

Aug. 6, 1946.

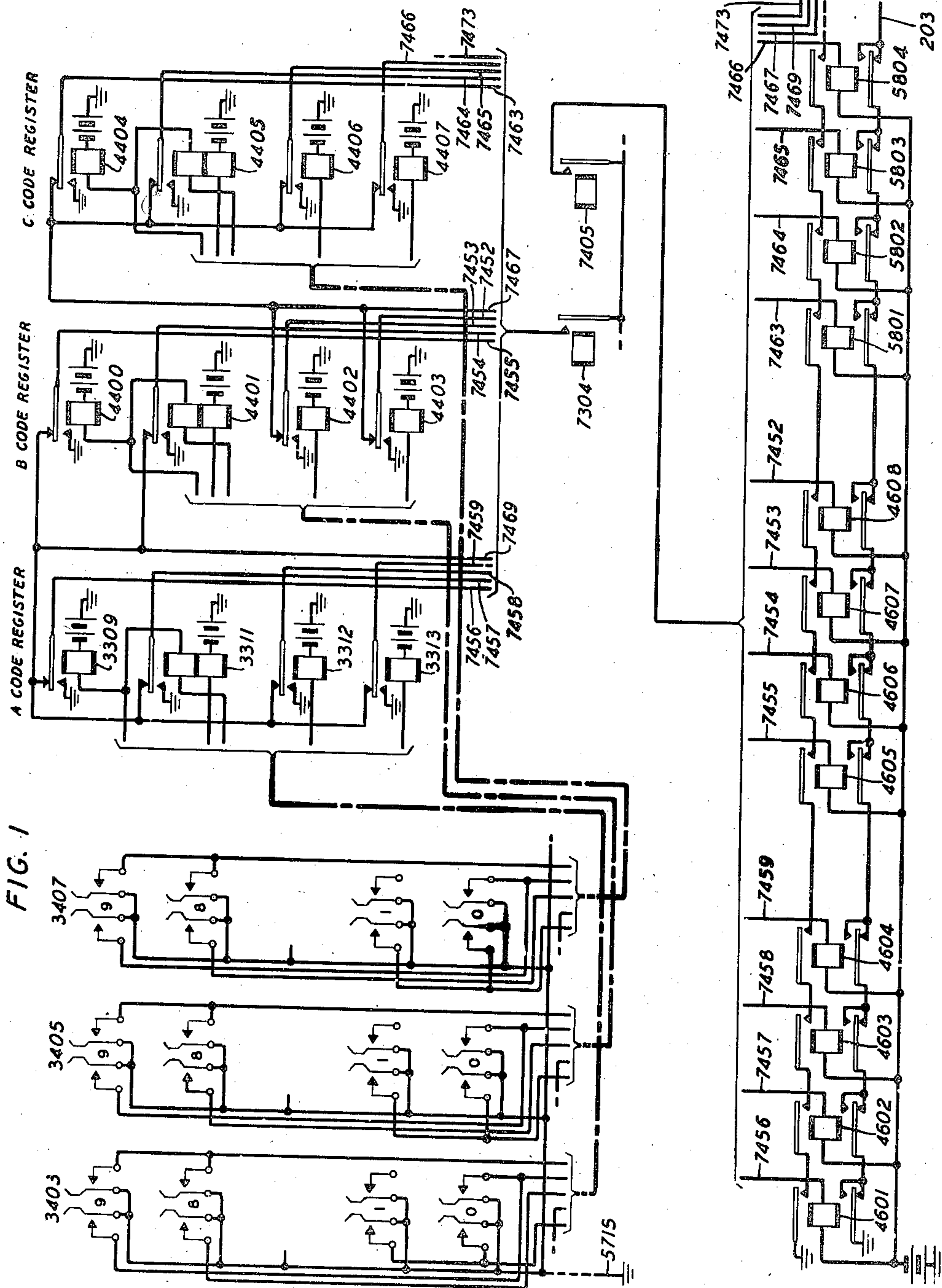
O. MYERS

2,405,230

TELEPHONE SYSTEM

Filed Feb. 17, 1945

2 Sheets-Sheet 1



INVENTOR
O. MYERS
BY *P. C. Smith*
ATTORNEY

Aug. 6, 1946.

