

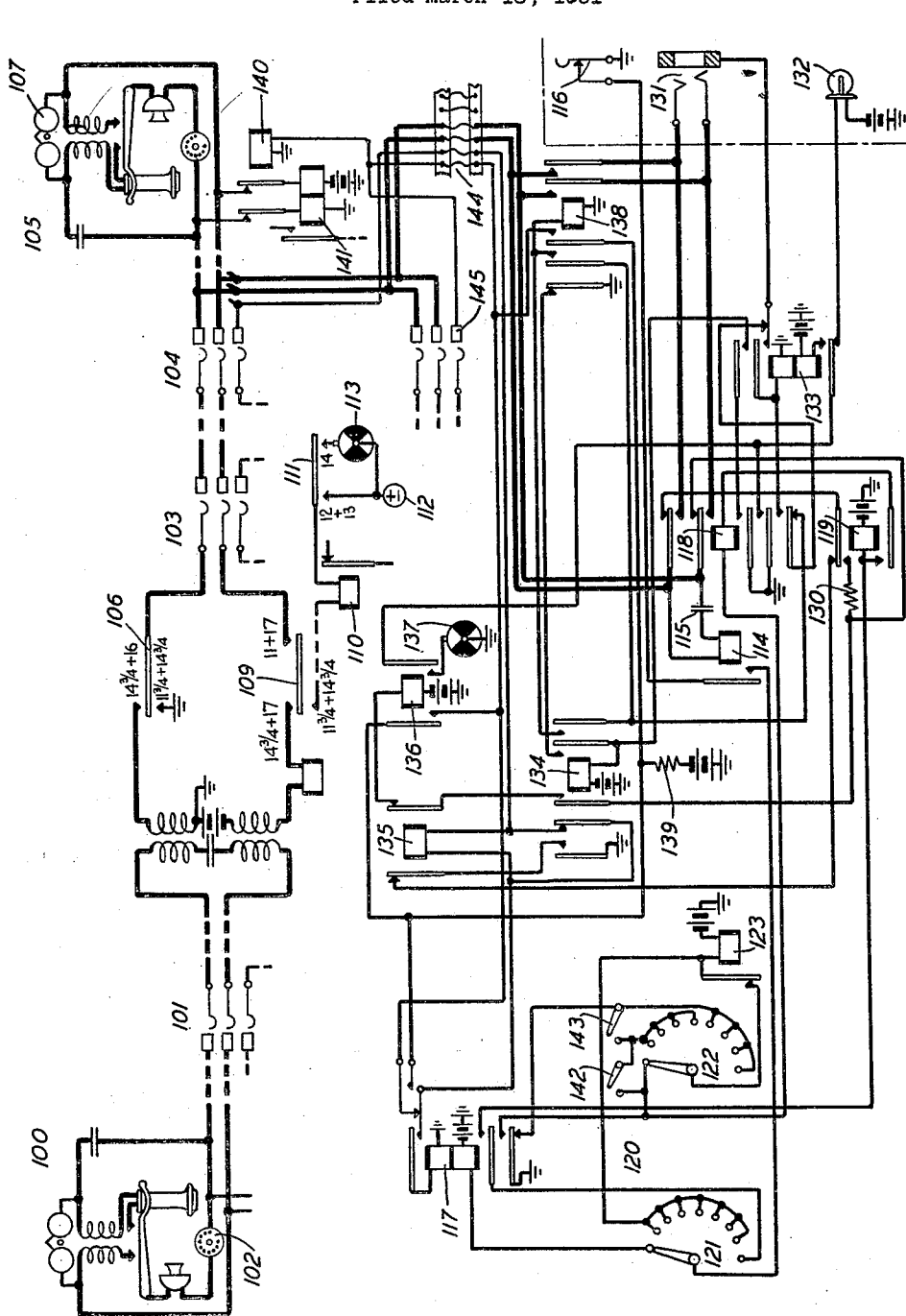
April 25, 1933.

E. E. HINRICHSEN

1,905,711

TELEPHONE SYSTEM

Filed March 18, 1931



INVENTOR
E. E. HINRICHSEN
BY *P. C. Smith*
ATTORNEY

UNITED STATES PATENT OFFICE

EDWARD E. HINRICHSEN, OF NEW YORK, N. Y., ASSIGNOR TO BELL TELEPHONE LABORATORIES, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

TELEPHONE SYSTEM

Application filed March 18, 1931. Serial No. 523,338.

This invention relates to telephone systems and has for its object to increase the efficiency of such systems by reducing the number of uncompleted calls.

5 The two chief reasons for failure to complete connections are that the line is already busy or that the subscriber does not answer. Where the line is busy a second call after a short interval will usually be completed.
10 Where the call is not answered it may require many trials before a response is received.

