

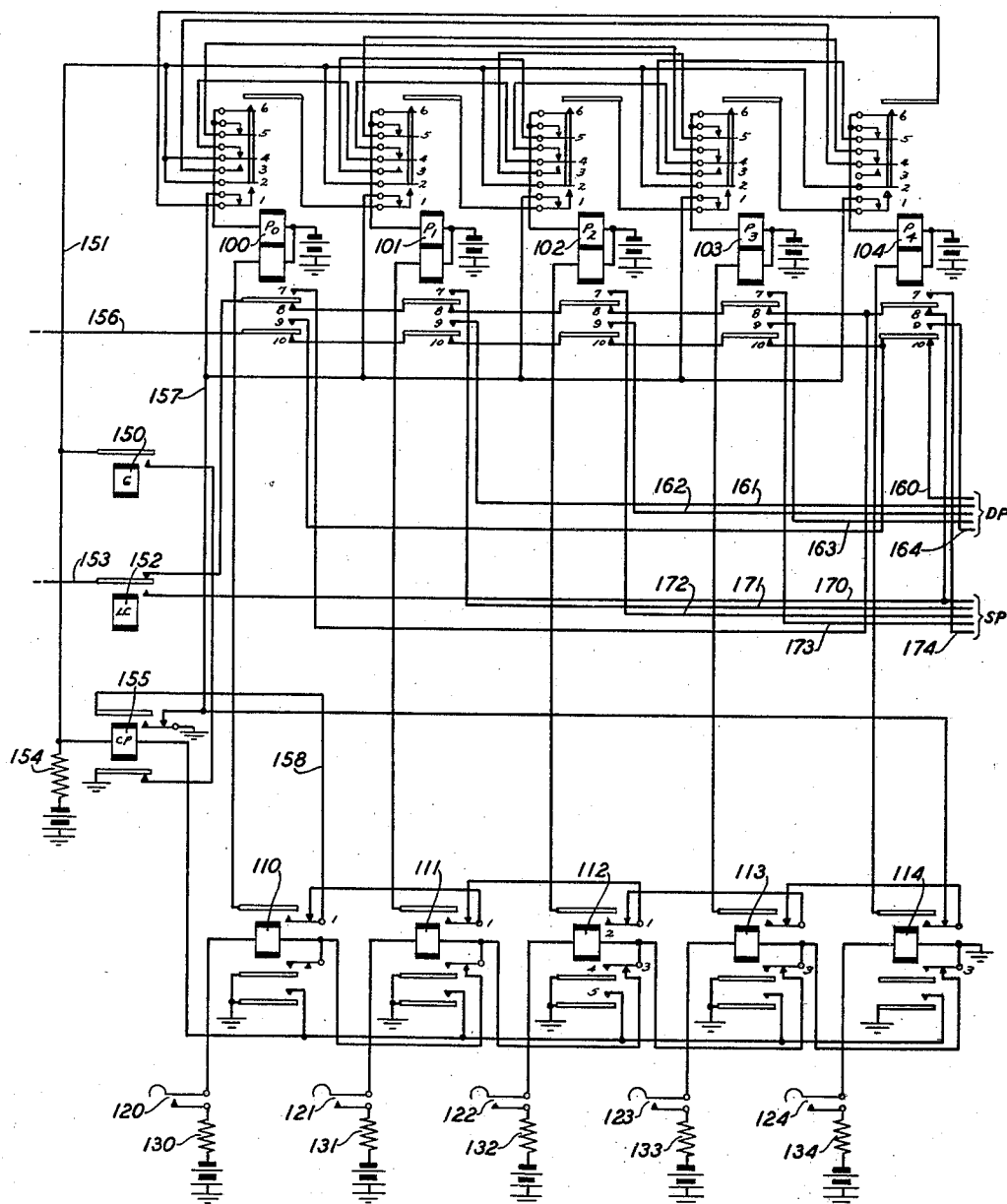
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A. E. JOEL, JR

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PROGRESSIVE SELECTING CIRCUIT

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INVENTOR
A. E. JOEL, JR.
BY
C. Mathie

ATTORNEY

UNITED STATES PATENT OFFICE

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PROGRESSIVE SELECTING CIRCUIT

Amos E. Joel, Jr., New York, N. Y., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

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This invention relates to progressive selecting arrangements and more particularly to such arrangements employing chains of relays.

