Feb. 8, 1938. A. J. BUSCH 2,107,746

RELAY CIRCUIT

Filed March 11, 1936

FIG. 1

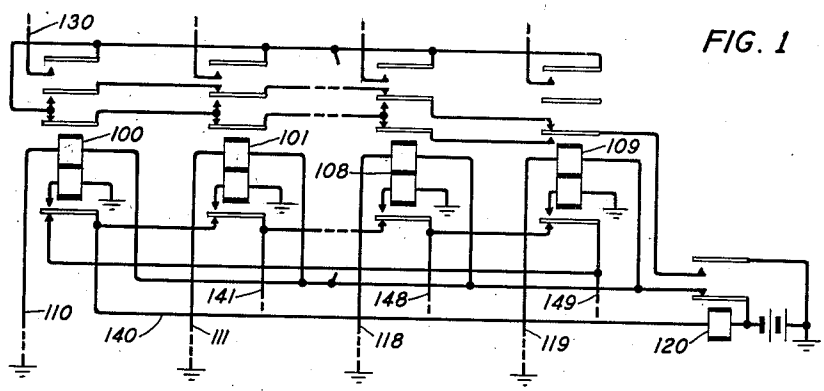
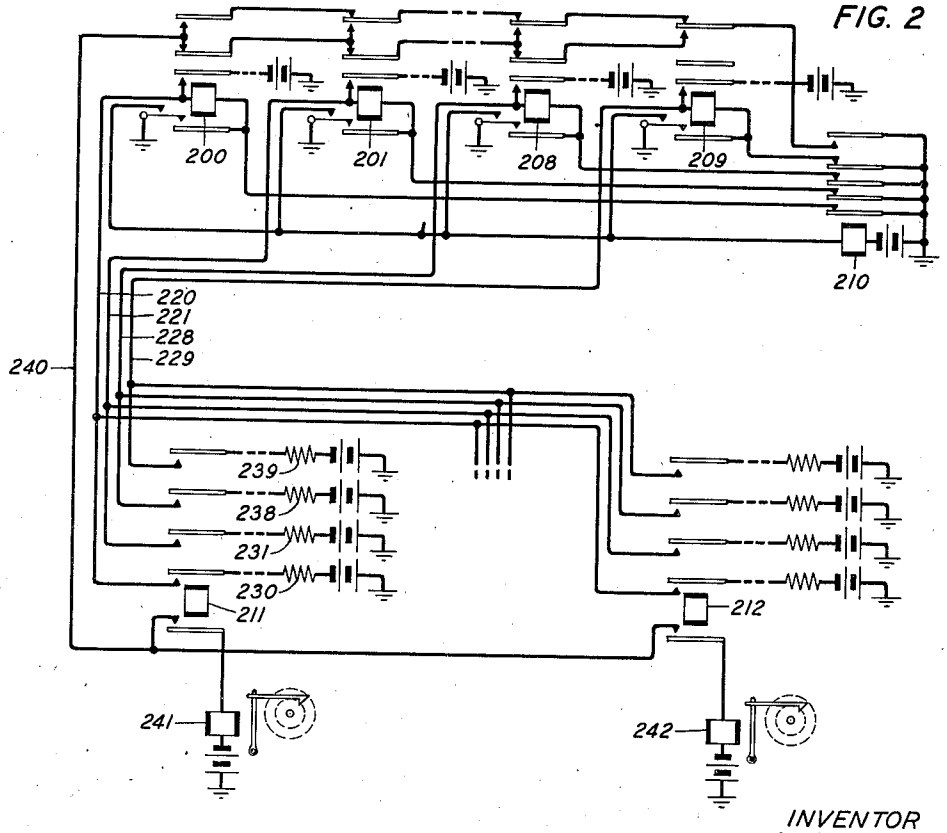


FIG. 2



INVENTOR
A. J. BUSCH
BY
P. C. Smith
ATTORNEY

Patented Feb. 8, 1938

2,107,746

UNITED STATES PATENT OFFICE

2,107,746

RELAY CIRCUIT

Aloysius J. Busch, Bellerose, N. Y., assignor to Bell Telephone Laboratories Incorporated, New York, N. Y., a corporation of New York

Application March 11, 1936, Serial No. 68,241

6 Claims. (Cl. 179—8)

This invention relates to telephone systems and has for its object to increase the speed with which selections take place.

The invention finds one embodiment in the cross-bar system where a plurality of elements are tested simultaneously, by connecting a test relay to each element. The relays are arranged to operate when the elements to which they are connected are idle. When the relays have operated all but one of them is released and the release of these relays immediately indicates the element selected. If only one relay operates, indicating that the last element of the group has been seized, a circuit is immediately closed for a group busy meter. The indicating circuit and the metering circuit extend over the front contact of one relay and the back contacts of all of the remaining relays.

For a complete cross-bar telephone system of which the present disclosure is a part, reference is made to the application of W. W. Carpenter, Serial No. 68,262, filed March 11, 1936, now Patent No. 2,089,921, issued Aug. 10, 1937.

The invention will be more clearly understood from a consideration of the following description in connection with the accompanying drawing, in which:

Fig. 1 shows a series of test relays with a circuit for immediate selection; and

Fig. 2 shows a similar group of relays equipped with a circuit for operating a meter.

Referring first to Fig. 1, the group of relays for making selections includes a series, usually of ten relays, 100 to 109, each relay having two windings, the upper windings of these relays being connected in multiple to battery over the upper back contact of relay 120. The lower windings of the relays are used for locking the relays and are connected to ground. When it is desired to make a test, relays 100 to 109 are connected simultaneously over conductors 110 to 119 to the equipment to be tested, idle equipment being characterized in this case by ground. Assuming that the equipment connected to conductor 110 is idle, ground will be connected over that conductor to the upper winding of relay 100, back contact of relay 120 to battery. Relay 100 operates, closing a locking circuit for itself from ground through its lower winding and lower front contact, conductor 140, through the winding of relay 120 and battery. If other relays are connected to idle equipment they also will operate but cannot lock since their locking circuits are opened at the contact of relay 100.

