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TELEPHONE SYSTEM

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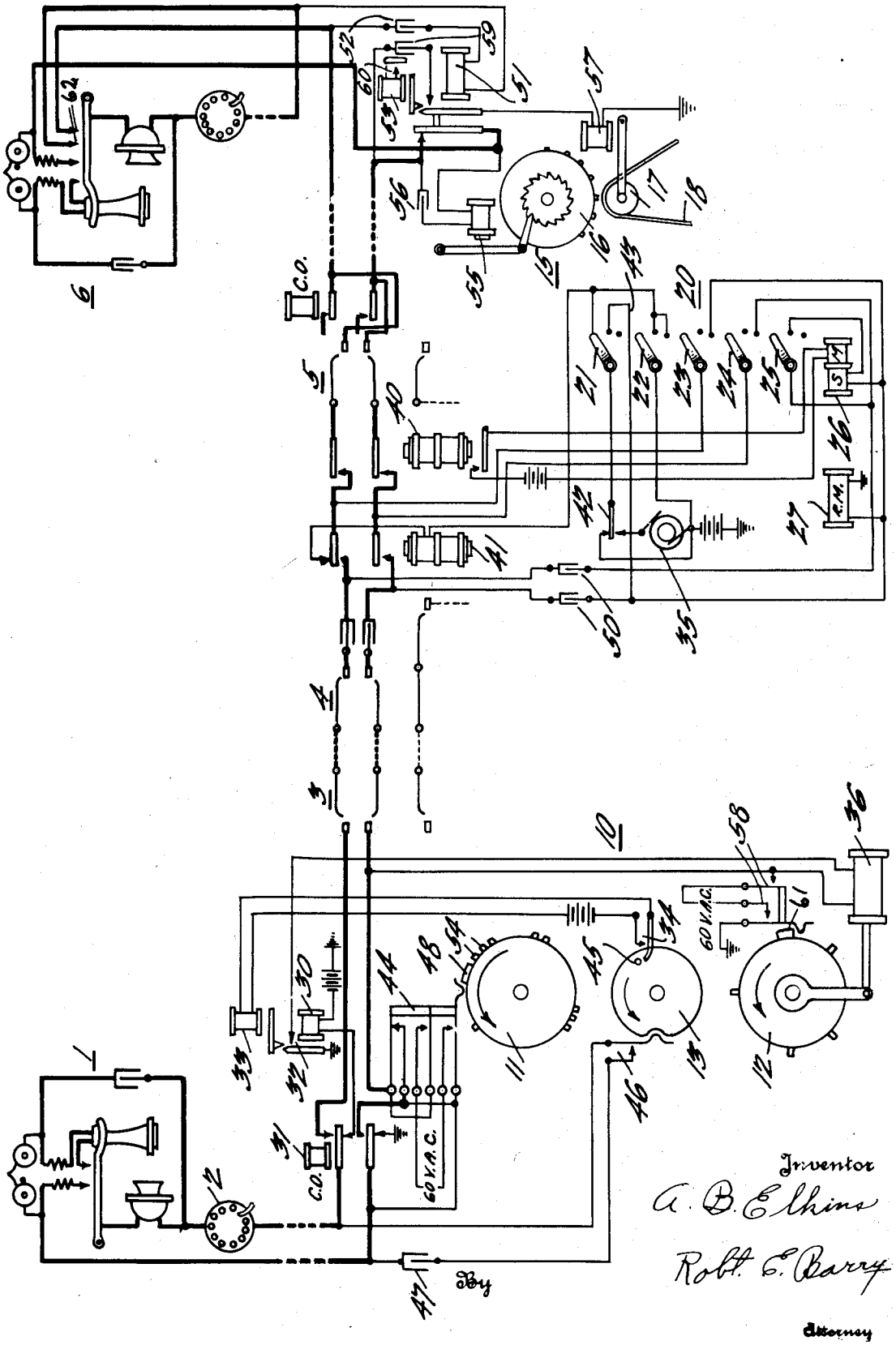

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TELEPHONE SYSTEM

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This invention relates to telephone systems and more particularly to systems of this character provided with means for indicating or recording the numbers of calling lines, preferably combined with the subscribers' substations or accessible to the called subscriber.