Relay distributing or selecting arrangements are known which employ the repeated sequential operation of a series of pairs of relays in response to the repeated closure of a control contact. Other known arrangements employ a chain of relays having a single relay for each step but require an additional relay or the action of auxiliary apparatus to initiate the sequential operation. Arrangements of the latter type have heretofore always started their sequential operation with one particular relay.

The present invention relates to a distributing arrangement of the latter type and provides means by which the sequential operation of a series of relays may be started by the same contact closure means which controls the subsequent sequential operation.

In addition, means is provided by which the repeated sequential operation of the relay chain may be initiated with any desired relay of the chain. More specifically, the relays of the chain have secondary windings and means is provided including such winding to operate any desired relay, whereby subsequent closures of the control contact are effective to continue the sequential operation beginning with the next relay of the chain. This means for operating any desired relay is effective to release any previously operated relay but is ineffective during the closure of the control contact.

Furthermore, means is provided to render a predetermined relay effective when none of said relays is operated.

For a clearer understanding of the invention, reference may be made to the following detailed description taken in connection with the drawing which illustrates the invention as applied to a chain of five relays.

The chain of relays shown in the drawing, comprises relays 100, 101, 102, 103 and 104, each relay having six upper contacts employed in the sequential operation of the chain and four lower contacts for performing any desired progressive or distributive function. As many pairs of lower contacts may be provided as is required for the operations to be performed.

The successive operation of relays 100 to 104 is brought about by repeated closures of a control contact shown as controlled by relay 150.

Assuming that none of the relays is operated, the first closure of the contact of relay 150 completes a circuit from ground at the lower contact

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of relay 155, contact of relay 150, conductor 151, contact 4 of relays 100, 101, 102 and 103, contact 5 of relay 100 to the upper winding of relay 100 and battery.

Relay 100, in operating, closes a locking circuit for itself which may be traced from battery through its upper winding, contact 6 of relay 100, contact 1 of relay 101, conductor 157 to ground at the normally closed upper contact of relay 155. Relay 100 opens its own operating circuit at its contact 4 and at contact 3 closes a circuit from the ground, applied to conductor 151, over contact 3 of relay 100, contact 4 of relay 104, contact 5 of relay 101 to the upper winding of relay 101 and battery. Relay 101 also operates, locking in a circuit from battery through its upper winding, contact 6 of relay 101, contact 1 of relay 102 to ground on conductor 157.

Relay 101 also, at its contacts 1 and 2, transfers the locking circuit for relay 100 from the steady ground on conductor 157 to the intermittent ground on conductor 151. Therefore, when relay 150 opens its contact, relay 100 releases, leaving relay 101 operated and locked.

The second closure of the contact of relay 150, closing ground to conductor 151 completes a circuit, extending from conductor 151 over contact 4 of relay 100, contact 3 of relay 101, contact 5 of relay 102 to the upper winding of relay 102 and battery. Relay 102 operates in this circuit, closing a locking circuit for itself from battery through its upper winding, over its contact 6, contact 1 of relay 103 to ground over conductor 157.

At its contact 5, relay 102 opens its own operating circuit, at contact 4 opens the operating circuit used for operating relay 100 and at contact 3 prepares an operating circuit for relay 103. At its contacts 1 and 2, relay 102 transfers the locking circuit of relay 101 from conductor 157 to conductor 151, so that relay 101 is held operated as long as the contact of relay 150 is closed, but when relay 150 opens its contact relay 101 is released. Therefore during the open period of the contact of relay 150, relay 102 is operated alone.

The third closure of the contact of relay 150 operates relay 103 over the normally closed contacts 4 of relays 100 and 101, contact 3 of relay 102, contact 5 of relay 103 to the upper winding of relay 103 and battery. Relay 103 locks and provides a temporary locking circuit for relay 102 in a manner similar to the operations traced for relay 102, relays 102 and 103 remaining op-

erated throughout the third closure of the contact of relay 150. When relay 150 opens its contact, relay 102 releases.

When relay 150 closes its contact for the fourth time, relay 104 operates over its contact 5, contact 3 of relay 103 and contacts 4 of relays 102, 101 and 100. Relay 104 locks in a circuit from battery through its upper winding, contact 6 of relay 104, contact 1 of relay 100 to ground on conductor 157. Relay 104 transfers the locking circuit of relay 103 from conductor 157 to conductor 151 but does not prepare the circuit for relay 100, since that is carried over a back contact, contact 4, of relay 103. When relay 150 releases, relay 103 also releases.