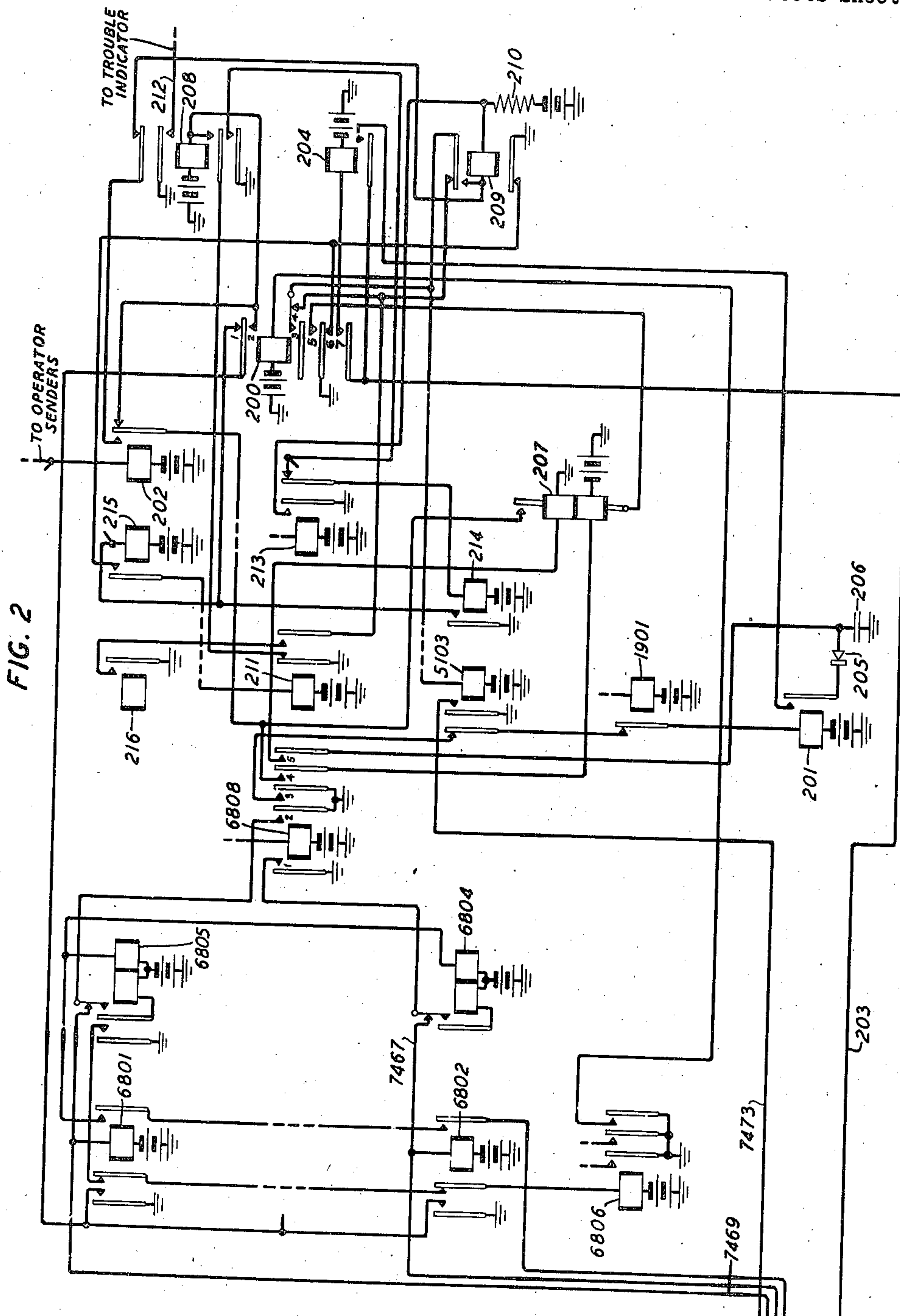
O. MYERS

2,405,230

TELEPHONE SYSTEM

Filed Feb. 17, 1945

2 Sheets-Sheet 2



INVENTOR
O. MYERS
BY *P. C. Smith*
ATTORNEY

UNITED STATES PATENT OFFICE

2,405,230

TELEPHONE SYSTEM

Oscar Myers, Mount Vernon, N. Y., assignor to
Bell Telephone Laboratories, Incorporated, New
York, N. Y., a corporation of New York