At present, a called subscriber who is absent when a call is initiated to his telephone has no means of knowing that he has been called or the number of the calling line. As a result, many calls are delayed and the calling subscriber usually repeats the call several times when he receives no answer, thus increasing the burden on the telephone exchange equipment and upon the operators in the case of a manual exchange.

The object of the present invention, in general terms, is to obviate these inconveniences for the subscribers and decrease the number of incomplete calls, while at the same time the revenue of the telephone company is increased by the rental charges for number recording apparatus supplied to the subscribers.

A further object of the invention is to provide, in a system of the above-indicated character, a controlling device individual to each calling line for actuating the number-recording apparatus of the called line, said controlling device being located in the exchange to decrease maintenance costs and being operated automatically as soon as a call has been extended to a called line. Obviously where the controlling device is located at the exchange, the invention is applicable to either manual, automatic or semi-automatic exchanges, whereas if the dial of the calling subscriber were utilized as the controlling device for the recorder, as has been proposed, the system would only be applicable to automatic exchanges where dials are provided at the subscriber's stations.

A still further object of the invention is to provide, in a system of the above-indicated character, an improved and simplified controlling device of the current-impulse type for actuating number-recording apparatus, for example, at the called subscriber's telephone, said controlling device being preferably initiated in operation over the talking circuit through the connecting apparatus at the exchange and operative to send impulses over the talking circuit to actuate the recording apparatus.

Other objects and advantages of my invention will appear from the following detailed description of a preferred embodiment thereof which is shown in the accompanying drawing.

The single figure of the drawing illustrates diagrammatically an embodiment of the invention in an automatic or machine-switching telephone exchange, certain elements of which are shown conventionally for the sake of clearness.

Referring to the drawing, 1 represents the substation of a calling line which includes a dial 2 whereby a subscriber after removing his receiver from the hook may extend a circuit through the line finder or line switch 3, selector switch 4 and connector or final selector switch 5 to a called substation 6. The talking circuit includes a pair of contacts of each of said switches and is shown in heavy lines. The current supply to the telephones at the respective substations and the operating and releasing means for the switches are of the usual character and are omitted from the drawing for the sake of clearness. Obviously, the switching apparatus forms no part of the present invention which may be applied to manual exchanges as well as to automatic or semi-automatic exchanges.

A current-impulse sending device 10 comprising two impulse plates 11 and 12, and a contact device 13 is provided in the exchange for each calling line. The impulse-sending device 10 may be arranged for example at the main distributing frame or adjacent the group of line switches 3 allotted to a group of calling lines. The operation of each impulse-sending device 10 is initiated over the talking circuit when connection is established with a called line, as will be explained hereinafter, and each device is arranged to send a distinctive series of impulses, corresponding to the designation of the calling line, over the talking circuit to actuate a recording device 15 associated with the called line to record the number of the calling line.

The recording device 15 is preferably located at the substation 6 or at some location where it is accessible to the called subscriber and may be of any known construction operative in response to current impulses to effect an indication or record of the impulses and consequently of the number of the calling line. As shown, the device 15 comprises a variably operable type wheel 16 and a movable tape wheel 17 for printing characters upon a tape 18 in accordance with the adjustment of the type wheel 16.

Associated with each connector switch or cord circuit 5 is a side-switch 20 comprising five switch members 21, 22, 23, 24 and 25 adapted to be actuated step-by-step over the associated contacts by a stepping magnet 26 and returned to normal by a release magnet 27. This side-switch is also of known construction and is shown diagrammatically.

In the process of completing a call from the substation 1, the switches 4 and 5 are controlled by the dial 2 to select the group of lines containing the called line and then the terminals of the called line in the usual manner. It will be understood that the line relay 30 and the cut-off relay 31 are energized upon removing the receiver from the hook at substation 1 to initiate the operation of the line switch 3 and close the talking circuit through the contacts of the last-mentioned relay. The operation of the cut-off relay 31 deenergizes the line relay 30 but the latter is provided with one set of contacts 32 which are latched in the closed position until the operation of an auxiliary relay 33 controlled by the contacts 34 of the contact device 13.

