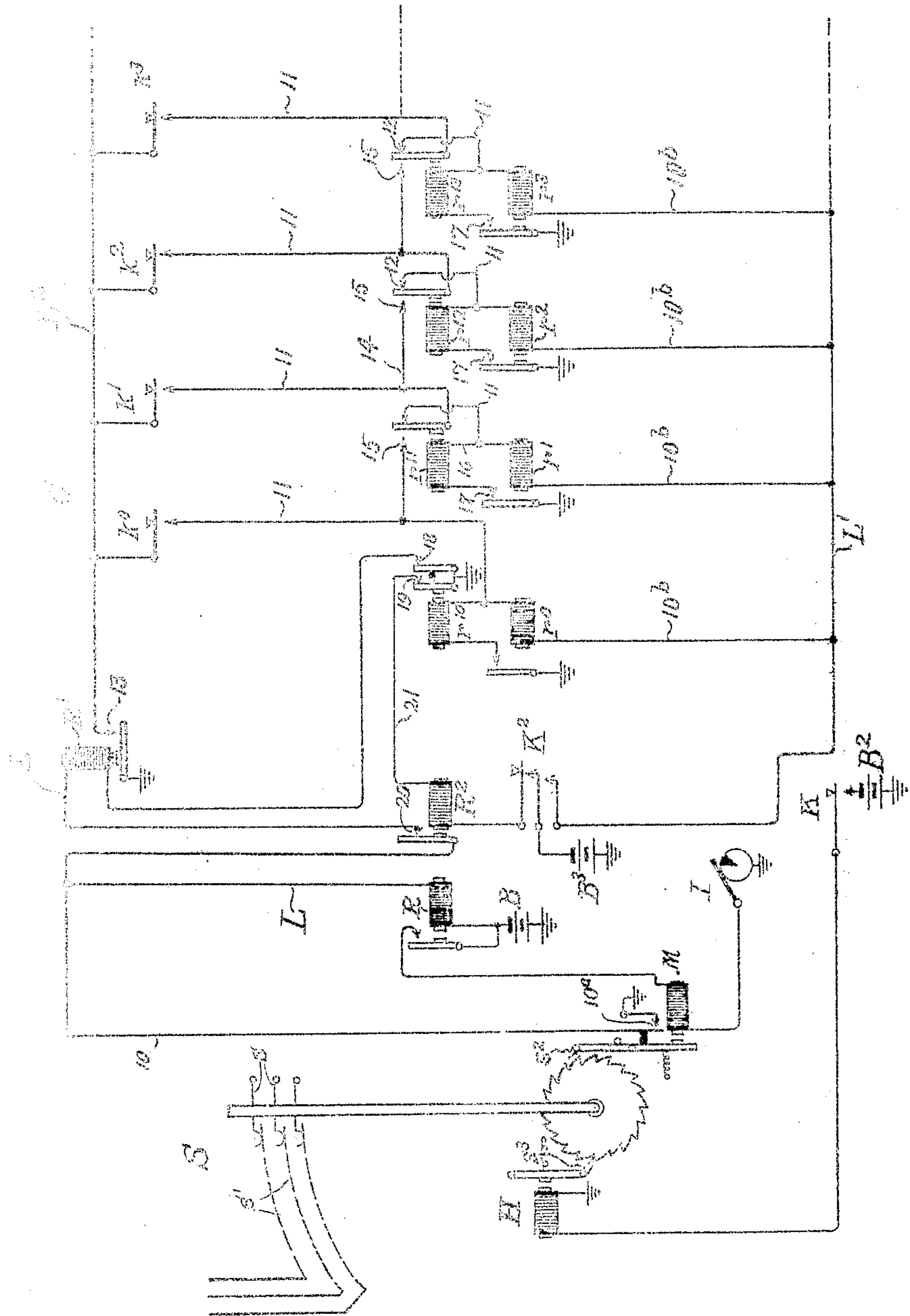


E. G. MOLINA.
CONTROLLING APPARATUS.
APPLICATION FILED SEPT 14, 1911.

1,039,888.

Patented Oct. 1, 1912.



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UNITED STATES PATENT OFFICE.

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CONTROLLING APPARATUS.

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To all whom it may concern:

Be it known that I, EDWARD C. MOLINA, residing at East Orange, in the county of Essex and State of New Jersey, have invented certain Improvements in Controlling Apparatus, of which the following is a specification.

This invention pertains to electromagnetic circuit controlling apparatus, and is especially directed to means for governing the movement of automatic telephone selecting switches. In systems of this character, the travel of each selector switch to a particular fixed contact or group of such contacts is frequently initiated by the depression of a particular key in a key group, whereupon current impulses transmitted in synchronism with the advance of the selector brushes successively change the condition of an appropriate electromechanism or electromechanisms until the number of impulses received corresponds to the key depressed. Then circuit changes are produced which arrest the selector at the desired point. For this electromechanism which is interposed between the keys and selector a series of relays may be employed, the successive energization of said relays counting the current impulses or selector positions. These relays are subject to all the usual contact troubles, and since there are many in the series, usually twenty or more, and a plurality of contacts, ordinarily six, are required for each relay, these difficulties assume considerable proportions.

