

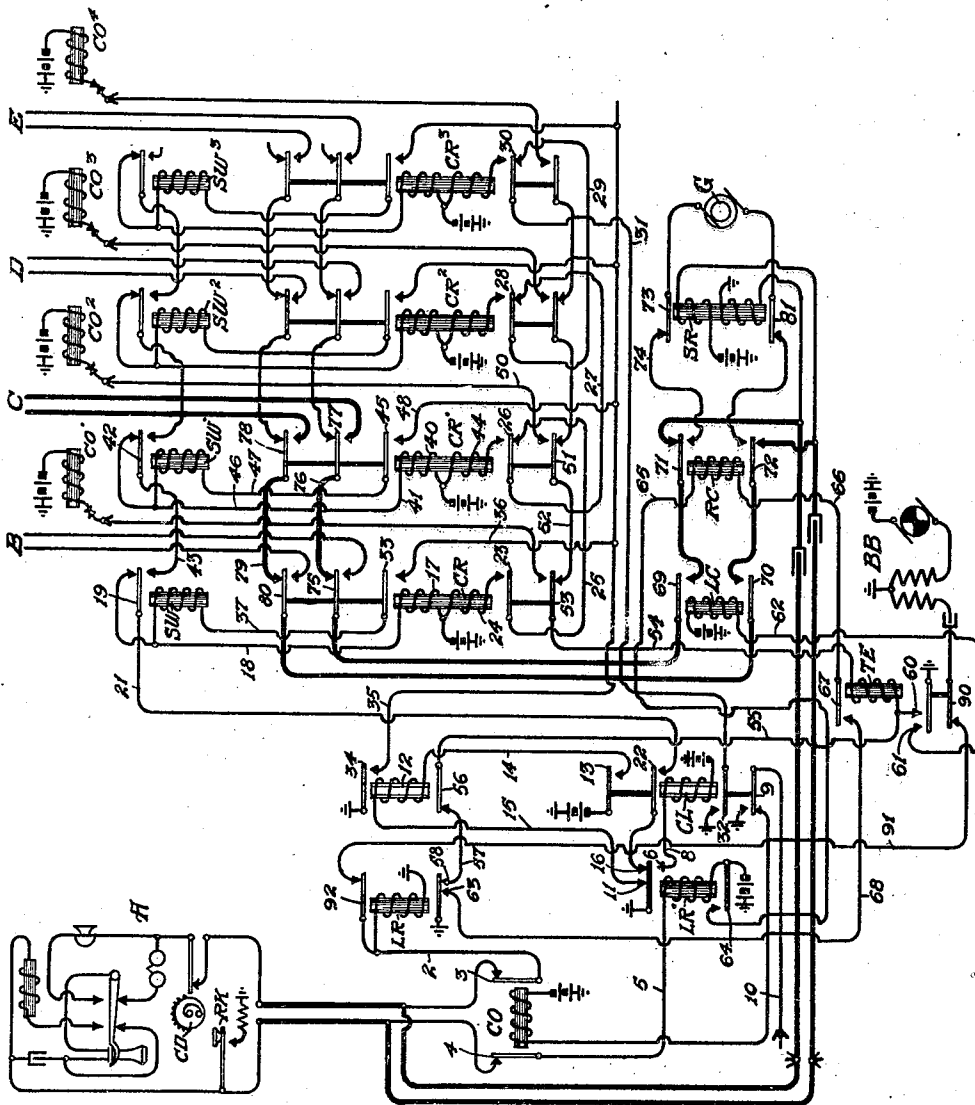
Feb. 3, 1925.

G. A. YANOCHOWSKI

1,524,900

TELEPHONE SYSTEM

Original Filed Sept. 9, 1921



Inventor:
George A. Yanochowski.
By Curtis B. Samp.
Attorney.

UNITED STATES PATENT OFFICE.

GEORGE A. YANOCHOWSKI, OF CHICAGO, ILLINOIS, ASSIGNOR TO KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

TELEPHONE SYSTEM.

Application filed September 9, 1921, Serial No. 499,422. Renewed September 13, 1924.

To all whom it may concern:

Be it known that I, GEORGE A. YANOCHOWSKI, a citizen of the United States of America, resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Telephone Systems, of which the following is a specification.

