

March 19, 1929.

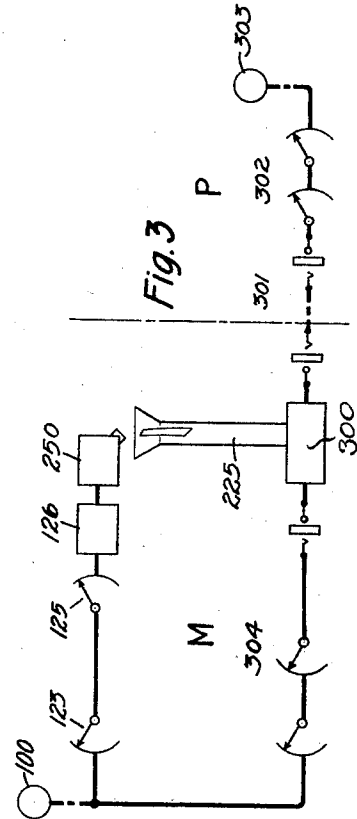
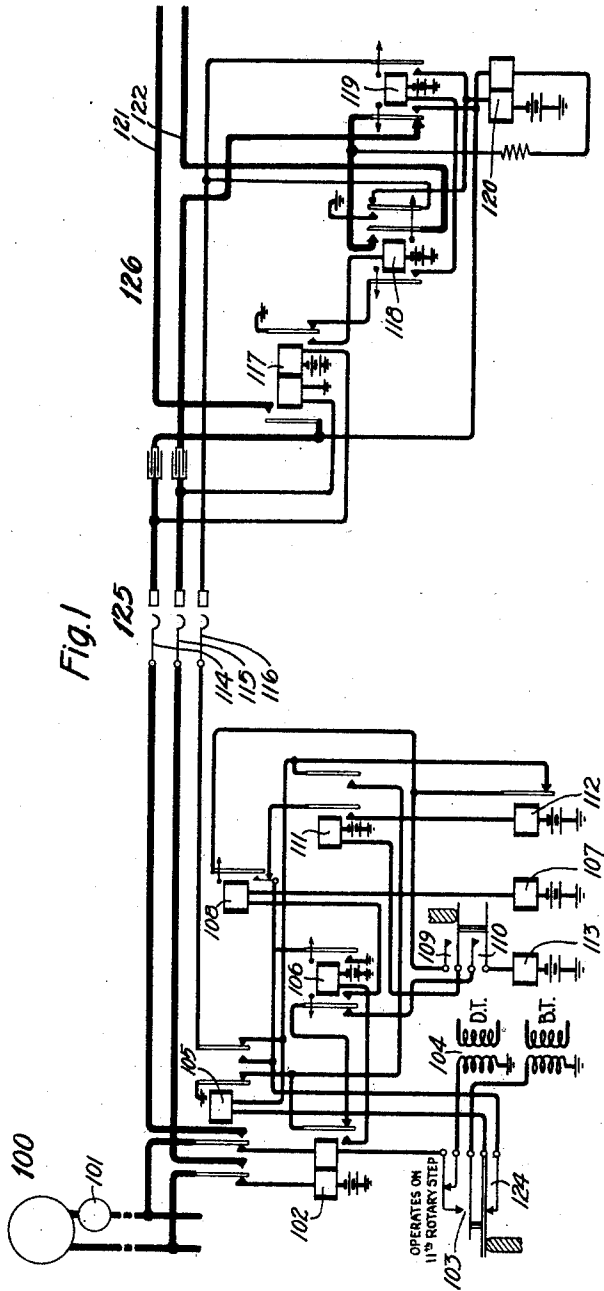
T. M. HAMER

