

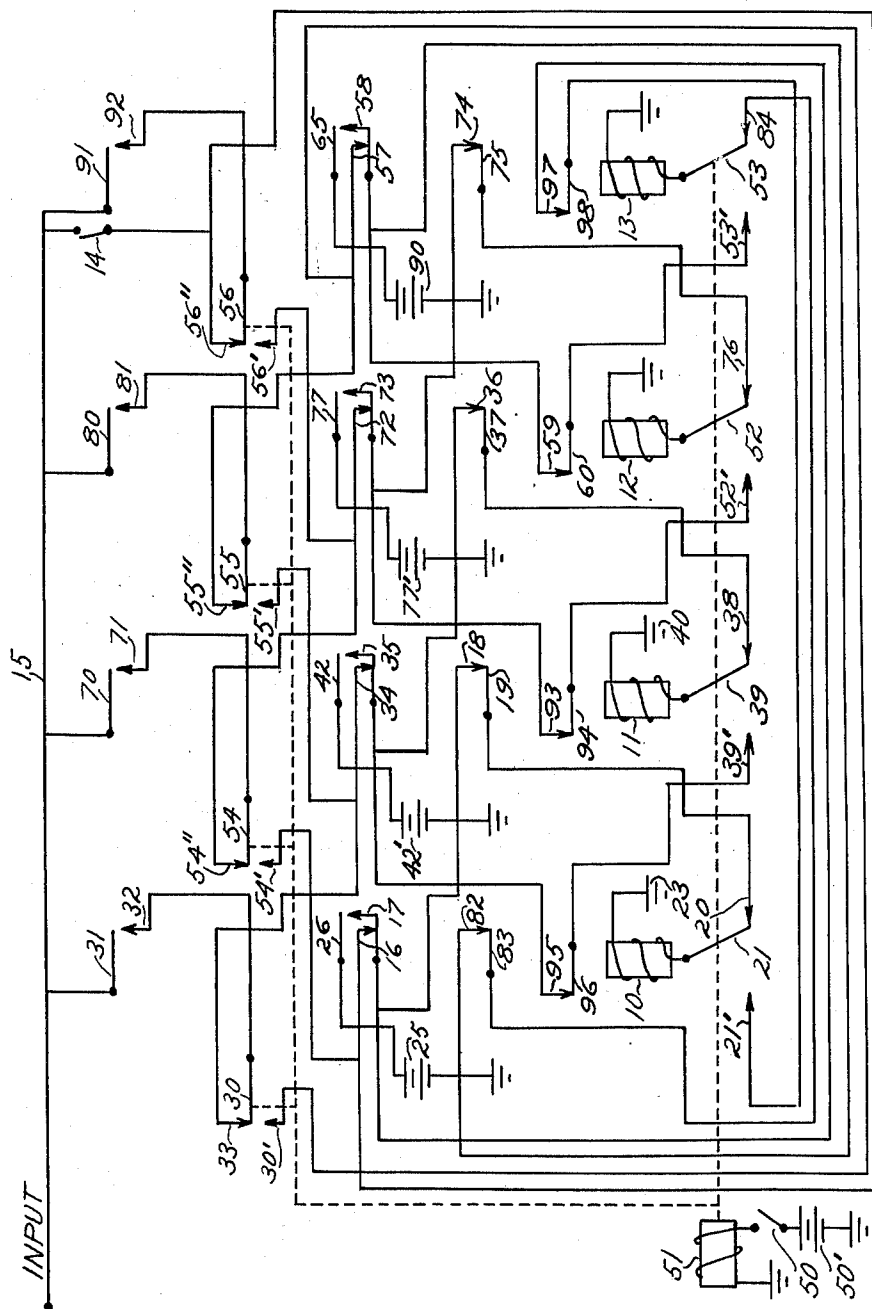
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RING CIRCUIT

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RING CIRCUIT

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The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

This invention is in electrical apparatus and particularly is a relay ring circuit.

One object of the invention is to provide in a ring circuit means for providing automatic consecutive release of the relays.

Another object is to provide a relay ring circuit wherein but one relay is required for each stage of the ring.

An additional object is to provide a relay ring circuit wherein the order in which the relays are closed may be reversed or otherwise modified at will.

A further object is to provide a reversing ring circuit wherein a continuous applied signal will produce free continuous stepping.

Additional objects will be apparent from a reading of the following specification and claims.

The single drawing is a diagram of a four-stage relay ring according to my invention.

It is believed that no elaborate description of the circuit will be necessary, its features being apparent from the drawing and from the description of the operation of the ring.

With reference to the drawing, the ring circuit proper can be seen to comprise four relay windings, 10, 11, 12, and 13, each with a plurality of contacts operated thereby. Except for the contacts shown connected to relay 51 by broken lines, it should be understood that in the illustrated embodiment of the invention each of the relays 10, 11, 12, and 13 operates the several movable contacts located directly above it, and, furthermore, that the contacts shown with arrowheads are not electromagnetically actuated although they may in a few instances be mechanically moved (as contact 17 in the make-before-break contact group 26, 17, and 16). In other words, only those contacts shown as straight lines (see 39, 42, 56, and 65, for examples) are magnetically responsive. It should also be understood for the purposes of this description that all magnetically movable contact members (except as otherwise noted) should be assumed to be drawn downwardly upon energization of the appropriate relay and returned to the positions shown upon deenergization thereof. Movable contacts 21, 39, 52, and 53 are drawn toward relay 51 upon energization thereof, and contacts 30, 54, 55, and 56 are moved downwardly thereby; again, these contacts should be understood to be returned to the positions shown upon deenergization of relay 51.