My invention relates to telephone systems and has to do more particularly with systems of this type in which impulses transmitted from a calling substation actuate relays to select the contacts of the line being called. The system which is herein disclosed is particularly applicable to private branch exchange systems, and commonly known in the art as a private automatic exchange, although my invention is in no sense limited to such use.

A system of the type as above described does away with the usual operator used in manual private branch exchanges, and an object of my invention is the provision of an improved circuit arrangement which embodies desirable features and advantages, all in an efficient, simple and economical manner.

A feature of my invention is the provision of a plurality of counting relays, certain of which relays are actuated to select a called subscriber by means of a predetermined number of impulses transmitted from a calling substation.

The above features as well as other novel features of my invention, through the provision of which the above mentioned and other advantageous results are attained, will be described by reference to the accompanying drawing.

Referring now more in detail to my invention as illustrated in the accompanying drawing, I show a calling substation A comprising the usual substation apparatus, and in addition, comprises a calling device CD and a grounding or ringing key RK for purposes as will be presently described. The calling substation A has associated therewith a pair of line relays LR and LR' which relays are energized when the branch exchange subscriber A initiates a call. The relays LR and LR' are also influenced by the interruptions of the calling device at the calling substation A when transmitting a predetermined number of impulses to ex-

tend his line to that of another substation 55 connected to the branch exchange. A cut off relay CO is also associated with the calling line and is energized when the line of substation A is seized as a called line, and when in an idle condition as will be 60 more fully hereinafter described. A slow acting control relay CL and a slow acting relay 12 are provided and are under the control of the line relays LR and LR'. A switching relay SW and a counting or connecting relay CR are also provided, and control 65 the selection of a called line according to a predetermined number of impulses transmitted from a calling substation. A test relay TE is also provided which is energized or remains in its de-energized condition 70 depending upon the idle or busy condition of the called line tested as said relay TE is slightly slow to energize due to its construction and the arrangement of its 75 armatures. A busy-back signal BB is associated with the test relay TE and transmits a busy signal to the calling line in the event that the called line is busy, either as a calling or called line. A link control relay 80 LC is also provided which is energized when a called line is idle to close the continuity of the talking conductors, and a ringing control relay RC is also provided which 85 controls the application of ringing current to the called line. A supervisory relay SR is also provided which energizes when the called party responds to disconnect the ringing current from the called line.

At B, C, D and E I show lines which 90 terminate in substations similar to A, and associated with each substation I illustrate just sufficient apparatus to clearly describe how a connection may be extended from a 95 calling line to a called line. Each substation is provided with relays CR and SW for each other substation that that substation has access to. From this it will be seen that each subscriber's line is multiplied to relay contacts of the relays of each other 100 subscriber that has access to that particular subscriber's line.

Assuming now that the private automatic exchange subscriber at substation A initiates a call, the removal of the receiver at the said 105 substation A closes an energizing circuit for the line relays LR and LR' traced from ground through the winding of the relay

LR, conductor 2, normal contact 3, of the cut off relay CO, through the closed contacts at the substation switchhook, back through normal contact 4 of the cut off relay CO, conductor 5 to battery through the winding of the relay LR'. The relay LR' upon energization closes its alternate contact 6, establishing an energizing circuit for the slow-acting control relay CL, traced from battery through the winding of the relay CL, conductor 8 to ground at alternate contact 6 of the relay LR'. The closing of alternate contact 9 of the relay CL places a busy ground upon the common conductor 10 so that should any other substation of the branch exchange attempt to call the calling subscriber A, the line will indicate busy.

