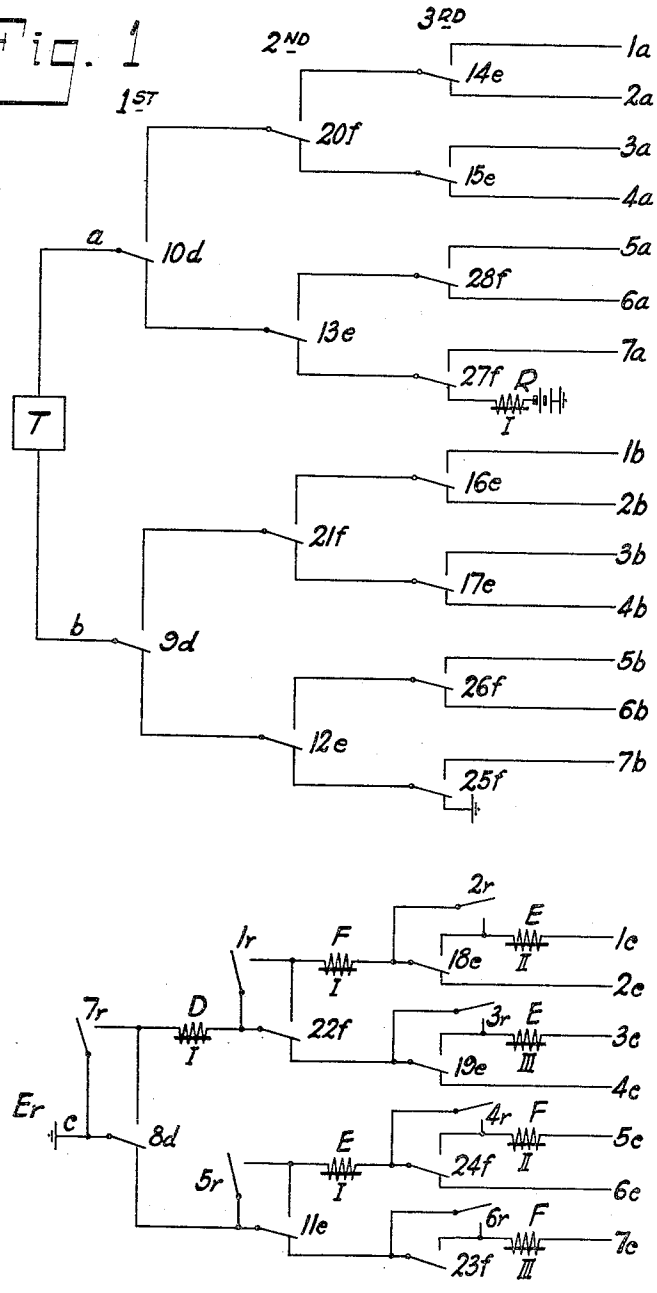
Feb. 9, 1932. M. LANGER 1,844,256

CIRCUIT ARRANGEMENT FOR RELAY SELECTORS IN TELEPHONE SYSTEMS

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Fig. 1



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Fig. 2

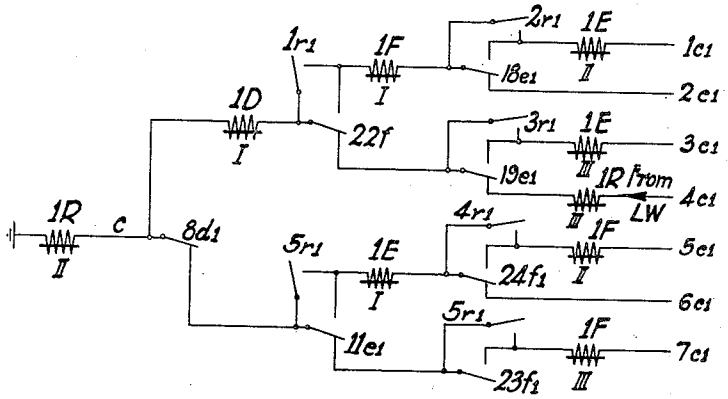
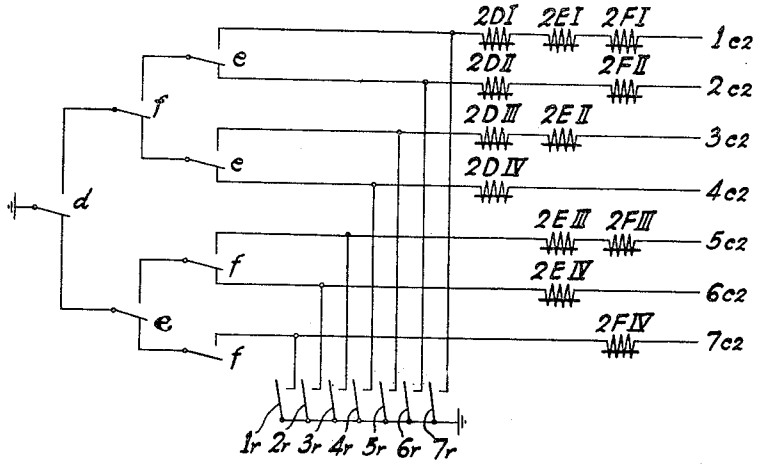