The object of my invention is to so arrange the controlling apparatus that the contact defects are minimized.

The accompanying drawing shows diagrammatically an embodiment of the invention.

The apparatus to be controlled, in this case a telephone line selector, appears at S. I have chosen to illustrate that type in which the brushes or movable contact members s are advanced step by step over the fixed contacts s' by ratchet mechanism s'' . The ratchet mechanism is actuated by a motor magnet M , in circuit with a battery or other source B of current and an interrupter I , through the front contact and armature of a relay R having its winding in the main or starting circuit L , which is also shown as receiving current from the bat-

tery B . In series with relay R in the circuit L is the winding of a relay R^1 . When the motor magnet is energized, relay R^1 is short circuited by a path to ground through a conductor 10 and a contact 10^1 closed by the armature of the motor magnet in its attracted position. The selector is retained in the position to which it is moved by the motor magnet by a pawl s^3 , this being withdrawn to permit the selector brushes to return to normal by a release magnet H governed by a release key K , applying current to the magnet H from a battery indicated at B^2 .

The release key would ordinarily be at a distance from the selector, as at the position of an operator, who is also equipped with a controlling apparatus C . I have illustrated but a portion of this controlling apparatus, which will vary as to the number of elements according to the number of impulses to be counted. The more essential parts consist of a set of keys or manually operable contact devices, of which four only are shown, designated by the characters k^0, k^1, k^2, k^3 , and a series of relays $r^0, r^{10}, r^1, r^{11}, r^2, r^{12}$; and r^3, r^{13} . The keys may represent, for example, the digits in a telephone line designation, while the relays are arranged in pairs corresponding to the keys. What may be called the primary relays r^0, r^1, r^2 and r^3 , have their windings connected by a lead 11 and branches 10^0 through the contacts of a normally open starting key K^2 to a battery B^2 . The other extremities of the windings of these relays, except those of the terminal pair r^0, r^{10} , are each joined by a conductor 11 through the back contact 12 of the associated secondary relay, as r^{11}, r^{12} or r^{13} , of the pair to the corresponding key, all the keys of the set having their cooperating contacts connected in multiple by a lead 12 to the front contact 13 of the selector-governed relay R^1 , the armature of which is grounded. A branch 14 of each conductor 11 terminates in the front contact 15 of the adjacent secondary relay belonging to the next higher digit key, and another branch 16 includes the winding of the secondary relay of its own pair and the single front contact 17 of the corresponding primary relay, furnishing a locking circuit to ground for said relays. The terminal pair r^0, r^{10} of the series of relays differs in its connec-

tions from the others, in having the conductor 11 leading directly to the corresponding key without passing through a contact of the secondary relay; while r^{10} acts as a cut-off relay, having back contacts 18 and 19, which upon its energization open, respectively, the main controlling circuit L and the circuit of a starting relay R^2 . The last named relay has a front contact 20 in the lead L, and the circuit for its winding is from ground by way of conductor 21 to battery B^3 through contact 19 and contacts of the starting key K^2 .

In considering the operation of the system, suppose it is desired to advance the selector S to a point corresponding to the key k^2 . This key and the starting key K^2 are depressed by the operator and locked down in any suitable manner. Relay R^2 receives current from battery B^3 through key K^2 , conductor 21, and contact 19 of relay r^{10} to ground and closes contact 20, completing the main controlling circuit from battery B through the windings of relays R and R^1 to ground. Relay R attracts its armature, causing battery B and interrupter I to send current impulses through the magnet M to move the selector brushes over the contacts. A circuit is also completed through front contact 13 of relay R^1 , lead L^2 , depressed key k^2 , conductor 11, back contact 12 of relay r^{12} , winding of relay r^2 , conductor 10^b, lead L^1 and starting key K^2 to battery B^3 . Relay r^2 at contact 17 closes its locking circuit through the winding of relay r^{12} . The latter, however, does not at once operate, since the path to ground through conductor 11, key k^2 , lead L^2 and contact 13 of relay R^1 short circuits it. In the first step of the selector, contact 10^a of the motor magnet is made, and relay R^2 is short circuited by the conductor 10, relay R remaining energized. When the armature of relay R^2 falls back, it opens the short circuit of relay r^{12} which attracts its armature. The energization of the first pair of relays r^2 , r^{12} , determined by the depression of key k^2 , thus corresponds to the first full step forward of the selector brushes, or an advance from one set of fixed contacts to the next.