If the called line is busy, the connection is not completed but a busy tone is connected in circuit with the calling party's receiver in accordance with the usual practice by the busy-test apparatus. If the called line is idle, a ringing-current generator 35 is connected to the circuit which would normally result in ringing the bell at the called substation 6. In the system shown, however, the ringing current is diverted to energize a solenoid 36 to initiate the operation of the current-impulse transmitting device 10.

The control of the ringing current is effected by the side-switch 20 which may be operated in any desired manner. The ordinary connector switch embodies two relays 40 and 41, the former being energized when ringing current is to be applied to the circuit and the latter being responsive to the removal of the receiver from the switchhook at the called substation to cut off the ringing current and complete the talking circuit through the armatures and front contacts shown on the drawing. This is a well-known arrangement which has been in general use for many years and it is deemed unnecessary to illustrate the operating circuits for the relays 40 and 41. The operation of relay 40 closes a momentary circuit through its lower armature and front contact and the right-hand winding of the stepping-magnet 26 for stepping the side-switch contacts 21—25 to the second position.

Upon the operation of the ringing interrupter 42, the ringing current from generator 35 instead of being applied to the ringer at the called substation is utilized to energize the solenoid 36 through a circuit including the switch contact 21, conductor 43, lower conductor of the talking circuit, lower contacts of switches 4 and 3, winding of solenoid 36 and contacts 32 of line relay 30. The energization of solenoid 36 causes the impulse plates 11 and 12 and the contact device 13 of the impulse sending device 10 to make one complete revolution in, for example, 20 seconds. The energy of the solenoid may be stored up in a spring which is so connected to the impulse plates as to cause rotation thereof at a uniform speed. During such rotation, the impulse plates 11 and 12 transmit a series of impulses over the talking circuit to actuate the recorder 15 at the called substation, and at the completion of one revolution, the contacts 34 of the contact device 13 are actuated by a pin 45 to energize the magnet 33 to open the latched contacts 32 of the line relay 30. The contact device 13 is further provided with contacts 46 for shunting the circuit of the calling subscriber's telephone during the operation of the impulse-sending device, the shunt circuit including a condenser 47.

When the operation of the impulse-sending device 10 is initiated, the first projection 48 on the impulse plate 11, which is wider than the other projections, actuates the contact device 44 to send a current impulse from a source of 60-volt, alternating current for energizing the left-hand winding of the stepping magnet 26 to step the side-switch contacts 21—25 into the third position, the circuit of the said winding including the two lower pair of contacts of contact device 44, the talking-circuit conductors up to the contacts of relay 41, the condensers 50 and the side-switch contact 25. The operation of the side-switch contacts 21—25 into the third position breaks the described circuit of the stepping magnet 26 and the initiating circuit from the ringing generator, and closes shunt circuits around the contacts of relay 41 through the side-switch contacts 23 and 24 so that current impulses from the impulse plates 11 and 12 are transmitted over the talking circuit to the called substation to control the recorder 15.

The metallic circuit to the calling substation 1 is maintained closed during this period through the upper contacts of the contact device 44 except for the periods when the current impulses are superimposed upon the circuit. In this manner the premature re-

lease of the switching means for interconnecting the lines is prevented. Likewise, in the second and third positions of the side-switch 20, battery potential is maintained through the switch member 22 and upper winding and upper back contact of the relay 41 upon the upper conductor of the talking circuit extending to the called substation 6. Thus the same circuit conditions obtain as in prior systems which did not embody the recorder 15 and side-switch 20.

The projection 48 of the impulse plate 11 first energizes the relay 51 over a circuit including the talking circuit conductors through switches 3, 4 and 5, the condensers 50, side-switch contacts 23 and 24, left-hand back contact of relay 51 and condenser 52. The contacts of relay 51 are latched in the operated position until released by a magnet 53 actuated in any desired manner after the completion of the number-recording function of the recorder 15. After the relay 51 has operated, the subsequent current impulses from the projections 54 of the impulse plate 11 control the stepping magnet 55 of the recorder 15 in accordance with the first digit of the number of the calling line, the circuit of the magnet 53 including the condenser 56 and the circuit of the called substation 6. After the operation of the type wheel, the printing of the first digit upon the tape 18 and the restoration of the type wheel to normal is effected by the energization of the printing magnet 57 by the closure of the contacts 58 of the impulse plate 12, the circuit including the condenser 59 and the front contacts of relay 51. The remaining digits are printed in a similar manner under the alternate control of the impulse plates 11 and 12 until the entire number is printed whereupon the closure of contacts 34 energizes the magnet 33 to release the contacts 32 of relay 30 and prevent further energization of the solenoid 36.