1,705,917

TOLL SERVICE TELEPHONE EXCHANGE SYSTEM

Filed Nov. 3, 1924

2 Sheets-Sheet 1



Inventor:
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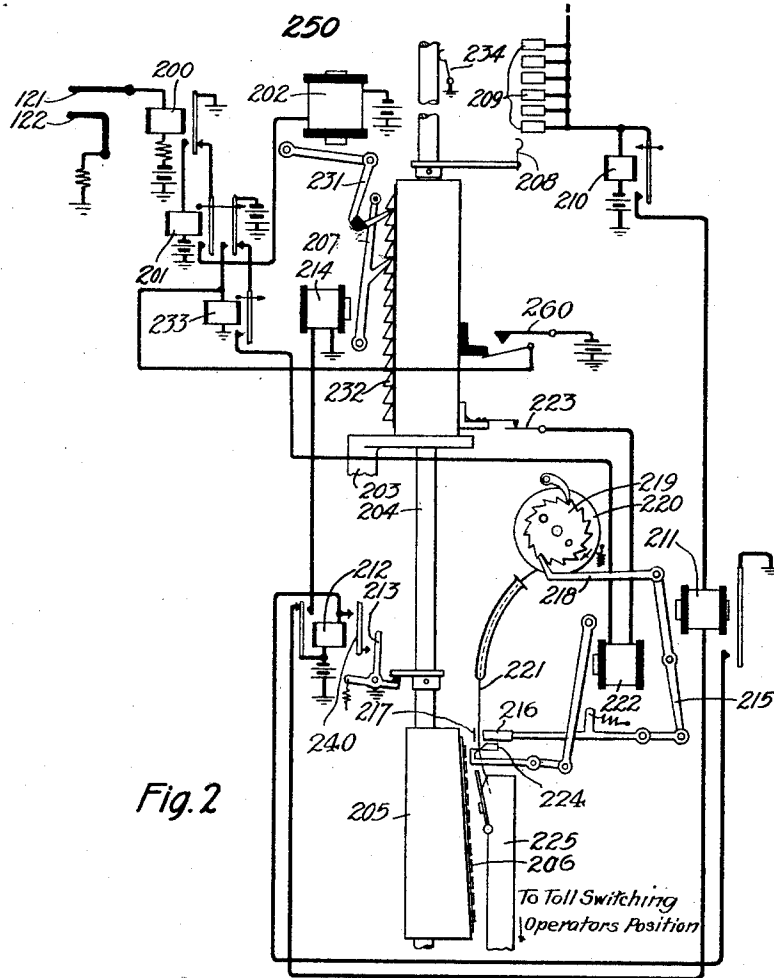
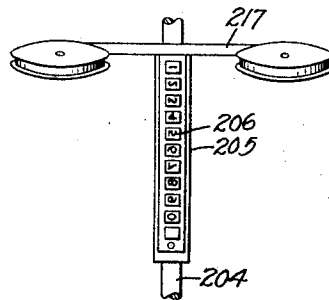


Fig. 2

Fig. 4



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UNITED STATES PATENT OFFICE.

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TOLL-SERVICE TELEPHONE-EXCHANGE SYSTEM.

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This invention relates to telephone exchange systems, and particularly to a method of and an apparatus for expediting the establishment of toll connections in exchange areas having automatic switching mechanism.

In telephone exchange systems in which local service connections are established between subscribers' lines by machine switching means, it has heretofore been the customary practice when subscribers desired toll connections for the calling subscriber to obtain a connection with a toll recording operator's position by first dialing a special number, for example, by dialing a single digit 0. The calling subscriber upon the response of the operator, then gives the operator the necessary data for enabling the further extension of the connection to the desired station at the toll point, such data including the name of the town or toll point, the number of the desired line, and the number of the calling line. The recording operator then makes out a ticket, tabulating this data, and through a ticket distributing mechanism sends the ticket to the toll switching operator who has trunks outgoing to the desired toll point. The calling subscriber then hangs up and waits for the establishment of the desired connection. As soon as the toll operator succeeds in getting the desired connection, the calling subscriber's line is selected and connected over the established toll connection to the desired line in the distant toll point.

This procedure requires the services of at least two operators, viz, the recording and the toll switching operators. In accordance with the present invention, it is proposed to enable the calling subscriber to remotely control the making of his own toll ticket and the dispatching of such ticket to the toll switching operator or to a clerk who will route the ticket to the proper operator. In this manner, the toll recording operators' positions are dispensed with, thus saving materially in the apparatus and the number of operators necessary.

It is, therefore, an object of the invention to provide an improved method for expediting the extension of toll connections from subscribers' lines in machine switching areas.

A further object of the invention resides in the provision of means for enabling a

calling subscriber to control the making and distribution of a toll ticket, whereby the services of a recording operator are dispensed with.