Assuming now that it is subscriber C that is wanted, and assuming that his call number is 2, the private automatic branch exchange subscriber at substation A operates the calling device CD to send two impulses of current causing two interruptions of the impulse springs of the calling device CD causing line relays LR and LR' to be de-energized and energized twice. The first interruption of the impulse spring contacts of the calling device CD brings about the de-energization of the line relay LR and the line relay LR', and the closing of normal contact 11 of the now de-energized relay LR' establishes an energizing circuit for the slow-acting relay 12, traced from battery through the alternate contact 13 of the relay CL, conductor 14 through the winding of the relay 12, conductor 15 to ground at normal contact 11 of the relay LR'. The closing of normal contact 16 of the line relay LR' establishes an energizing circuit for the connecting relay CR traced from battery through the upper winding 17 of the relay CR, conductor 18, normal contact 19 of the switching relay SW, conductor 21, alternate contact 22 of the relay CL to ground at normal contact 16. The relay CR upon energization closes its alternate contact 23 establishing a locking circuit for the said relay CR traced from battery through the lower winding 24 of relay CR, alternate contact 23, conductor 25, normal contact 26 of the relay CR', conductor 27, normal contact 28 of the relay CR², conductor 29, normal contact 30 of the relay CR³, conductor 31 to ground at alternate contact 32 of the relay CL. The closing of alternate contact 33 of the relay CR establishes an energizing circuit for the relay SW, traced from ground at alternate contact 34 of the relay 12, conductors 35 and 36, alternate contact 33 of the relay CR, conductor 37 through the winding of the switching relay SW, conductor 18 to battery through the upper winding 17 of the relay CR. Relay SW does not energize at this time

due to the fact that its winding is shunted out by the grounded impulse upon conductor 21; as soon, however, as the line relay LR' energizes the shunt is removed and relay SW energizes in series with relay CR. Relay SW energizing connects the impulse conductor 21 through to the next relay CR'. It will thus be seen that it takes a de-energization and an energization of the impulse relay to operate one of the counting relays and the switching relay to extend the impulse conductor through to the next counting relay. After the first impulse, of the calling device CD, line relays LR and LR' are again energized over the calling line. The relay CL due to its slow to release construction remains energized during the sending of impulses and it is not affected by the rapid interruptions of the alternate contact 6 of the relay LR'. The relay 12 is energized upon the first de-energization of relay LR' and remains energized during the sending of impulses due to its slow to release construction, and it is therefore not affected by the rapid interruptions of the contact 11 of the relay LR'. The relay SW and relay CR when energized remain energized during the sending of impulses due to the slow to release construction of relay 12, which remains energized during the sending of the impulse from the calling substation over a circuit as previously described. The next impulse sent from the calling substation again opens the energizing circuits of the line relays LR and LR', and the closing of normal contact 16 establishes an energizing circuit for the connecting relay CR' from battery through the winding of the relay CR', the conductor 46, normal contact 42 of the switching relay SW', conductor 43, alternate contact 19 of the relay SW, conductor 21, through alternate contact 22 of the relay CL, to ground at normal contact 16 of the relay LR'. The closing of alternate contact 26 of the relay CR' establishes a second energizing circuit for the relay CR' through its lower winding 44 traced from battery through the winding 44, alternate contact 26, conductor 27, normal contact 28 of relay CR², conductor 29, normal contact 30 of the relay CR³, conductor 31 to ground at alternate contact 32 of the relay CL. The opening of normal contact 26 of the relay CR' opens the energizing circuit of the relay CR through its winding 24, but the relay CR remains energized through its winding 17, through relays SW to ground at alternate contact 34 of relay 12. The closing of alternate contact 45 of the relay CR' establishes an energizing circuit for the switch relay SW' traced from battery through the winding 40 of the relay CR', conductor 46, through the winding of the

switch relay SW', conductor 47, alternate contact 45 of the relay CR', conductors 48 and 35 to ground at alternate contact 34 of the relay 12. Relay SW' and CR' operate as before mentioned for relays SW and CR. For each impulse transmitted by the calling device a relay SW and a relay CR will be operated. While I have shown only four sets of counting relays, it is apparent that the number of relays SW and CR will depend upon the size of the P. B. X., that is, upon the number of substations.

After the last impulse has been sent, the line relays LR and LR' are again energized over the line and the opening of the normal contact 11 of the relay LR' opens the energizing circuit of the relay 12, and the relay 12 upon de-energization, opens its alternate contact 34 to open the energizing circuits of the switching relays SW and SW', and they now restore to normal. The opening of alternate contact 34 of relay 12 also opens the energizing circuit of relay CR through its winding 17 and the relay CR restores. The circuit through winding 40 of relay CR' is also opened at contact 34, but the relay CR' remains energized through its winding 44 to ground at alternate contact 32 of relay CL.