Fig. 3



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CIRCUIT ARRANGEMENT FOR RELAY SELECTORS IN TELEPHONE SYSTEMS

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The present invention relates to a circuit arrangement for relay selectors, such as are used for example in telephone systems for connecting an incoming line with one of several outgoing lines. Different arrangements have already been proposed for automatically selecting a free outgoing line, wherein the number of the relays of the relay selector is equal to the number of outgoing lines. But arrangements are also already known, wherein the number of test relays of the relay selector is less than the number of outgoing lines, but this arrangement requires specially constructed test relays, such as for example relays having their contacts operated in stages, polarized relays or the like. Now the object of the present invention is not to use any specially constructed relays and nevertheless to provide fewer of these relays than there are outgoing lines. This is achieved by providing in the test leads of the individual lines one or more windings of the test relays.

According to the invention, furthermore, all outgoing lines are simultaneously tested upon the arrival of an impulse for initiating the setting up of a connection over the relay selector; this avoids having to provide special devices for making ready a free outgoing line.

Several methods of carrying out the invention are shown by way of example in the drawings. Fig. 1 shows the complete circuit of a relay type switch. Fig. 2 shows a modification of the *c* lead or testing circuit of a relay switch such as shown in Fig. 1. Fig. 3 shows a further modification of the *c* lead of a relay switch such as shown in Fig. 1. In considering the two modifications it is to be understood that the *a* and *b* leads are arranged in the same manner as the corresponding leads in Fig. 1. The designations applied to relays and relay contacts are uniform throughout the drawings.

In Fig. 1 is shown a relay switch, which, when taken into use, connects the subscriber's station T with a free one of seven outgoing lines. The speaking connection extends over the leads *a* and *b*, while the lead *c* is used as a test lead. As test relays are provided three relays D, E, F, of these the relay D has one winding, while each of the relays E and F has three windings.

When the receiver is taken down at the subscriber's station T to initiate a call, the following circuit is established for winding I of the calling relay R: earth, battery, winding I of relay R, contact 27 *f*, contact 13 *e*, contact 10 *d*, lead *a*, subscriber's station T, lead *b*, contacts 9 *d*, 12 *e*, 25 *f*, earth. Relay R is operated and actuates its contacts 1 *r* to 7 *r*, inclusive. Thereby earth is applied to all outgoing *c* leads of the shown preselector; hence all accessible lines are simultaneously tested. If the line 2*a*, 2*b*, 2*c* be free, battery is present on the lead 2*c*, hence the following circuit is established: battery, (not shown) at the lead 2*c*, contact 18 *e*, winding I of relay F, contact 1 *r*, winding I of relay D, contact 7*r*, lead *c*, earth E*r*. In this circuit are operated the relays D and F over their winding I and actuate their contacts. Relay D operates its contacts 8 *d*, 9 *d*, 10 *d*, and relay F operates the contacts 20 *f*, 21 *f*, 22 *f*, 23 *f*, 24 *f*, 25 *f*, 26 *f*, 27 *f*, 28 *f*. The switching over of these contacts interrupts the circuit of relay R, which falls back. Contacts 1 *r* to 7 *r* are opened. But there still exists the test circuit extending over lead 2 *c* as follows: battery at lead 2 *c*, contact 18 *e*, winding I of relay F, contact 22 *f*, winding I of relay D, contact 8 *d*, lead *c*, earth E*r*. The following speaking connection also exists: lead 2 *a*, contacts 14 *e*, 20 *f*, 10 *d*, lead *a*, subscriber's station T, lead *b*, contacts 9 *d*, 21 *f*, 16 *e*, lead 2 *b*.