Just prior to the closure of contacts 34, the last projection 61 on the impulse plate 12, which is wider than the other projections, actuates the contacts 58 to send a long current impulse for energizing the slow-operating release magnet 27 of the side-switch 20 which is connected in parallel with the printing magnet 57. Thus while printing the last digit or letter of the calling line number by the recorder 15, the release magnet 27 is actuated to restore the side-switch 20 to normal. Preferably the last series of current impulses sent corresponds to the letter forming a part of the designation of the calling line and by reason of the location of this letter upon the type wheel 16 outside of the group of numerical digits, the type wheel 16 may be arranged to actuate the release contacts 60 controlling the release magnet 53 to disconnect the recorder 15 from the circuit and re-close the ringing and talking circuit to the called substation 6.

The restoration of the side-switch 20 to normal, restores the circuits of the connector to normal and permits ringing current to be applied to the called substation through the switch contact 21 and upper winding and back contact of relay 41, which as described above is actuated when the called party removes his receiver from the switch-hook, thereby cutting off the ringing current and completing the talking circuit between the calling and called substations.

When the called party answers, the contacts 62 cooperating with the switch-hook short-circuits the recording apparatus to provide a clear circuit to improve the speech transmission. The calling substation 1 is also provided with such contacts if equipped with a recorder 15.

If the called party is absent, upon his return to the telephone, he notes the fact that one or more calls have been received and is able to call the parties who have been attempting to get in touch with him. It is therefore unnecessary for the calling parties to repeat their calls at intervals in order to get in touch with the called party as soon as he returns. It will be evident that the improved service rendered by a system embodying my invention will justify an increased rental charge to the subscribers who are supplied with recorders.

Other important features of my invention include the simple construction of the impulse-sending device 10 located at the exchange to reduce maintenance expense and automatically operated when a call is extended to an idle called line; and the use of a controlling device or side-switch 20 associated with each connector or cord circuit, so that a substantially smaller number is required than in a system requiring one for each line.

Various modifications of the invention will occur to those skilled in the art and are intended to be considered within the scope of the invention if within the terms of the appended claims.

I claim:

1. A telephone exchange system comprising calling and called lines, means for interconnecting said lines, a recorder associated with the substation telephone on each of said lines, means individual to each of said calling lines for automatically actuating the recorder associated with a called line in accordance with the designation of the calling line when a call has been extended to said called line and means in the exchange for operating said actuating means.

2. A telephone exchange system comprising calling and called lines, a recorder associated with each of said called lines, means for interconnecting said lines, automatic

means for ringing the called line and means including said ringing means for actuating the recorder associated with said called line in accordance with the designation of a calling line.

3. A telephone exchange system comprising calling and called lines, automatic switching means for interconnecting said lines, said means including means responsive to busy called lines for preventing connection to such lines, a recorder associated with each of said called lines, means for automatically actuating the recorder on an idle line in accordance with the designation of a calling line and means for rendering said actuating means inoperative if the called line is busy.

4. A telephone exchange system comprising calling and called lines, automatic switching means for interconnecting said lines, said means including a relay for applying ringing current to an idle called line, a recorder associated with each of said called lines and means including said relay for actuating said recorder in accordance with the designation of a calling line.

5. A telephone exchange system comprising calling and called lines, automatic switching means for interconnecting said lines, a recorder associated with the substation telephone on each of said called lines, an impulse-sending device associated with each calling line, each of said devices being arranged to produce a distinctive series of impulses, and means for operating the impulse-sending device on a calling line and for thereby actuating the recorder on a called line directly upon the completion of a connection between a calling line and a called line by said automatic switching means.

6. A telephone exchange system comprising calling and called lines, automatic switching means for inter-connecting said lines, a recorder associated with the substation telephone on each of said called lines, means including an impulse-sending device associated with each of said calling lines for controlling said recorders in accordance with the designation of the calling line connected through said switching means to a called line, means for temporarily diverting ringing current from the called line and means controlled thereby for operating said impulse-sending devices.