From the foregoing it will be seen that the de-energization of relay 12 permits the de-energization of all relays SW and CR except the last relay CR to be operated, which connects the desired subscriber's line to the calling subscriber's line.

The closing of alternate contact 6 of the relay LR' now holds the slow release relay CL permanently energized through the winding of the said relay CL to battery.

The party at the substation A having transmitted the proper number of impulses to select the substation C, now depresses the ringing key RK at the substation to actuate the call signal at the called for substation C, and assuming that the subscriber thereat is idle, ringing current will be transmitted to the said called substation as will now be described. The depression of the ringing key RK at the calling substation A simultaneously grounds both sides of the line, and the ground from the alternate contact of the key RK which leads through normal contact 4 of the cut off relay CO to battery through the line relay LR', permits the line relay LR' to remain energized. The ground which extends through the normal contact 3 of the cut off relay CO extends through the winding of the line relay LR to ground, and this ground to ground connection through the winding of the line relay LR permits the same to de-energize, thus closing an energizing circuit for the cut off relay CO² associated with the idle substation C, which circuit may be traced from battery through the winding of the cut off relay CO², conductor 50, alternate contact 51, of the relay CR', conductor 52, normal contact 53 of the relay CR, conductor 54, through the winding of the test relay TE, conductor 55, normal contact 56 of the relay 12, conductor 57, to ground at normal contact 58 of the now de-energized line relay LR. The cut off relay CO² and the test relay TE are energized over this circuit, and the test relay TE upon energization closes its alternate contact 60 establishing a locking circuit for the cut off relay CO² and the test relay TE traced from battery through the winding of the cut off relay CO², conductor 50, alternate contact 51 of the relay CR', conductor 52, normal contact 53 of the relay CR, conductor 54 and through the winding of the relay TE to ground at its alternate contact 60, the said relays remaining energized until conversation is terminated.

The closing of alternate contact 61 of the test relay TE establishes an energizing circuit for the link connecting relay LC traced from battery through the winding of the relay LC, conductor 62 to ground at alternate contact 61 of the relay TE. The closing of normal contact 63 of the line relay LR' establishes an energizing circuit for the ringing control relay RC, traced from battery at alternate contact 64 of the relay LR', conductor 65 through the winding of the relay RC, conductor 66, alternate contact 67 of relay TE, conductor 68 to ground at normal contact 63 of line relay LR. The link connecting relay LC upon energization closes its alternate contacts 69 and 70 to close the continuity of the talking conductors through to the called substation C, and the closing of alternate contacts 71 and 72 of the ringing control relay RC connects the ringing generator G so as to transmit ringing current to the called line, the ringing circuit being traced from one pole of the generator G, through normal contact 73 of the supervisory relay SR, conductor 74, alternate contact 71 of the relay RC, alternate contact 69 of the relay LC, normal contact 75 of the connecting relay CR, conductor 76, through alternate contact 77 of the connecting relay CR', through the call bell and condenser at the called substation C, back through alternate contact 78 of the relay CR', conductor 79, normal contact 80 of the relay CR, alternate contact 70 of relay LC, alternate contact 72 of the relay RC, normal contact 81 of the supervisory relay SR to the other pole of the generator G. Each time the subscriber at the calling substation A depresses the ringing key RK, the line relay LR restores and closes an energizing circuit for the ringing control relay RC, and the ring control relay RC closes its alternate contacts 71

and 72 connecting the ringing generator G through to the called substation C. Upon the response of the called substation C and during a non-ringing period, the supervisory relay SR is energized, traced from battery through the upper winding of the relay SR, normal contact 72 of the relay RC, alternate contact 70 of the relay LC, normal contact 80 of the relay CR, conductor 79, alternate contact 78 of the relay CR', through the now closed contacts at the substation switch hook back through the alternate contact 77 of relay CR', conductor 76, normal contact 75 of relay CR, alternate contact 69 of the relay LC, normal contact 71 of the relay RC, through the lower winding of the relay SR to ground. The supervisory relay SR is energized over this circuit, and further depressions of the ringing key RK at the calling substation A does not further affect the ringing circuit as the supervisory relay SR is now energized and its normal contacts 73 and 81 are open preventing further application of ringing current from the generator G.