As soon as the locking circuit through the winding of relay 120 is established, that relay operates, disconnecting the operating battery from the remaining relays which immediately release. Relay 120 also closes a circuit from ground over its front contact to the armature of relay 109. Assuming that relay 100 is operated and therefore locked, the circuit closed by relay 120 extends over the back contact of relay 109, outer upper back contact of relay 108, upper back contacts of the intermediate relays and relay 101, inner upper front contact of relay 100, outer upper front contact of relay 100 to conductor 130 to seize the equipment found idle. This circuit is closed immediately that the unlocked relays release but does not become effective as long as more than one relay remains operated. For example, assume that relay 101 is operated and locked and that relay 109 fails to release because of a sticky contact, the circuit closed by relay 120 will extend as before to the inner armature of relay 109, over the front contact of that armature to the inner armature of relay 108 and over the back contacts of that relay and the intermediate relays to the armature of relay 100 where the circuit would be opened.

The relay chain is arranged to give preference to the equipment reached over conductor 110 and thereafter to the equipment reached over conductors 119, 118, etc. However, preference may be given to the equipment reached over conductor 111 by connecting the winding of relay 120 to conductor 141 instead of to conductor 140 and similarly preference may be given to other equipment by connecting relay 120 to some other one of the conductors 140 to 149.

Referring now to Fig. 2, there is provided a set of ten relays 200 to 209. These relays are single wound relays, one side of each winding extending to ground over a back contact of relay 210. The other side of the windings are connected over conductors 220 to 229 to equipment which is marked idle by battery through a resistance. This set of relays can be used to test any one of a plurality of groups of circuits and is connected to the desired group by means of relays 211 and 212. When a test is to be made and relay 211, for example, is operated, assuming that all of the circuits to be tested are idle, a circuit will be closed from battery through resistance 230, inner upper front contact of relay 211, conductor 220, winding of relay 200, inner upper contact of relay 210 to ground. Relay 200 operates closing a circuit from battery at its inner upper front contact through its winding and over its outer lower front contact to ground.

This locking battery is supplied over the contact of a relay (not shown) in order to release the locked-up relays when the equipment as a whole has completed its function. Relay 200 also connects ground over its two lower front contacts to the winding of relay 210 and battery. Similar circuits will be closed from resistances 231 to 239 to relays 201 to 209. These relays also lock between battery at their inner upper front contacts and ground at their outer lower front contacts, closing parallel circuits for relay 210.

Relays 200 to 209 over armatures which have not been shown control the selection of an idle piece of equipment and initiate its operation, a preference circuit deciding which piece of equipment is to be selected where more than one piece is idle. Assuming that only one piece of equipment is idle, for example that represented by resistance 238, relay 208 is operated in series with resistance 238, locking through the winding of relay 210 in the manner above described now making this last piece of idle equipment busy. Relays 200, 201 and 209 and the remaining relays of the series cannot operate. When relay 210 operates it closes a circuit from ground over its front contact, back contact of relay 209, outer upper front contact of relay 208, inner upper back contacts of the intermediate relays and relays 201 and 200, conductor 240, over the lower front contact of relay 211 to the winding of meter 241 and battery. Meter 241 records the fact that all of the pieces of equipment tested by this chain of relays over the contacts of relay 211 have become simultaneously busy. If the pieces of equipment reached over the contact of relay 212 were being tested the metering circuit would extend over the lower front contact of relay 212 to the winding of meter 242. Therefore, the metering circuit operates the meter individual to the group of equipment being tested at the particular time. If relay 209 were the only relay operated the circuit would extend over the front contact of that relay and the back contact of the remaining relays. Similarly the circuit is closed whenever only a single relay is operated and all of the remaining relays are normal.

What is claimed is:

1. In a telephone system, a plurality of circuit elements, means for marking these elements as busy or idle, a series of relays, means for connecting said relays to said elements each to each, and means for indicating the presence of an idle element comprising a chain circuit controlled by said relays and including the front contact of a single relay and a back contact of each of the remaining relays.

2. In a telephone system, a series of relays, a chain circuit controlled by said relays including the front contact of a single relay and the back contact of each of the remaining relays, and means to further extend said circuit over an additional front contact of said single relay.

3. In a telephone system, a series of relays, a chain circuit controlled by said relays including the front contact of a single relay and the back contact of each of the remaining relays, means for locking said single relay and means to further extend said circuit over an additional front contact on said single relay.

4. In a telephone system, a series of relays, a chain circuit controlled by said relays including the front contact of a single relay and the back contact of each of the remaining relays, and means whereby said circuit may be used for selecting purposes where only one of said relays may be locked and means for using said circuit to operate a meter when a plurality of said relays may be locked.

5. In a telephone system, a plurality of circuit elements, means for marking these elements as busy or idle and means for selecting an idle element comprising a plurality of relays, means for connecting said relays to said elements each to each, means to operate relays connected to idle elements, means responsive to the operation of any one of said relays to release all but one of said relays, and means immediately responsive to the release of said relays to indicate the element selected.

6. In a telephone system, a plurality of circuit elements, means for marking these elements as busy or idle, means for selecting an idle element comprising a plurality of relays, means for connecting said relays to said elements each to each, means to operate relays connected to idle elements, and means to operate a meter if only one of said relays becomes operated.

ALOYSIUS J. BUSCH.