In accordance with the present invention subscribers who receive many incoming calls, but who are of necessity away from their
15 telephones at intervals such as physicians, etc., may secure special service by which incoming calls which are not answered within a predetermined length of time will be
20 answered by an operator who will record the identity of the calling party and any message which he may care to give. The time interval may conveniently be measured by the intermittent application of ringing current to the subscriber's line and may be varied
25 in length to suit the requirements of particular subscribers. This service may be controlled by a key at the operator's position so that it may be effective only during certain
30 hours or at the request of the subscriber. If a call is received during the time that the service is effective the subsequent removal of the receiver at the subscriber's substation will immediately connect the subscriber with the
35 operator so that she may deliver the message received.

A somewhat similar arrangement, by which the service is given to all subscribers, is disclosed and claimed in United States application of F. S. Irvine, Serial No. 523,392,
40 filed March 18, 1931.

The drawing which illustrates one embodiment of the invention shows a calling subscriber's line extended by means of a skeletonized set of automatic switches to the
45 called subscriber's line with which is associated the circuits for providing the "don't answer" service.

If the subscriber at substation 100 initiates
50 a call, his line is seized by a line finder 101

and, following the operation of dial 102, will be extended by means of automatic equipment not shown) to an incoming selector 103 and a final selector 104, such as shown in United States Patent 1,658,829, granted to
55 C. H. Berry, February 14, 1928, and through them to the terminals of the wanted line. The incoming selector sequence switch will thereupon be advanced to position 12 in which a ringing circuit is established from ring-
60 ing source 112 over the left contact of cam 111 through the winding of relay 110, lower left and upper right contacts of cam 109, ring brush of incoming selector 103, through the final selector 104 to the ring terminal of the
65 subscriber's line, through the substation ringer 107, back over the tip brushes of the final selector 104 and incoming selector 103, lower contact of cam 106 to ground. Ring-
70 ing current is applied over this circuit for an interval during which the incoming selector sequence switch is advanced to position 14 where interrupter 113 is included in the ring-
75 ing circuit and the subscriber's bell is rung at measured intervals.

Subscribers, who wish the service of having calls incoming during their absence answered and recorded by an operator, will be provided with equipment such as shown at
80 the bottom of the drawing which is connected to the multiple terminals of his line as they appear in the line finder and final selector frames. A convenient method of so doing is by means of a cross-connecting rack such as
85 rack 144 so that the service may be furnished or discontinued without interfering with the multiple wiring of the line. Assuming that the subscriber at substation 105 is to receive
90 this service, at the same time that ringing current is applied to his bell 107, it is also applied over a parallel circuit which may be traced from the ring side of the line over rack
95 144, through condenser 115, winding of relay 114, over rack 144 to the tip side of the line. Therefore each time that ringing current is applied the subscriber's line, relay 114 is operated.

Key 116 is provided so that the service may be given only at such times as desired by the subscriber. With the key normal, as shown,
100

the operation of relay 114 in response to the first application of ringing current closes a circuit from ground at key 116 over the contact of relay 114, brush 121 of the timing switch 120 in its normal position, lower winding of relay 117 to battery. Relay 117 locks in a circuit from ground through its upper winding and inner upper front contact, back contact of relay 134, to battery connected to the sleeve terminals of the called subscriber's line by the final selector. It also closes a circuit from battery through resistance 139, outer upper front contact of relay 117, to the sleeve terminals 145 of the called line in the line finder frames and to the winding of cut-off relay 140 which functions to disconnect the line relay 141 from the tip and ring of the line. Relay 117, in addition, connects ground over its outer lower front contact, normal contact of brush 122, back contact and winding of magnet 123 to battery. Magnet 123 operates, opening its own contact and advancing the timing switch 120 to its second position. In this position a circuit is closed from battery through the winding of magnet 123, second terminal of brush 121, front contact of relay 114, to ground at key 116. Magnet 123 remains operated until relay 114 releases at the end of the first ringing period, when switch 120 is advanced to its third position.

It is possible for the subscriber to determine which of two periods of time shall elapse before calls are directed to the attention of the operator. For instance some subscribers may have their telephones at their elbows and if they do not answer after the bell has rung once or twice it is almost certain that they will not answer at all, while other subscribers, who move about more, may still answer after the bell has been rung a large number of times. People, who call such subscribers frequently, may know these habits or may learn them from previous experience and will be likely to hold the connection in proportion to the time they expect to wait for an answer. It is, therefore, advisable both from the standpoint of the subscriber and from the standpoint of the telephone company in reducing the number of uncompleted calls to vary the time interval measured by switch 120 according to the wishes and habits of the subscribers. The terminal bank of brush 122 has therefore been wired with two groups of strapped contacts and two simple switches 142 and 143 are provided. With switch 142 closed the ground connected by relay 117 to the first terminal of brush 122 is also connected to the next four terminals and switch 120 is rapidly advanced to position 6. The release of relay 114 after the first ringing impulse in this case advances switch 120 to position 7 instead of to position 3. If switch 142 is not closed the advance of switch 120 from position 3 is under the control of

relay 114 and switch 120 reaches position 7 only after five applications of ringing current. When switch 142 is open, switch 143 is usually closed to provide a circuit for restoring the timing switch to normal if the ringing current is removed before the timing interval is completed.