The subscriber at the substation A and the subscriber at the substation C are now in conversational circuit, the said talking circuit now being traced over the heavily marked conductors. After the subscribers have finished conversation they replace their receivers upon the respective switch hooks, and the replacing of the receiver at the substation A opens the energizing circuit of the line relays LR and LR'. The line relay LR' upon de-energization opens its alternate contact 6, allowing the slow relay CL to restore to normal. The relay CL restoring to normal, its alternate contact 32 is opened, opening the energizing circuit of the connecting relay CR', and the relay CR' now restores to normal. The relay CR' restoring, its alternate contact 51 is opened to open the series locking circuit through the cut off relay CO² and the test relay TE. The cut off relay CO² and test relay TE are de-energized due to the opening of said alternate contact 51 and now restore to normal.

The opening of alternate contact 61 of the relay TE opens the energizing circuit of the link connecting relay LC, which relay now restores to normal. The supervisory relay SR also restores to normal when the subscriber at the called substation C replaced his receiver upon the switch hook.

The apparatus used in establishing the connection between the substation A and the substation C is now at normal and available for use in establishing other connections.

Assuming now that the called substation C is busy, the operation of the circuit is

the same as previously described up to the time that the subscriber at the calling substation A depresses the ringing key RK. Should the subscriber at the substation C be busy as a calling line, its associated relay CL would be energized, and the ground through its alternate contact 9 would be connected to the common conductor 50, or, if the line is busy as a called line, there will be ground upon conductor 50 through the relay TE of the subscriber's line calling the said called line C, and when the subscriber at the substation A depresses the ringing key RK, he brings about the de-energization of the relay LR as above described, and the ground extending from normal contact 58 of the relay LR over conductor 57, through normal contact 56 of the relay 12, over conductor 55 through the winding of the test relay TE, over conductor 54, through normal contact 53 of the relay CR, over conductor 52 through alternate contact 51 of the relay CR', extends over the common conductor 50 to the ground placed upon the common conductor 50 associated with the busy line C. This ground to ground connection through the winding of the test relay TE permits relay TE to remain at normal, and a busy signal is transmitted to the calling subscriber at the substation A which may be traced from the busy signal apparatus BB through normal contact 90 of the relay TE, conductor 91, normal contact 92 of the relay LR, the normal contact 3 of the cut off relay CO, through the substation to ground.

The subscriber at the substation A receiving the busy signal knows that the called subscriber at C is busy, and he now replaces his receiver upon the switchhook, allowing the line relays LR and LR' to restore. The relay LR' restoring in turn opens the energizing circuit of the relay CL, and the relay CL de-energizing opens the circuit of the relay CR' at alternate contact 32 of the relay CL.

The operation of the cut off relay CO associated with the calling line A will be effected, when said line A is selected and connected as a called line, in the same identical manner and over a circuit similar to that as described in connection with the operation of the cut off relay CO² of the called line C as is fully described in detail in the foregoing specification.

Should the subscriber depress his ringing key RK after sending the required impulses to connect to the called line, he fails to energize the test relay TE, as before described, and the relay TE remaining at normal no energizing circuit is established for the link connecting relay LC and the ringing control relay RC, thus preventing ringing current from being transmitted to the encountered busy line.

The apparatus used in attempting to establish a connection with the busy substation C is now at normal and available for use in establishing other connections.

5 While I have illustrated and described a specific form of my invention, it is to be understood that my invention may be modified and changed by those skilled in the art without departing from the broad scope of
10 my invention. I therefore do not wish to be limited to the exact structure as shown, but aim to cover all such changes and modifications as come within the spirit and scope of the appended claims.

15 Having described my invention what I claim as new and desire to secure by Letters Patent is:

1. A telephone system including a calling telephone line, called telephone lines, an
20 automatic selector switch provided with a series of relays, an impulsing circuit for energizing said relays in succession, means for maintaining the last relay energized and for de-energizing the previously energized
25 relays of the series to extend said calling line to one of said called telephone lines, ringing means, and means controlled solely over the calling line for connecting and disconnecting said ringing means to and from
30 the connected to called line if said line is idle to signal the subscriber thereon.

