined number of operations of said impulsing means comprising a circuit leading to said impulsing means over a contact of each relay of the series, an operating circuit for said relays leading from said impulsing means and extended by each relay to the next relay of the series, a locking circuit for each relay extending over a portion of said first circuit, said locking circuit being opened by the operation of the next relay in the series, and a supplementary locking circuit for each relay controlled by said impulsing means and including one front contact of the next succeeding relay of the series and at least one back contact of each of the other relays of the series, means for preventing the operation of a relay in said series, the circuit leading to said impulsing means and said supplementary locking circuit for the other relays of said series including contacts of the relay whose operation is prevented.

5. A selecting circuit comprising a series of relays and a start relay, impulsing means, a circuit for operating said start relay including the back contacts of all of said series of relays, means for operating the first relay of said series under the control of said start relay and said impulsing means, circuits for successively operating said series of relays in response to successive closures of said impulsing means including a front contact of the previously operated relay and back contacts of all other relays of the series, means to cause an intermediate relay in said series to act as a start relay, the operating circuit for the succeeding relays in the series including contacts of all of the relays in the series.

6. A selecting circuit comprising a series of relays and a start relay, impulsing means, a circuit for operating said start relay including back contacts of all of said series of relays, means for operating the first relay of said series under the control of said start relay and said impulsing means, circuits for successively operating said series of relays in response to successive closures of said impulsing means including a front contact of the previously operated relay and back contacts of all other relays of the series, means to temporarily lock the previously operated relay under the control of said impulsing means and over contacts of all relays of the series, and means to cause an intermediate relay of said series to act as a start relay, the operating circuit and said temporary locking circuit for the relays remaining in said series including contacts on the relays excluded from said series.

7. A selecting circuit comprising a series of relays, impulsing means, an impulse circuit for operating said relays in succession in response to successive operations of said impulsing means, a locking circuit for each relay controlled by the succeeding relays in the series, each relay advancing said operating circuit to the next relay in the series and opening the locking circuit for the previously operated relay, and means for preventing the premature opening of said operating circuit comprising a supplementary locking circuit for said previously operated relay under the control of said impulsing means and extending over a front contact of the previously operated relay, a front contact of the instant relay and a back contact on each of the remaining relays.

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