Assuming that switch 142 is closed, the second and third operations of relay 114, in response to the intermittent application of ringing current to the subscriber's line, close the circuit of magnet 123, and advance brush 121 to its ninth terminal. When ringing current is applied for the fourth time, the circuit controlled by relay 114 is extended over the ninth terminal of brush 121, inner lower front contact of relay 117, winding of relay 119 to battery. Relay 119 operates, closing a locking circuit for itself over its lower contact through the winding of relay 118, to ground at the outer lower contact of relay 117. Relay 118 cannot operate at once being shunted by ground over the contact of relay 114. Relay 119 also connects resistance 130 over its front contact and the upper back contacts of relay 118 to the tip and ring terminals of the called subscriber's line, completing a direct current circuit for relay 110 which operates and, in the well known manner, brings about the disconnection of the ringing current source 112. When relay 114 releases at the termination of the ringing impulses, relay 118 operates and disconnects the terminals of the subscriber's line from resistance 130, connecting them through to the tip and ring of the jack 131 located at the operator's position. It also closes a circuit from ground over its middle lower front contact, back contact of relay 133, to lamp 132 and battery, lighting the lamp as a signal to the operator.

The operator responds to this signal by inserting the plug of one of her cords in jack 131 and operating her listening key. Battery connected to the sleeve of the plug is extended over the sleeve of jack 131, normal contact of relay 133, outer lower front contact of relay 118 to the upper winding of relay 133 and ground. Relay 133 locks over its upper alternate contact to the sleeve of jack 131, extinguishes lamp 132 and closes a second locking circuit for itself over its lower winding and lower front contact to ground at the middle lower contact of relay 118.

The operator may now converse with the calling subscriber, deliver any prearranged message, or take the number and message of the calling subscriber. When the operator removes her cord from the jack, one locking circuit of relay 132 is opened but that relay remains operated until the calling subscriber disconnects and the train of switches is released resulting in removal of battery from the sleeve of the called line. This brings about the release of relays 117, 140, 119, 118

and 133. The second locking circuit of relay 133 prevents the relighting of lamp 132 after the call has been answered by the operator.

When relay 133 was operated it also closed a circuit from ground over the inner lower front contact of relay 118, outer upper front contact of relay 133, winding of relay 134 to battery. Relay 134 locks over its inner right contact to ground at the left back contact of relay 138. Relay 134 sets up a condition whereby the initiation of a call on line 105 will bring about the connection of that line with the operator's position. To this end relay 134 prepares a circuit from the tip side of the subscriber's line, outer upper back contact of relay 118, back contact of relay 119, left back contact of relay 135, outer left front contact of relay 134 to ground, and from the ring side of the line over the inner upper back contact of relay 118, inner left front contact of relay 134, right back contact of relay 135, winding of relay 136 to battery. It also prepares a circuit from ground through the winding of relay 138, outer right contact of relay 134, lower back contact of relay 118, normal contact of relay 133 to the sleeve of jack 131. With relay 134 operated, the shunt around relay 135 is opened and this relay is connected between the sleeve terminal of the line at the final multiple and the cut-off relay 140. If, now, another call comes in for line 105, battery connected to the sleeve of the final selector operates relays 135 and 140 in series. The operation of relay 135 opens the circuit above indicated for relay 136, but relay 134 remains locked, and as soon as the incoming call has been cared for the circuit condition just described is restored. Otherwise the operation, in connection with an incoming call is the same as above described.

When the subscriber at substation 105 initiates a call, connecting his transmitter and dial across the tip and ring conductors to form a direct current path, relay 136 operates and connects battery through resistance 139 to the line finder sleeve terminals operating relay 140 and cutting off the line relay 141. It also closes a circuit from ground through interrupter 137 over the lower back contact of relay 133 to lamp 132 to cause the lamp to flash. The operator may now insert her plug in jack 131 completing the circuit of relay 138 which opens the locking circuit of relay 134, closes a substitute holding circuit for itself under the control of the operator, closes a substitute holding circuit for the cut-off relay 140 and connects the talking conductors through to the jack 131. The release of relay 134 opens the circuit of relay 136 which extinguishes lamp 132. The operator may deliver any messages which she has received for the subscriber and then remove her plug from jack 131. Relay 140 is then released

and relay 141 can operate so that the call initiated by the subscriber can proceed.