The objects of the invention are attained by the provision of a ticket printing mechanism common to a group of subscribers' lines which may be selected by a calling subscriber who desires a toll connection by dialing a predetermined number. The printing mechanism is arranged to print successive digits dialed by the calling subscriber, representing the number of the line desired, the name of the town or city in which the desired line is located, and the number of the line of the calling subscriber. Since calling dials now in general use in large machine switching areas have the finger-holds both numbered and lettered, the subscriber will first dial the office code letters and digits of the number of the line desired, then the letters of the name of the town or city, then the office code letters and digits of his own number; as, for example, 736 1234 6399675 62 1234.

In the illustration above given, 736 represents the office code PEN for the Pennsylvania office and 1234 the number of the line desired in that office; the next seven digits 6399675 represent the city of New York in which the desired line terminates, the several digits having alphabetical equivalents of the seven letters in New York; the next two digits 62, the office code MA for the main office in which the calling line is located; and 1234, the number of calling line in that office.

As soon as the calling subscriber has dialed the digits and the printing mechanism has printed them in succession on a movable tape, the calling subscriber restores his receiver and the printed portion of the tape is thereupon automatically severed and dispatched to the toll switching operator of the calling office, who then proceeds to establish the toll connection in the usual manner. By the provision of the printing and dispatching mechanism, the making of the toll ticket is placed under the control of the calling subscriber, and thereby the services of the recording operator are dispensed with.

It is thought that the invention will be best understood by reference to the following detailed description and the accompanying drawings, in which—

Fig. 1 shows a subscriber's line, and one of a chain of selector switches and a repeater by means of which the calling line may be extended to the printing mechanism of Fig. 2.

Fig. 2 shows an embodiment of a printing mechanism which may be selected and operated by a calling subscriber for printing the toll tickets.

Fig. 3 is a diagrammatic illustration of the circuits and apparatus involved in the practice of the applicant's improved method of handling toll service.

Fig. 4 discloses a detail of the mechanism, illustrating the arrangement of the type faces and the inking ribbon.

Referring to Fig. 3, the subscriber's line 100 is disclosed as having access to the selector switch 125 through a line finder 123. A repeater is designated by the rectangle 126 and a printing mechanism by the second rectangle 250. The toll operator's position is designated 300 and is connected to the printing mechanism by any suitable message carrier such as a tube system or belt conveyor. The toll trunk indicated at 301 extends from the originating exchange M to the toll point P, where it terminates before an operator who is enabled, by means of automatic switches 302, to extend the toll connection to the desired office and desired line of the toll point. To enable the toll operator to extend the toll connection to the calling line, selector switches 304 are disclosed which may be set from the operator's position in a well known manner.

The selector switches shown diagrammatically at 123, 125, 302 and 304 in Fig. 3, and in more detail at 125, Fig. 1, are of the well known step-by-step type and need no particular description herein.

It is believed that the invention will be best understood and particularly the operation of the printing device of Fig. 2, through a detailed consideration of the manner in which a calling subscriber may select and operate the printing device to record the data necessary for the use of the toll switching operator. For the purpose of this description, it will be assumed that the calling subscriber desires a toll connection to the line in the office and city above set forth.

To initiate a toll call, the calling subscriber 100 removes his receiver from the switchhook, establishing a circuit for the line finder (not shown) which, in the well known manner, extends the calling line to the first idle selector switch, such as 125, having access to trunks terminating in printing devices. Upon the seizure of the selector switch, a circuit is established over the line loop for the line relay 102, extending from battery through the left winding of this relay, the outer left back contact of

loop, returning through the inner left back contact of relay 105, the right winding of relay 102, the upper normally closed contacts of off-normal springs 103, to ground through the left winding of the tone coil 104. Relay 102 energizes in this circuit and establishes a circuit for the slow-to-release relay 106, extending from battery through the winding of relay 106, the front contact of relay 102, to ground at the inner right back contact of relay 105. Relay 106 at its left front contact prepares a circuit for the primary magnet 107 which is effective upon the first deenergization of line relay 102 in response to the first digit dialed by the calling subscriber. It will be assumed that to obtain connection with the printing mechanism, the subscriber dials the digit 0, thereby opening the circuit through his substation loop ten times, causing ten successive deenergizations of line relay 102.