The next operation of relay 150 closes the previously traced circuit for relay 100, since this circuit is independent of relay 104. Relay 100 locks as before to conductor 157 and transfers the locking circuit for relay 104 to conductor 151. However, since relay 104 is operated, relay 101 cannot operate at this time and relays 104 and 100 remain operated until relay 150 opens its contact to release relay 104.

The next operation of relay 150 closes the operating circuit for relay 101 and the chain of relays continues to operate sequentially as long as relay 150 continues to intermittently ground conductor 151.

The distributing contacts on relays 100 to 104 serve to connect incoming conductor 156 successively with the conductors 160 to 164 and conductor 153 successively with conductors 170 to 174. It will be noted that conductor 156 is connected to conductor 160 either with relay 100 operated or with none of the relays 100 to 104 operated so that a connection will exist through these distributing relays even if their operation is interrupted. Conductor 153 is also connected to conductor 170 with relay 100 operated or with none of the relays 100 to 104 operated, and in addition an auxiliary relay 152 may be operated to suspend distribution of the latter circuits if desired.

Each of the relays 100 to 104 has a secondary, lower winding by means of which a particular relay may be operated arbitrarily to start the distribution at a desired point. For controlling these secondary windings a set of keys 120 to 124 is provided together with a set of relays 110 to 114.

Assuming that chain relay 104 has been operated, but that it is desired to restart the distributing operation with relay 102, key 122 will be operated, closing a circuit from battery through resistance 132, contact of key 122, winding of relay 112, normally closed contacts 3 of relays 113 and 114 to ground. Relay 112 operates in this circuit, opening its contacts 3 to prevent the operation of relays 110 or 111 and connecting ground to its winding at its contact 4 to render it independent of relays 113 and 114. Therefore, if two keys should be accidentally closed at the same time, only one would be effective. At contact 5 relay 112 closes a circuit for relay 155 through resistance 154 to battery. Relay 155 at its lower contact disconnects ground from the contact of relay 150 to suspend the operation of the chain relays. At its upper contacts, relay 155 disconnects ground from conductor 157, which releases the previously locked chain relay 104, and connects ground to conductor 158 which extends over the normally closed contacts 1 of relays 110 and 111, contact 2 of relay 112, to the lower winding of relay 102 and battery. Relay 102 operates in this circuit and prepares the previously traced locking

circuit for itself. When key 122 is released, relay 112 releases and at its transfer contacts 1 and 2, closes a circuit from ground at the front contact of relay 155, conductor 158, over contacts 1 of relays 110 to 114 to conductor 157 to complete a temporary locking circuit for relay 102 before it opens the operating circuit previously traced. The release of relay 112 opens the circuit of relay 155 which also releases and at its upper contacts connects ground directly to conductor 157 to close the usual locking circuit for the chain relays, before removing ground from conductor 158, and opening the temporary locking circuit. Relay 155 again connects ground to the contact of relay 150 to permit the sequential operation of the chain relays to start. Since relay 102 is operated, the first subsequent closure of the contact of relay 150 completes an operating circuit for relay 103 and the operation of the relay chain continues from that point. It may be noted that relay 150 in connecting ground to conductor 151 also closes a shunt around the winding of relay 155 to prevent interference with any distributed function which may be taking place at the time.

It is to be understood, of course, that the invention is not limited to the use of a five relay chain, but that by including as many relays wired like relay 102 as desired, the chain might be increased to any desired length. For a long chain of relays it might be preferable to provide resetting keys and relays for only a limited number of the chain relays.

A chain of relays of the present type may serve a large variety of purposes. It may be used to distribute the preference of choice over a group of circuits in order to insure uniform use thereof in common control circuits such as shown in Patent 2,235,803, granted March 18, 1941 to W. W. Carpenter; it may be used as the selecting means in routine test circuits such as shown in Patent 2,225,688, granted December 24, 1940 to J. W. Dehn; it may be used under the control of an accurately timed contact as a means to measure and indicate time intervals as shown in Patent 2,362,425, granted November 7, 1944 to F. M. Wiese. The present arrangement would be particularly valuable in the two latter uses since it would permit starting a routine test with any desired circuit or to reset the time with a minimum of delay.

