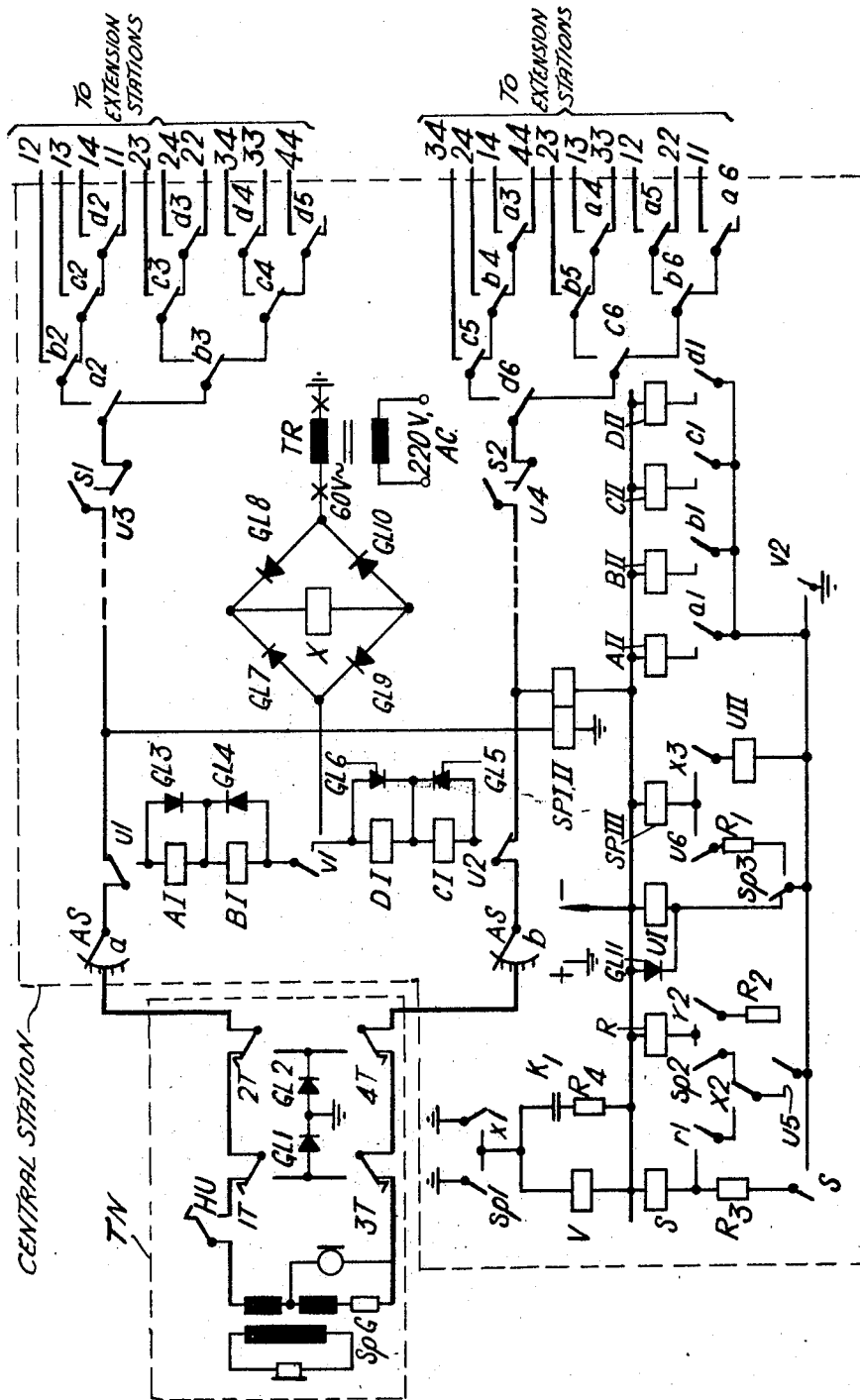


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CIRCUIT ARRANGEMENT FOR SELECTING A TELEPHONE  
EXTENSION BY SELECTOR KEYS  
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## CIRCUIT ARRANGEMENT FOR SELECTING A TELEPHONE EXTENSION BY SELECTOR KEYS

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4 Claims

### ABSTRACT OF THE DISCLOSURE

Each extension station in an automatic telephone system is equipped with four push buttons two in series with each speech wire. Removal of a receiver will cause relays to couple to speech wires and to a source of positive and negative half-waves. The relays are by-passed by rectifiers to respond to either positive or negative half-waves. When one push button is depressed, contacts are closed through one of the relays which operates to establish the first stage of a connection to the called station. Release of the first push button and depression of another completes the connection by operation of another relay.