Upon the first deenergization of relay 102, a circuit is established for the primary magnet 107, extending from battery through the winding of magnet 107, the winding of slow-to-release relay 108, the left front contact of relay 106, the back contact of relay 102, to ground at the inner right contact of relay 105. Upon the next energization of relay 102, the circuit just traced is opened and magnet 107 deenergizes, advancing the switch shaft one step. In response to successive deenergizations of line relay 102, magnet 107 advances the switch shaft until in response to the tenth deenergization of relay 102, the switch shaft is advanced to position its wipers 114, 115 and 116 opposite the uppermost or tenth level of the terminals in the switch bank.

As soon as the switch shaft advanced one step from its normal position, the off-normal contacts 109 were closed, and since relay 108 energized in series with primary magnet 107 and remained energized through the series of impulses, a circuit was established for relay 111 which may be traced from battery through the winding of relay 111, off-normal contacts 109, alternate contacts of relay 108, to ground at the right front contact of relay 106. Relay 111 upon energizing, locks independently of the contacts of relay 108 in a circuit extending from battery through the winding of relay 111, off-normal contacts 109, normally closed contacts of the secondary magnet 112, outer right contact of relay 111, to ground at the inner right contact of relay 105.

When the first series of impulses is terminated and relay 102 remains energized for a longer period, the slow-to-release relay 108 deenergizes, opening the initial energizing circuit of relay 111 and closing a circuit for the secondary magnet 112, which may be traced from battery through the winding of magnet 112, the inner right contact of

relay 111, the normal contacts of relay 108, to ground at the right contact of relay 106. Magnet 112 energizes in this circuit, opening the locking circuit of relay 111, which relay thereupon deenergizes, in turn opening the energizing circuit of magnet 112, advancing the switch shaft one step in a rotary direction.

If the first trunk terminating in a printing device is busy, ground potential will appear on the sleeve terminal of such trunk, and consequently relay 111 will again energize in a circuit extending from battery, through the winding of relay 111, off-normal contacts 109, normal contacts of magnet 112, outer right back contact of relay 105, test wiper 116, to ground on the sleeve terminal of the first trunk of the group. Relay 111 upon energizing, again closes the circuit of magnet 112 which, in the manner previously described, opens the circuit of relay 111, in turn opening the circuit of magnet 112. In this manner, relay 111 and magnet 112 cooperate with each other to advance the wipers 114, 115 and 116 of the selector switch 125 over terminals of the tenth level of the switch bank, so long as the test wiper 116 encounters busy ground potential upon the sleeve terminals of the trunks terminating in the tenth level.

When an idle trunk is encountered, which will have battery potential upon its test terminal, no circuit for the relay 111 is closed and further operation of the stepping magnet 112 is prevented. Relay 105, which during the hunting movement of the selector switch was shunted by ground potential on test terminals of busy trunks, now becomes energized in a circuit extending from battery through the winding of relay 111, off-normal contacts 109, normal contacts of secondary magnet 112, winding of relay 105, off-normal contacts 124, to ground at the right contact of relay 106. Relay 105 energizes in this circuit, but being of high resistance prevents the energization of relay 111. Relay 105 upon energizing, disconnects relay 102 from the calling line and extends the calling line over wipers 114 and 115 to the repeater circuit 126, which terminates in the printing mechanism 250 disclosed in Fig. 2.

Relay 102 upon deenergizing, opens the circuit of relay 106, which at its right contact opens the previously traced circuit for relay 105, but since relay 106 is slow-to-release, a holding circuit for relay 105 is established before the complete release of relay 106, which may be traced from battery, through the winding of relay 111, off-normal contacts 109, normal contacts of magnet 112, winding of relay 105, off-normal contacts 124, outer right front contact of relay 105, wiper 116, to ground at the outer right front contact of relay 118, relay 118 having ener-

gized in response to the energization of relay 117, the latter relay being energized over the wipers 114 and 115 of the selector switch 125 and over the calling subscriber's line loop as soon as the calling line was cut through to the repeater 126 through the energization of relay 105.

Relay 117 upon energizing over the subscriber's line loop in addition to closing the obvious circuit for relay 118, also closes at its left front contact one break in a loop circuit extending over conductors 121 and 122 through the winding of line relay 200 of the printing device 250. Relay 118 upon energizing, closes a second break in the loop over conductors 121 and 122. The circuit of relay 200 may be traced from battery through the winding of this relay, conductor 121, left contact of relay 117, right winding of relay 120, inner right contact of relay 118, conductor 122 to ground. Relay 200 energizes in this circuit preparing an obvious circuit for the slow to release relay 201, which in turn, closes a circuit for the slow-to-release relay 233.