Application February 17, 1945, Serial No. 578,441

11 Claims. (Cl. 179—27)

1

This invention relates to telephone systems, and more particularly to systems in which operators control automatic switching equipment, and has for its object to overcome the effects of unstandard operations on the part of such operators.

Certain types of automatic telephone switches, for example, cross bar switches are operated by means of common control circuits known as register senders and markers. The designation of a wanted subscriber is first registered in a register sender. When digits representing the office designation have been registered, the sender is connected with a marker and that designation is transmitted to the marker. In the marker the registered office designation causes the operation of a route relay which controls the selection of a trunk to the wanted office and the operation of the switches to extend the connection to that office.

Certain operators who control cross bar switching equipment are provided with key-sets comprising a row of keys for each digit, the operation of a key setting up a registration in the corresponding register of an associated sender. The keys lock as operated and are normally released by the action of release magnets under the control of the sender.

However if a second key is operated in any one row, the previously operated key is released and the second key locked. If one of the keys representing the office code is changed in this manner, either accidentally or in an attempt to correct an error, while the marker is associated with the sender, a trouble release of the marker follows. As a rule, this trouble release results from the fact that the release of the first key breaks down the circuits causing the operation of one route relay, while the operation of the second key closes circuits for operating a different route relay and the overlapping release and closure of the circuits controlled by the two route relays results in the simulation of false crosses between these circuits and the operation of cross detecting relays.

The trouble release of a marker is normally accompanied by a record on the trouble recorder, but the records accompanying a release due to the change of a code key are misleading since they indicate a cross condition which does not exist.

In accordance with the present invention means is provided for detecting the change of one or more of the code keys, which means is ef-

2

fective to release the marker without making a trouble indicator record.

The features of the invention will be more apparent from a consideration of the following description read in connection with the drawings in which Fig. 1 shows a portion of an operator's key-set, and the code registers of a sender and a marker with a schematic showing of a marker connector. Fig. 2 shows certain control relays of the marker, and the circuits for detecting a changed key and thereby modifying the action of the marker.

The invention is particularly applicable to telephone systems of the type disclosed and claimed in Patent 2,236,246 to King, McKim and Myers, granted March 25, 1941, and the drawings have been based on that disclosure. All of Fig. 1 has been taken therefrom as well as certain of the relays of Fig. 2 and the same reference numerals have been employed. Reference is also made to that patent for the circuits and operations omitted from the present disclosure.

Further reference is made to Patents 2,235,803 to W. W. Carpenter, granted March 18, 1941, and 2,202,921 to A. C. Powell, granted June 4, 1940, for an understanding of the trouble indicator and the manner in which it is employed for recording trouble conditions. Such circuits form a part of the marker on which the King-McKim-Myers patent, above-identified, was based but were omitted from the patent drawing to avoid further complicating the disclosure.

An operator's position in a cross bar toll office is equipped with a key-set including a large number of rows of keys, each row containing a key for each of the ten digits. The individual keys lock when operated but may be released by operating another key which is locked in turn. After the operations resulting from the registration have been completed, all locked keys are released by a set of release magnets. In the drawing, four keys have been shown in each of the three rows on which the code digits are set up.

Assuming that the operator sets up a code 189 by operating key 1 in row 3403, key 8 in row 3405 and key 9 in row 3407, ground supplied to the key-set over conductor 5715 is extended over the left contact of key 1 of row 3403 to battery through the winding of relay 3309 in the A code register. Circuits are closed from ground over the left contact of key 8 of row 3405 to battery through the lower winding of relay 4401 and over the right contact of the same key to battery through the winding of relay 4403 of the B code register. Similarly, the operation of key

3

9 in row 3407 causes the operation of relays 4406 and 4407 in the C code register.