The invention relates to circuitry for key-controlled telephone systems and particularly for relatively small subscriber's systems with extension stations. It is an object of the invention to enable a selection by keys between at least ten different lines by remote control with very simple means. Different from the previously known key-operated selectors the selecting signals are not audio-frequency signals generated in each extension station by a separate audiofrequency generator and transmitted to the receiver in the central station. Instead the central station equipment transmits a general selection signal to the controlling extension station where digit keys are operated to modify this selection signal for utilization by the receiving equipment in the central station.

The circuitry according to the invention differs also from the previously known key selection methods using direct current mainly in that in the latter the polarity of the control wires is sensed in chronological succession by complicated and expensive relay devices whereas the invention uses low-frequency alternating current which is e.g. derived from the public supply system and stepped down as a control current or general selection signal so that the previously required expenditure is avoided.

Another advantage of this circuitry is the direct setting of the line-selecting relays. This enables the selective connection of up to ten two-wire lines to the central station equipment by only four relays.

The circuitry enables also the selection of one of ten extension stations by the use of only four keys in each extension station provided that the connection to each of the extension stations is established by two key depressions. Each key has only a single change-over contact.

The circuitry according to the invention for selecting a conversation partner by selecting keys is characterized in that an alternating current source is provided in the central station and two series-connected selecting key contacts are provided in each speech wire in each extension station, the voltage of the alternating current source is applied to each speech wire by a contact, which is indirectly closed by the depression of any desired selecting key, and two relays associated with each wire and by-passed each by a rectifier, which rectifiers are connected in phase opposition, and the alternating current flows through the respective closed selecting key contacts and

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one of two phase-opposed rectifiers back to the alternating current source, so that the closing of a certain selecting key contact causes a certain relay to pick up and prepare the speech channel with its contact (after the first depression of a key) and to establish the speech channel (after the second depression of a key).

Further according to the invention, the central station is provided with a relay which is responsive to the alternating current source and connected in the diagonal of a rectifying bridge.

Further according to the invention, an engaging relay energizable by the cradle switch, a time-limit relay, a changeover relay, a relay for signalling the first selection and a relay for signalling the second selection are provided.

Finally, in accordance with the invention, each of the selecting relays has a second winding, which is self-holding by a separate contact during the conversation. The alternating current source is preferably the lighting supply system (50 Hz).

FIG. 1 shows the application of the invention to a subscriber's system with ten extensions.

When the receiver in one of the extension stations is lifted, the finder is adjusted to this extension station. (The adjusting means are not shown). The windings SPI and SPII of relay SP are energized through the extension station loop and relay V through the contact *sp1*. It may be assumed, for instance, that the extension station 34 is selected from an extension station TN. In extension station TN, the key 3T is briefly depressed. This will interrupt the speech loop and cause the relay SP to drop out. Relay U is energized through contacts *sp3*. By contacts *u1* and *u2*, relays A and B are connected to the *a*-wire and relays C and D to the *b*-wire. As relay V is energized, the general selection signal consisting of an A.C. voltage of 50 cycles is applied to the speech wires by contact V1 and the four relay windings AI, BI, CI and DI.

The subsequent explanations are based on the following definition: When the speech wires carry a control current generated by the transformer TR and flowing from the central station to the extension station, reference will be made to a positive half-wave. A current in the opposite direction, from the extension station to the central station, will be defined as a negative half-wave. As is apparent from FIG. 1, the four keys 1T, 2T, 3T, 4T offer four different mutually exclusive possibilities.

When 1T is depressed, the positive half-wave can become effective on the *a*-wire and relay A will pick up because in this case B is short-circuited by G14. The *b*-wire is interrupted. C and D cannot be energized.

(1) +, TR, G18, X, G19, v1, G1 4, AI, u1, AS-a, 2T 1T, G1 1, +,

When 2T is depressed, the negative half-wave becomes effective on the *a*-wire. The *b*-wire is interrupted. Only relay B picks up:

(2) +, G12, 2T, AS-a, u1, G13, BI, v1, G17, X, G1 10, TR, +,

When 3T is depressed, the *a*-wire is disconnected and the positive half-wave of the general selection signal can become effective on the *b*-wire. Relay C picks up:

(3) +, TR, G18, X, G19, v1, G16, CI, us, AS-b, 4T 3T, G11, ground.