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Assuming a series of pulses to be applied to the input of the ring, operation is started by closing switch 14 momentarily. The first pulse follows a circuit which includes line 15, contacts 16 and 17, 18 and 19, and 20 and 21, to winding 10 and ground at 23. Immediately upon operation of relay 10, a circuit is closed from battery at 25 through contacts 26 and 17, 18 and 19, and 20 and 21 to winding 10 to lock the relay so that upon extinction of the operating pulse relay 10 will nevertheless remain in its operated condition. Contacts 16 and 17 will, of course, be separated immediately after 26 and 17 are closed. The energization of winding 10 does not affect the position of movable contact member 21 or the movable contact member 36, the operation and function of which will be later described.

A second operating pulse will follow a circuit which includes contacts 31 and 32, 36 and 33, 34 and 35, 36 and 37, 38 and armature 39, to winding 11 and ground at 40. The relay is locked just as was relay 10 by the closing of movable contact 42 upon contact 35 whereby a circuit is established from battery 42' through contacts 42 and 35, 36 and 37, 38 and 39, winding 11, and ground 40; simultaneously with the closing of relay 11, the locking circuit for relay 10 is opened by the opening of contacts 18 and 19. A third operating pulse will follow a path which includes contacts 76 and 71, 54 and 54', 72 and 73, 74 and 75, 76 and 52, winding 12, and ground. The relay 12 is locked by the closing of movable contact 77 upon 73, and the locking circuit for relay 11 is opened by the opening of contacts 36 and 37. A fourth operating pulse will follow a circuit including 80 and 81, 55 and 55', 57 and 58, 82 and 83, 84 and 53, winding 13, and ground. Relay 13 is locked by the closing of contact 65 upon 58, and the locking circuit for relay 12 is opened by the opening of contacts 74 and 75. Batteries 77' and 90 energize locking circuits for relays 12 and 13, respectively, in the manner described for relays 10 and 11.

The indicated sequence of operations will continue as long as proper energizing pulses are supplied. Where but one operation per applied pulse is desired, the length of the pulses must be properly related to the closing time of the relays. Should a continuous signal be applied to the input of the ring, the relays will close and open in succession, the speed of operation of the ring depending upon the characteristics of the relays therein.

The order in which the relays operate can be reversed by closing switch 50 thereby to complete a circuit including battery 50' and energizing

winding 51 and to close armatures 21, 39, 52, and 53 against fixed contacts 21', 39', 52', and 53', respectively, and at the same time to close movable contacts 30, 54, 55, and 56 upon contacts 30', 54', 55' and 56'.

If winding 51 is energized, together with winding 10, and a pulse enters the ring through contacts 31 and 32, and 30 and 30', for example, the pulse will follow a circuit which includes contacts 57 and 58, 59 and 60, and 53' and 53 to winding 13 and ground, and relay 13 is then locked operated by the closing of contact 65 upon contact 58 which brings battery 90 into the circuit of the relay winding. The following input pulse will enter the chain through contacts 91-92, and follow a path defined by contacts 56 and 56', 72 and 73, 93 and 94, 52' and 52, winding 12 and ground. The succeeding input pulse enters the system through contacts 80 and 81 (the locking circuit for relay 13 having been opened at 59-60 upon operation of relay 12) and operates relay 11 through a circuit including contacts 55 and 55', 34 and 35, 95 and 96, and 39' and 39, and the following pulse enters through contacts 70 and 71, and 54 and 54', and utilizes an analogous circuit including contacts 97 and 98 to operate relay 10. The further operation of the ring in a reversed direction will be obvious.

No output contacts have been shown or described. Each ring stage may control through additional contacts one or more output stages in any desired fashion.

The foregoing description is in specific terms, and many modifications will suggest themselves. For the true scope of the invention, reference should be had to the appended claims.

I claim:

1. The combination of energy supply means and a pair of contacts, a chain of electro-responsive switches each having energizing means and a pair of contacts associated therewith and each when energized operating its pair of contacts, a pair of circuits including said supply means and one of said energizing means one of said circuits including the pair of contacts operated only by the switch ahead of that associated with said one energizing means and the other including the pair of contacts operated only by the switch behind that associated with said one energizing means, and other homologous pairs of circuits including said supply means and each other energizing means.

2. The combination of claim 1, further char-

acterized by an additional switch, a plurality of contacts operated thereby all of said contacts having two operative positions, one of said contacts closing one of said circuits of said pair when in one position and the other circuit of said pair when in its other position and the others of said contacts homologously controlling the said other pairs of circuits to vary the connecting paths between said supply means and said energizing means, and thereby selectively to close said further pairs of contacts.

3. A relay ring circuit comprising a power supply, first, second, third, . . . and *n*th relays, each including energizing means and a plurality of pairs of contacts, a pair of energizing circuits including said power supply and the energizing means of said second relay one of said circuits including one of the said plurality of pairs of contacts operated by said first relay and the other of said circuits including one of the said plurality of pairs of contacts operated by said third relay, an additional pair of energizing circuits including said supply means and the energizing means of said first relay one of said additional circuits including one of said plurality of pairs of contacts operated by said *n*th relay and the other of said additional circuits including one of said plurality of pairs of contacts operated by said second relay, homologous pairs of energizing circuits including said supply means and the energizing means of each other relay, and further switching means for selecting individual circuits from each of said pairs of energizing circuits.

4. The combination of claim 3, further characterized by a further power supply, locking circuit including said further power supply, the energizing means of each of said relays, and another of the said plurality of pairs of contacts operated thereby.

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