When the digits of the office code have been registered in the sender, the marker connector, represented by relays 7304 and 7405, is operated to connect the sender with an idle marker thereby establishing a large number of connections between the sender and the marker.

Each of the operated relays in the sender registers closes an obvious circuit for a corresponding relay in the marker registers. Since sender relays 3309, 4401, 4403, 4406 and 4407 were operated, marker relays 4601, 4606, 4608, 5803 and 5804 are now operated.

When the marker was seized, relay 6808 was operated, connecting ground over its contact 1, normal contacts of relay 6804, conductor 7457 to battery through the winding of relay 6802 and through the marker connector to the B and C code registers where the circuit is extended over the back contact of relay 4402 and conductor 7453 to battery through the winding of relay 4607, over the back contact of relay 4404 and conductor 7463 to relay 5801 and over the back contact of relay 4405 and conductor 7464 to relay 5802. At its contact 2, relay 6808 connects ground over the normal contacts of relay 6805 to battery through the winding of relay 6801 and over conductor 7469 through the marker connector to the A and B code registers where the circuit is extended over the back contacts of relays 3311, 3312, 3313 and 4400 and over conductors 7457, 7458, 7459 and 7455 to battery through the windings of relays 4602, 4603, 4604 and 4605. All of the marker code register relays have therefore been operated, either directly from the operated sender code register relays or indirectly over the back contacts of the non-operated relays.

At this time a chain circuit is completed over the upper front contacts of the marker register relays, over front contacts of relays 6802 and 6801 to battery through the right windings of relays 6805 and 6804. The latter relays operate, locking under control of relay 6808 and disconnecting ground from conductors 7469 and 7467, permitting the release of the marker register relays operated over those conductors and also releasing relays 6802 and 6801. A circuit is now closed from ground at the front contact of relay 6805, over the back contacts of relays 6801 and 6802 to the winding of relay 6806 and battery. The operation of relay 6806 indicates that the code registers have been operated and that the circuits connecting the sender registers with the marker registers have been tested and found free from opens or grounds so that the registration in the marker corresponds to that of the sender.

Relay 6806 prepares the circuits for translating the registered code and operating the corresponding route relay to control the selection of an idle outgoing trunk and the extension of the connection to the selected trunk. These operations take place as described in detail in the above-identified patent to King-McKim-Myers.

The remaining equipment of Fig. 2 is provided for the purpose of detecting any changes in the code key settings for releasing the marker without a trouble record and permitting a second trial and completion of the call by the same or a different marker according to the new key setting.

When relay 6808 operated, it closed a circuit from ground at its contact 3, over the back contacts of trouble release relay 5103 and release relay 1901 for a supplementary off-normal relay 201. When the marker is connected with an oper-

4

ator sender, relay 202 is operated. When relay 6806 operates, following the setting and test of the marker registers, it operates relay 200 over an obvious circuit. Relay 200, in turn, completes a circuit from ground over a chain circuit carried over a front or back contact on each register relay, over conductor 203, contact 7 of relay 200 through the winding of relay 204 and battery.

Relay 204 closes a circuit from battery through its winding, contact 7 of relay 200, front contact of relay 204, front contact of relay 201, rectifier 205, condenser 206 to ground. This circuit is ineffective as long as the call progresses normally. However, if the operator, accidentally or intentionally, depresses another key in the rows 3403, 3405 and 3407, thereby restoring the key previously operated, the sender register relay is released and a new one operated, in turn releasing a marker register relay and operating a different one. The release of the one marker register relay and the operation of the other register relay causes a momentary opening of the chain circuit above-described, and the energy of relay 204 discharges through rectifier 205 and is stored in condenser 206. The combination of rectifier and condenser act as an impulse lengthener, the rectifier being so poled that the condenser cannot discharge to ground over the chain circuit when it is reclosed.

Instead, condenser 206 discharges in a circuit over the contact 5 of relay 6808, upper winding of polarized relay 207 to ground. Relay 207 operates in response to this discharge current and closes a locking circuit for itself from battery through its lower winding, contact 4 of relay 6808, operated contact of relay 207, to ground at contact 5 of relay 200.