2. A telephone system including a calling telephone line, called telephone lines, a
35 selector switch having a series of connecting relays, a plurality of lines selectable by said relays, an impulsing circuit for energizing the relays in succession, means operable subsequently for maintaining the last
40 relay of the series energized to select the desired line and for de-energizing the previously energized relays of the series to extend said calling line to one of said called telephone lines, ringing means, and means
45 controlled solely over the calling line for connecting and disconnecting said ringing means to and from the connected to called line if said line is idle, to signal the subscriber thereon.

3. A telephone system including a selector switch having a series of relays, a
50 plurality of lines selectable by said relays, an impulsing circuit for energizing the relays in succession, means for maintaining the last relay of the series energized to select
55 the desired line and for de-energizing the previously energized relays of the series, busy signaling means, automatic testing means for connecting a calling subscriber's line with the said selected desired line if
60 said last line is idle, and to connect said busy signaling means in a circuit with the calling line if said selected desired line is busy.

4. A telephone system including a selector switch having a series of relays, a plu-

70 rality of lines selectable by said relays, an impulsing circuit for energizing the relays in succession, means for maintaining the last relay of the series energized to select the desired line and for de-energizing the
75 previously energized relays of the series, automatic testing means for connecting a calling subscriber's line with the said selected desired line if said last line is idle, and means for either signaling the said de-
80 sired line if it is idle, or for transmitting a busy signal to the said calling line if said desired line is busy.

5. A telephone system including a series of relays controlled over the calling sub-
85 scriber's line, called lines adapted to be selected by said relays, and impulsing circuit for energizing the relays in succession, a holding circuit operable to maintain the operated relays energized while impulses
90 are being transmitted over the impulsing circuit, means for thereafter maintaining only the last relay operated of the series in its energized position to connect with the de-
95 sired line while the other relays of the series are returned to their de-energized position, busy back means, and means for automatically connecting said busy back means in circuit with the calling line if
100 said desired line is busy.

6. A telephone system including a series of relays, lines adapted to be selected by
105 said relays, an impulsing circuit for energizing the relays in succession, a holding circuit operable to maintain the operated relays energized while impulses are being transmitted over the impulsing circuit, means
110 for thereafter maintaining only the last relay operated of the series in its energized position to connect with the desired line while the other relays of the series are re-
115 turned to their de-energized position, and means for signaling the desired line if it is idle, or for transmitting a busy signal to the calling line if the desired line is
120 busy.

7. A telephone system including a calling
125 subscriber's line and a plurality of called subscribers' lines, a selector switch having a series of relays, an impulsing circuit for energizing the relays in succession, means
130 for de-energizing all of the relays of the series that have been operated except the last one, said last relay remaining energized to connect the calling subscriber's line with the called subscriber's line, ringing current
135 means, and means controlled solely over the calling line for connecting and disconnecting said ringing current means to and from the called line for signaling the subscriber thereon.

8. A telephone system including a selector switching having a series of pairs of
140 relays for connecting to desired lines, each pair of relays comprising a connecting re-

lay and an auxiliary relay, an impulsing circuit for energizing the connecting relays in succession, means controlled by said auxiliary relays for switching the impulsing circuit from one connecting relay to another, means operable at the end of the series of impulses for de-energizing all of the connecting relays operable except the last one of which remains energized to extend the connection to the desired line, ringing current means, and means controlled solely over the calling line for connecting and disconnecting said ringing current means to and from the called line for signaling the subscriber thereon.

9. A telephone system having a selector switch provided with a series of connecting relays, an impulsing circuit for energizing the connecting relays in succession, circuits controlled by the succeeding relays for opening the circuits of previously operated connecting relays, maintaining circuits for holding the operated connecting relays energized, means for de-energizing all but the last operated connecting relay to extend the connection to the desired line, and test means for permitting the signaling of the subscriber on said desired line if it is idle or for transmitting a busy signal to the calling line if the desired line is busy.

10. A telephone system having a selector switch provided with a series of connecting relays, an impulsing circuit for successively energizing said connecting relays, interconnecting circuits whereby the operation of a succeeding relay opens the circuit of an operated preceding relay, holding circuits for maintaining the operated connecting relays energized during the time that impulses are being transmitted over the impulsing circuit, automatic means for maintaining energized the last operated connecting relay and for de-energizing the preceding operated connecting relays to extend the connection to the desired line, and test means for permitting the signalling of the subscriber on said desired line if it is idle or for transmitting a busy signal to the calling line if the desired line is busy.