In case unanswered calls are to be extended to the operator only during certain periods, the circuit may be disabled at other times by operating key 116. This prevents the operation of relay 114 from causing the operation of relay 117 and thereby prevents the initiation of the cycle of operations above described.

If at any time during the operation of the timing switch 120 the subscriber at substation 105 removes his receiver from the switch-hook, he causes the operation of relay 110 and the disconnection of ringing current at the incoming selector. Therefore relay 114 cannot continue to operate and switch 120 remains in the position reached at that time. Relay 117 remains locked to the sleeve terminal of the final selector as long as the line remains busy at that point and holds the cut-off relay 140 operated to mark the line finder terminals busy. When the conversation has been completed and final selector 104 releases, relay 117 also releases closing a circuit from ground over its lower back contact to the strapped terminals of brush 122 and thence over the back contact and winding of magnet 123 to battery, stepping the timing switch back to normal. If a calling subscriber abandons a call before the timing switch has completed its operation, the disconnection of the final selector releases relay 117 and closes the restoring circuit for switch 120.

What is claimed is:

1. In a telephone system, a calling line, a called line, means to establish a connection from said calling line to the terminals of said called line, means to apply ringing current to said called line at definite intervals, a stepping switch, a signal, means effective in a particular position of said stepping switch to operate said signal, means responsive to each application of ringing current to advance said switch one step, whereby said signal will be operated after a predetermined elapsed time, other means for advancing said switch, and means to render said other means effective to vary said elapsed time.

2. In a telephone system, a calling line, a called line, means to establish a connection from said calling line to the terminals of said called line, means to apply ringing current to said called line at definite intervals, a stepping switch individual to said line, a signal, means effective in a particular position of said stepping switch to operate said signal, means responsive to each application of ringing current to advance said switch one step, whereby said signal will be operated after a predetermined elapsed time, other means for advancing said switch, and means to render said other means effective to vary said elapsed time.

3. In a telephone system, a calling line, a telephone exchange, a called line at said exchange, an operator's position at said exchange, a signal at said position, means to establish a connection from said calling line to the terminals of said called line, means in said exchange to apply ringing current to said called line, means at said exchange responsive to said ringing current to measure a predetermined time, means effective at the end of said predetermined time to operate said signal and to connect said calling line with said operator's position independent of said called line, and means responsive to said last mentioned means to prepare a connection between said called line and said operator's position.

4. In a telephone system, a subscriber's line, means to establish a connection to said line, means to apply ringing current to said line, means responsive to said ringing current to measure a time interval, means effective if the subscriber on said line fails to respond before the expiration of said interval to extend said connection to an operator's position, and means operated in response to said extension to render the subsequent initiation of a call on said line effective to connect said line with said operator's position.

5. In a telephone system, a subscriber's line, means to establish a connection with said line, an operator's position, means effective if the subscriber on said line fails to answer before the expiration of a predetermined length of time to extend said connection to said operator's position, and means operative in response to said extension to render the subsequent initiation of a call on said line effective to connect said line with said operator's position.

6. In a telephone system, a subscriber's line, means to establish a connection with said line, an operator's position, means effective if the subscriber on said line fails to answer before the expiration of a predetermined length of time to extend said connection to said operator's position, and means operative in response to said extension to render the initiation of a call on said line effective to connect said line with said operator's position and to display a distinctive signal at said position.

7. In a telephone system, a subscriber's line, means to establish a connection with said line, an operator's position, means effective if the subscriber on said line fails to answer before the expiration of a predetermined length of time to extend said connection to said operator's position, a relay operated in response to said extension and means under the control of said relay to render the initiation of a call on said line effective to connect said line with said operator's position.

8. In a telephone system, a subscriber's line, means to establish a connection with said

line, an operator's position, means effective if the subscriber on said line fails to answer before the expiration of a predetermined length of time to extend said connection to said operator's position, a relay operated in response to said extension, means under the control of said relay to render the initiation of a call on said line effective to connect said line with said operator's position, and means operated in response to the extension of other calls to said line to render the control of said relay ineffective.

9. In a telephone system, a subscriber's line, means to establish a connection with said line, an operator's position, means effective if the subscriber on said line fails to answer before the expiration of a predetermined length of time to extend said connection to said operator's position, a relay operated in response to said extension, means under the control of said relay to render the initiation of a call on said line effective to connect said line with said operator's position, and means operated in response to the extension of other calls to said line to temporarily render the control of said relay ineffective.

In witness whereof, I hereunto subscribe my name, this 16th day of March, 1931.

EDWARD E. HINRICHSEN.