Relay 207 operated, closes a circuit from ground at contact 5 of relay 200, front contact of relay 207, front contact of relay 202, back contact of relay 208, winding of relay 209, resistance 210 to battery. Relay 209, at its lower contact disconnects ground from the operating circuit of relay 211 which normally functions in case of trouble to call in the trouble indicator, thereby preventing a false indication on the trouble recorder.

At its upper contact, relay 209 extends its operating ground to the winding of trouble release relay 5103 which grounds conductor 7473 leading to the sender, causing the sender to release this marker and select another marker for a second trial.

A number of safeguards are included in the circuit. For example, if the marker is in use with a sender other than an operator's sender, relay 202 is not operated. If under such a condition relay 207 operates falsely, a circuit is closed from ground at contact 5 of relay 200, contact of relay 207, back contact of relay 202 to the winding of relay 208 and battery. Relay 208 locks under the control of trouble indicator relay 211, opens the circuit of relay 209, grounds conductor 212 leading to the trouble indicator and closes a circuit over the back contact of relay 213 to the winding of relay 214 and battery.

Relay 214 operates relay 215 which closes a circuit from the back contact of relay 209 to the winding of relay 211 to call in the trouble indicator. When a trouble indicator record has been made, relay 215 operates, closing a circuit from ground over its front contact, contact of relay 211, upper back contact of relay 209 to the winding of relay 5103 to bring about the release of the marker.

Both release relay 1901 and trouble release relay 5103, in operating, open the circuit of relay 201 so that condenser 206 will not be charged when the code relays release at the end of a call.

Relay 213, which operates when the marker is seized in connection with a second trial, reorder call, opens the circuit of relay 214 and short-circuits the winding of relay 209 in order to attempt to complete the connection in spite of troubles which would otherwise operate either relay 214 or 209 and cause a trouble release of the marker.

What is claimed is:

1. In a telephone system, manually operable keys, a selection control device having a plurality of sets of relays, one or more relays being operated in each relay set by successive operations of said keys for controlling a particular selection, an error detecting circuit mechanism, means in each relay set for operating said error detecting circuit mechanism by the operation of one or more different relays in a relay set after the relays in the relay sets have been operated, and means in said error detecting circuit mechanism for releasing said selection control device.

2. In a telephone system, manually operable keys, a selection control device having a plurality of sets of relays, one or more relays being operated in each relay set by successive operations of said keys for controlling a particular selection, an error detecting circuit mechanism, means in each relay set for operating said error detecting circuit mechanism by the operation or release of one or more different relays in a relay set after the relays in the relay sets have been operated, and means in said error detecting circuit mechanism for releasing said selection control device.

3. In a telephone system, manually operable keys, a selection control device having a plurality of sets of relays, one or more relays being operated in each relay set by successive operations of said keys for controlling a particular selection, an error detecting circuit mechanism, means in each relay set for operating said error detecting circuit mechanism by the operation or release of one or more different relays in a relay set in response to a further operation of said manually operable keys after the relays in the relay set have been operated, and means in said error detecting circuit mechanism for releasing said selection control device.

4. In a telephone system, a manually operable key-set comprising a plurality of rows of locking keys, a selection control device having a plurality of relay registers, means responsive to the operation of one key in each of said rows for operating one or more relays in each of said registers, said registers serving to control a selection in accordance with the relays operated, error detecting means, and means responsive to the subsequent operation of a different key in one of said rows, thereby operating or releasing one or more relays in said registers, for operating said error detecting means to restore said selection control circuit to normal.

5. In a telephone system, a manually operable key-set comprising a plurality of rows of locking keys, a selection control device having a corresponding plurality of relay registers, means for associating said selection control device with said key-set, means responsive to the operation of one key in each of said rows for operating one or more relays in each of said registers, said registers serving to control a selection in accordance with the relays operated, error detecting means, and

means responsive to the subsequent operation of a different key in one of said rows, thereby operating or releasing one or more relays in said registers, for operating said error detecting means to disconnect said selection control circuit from said key-set.