The closing of contact 15 by relay r^{12} extends the circuit controlled by the selector-governed relay R^1 through conductor 14 to the succeeding pair of relays r^1 , r^{11} , or those preceding it in the series, considering them in the order of the digit values of the keys from zero upward. When the motor magnet M is deenergized and energized by a current intermittance and impulse, the actuation and release of relay R^1 results in circuits for relays r^1 , r^{11} similar to those of relays r^2 , r^{12} . Another selector step is thereby counted, and the circuit governed by relay R^2 is shifted to the terminal pair of relays r^0 , r^{10} which count the last impulse.

Upon the energization of relay r^{10} , on the arrival of the selector brushes at the contacts sought, its contact 18 severs the main controlling circuit, releasing the relays R and R^1 . The selector brushes are consequently held up by the pawl s^3 upon the terminals of the wanted line. Contact 19 of relay r^{10} deenergizes the starting relay R^2 . Keys K^2 and k^2 are freed by the operator, and the counting circuit is thereby broken and the entire controlling apparatus restored to normal ready for another operation. The connection at the selector being no longer needed, the operator may depress the key K, energizing the release magnet H and withdrawing the retaining pawl s^3 to allow the restoration of the selector brushes to their initial position.

It should be especially observed that by restoration of the selector brushes to their contacts for each pair of relays in the counting series perform all the functions involved in the establishment and transfer of the connections effecting the energization of both relays of each pair at times corresponding to the beginning and completion of a selector step, the sequential energization of each following pair, the locking of both relays of each pair, and the opening of two controlling circuits upon the completion of the desired number of selector steps.

In this detailed disclosure of my invention, which is capable of varied application, many of the elements have been much simplified over what would commonly be used in practice, to enable it to be more clearly understood; therefore, the invention is not to be considered as limited to this particular embodiment or to cover less than is expressed in the following claims.

I claim as my invention:

1. Controlling apparatus comprising a series of successively coöperating electromechanisms, means for supplying current impulses thereto, means for determining the first electromechanism to be energized by the current impulses, and circuit controlling means operable upon the energization of one of the electromechanisms.

2. A selection controlling apparatus comprising a series of electromechanisms, means for supplying energizing current thereto, and means for determining the first electromechanism to be energized, said electromechanisms thereafter each effecting the energization of a succeeding electromechanism, a terminal electromechanism of the series controlling selection.

3. An apparatus for counting current impulses comprising a series of electromechanisms, means for first operating one or another of the electromechanisms according to the number of impulses to be counted, and a single circuit controlling electromechanism operable through a chain of preceding

electromechanisms in the series from that first operated and a circuit controlled thereby.

4. The combination with a selecting apparatus, of keys for governing its movement, a controlling circuit for the selecting apparatus, and a series of relays, the energization of said relays being determined by the keys and the last of the series being provided with means whereby the condition of the controlling circuit is changed.

5. The combination with a selecting apparatus, of a set of keys, a series of relays, connections whereby the particular key actuated determines the first relay to be energized in the series, the energization thereafter being extended along the series and the relay last energized having means for controlling the movement of the selecting apparatus.

6. The combination with a selecting apparatus, of keys for governing its movement, a controlling circuit for the selecting apparatus, a series of relays, the energization of said relays being determined by the keys, and cut-off means for said circuit actuated by a terminal relay of the series.

7. A controlling apparatus comprising a set of keys, a series of relays arranged in pairs, a circuit governed by the keys for energizing one relay of a pair, said relay in its energization extending the circuit to the other relay of the pair, and circuit controlling means under the influence of one of the relays.

8. In a telephone system, the combination with a selector, of a relay under the influence of the selector, a series of controlling relays for the selector, and a circuit completed at a contact of the first named relay for energizing a controlling relay, said circuit being extended by said controlling relay to another relay of the series.

9. In a telephone system, the combination with a selector, of a relay under the influence of the selector, a series of controlling

relays for the selector, a circuit completed at the contact of the first named relay for energizing a controlling relay, and a branch circuit completed by said controlling relay through another relay of the series but being short circuited at the contact of the first named relay.

10. In a system for controlling selection, a source of current, and a series of relays arranged in pairs, each pair including a primary and a secondary relay, the winding of each primary relay of a plurality of the pairs being connected to the source of current through a contact of the associated secondary relay, said primary relay having a contact for completing a circuit through the winding of the secondary relay, and said secondary relay being provided with a contact for extending the circuit from the source of current to another relay of the series.

11. In a system for controlling selection, a source of current, and a series of relays arranged in pairs, each pair including a primary and a secondary relay, the winding of each primary relay of a plurality of the pairs being connected to the source of current through a contact of the associated secondary relay, said primary relay having a contact for completing a circuit through the winding of the secondary relay, and said secondary relay being provided with a contact for extending the circuit from the source of current to another relay of the series, a secondary relay of a pair having selection controlling contacts.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses, this twelfth day of September, 1911.

EDWARD C. MOLINA.

Witnesses:

SAMUEL RASMISON,
S. G. RAMSDALL.