A connection is now extended from the calling line to the printing device and the calling subscriber proceeds to dial the necessary digits to print the required information for the establishment of the desired toll connection. In accordance with the previous assumption, the calling subscriber first dials the digit 7 corresponding to the letter P of the office designation of the desired line. In response to the operation of the dial the relay 117 deenergizes intermittently opening at its left front contact the previously traced circuit for the line relay 200 of the printing device. Upon the first deenergization of relay 117 a circuit is closed for the slow-to-release relay 119 extending from battery through the winding of relay 119, the left contact of relay 118 to ground at the right back contact of relay 117. Relay 119, upon energizing, places a shunt around the right winding of relay 120 so that the pulsing circuit extending from the repeater to the printing device is free from resistance at the repeater, this pulsing circuit now extending from conductor 121, through the left contact of relay 117, the left front contact of relay 119, the inner right contact of relay 118 to conductor 122. Since relay 119 is slow to release this shunt circuit is maintained until the end of the series of impulses.

At the printing device 250 upon each deenergization of relay 200 with relay 201 energized, a circuit is established for the magnet 202 extending from battery through the winding of the magnet, the inner front contact of relay 201 to ground at the back contact of relay 200. Upon each energization of magnet 202, the pawl 231 cooperates with the rack 232 lifting the shaft 204 one step in a vertical direction.

As soon as the shaft advances one step, the brush 208 engages the lowermost of a series of contacts 209, momentarily establishing a circuit from battery through the winding of slow-to-operate relay 210, contact 209, brush 208 to ground through brush 234. Since, however, relay 210 is adjusted to be slow-to-operate, it does not receive sufficient current during the momentary contact of brush 208 with the first terminal 209 to cause it to attract its armature. In response to successive impulses and the consequent successive operations of magnet 202, the switch shaft advances, engaging brush 208 with successive contacts 209 until the shaft has been advanced seven steps in response to the seven impulses of the first series dialed by the calling subscriber. Upon the termination of the first series of seven impulses, relay 200 remains energized for a longer period permitting the brush 208 to rest upon a contact 209 for a sufficient interval to cause the energization of relay 210. The shaft is now maintained in its elevated position by a holding pawl 207 which engages the teeth of the rack 232.

Upon the energization of relay 210 a circuit is closed for the printing magnet 211 extending from ground at brush 234, brush 208, contact 209, the contact of relay 210, winding of printing magnet 211, the left back contact of relay 212 to battery. Magnet 211, upon energizing, attracts its armatures, the left-hand armature 215 operating to press the printing platen 216 against the tape 221, forcing the tape against the inking ribbon 217 and the particular type face such as 206 carried by the type block 205, which has been positioned opposite the platen 216 through the elevation of the shaft 204. It having been assumed that the first digit dialed was 7 and that the shaft 204 has therefore been raised seven steps, the type face bearing the numeral 7 will have been positioned opposite the platen 216 and will be impressed upon the tape 221 through the operation of the platen.

The armature 215 in addition to operating the printing platen, also operates the pawl 218 which engages back of a tooth of the ratchet wheel 219 which is attached to the tape feeding drum 220. Magnet 211 at its right armature and contact closes an obvious circuit for relay 212 which locks in a circuit extending through armature 240 the bell crank lever 213 to ground, this lever 213 having been released into contact with armature 240 through the upward movement of the shaft 204. Relay 212 is thus maintained energized until the shaft is again restored to its normal position as will be hereinafter described.

Relay 212 upon energizing opens the previously traced circuit for magnet 211 which thereupon deenergizes, opening the initial

energizing circuit of relay 212, withdrawing the platen 216 and through the pawl 218 advancing the drum 220 to advance the tape 221 in readiness for receiving the next impression. Relay 212 at its left front contact also closes an obvious circuit for the release magnet 214 which withdraws the holding pawl 207 and the stepping pawl 231 from the teeth of rack 232 thereby permitting the shaft 204 carrying the printing block 205 to restore to its normal position. As soon as the shaft 204 reaches its normal position, brush 208 disengages contact 209 releasing relay 210, and arm 213 is moved by the switch shaft to open the locking circuit of relay 212. Relay 212 thereupon deenergizes, opening the circuit of release magnet 214. Since relay 201 is at this time energized, remaining energized until the subscriber finishes dialing and restores his receiver to its switchhook, no circuit is effective for the slipping magnet 222. The printing mechanism is now conditioned for printing the second digit of the data to be recorded.