When the connection is to be released, the battery applied to the lead 2 *c* is disconnected in some known manner, so that the relays D and F can be deenergized and the switch can return to the normal position.

In the Fig. 2 is shown the *c* lead or test circuit of a preselector, the calling relay of which is not disconnected after a call has been received, so that it remains energized. The switch also shows a device for incoming calls. The circuit of the *a* and *b* leads of the switch is the same as that in Fig. 1 to which reference is made. When the subscriber takes down his receiver to set up a connection

over a switch provided with a *c* lead arranged according to Fig. 2, a circuit is established for a winding I of a calling relay 1R which corresponds to the relay R, shown in Fig. 1. Relay 1R operates its contacts 1 *r* 1 to 6 *r* 1, thereby the outgoing lines 1 *c* 1 to 7 *c* 1, inclusive, are tested at the same time. Idle lines are marked by battery on the *c* lead. If, for example the first line is idle when a call is initiated as above described, a circuit is established: battery (not shown), lead 1 *c* 1, winding II of relay 1E, contact 2 *r* 1, winding I of relay 1F, contact 1 *r* 1, winding I of relay 1D, *c* lead, winding II of relay 1R, earth. Relays 1D, 1E, and 1F are operated in this circuit and relay 1R (corresponding to relay R of Fig. 1) is maintained energized. Referring now to the *a* and *b* leads shown in Fig. 1, it will be seen that the operation of relays 1D, 1E, and 1F completes the following speaking connection: lead 1*a*, contact 14*e*, contact 20*f*, contact 10*d*, *a* lead, subscriber's station T, *b* lead, contact 9*d*, contact 21*f*, contact 16*e*, lead 1*b*. In case the first line is busy, ground on lead 1 *c* 1 will prevent the operation of the relays in the combination above described and a different line will be connected with. The combinations in which the relays operate in calls over different lines are as follows: line 2, relays 1F and 1D; line 3, relays 1E and 1D; line 4, relay 1D; line 5, relays 1E and 1F; line 6, relay 1E; and line 7, relay 1F. The original energizing circuit of the calling relay (1R) is opened on the establishment of the connection with an idle line but the relay is maintained operated by its second winding which is energized in series with one or more of the connecting relays as above described.

It will be clear from the foregoing that the setting up of the connection takes place in the same manner as already described for Fig. 1, the only difference being that the relay 1R receiving the call remains energized during the connection. When the calling subscriber hangs up his receiver to release the connection, the battery connected to the test lead is switched off in any known manner, thus interrupting the test circuit and deenergizing the relays located therein. The switch is then again ready to receive another call.

Incoming calls are received over the fourth line. On the receipt of an incoming connection a circuit is established from battery over the lead 4 *c* 1, over winding III of relay 1 R, which opposes the windings II and I of relay 1 R, over contacts 19 *e* 1, 22 *f*, winding I of relay 1 D, lead *c*, winding II of relay 1 R, earth. In this circuit relay 1 D is operated, but relay 1 R cannot be operated, because the winding III opposes the winding II of the relay. Relay 1 D, by switching over the contact 8 *d* 1 and the contacts corresponding to contacts 9 *d* and 10 *d* (Fig. 1), switches the incoming leads 4 *a*, 4 *b* (Fig. 1) through to the subscriber's station T.

To release the connection, the circuit over lead 4 *c* 1 is opened, relay D 1 falls back, thereby returning the relay switch to the normal position.

A further example is shown in Fig. 3. Here the test circuits instead of being established over the contact pyramids, is established by applying earth direct to the test relays located in the separate leads. Here again only the *c* leads are shown, because the *a* and *b* leads are connected in the same manner as in Fig. 1.

When a call is initiated, calling relay R operates as before described and the contacts 1 *r* to 7 *r*, inclusive, are actuated, thereby applying earth to each outgoing lead over the corresponding windings of the test relays. Here likewise a free line is designated by the application of battery to the *c* lead. The energizing of the windings of the test relays located in the test circuit causes their associated contacts to be actuated, hence the connection is established in the manner previously described. The combinations of relays operated for connecting up the various lines are exactly the same as described for Fig. 2. In the example according to Fig. 3 the calling relay R can be released after switching through has been effected, because the test circuit, independently of the contacts of relay R is maintained only by the contacts of the test relays by means of the earth applied to the *c* lead.