11. A telephone system having a selector switch provided with a series of relays, an impulsing circuit for successively energizing said relays, interconnecting circuits whereby the operation of a succeeding relay opens the circuit of an operated preceding relay, holding circuits for maintaining the operated relays energized during the time that impulses are being transmitted over the impulsing circuit, automatic means for maintaining energized the last operated relay and for de-energizing the preceding operated relays, a calling telephone, called telephone lines, means controlled by said relays for connecting said calling telephone

line to a desired one of said called telephone lines, and test means for signalling the subscriber on said desired line if it is idle or for transmitting a busy signal to the calling line if the desired line is busy.

12. A telephone system having a selector switch provided with a series of relays, an impulsing circuit for successively energizing said relays, interconnecting circuits whereby the operation of a succeeding relay opens the circuit of an operated preceding relay, holding circuits for maintaining the operated relays energized during the time that impulses are being transmitted over the impulsing circuit, automatic means for maintaining energized the last operated relay and for de-energizing the preceding operated relays, a calling telephone line, called telephone lines, means controlled by said relays for connecting said calling telephone line to a desired one of said called telephone lines, and means for signaling the desired called line if the said line is idle, or for transmitting a busy signal to said calling line if said called line is busy.

13. A telephone system including a series of switching relays, a plurality of telephone lines, a pair of line relays for successively operating said switching relays for establishing a connection with any one of said telephone lines, means for causing the de-energization of one of said line relays for connecting ringing current to a connected telephone line if the said line is idle, or to connect to a busy back signal if the said telephone line is busy.

14. A telephone system including a calling subscriber's line and a plurality of called subscribers' lines, a selector switch including a series of switching relays, a pair of line relays in series with said calling line for causing the successive operation of said switching relays for interconnecting said calling line with any one of said called lines to the exclusion of the other of said called lines.

15. A telephone system including a calling substation and a plurality of called substations, a pair of line relays adapted to be operated at said calling substation, a series of switching relays adapted to be successively operated by said line relays to interconnect said calling substation and one of said called substations, calling substations means for applying ringing current to said called substations if idle, and for connecting a busy back signal in circuit with said calling substation if said called substation is busy.

16. A telephone system including a selector switch having a series of connecting relays, a calling subscriber's line and a plurality of called subscribers' lines, a pair of line relays controlled over said calling line and adapted to transmit impulse current to said connecting relays whereby said connecting

relays energizes successively during the sending of impulses to select one of said called lines, the last connecting relay to energize remaining operated to connect said calling line and the selected called line in circuit while the previously energized connecting relays restore to normal.

17. A telephone system including a selector switch having a series of relays, a calling line and a plurality of lines selectable by said relays, means for operating said relays in rotation and means for maintaining the last relay of the series operated to select and connect the desired called line in circuit with said called line and for de-energizing the previously energized relays of the series, automatic test means, and means for operating said test means if the selected line is idle to apply ringing current to said selected line, said test means not being affected by said last means if said selected line is busy whereby a busy signal is transmitted to said calling line.

18. A telephone system including a calling line and a plurality of called lines, a series of connecting relays for interconnecting said calling line and one of said called lines, a pair of line relays for transmitting an impulse current to energize said switching relays in rotation to select one of said called lines, means for maintaining the last relay of the series energized and for de-energizing the previously energized relays of the series, means for de-energizing one of said line relays whereby means are operated to signal the selected line if idle and to connect busy signal to said calling line if said selected line is busy.

19. A telephone system including a selector switch having a group of relays in series, a plurality of lines selectable by said relays, means for energizing said relays in rotation, the second relay energizing opens the holding circuit for the first energized relay, the third relay energizing opens the holding circuit for said second relay, etc., means for maintaining the relay of the series last to energize operated to select one of said lines, and automatic test means for connecting a calling line with said selected line if said selected line is idle.