The second and succeeding digits dialed by the calling subscriber are received by the printing device 250 and printed upon the tape 221 in the manner above set forth, the printing device restoring to its normal condition after the printing of each digit. When the calling subscriber has dialed all of the digits for printing the data of the desired toll connection, he restores his receiver to the switchhook thereby opening the circuit of relay 117 which in turn opens the circuit of relay 118. The loop circuit extending over conductors 121 and 122 through the winding of relay 200 of the printing device is now opened, permitting the release of relay 200 and the release of slow-to-release relay 201. When relay 200 releases and before 201 has released, the circuit of stepping magnet 202 is closed and the shaft 204 is moved up one step. Thereupon, relay 210 operates, operating the magnet 211 which in turn operates relay 212. Relay 212, as described, operates the magnet 214 and the shaft is again released to normal. If, when the relay 201 releases, the shaft 204 is away from its normal position, relay 233 is held operated in a circuit closed through the off-normal contact 260. When, therefore, the shaft 204 is finally returned to its normal position and before relay 233 has had time to release, a circuit is established for the clipping magnet 222 which may be traced from battery through the outer right back contact of relay 201, front contact of relay 233, winding of magnet 222, contacts 223 closed in the normal position of shaft 204 to ground at brush 234. This circuit is maintained closed until relay 233 completely deenergizes, but for a sufficient interval to enable magnet 222 to attract its

armature and operate the clipper 224 for severing the tape 221. The severed portion of the tape 221 then falls by gravity into the chute 225 and is then distributed in any
5 desired manner to the toll switching operator's position.

Upon the release of relay 118 at the repeater 126 ground potential is removed at the outer right front contact of relay 118,
10 from the sleeve terminal of the repeater trunk and the holding circuit for relay 105 is thereupon opened and relay 105 deenergizes. A circuit is now closed from ground at the inner right back contact of relay 105,
15 the back contact of relay 102, the left back contact of relay 106, off normal contacts 110 to battery through the winding of release magnet 113. Magnet 113 energizes and in the well known manner causes the restoration of the selector switch 125. The other
20 apparatus employed by the calling subscriber in establishing a connection with the printing device is restored in the well-known manner.

When the toll switching operator at position 300 receives the severed tape bearing the printed numerals corresponding to the number of the wanted line, the name of the city in which the line is located and the
30 number of the calling line, she proceeds to obtain the assignment of a toll trunk 301 extending to the city in which the wanted line is located. When the operator in the distant city, having received from the toll
35 operator the number of the wanted line, has obtained connection with the desired line, for example, line 303, through the operation of selector switches 302, the toll operator at position 300 proceeds to call the calling
40 subscriber 100 by means of the selector switches 304. The established toll connection then extends from the calling line 100 through the switches 304, through the toll operator's position 300, over the toll trunk
45 301 and through the switches 302 at the distant toll point to the wanted subscriber's line 303.

What is claimed is:

1. In a telephone exchange system in
50 which connections are established between subscribers' lines by means of automatic switching mechanism, the method of handling calls initiated by subscribers for distant toll points which consists in automatically making a toll ticket under the remote
55 control of the calling subscriber and automatically removing the ticket from the point where it is made to a remote point where the desired call may receive attention.

2. In a telephone exchange system in which connections are established between
60 subscribers' lines by means of automatic switching mechanism, the method of handling calls initiated by subscribers for distant toll points which consists in automatically

making a toll ticket under the remote control of the calling subscriber, automatically removing the ticket from the point where it is made to a remote point where the desired
70 call may receive attention and thereafter establishing the desired toll connection from the calling line to the desired line in the toll point.

3. In a telephone exchange system in which connections are established between
75 subscribers' lines by means of automatic switching mechanism, the method of handling calls initiated by subscribers for distant toll points which consists in automatically printing a toll ticket under the remote
80 control of the calling subscriber listing the number of the line wanted, the town or city in which it is located and the number of the calling line, and automatically removing the ticket from the point where it is
85 printed to a remote point where the desired call may receive attention.