Finally when 4T is depressed, relay D picks up:

(4) +, G12, 4T, AS-b, u2, G15, DI, v1, G17, X, G110, TR, +,

We will now revert to our example. Key 3T is depressed so that relays C and X have picked up in circuit (3). Relay X serves for indicating whether a key is depressed and is energized as long as any of the four keys 1T to 4T is depressed.

Contact x3 energizes relay SP in SPIII and holds U in UII because the first winding of U is de-energized when *sp3* is open.

When key 3T is released, X and U drop out in this succession. The final selector relay C holds itself by its own contact *c1* and winding CII.

V does not drop out during the selecting operation because its release is delayed by  $K_1$  and  $R_4$  and because it is held by the contact *x1* immediately when X has picked up. The release of relay U is delayed by G111. This delay of the release is required to ensure an energization of relay R after the first depression of a key. Relay R is energized through *x2* in its inoperative position and through *u5* in its operative position and holds by its own contact *r2*.

(5) —, R, *sp2*, *x2*, *u5*, *v2*, +.

(6) —, R, *r2*, *R2*, *v2*, +.

Thus, relay R records that the first selection has been performed. At this time, relays SP, V, C, R are energized. Now the key 4T is depressed. When SP has dropped out and U has picked up, the relays X and D are energized in circuit (4). Relay S is energized through the closed contact *r1* to indicate that the second selection has been performed.

(7) —, S, *r1*, *x2*, *u5*, *v2*, +.

S is held by its own contact:

(8) —, S,  $R_3$ , *s*, *v2*, +.

When key 4T of TN is now released, X and U will drop out. Relays SP, V, C, D, R, S are energized. Thus, the connection to the extension station 34 by contacts *s1*, *u3*; and *s2*, *u4* is not established until key 4T has been released.

(9) . . . *a*-wire, *s1*, *u3*, *a2*, *b3*, *c4*, *d4*, *a*-wire to extension station 34, telephone apparatus of extension station 34, *b*-wire to central station, *c5*, *d6*, *u4*, *s2*, *b*-wire . . .

The calling and audible ringing signals have not been mentioned because the invention is not concerned with them.

I claim:

1. Circuits for selecting one station from among a plurality of telephone extension stations through operation of selection keys at a first extension station, said circuits comprising an alternating current source coupled to rectifier means to provide positive and negative half-waves, two speech wires for interconnecting the extension stations, two selecting key contacts (1T, 2T, 3T, 4T) provided in series with each speech wire in each extension station, means closing a normally open separate contact (*v1*) in response to lifting of a receiver at the first extension station, said separate contact coupling the positive and negative half-waves provided by the rectifier

means to first terminals of two pairs of relays (A1, B1, C1, D1), means connecting each pair of relays in series between said separate contact and a respective normally open relay contact (*u1*, *u2*), means coupling a rectifier (GL3, GL4; GL5, GL6) in parallel with each of said relays, said rectifiers forming circuits in phase opposition to each other to serve as by-pass paths for current in different directions so that the half-waves can flow only through one relay and one of the rectifiers at a time, closure of a selecting key contact completing a particular path through an additional rectifier to ground to permit current to flow through one and only one of the pairs of relays to operate it and establish the first stage of a connection to the called extension, closure of a second selecting key completing a second path to establish the connection to the called extension.

2. Circuits as claimed in claim 1 in which the rectifier means to provide positive and negative half-waves has the configuration of a rectifying bridge, and a relay (X) which is responsive to the alternating current of the alternating current source is connected in the diagonal of the rectifying bridge, said relay operating to close open contacts for critical circuits when said key contacts are closed.

3. Circuits as claimed in claim 1 in which the means closing the normally open separate contact (*v1*) in response to lifting of a receiver includes an engaging relay (SP) connected to operate as the receiver is lifted, said engaging relay closing a plurality of contacts to cause the operation of a time limit relay (V) and thus close the open separate contact.

4. Circuits as claimed in claim 3 in which operation of the engaging relay (SP) closes circuits preparing additional relays for subsequent operation by closure of the key contacts, said relays including a change-over relay (U), a relay (R) of use in signalling the first selection, and a relay (S) of use in signalling the second selection.

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