7. A telephone exchange system comprising calling and called lines, means for interconnecting said lines, means associated with each called line for automatically recording the designation of a calling line and means responsive to the completion of the connection between a calling and a called line for immediately initiating the operation of said automatic recording means.

8. A telephone exchange system comprising an exchange, calling and called lines terminating thereat, means for interconnecting said lines, a recorder associated with each of said called lines and means in said exchange individual to each of said calling lines for actuating said recorders in accordance with the designation of a calling line as soon as a call has been extended from said calling line to an idle called line, said means including two impulse plates, one provided with projections corresponding to the digits of the number of the calling line, contact devices associated with each of said plates and motor means for actuating the plates.

9. A telephone exchange system comprising calling and called lines, means for interconnecting said lines, a recorder associated with each of said called lines, means individual to each of said calling lines for actuating said recorders in accordance with the designation of a calling line and means for operating said actuating means as soon as a call has been extended from said calling line to a called line, said actuating means including two rotatable impulse plates secured together, one of said plates embodying contact means for adjusting said recorder in accordance with the digits of the number of the calling line, the other of said plates embodying contact means for actuating the recorder to effect a record of said digits in succession, and motor means for rotating said impulse plates.

10. A telephone exchange system comprising an exchange, calling and called lines terminating thereat, means for interconnecting said lines, a recorder associated with each of said called lines and means in said exchange individual to each of said calling lines for actuating said recorders in accordance with the designation of a calling line when a call has been extended from said calling line to a called line, said means including current-impulse transmitting means for sending current impulses over the talking circuit to control the recorder and means for shunting the circuit extending to the calling substation during the operation of the current-impulse transmitting means.

11. A telephone exchange system comprising calling and called lines, means for interconnecting said lines, a recorder associated with each of said called lines and means individual to each of said calling lines for actuating said recorders in accordance with the designation of a calling line when a call has been extended from said calling line to a called line, said means including current-impulse transmitting means and motor means for actuating the same, and means including a side-switch individual to each connector switch for initiating the operation of said motor means.

12. A telephone exchange system comprising an exchange, calling and called lines terminating thereat, means in said exchange for

interconnecting said lines, a recorder associated with one of said called lines, selectively operable controlling means in said exchange for actuating said recorder and means including a relay in said exchange for initiating the operation of said recorder when a calling line is connected to said called line.

13. A telephone exchange system comprising an exchange, calling and called lines terminating thereat, means in said exchange for interconnecting said lines, a recorder associated with one of said called lines, selectively operable controlling means in said exchange for actuating said recorder and means including a relay in said exchange for initiating the operation of said recorder as soon as a calling line is connected to said called line if said line is idle.

14. A telephone exchange system comprising an exchange, calling and called lines terminating thereat, means in said exchange for interconnecting said lines, means associated with a called line for automatically recording the designation of a calling line and means in said exchange individual to each calling line for controlling said recording means.

15. A telephone exchange system comprising an exchange, subscribers' lines terminating thereat, automatic switching means for selecting any one of said lines, an electrical recording device associated with one of said lines, controlling means in said exchange for variably operating said device and means responsive to the selection of said line by said automatic switching means for initiating the operation of said controlling means.

16. A telephone exchange system comprising an exchange, subscribers' lines terminating thereat, automatic switching means for selecting any one of said lines, an electrical recording device associated with one of said lines, a current-impulse sending device in said exchange for controlling said recording device and means for rendering the sending device operative to control said recording device as soon as said line is selected by said switching means.

17. A telephone exchange system comprising an exchange, subscribers' lines terminating thereat, automatic switching means for selecting any one of said lines, an electrical printing device associated with one of said lines, a current-impulse sending device in said exchange for controlling said printing device and means for rendering the sending device operative to control said printing device as soon as said line is selected by said switching means.

18. A telephone exchange system comprising an exchange, calling and called lines terminating in said exchange, means including a line-finder switch individual to each calling line for interconnecting said lines, a recorder associated with each called line and controlling means for said recorders individual to each calling line and associated with the line-finder switches.

In testimony whereof, I hereto affix my signature.

ARTHUR B. ELKINS.