4. In a telephone exchange system in which connections are established between
90 subscribers' lines by means of automatic switching mechanism, the method of handling calls initiated by subscribers for distant toll points which consists in transmitting impulses from the calling line to extend
95 a connection to a toll ticketing point in the exchange, transmitting further impulses to control the automatic printing of the necessary data on a toll ticket to enable the extension of a desired toll connection, and dispatching the ticket to a point where the
100 desired connection may be established in accordance with the printed data.

5. In a telephone exchange system in which connections are established between
105 subscribers' lines by means of automatic switching mechanism, the method of handling calls initiated by subscribers for distant toll points which consists in transmitting impulses from the calling line to extend
110 a connection to a toll ticketing point in the exchange, transmitting further impulses to control the automatic printing of the necessary data on a toll ticket to enable the extension of a desired toll connection, dispatching the ticket to a point where the
115 desired connection may be established in accordance with the printed data, dismissing the connection between the ticketing point and the calling line whereby the apparatus involved therein is made available for the
120 use of other lines and thereafter establishing the desired toll connection from the calling line to the desired line in the toll point.

6. In a telephone exchange system, a calling line, a printing device, and selector
125 switches under the control of the calling line for selecting and associating said printing device with the calling line, said printing device having means for feeding a tape therethrough, means under the control of
130

the calling line for printing on said tape the data necessary for enabling the extension of desired connections from the calling line, and means for severing the printed portion of said tape and dispatching it to a point where it may receive attention.

7. In a telephone exchange system, a calling line, an impulse transmitter for said line, a printing device, and subscriber controlled means for extending a connection from said line to said device, said device having type faces, a printing platen, a paper feeding mechanism, means responsive to successive series of impulses transmitted by said transmitter for successively and selectively positioning said type faces before said platen, means operative upon the termination of each series of impulses to operate said platen to press the paper against the selected type face, means operative after each impression to restore said type faces to their normal position and to operate said paper feeding mechanism, and means operative upon the termination of all of said series of impulses for severing the printed portion of said paper and dispatching it to a point where it may receive attention.

8. In a telephone exchange system, a calling line, an impulse transmitter for said line, a printing device, and subscriber controlled means for extending a connection from said line to said device, said device having type faces, a printing platen, a paper feeding mechanism, means responsive to successive series of impulses transmitted from said line for successively and selectively positioning said type faces before said platen, means operative upon the termination of each series of impulses to operate said platen to press the paper against the selected type face, means operative after each impression to restore said type faces to normal position and to operate said paper feeding mechanism, and means operative upon the release of the established connection by the calling subscriber following the termination of all of said series of impulses for severing the printed portion of said paper and dispatching it to a point where it may receive attention.

9. In a telephone exchange system in which connections are established between subscribers' lines by means of automatic

switching mechanism, the method of handling calls initiated by subscribers for distant toll points which consists in automatically indicating to a toll operator the designations of both the calling and called lines.

10. In a telephone exchange system in which connections are established between subscribers' lines by means of automatic switching mechanism, the method of handling calls initiated by subscribers for distant toll points which consists in automatically printing a toll ticket under the remote control of the calling subscriber listing the number of the line wanted, the town or city in which it is located and the number of the calling line.

11. In a telephone exchange system in which connections are established between subscribers' lines by means of automatic switching mechanism, the method of handling calls initiated by subscribers for distant toll points which consists in automatically indicating to a toll operator the designation of the calling line, and the geographical location and designation of the called line.

12. In a telephone system, a calling line, an impulse transmitter therefor, a called line, a recording device, means controlled by said transmitter for extending the calling line to said recording device, means for establishing a connection between the calling line and called line, and means responsive to impulses sent from said transmitter for operating the recording device to prepare a permanent record for use in the establishment of said connection.

13. In a telephone system, a calling line, an impulse transmitter therefor, a called line, a recording device, means controlled by said transmitter for extending the calling line to said recording device, an operator's position, means controlled by the operator for establishing a connection between the calling line and called line, and means responsive to impulses sent from said transmitter for operating the recording device to prepare a printed record for the use of the operator in the establishment of said connection.

In witness whereof, I hereunto subscribe my name this 28th day of October A. D., 1924.

THURSTON M. HAMER.