20. A telephone system including a selector switch having a series of pairs of relays, each pair of relays comprising a connecting relay and an auxiliary relay, a calling line, a plurality of called lines adapted to be selected by said pairs of relays, means for transmitting a number of current impulses to energize a number of said pairs of relays, the number of pairs of relays energized being the same as the number of impulses transmitted, means for maintaining the last pair of said switching relays energized operated to select one of said called

lines and for de-energizing the previously energized pairs of relays, and means for connecting said calling subscriber in circuit with the said selected line if said selected line is idle, said means preventing the interruption of said selected subscriber if busy by said calling subscriber and for connecting a busy signal to said calling line.

21. A telephone system including a selector switch having a series of relays, a plurality of called lines adapted to be selected by said relays, a calling line and means controlled over said calling line for operating the relays of the series in rotation, means for maintaining the last operated relay of the series energized to select one of said called lines, and for restoring the previously operated relays of the series, test means, other means for effecting said first means to cause the operation of said test means to connect said selected called line in circuit with said calling line if said called line is idle and to connect ringing means to said called line.

22. A telephone system including a calling subscriber's line and a plurality of called subscribers' lines, a selector switch having a series of relays, an impulse circuit for energizing the relays in succession, means for de-energizing all of the relays of the series that have been operated except the last one, said last relay remaining energized to connect the calling subscriber's line with the called subscriber's line, means for ringing the called subscriber, and means for automatically disconnecting ringing current from the called subscriber's line.

23. A telephone system including a series of relays, a calling line, a plurality of selectable called lines adapted to be selected by said switching relays, impulse means for successively energizing said relays, means for maintaining the last energized lay of the series operated to select one of said called lines while the previously energized relay of the series returns to normal, automatic test means for interconnecting said calling line and said selected line, and for connecting ringing means to said called line if said selected line is idle and for preventing the interruption of and the application of ringing current to said selected line if busy, and means for rendering said calling line and said selected line busy when said lines are in use.

24. A telephone system including a selector switch having a series of connecting relays, a pair of line relays and a pair of slow-acting relays, one of said line relays controlling the circuits of said pair of slow-acting relays, subscriber controlled means for operating said pair of line relays to transmit impulses of current to energize said connecting relays in rotation, means for

maintaining the succeeding energized relay of said series operated and to de-energize the preceding energized relay.

25. A telephone system including a calling line and a plurality of selectable called lines, a series of switching relays adapted to select one of said called lines, a pair of line relays and a pair of slow-acting relays, one of said line relays controlling the circuits of said slow-acting relays, means controlled over said calling lines for operating said line relays to transmit current impulses to energize said switching relays in rotation, means for maintaining said last relay of the series operated to select one of said called lines and to de-energize the preceding energized relay of the series, means for de-energizing one of said line relays, a test relay for connecting said calling line and said selected line and operable upon the de-energization of said line relay providing said selected line is idle.

26. A telephone system including a calling line and a plurality of selectable called lines, a series of counting relays adapted to select one of said called lines, a pair of line relays and a pair of slow acting relays, one of said line relays controlling the circuits of said slow acting relays, means controlled over said calling line for operating said line relays to transmit current impulses to energize said counting relays in rotation, means for maintaining the said last relay of the series operated to select one of said called lines and to de-energize the preceding ener-

gized relay of the series, means for de-energizing one of said line relays, a test relay for connecting said calling line and said selected line and operable upon the de-energization of said line relay providing said selected line is idle, and means for preventing the operation of said test means when said line relay is de-energized if said selected line is busy, to connect busy signal to said calling line.

27. A telephone system including a calling line and a plurality of selectable called lines, a series of counting relays adapted to select one of said called lines, a pair of line relays and a pair of slow-acting relays, one of said line relays controlling the circuits of said slow acting relays, means controlled over said calling lines for operating said line relays to transmit current impulses to energize said counting relays in rotation, means for maintaining said last relay of the series operated to select one of said called lines and to de-energize the preceding energized relay of the series, means for de-energizing one of said line relays, a test relay for connecting said calling line and said selected line and operable upon the de-energization of said line relay providing said selected line is idle, said test means when operated also connecting ringing means to said selected line.

Signed by me at Chicago, in the county of Cook and State of Illinois, this 7 day of September, 1921.

GEORGE A. YANOCHOWSKI.