6. In a telephone system, a manually operable key-set comprising a plurality of rows of locking keys, a selection control device having a corresponding plurality of relay registers, means for associating said selection control device with said key-set, means responsive to the operation of one key in each of said rows for operating one or more relays in each of said registers, said registers serving to control a selection in accordance with the relays operated, error detecting means, means responsive to the operation of said register relays for preparing a circuit for said error detecting means, and means responsive to the subsequent operation of a different key in one of said rows, thereby operating or releasing one or more relays in said registers, for operating said error detecting means to disconnect said selection control circuit from said key-set.

7. In a telephone system, a manually operable key-set comprising a plurality of rows of locking keys, a selection control device having a corresponding plurality of relay registers, means for associating said selection control device with said key-set, means responsive to the operation of one key in each of said rows for operating one or more relays in each of said registers, said registers serving to control a selection in accordance with the relays operated, error detecting means, means responsive to the operation of said register relays for preparing a circuit for said error detecting means comprising a chain circuit including contacts on all of said register relays, and means responsive to the subsequent operation of a different key in one of said rows, thereby operating or releasing one or more relays in said registers and opening and reclosing said chain circuit, for operating said error detecting means to disconnect said selection control circuit from said key-set.

8. In a telephone system, a manually operable key-set comprising a plurality of rows of locking keys, a selection control device having a plurality of relay registers, a trouble indicator, means responsive to the operation of one key in each of said rows for operating one or more relays in each of said registers, said registers serving to control a selection in accordance with the relays operated, error detecting means, means responsive to the subsequent operation of a different key in one of said rows, thereby operating or releasing one or more relays in said registers, for operating said error detecting means and for altering the selection to be controlled by said registers, means normally responsive to the alteration of a selection to connect said selection control device with said trouble recorder, said trouble recorder effective to restore said selection control device, and means under the control of said error detecting means to restore said selection control circuit to normal independent of said trouble recorder.

9. In a telephone system, a manually operable key-set comprising a plurality of rows of locking keys, a selection control device having a plurality of relay registers, a trouble indicator, means responsive to the operation of one key in each of said rows for operating one or more relays in each of said registers, said registers serving to control a selection in accordance with the relays operated, error detecting means, means responsive

7

to the subsequent operation of a different key in one of said rows, thereby operating or releasing one or more relays in said registers, for operating said error detecting means and for altering the selection to be controlled by said registers, means normally responsive to the alteration of a selection to connect said selection control device with said trouble recorder, said trouble recorder effective to restore said selection control device, and means under the control of said error detecting means to restore said selection control circuit to normal and to prevent the operation of said trouble recorder.

10. In a telephone system, a manually operable key-set comprising a plurality of rows of locking keys, a selection control device having a corresponding plurality of relay registers, means for associating said selection control device with said key-set, means responsive to the operation of one key in each of said rows for operating one or more relays in each of said registers, said registers serving to control a selection in accordance with the relays operated, a condenser, a rectifier, a chain circuit including contacts on all of said register relays, means operated over said chain circuit to prepare a charging circuit for said condenser in series with said rectifier, means responsive to the subsequent operation of a different key in one of said rows to open and reclose said chain circuit, the opening of said chain circuit render-

8

ing said charging circuit effective, a discharge circuit for said condenser independent of said rectifier and means operative in said discharge circuit to cause the disconnection of said selection control circuit from said key-set.

11. In a telephone system, a manually operable key-set comprising a plurality of rows of locking keys, a selection control device having a corresponding plurality of relay registers, means for associating said selection control device with said key-set, means responsive to the operation of one key in each of said rows for operating one or more relays in each of said registers, said registers serving to control a selection in accordance with the relays operated, a condenser, a rectifier, means responsive to the operation of said register relays for preparing a charging circuit for said condenser in series with said rectifier, a chain circuit including contacts on all of said register relays for rendering said charging circuit ineffective, means responsive to the subsequent operation of a different key in one of said rows, thereby operating or releasing one or more relays in said registers and opening and reclosing said chain circuit, for rendering said charging circuit effective, a discharge circuit for said condenser independent of said rectifier and means operative in said discharge circuit to cause the disconnection of said selection control circuit from said key-set.

OSCAR MYERS.