Obviously circuits can also be conceived wherein the contacts 1 *r* to 7 *r* in the circuit according to Fig. 3, instead of being operated by the calling relay R, are operated separately by some other means, so that when a certain contact is operated, only a particular line is switched through.

What is claimed is:

1. In a relay switching device for connecting an incoming line to an idle one of a plurality of outgoing trunks, switching relays less in number than the number of accessible trunks, and windings of one or more of said relays in the test conductor of each of said trunks.

2. In a trunk selecting switch having access to a plurality of outgoing trunks, a less plurality of switching relays for connecting with an idle one of said trunks, and windings of one or more of said relays in the test conductor of each of said trunks.

3. In a trunk selecting switch having access to a plurality of outgoing trunks, a less plurality of switching relays for connecting with an idle one of said trunks, and means for simultaneously testing the busy or idle condition of all of said trunks.

4. In a trunk selecting switch having access to a plurality of outgoing trunks, a less plurality of switching relays operable in va-

rious combinations to connect with an idle one of said trunks, each of said relays designating several of said trunks, a test conductor individual to each trunk, and a winding of each relay in the test conductor of each trunk designated by the relay.

5. In a trunk selecting switch having access to outgoing trunks, a switching relay for connecting with an idle trunk, and a plurality of windings of said relay for simultaneously testing a plurality of said trunks for their idle or busy condition.

6. In a telephone system, a switching device terminating a line and having access to a plurality of outlets, means in said device for extending calls from said line to an idle one of said outlets, and circuit connections whereby calls to said line may be extended to said device over a particular one of said outlets.

7. In a telephone system, a switching device terminating a line and having access to a plurality of trunks, a line relay having two opposing windings, means for operating said relay over one winding to initiate the operation of said device responsive to a call from the line, and means including the two windings of said relay for preventing the operation of the relay on calls to said line.

8. In a relay trunk selecting switch in which the contacts are connected in stages in pyramid formation, relays for controlling the switching stages, and circuit arrangements whereby one relay controls contacts in two stages.

9. In a relay trunk selecting switch in which the contacts are connected in stages in pyramid formation, relays equal in number to the switching stages, and circuit arrangements whereby contacts in each switching stage beyond the first stage are controlled by a plurality of relays.

10. In a trunk selecting switch having access to a plurality of outgoing trunks, a test conductor for each trunk, a plurality of switching relays less in number than the number of trunks, means for connecting said relays to said test conductors to test the trunks for their idle or busy condition, and means for energizing a combination of said relays to connect with a trunk tested and found idle.

11. In a trunk selecting switch having access to a plurality of outgoing trunks, a less plurality of switching relays for connecting with an idle trunk, and means responsive to the switch being taken into use for connecting said relays to said trunks to simultaneously test all of the trunks for their idle or busy condition.

12. In a trunk selecting switch having access to a plurality of outgoing trunks, a less plurality of switching relays for connecting with idle ones of said trunks, a test conductor for each trunk, and means responsive to the switch being taken into use for completing test circuits each including the test conductor of a trunk and one or more of said relays.

13. In a trunk selecting switch having access to a plurality of outgoing trunks, a less plurality of switching relays for connecting with idle ones of said trunks, a test conductor for each trunk normally connected to one or more of said relays, and means responsive to the switch being taken into use for completing a circuit for each test conductor and the relays connected thereto.

14. In a switching device having access to a plurality of outlets, a less plurality of switching relays, and means for operating two or more of said relays in series to connect with certain of said outlets.

15. In a switching device having access to a plurality of outlets, a less plurality of switching relays, means for operating said relays individually to connect with certain of said outlets, and means for operating two or more of said relays in series to connect with other of said outlets.

16. In a switching device having access to a plurality of outlets, a less plurality of switching relays each designating several of said outlets, windings for said relays, and a test circuit for each outlet including serially connected windings of each relay designating the outlet.

In witness whereof, I hereunto subscribe my name this 13th day of September, A. D. 1929.

MAX LANGER.