What is claimed is:

1. A selecting circuit comprising a chain of relays, an intermittently closed contact, means responsive to the closure of said contact with one of said relays operated to operate the next relay of said chain, contacts operated by said next relay for closing a locking circuit for itself independent of said contact and for closing a locking circuit for said one relay under the control of said intermittently closed contact, means normally effective to operate a particular one of said relays in response to the first closure of said intermittently closed contact, auxiliary means for causing the first closure of said intermittently closed contact to operate any desired one of said relays, comprising a secondary winding on each of said chain relays, a key individual to each of said relays and means under the control of each of said keys to energize the secondary winding of the associated chain relay, and means also under the control of each of said keys for unlocking any previously locked relay of said chain.

2. A selecting circuit comprising a chain of relays, a common locking ground for said relays, an intermittently closed contact, means respon-

sive to the closure of said contact after one of said relays has been operated and locked to operate the next relay of said chain, contacts operated by said next relay for closing a locking circuit for itself to said common locking ground independent of said intermittent contact and for placing said one relay under the control of said intermittent contact, means normally effective to operate a particular one of said relays in response to the first of a series of closures of said intermittent contact, auxiliary means for causing the first of a subsequent series of closures of said intermittent contact to operate any desired one of said relays comprising a secondary winding on each of said chain relays, a key individual to each of said relays and means responsive to the momentary operation of one of said keys to energize the secondary winding of the associated chain relay, and means also under the control of said key for closing an individual locking circuit for said associated chain relay, for disconnecting said common locking ground from any previously locked relay of said chain and for rendering said intermittently closed contact ineffective to operate the relay next to said associated chain relay until said key is released.

3. A selecting circuit comprising a chain of relays, a common locking ground for said relays, an intermittently closed contact, means responsive to the closure of said contact after one of said relays has been operated and locked to operate the next relay of said chain, contacts operated by said next relay for closing a locking circuit for itself to said common locking ground independent of said intermittent contact and for placing said one relay under the control of said intermittent contact, means normally effective to operate a particular one of said relays in response to the first of a series of closures of said intermittent contact, auxiliary means for causing the first of a subsequent series of closures of said intermittent contact to operate any desired one of said relays comprising a secondary winding on each of said chain relays, a key individual to each of said relays and means responsive to the momentary operation of one of said keys to energize the secondary winding of the associated chain relay, and means under the control of said intermittently closed contact for rendering said key-controlled means ineffective to energize the associated chain relay until the end of a previous closure of said intermittently closed contact.

4. A selecting circuit comprising a chain of relays, a common locking ground for said relays, an intermittently closed contact, means responsive to the closure of said contact after one of said relays has been operated and locked to operate the next relay of said chain, contacts operated by said next relay for closing a locking circuit for itself to said common locking ground independent of said intermittent contact and for placing said one relay under the control of said intermittent contact, means normally effective to operate a particular one of said relays in response to the first of a series of closures of said intermittent contact, auxiliary means for causing the

first of a subsequent series of closures of said intermittent contact to operate any desired one of said relays comprising a secondary winding on each of said chain relays, a key individual to each of said relays and means responsive to the momentary operation of one of said keys to energize the secondary winding of the associated chain relay, means also under the control of each of said keys for closing an individual locking circuit for said associated chain relay, for disconnecting said common locking ground from any previously locked relay of said chain and for rendering said intermittently closed contact ineffective to operate the relay next to said associated chain relay until said key is released and means under the control of said intermittently closed contact for rendering said key-controlled means ineffective to energize the associated chain relay until the end of a previous closure of said contact.

5. A selecting circuit comprising a chain of relays, common locking ground for said relays, an intermittently closed contact, means responsive to the closure of said contact when one of said relays has been operated and locked to operate the next relay of said chain, contacts operated by said next relay for closing a locking circuit for itself to said common ground independent of said intermittent contact and for placing said one relay under the control of said intermittent contact, means normally effective to operate a particular one of said relays in response to the first of a series of closures of said intermittent contact, auxiliary means for causing the first of a subsequent series of closures of said contact to operate any desired one of said relays comprising a secondary winding on each of said chain relays, means individual to each of said relays to energize the secondary winding of said associated chain relay in response to a momentary operation of said energizing means, means also under the control of each said energizing means for closing an individual locking circuit for said associated chain relay, for disconnecting said common ground from any previously locked relay of said chain and for rendering said intermittently closed contact ineffective to operate the next relay prior to the termination of the momentary operation of said energizing means and means under the control of said intermittently closed contact for preventing the energization of any secondary winding until the end of a previous closure of said contact.

AMOS E. JOEL, JR.

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