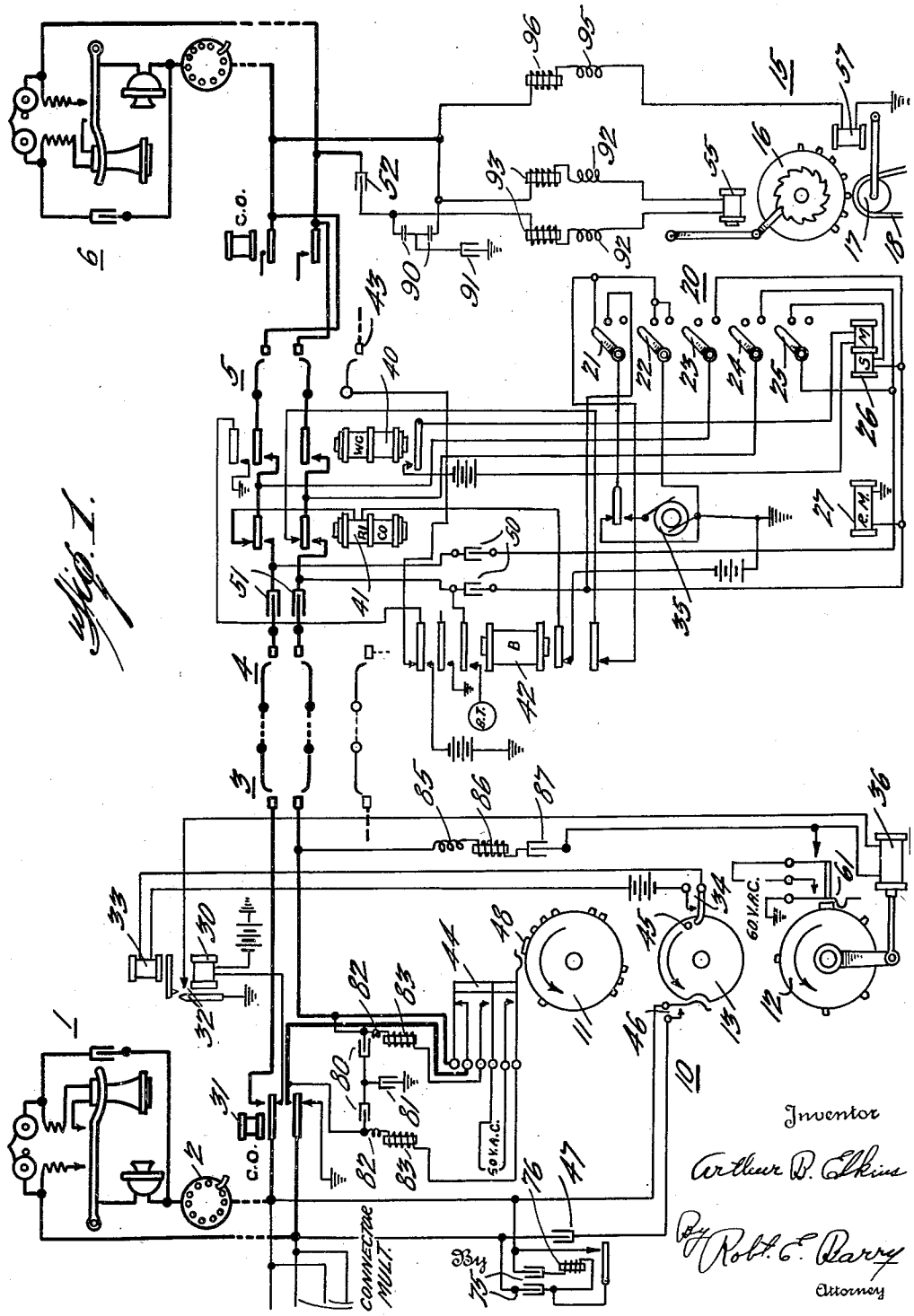
June 27, 1933. A. B. ELKINS 1,915,413

TELEPHONE SYSTEM

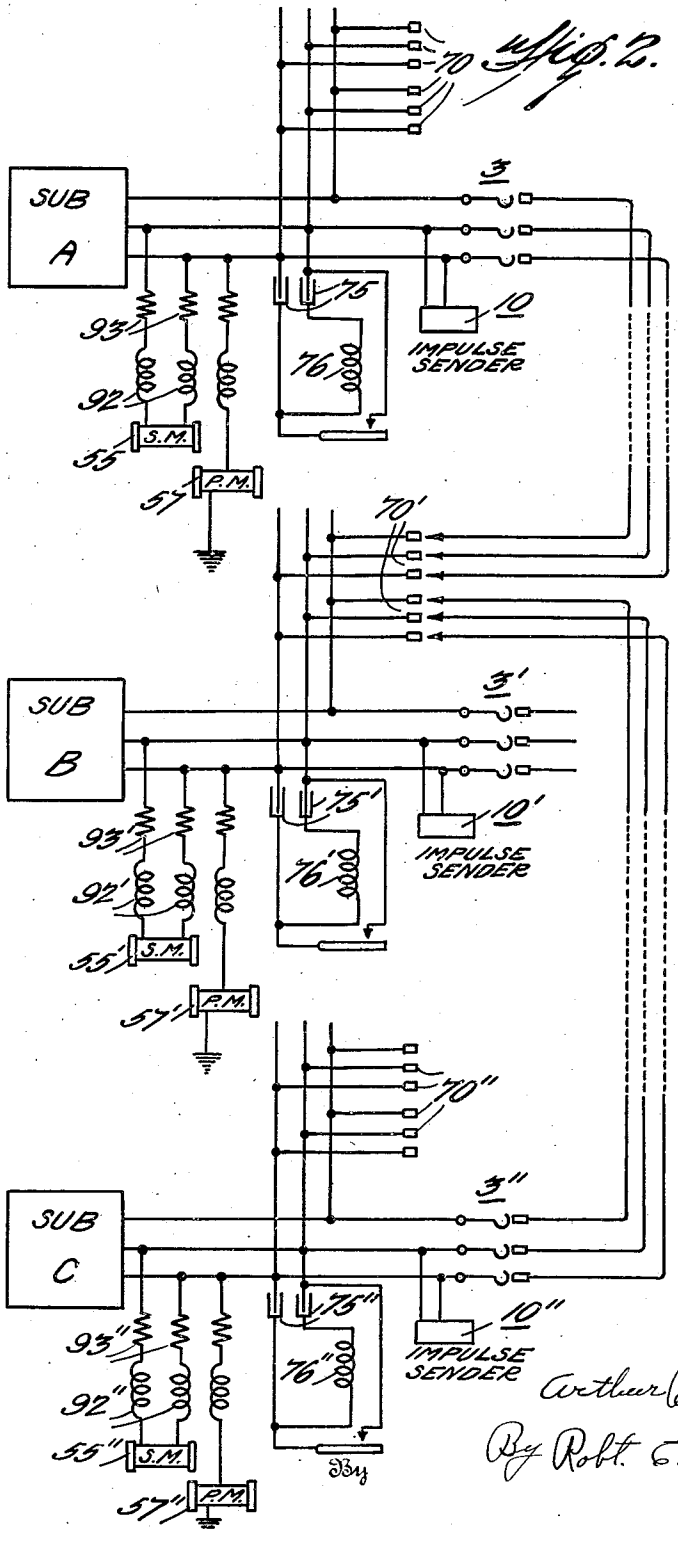
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TELEPHONE SYSTEM

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UNITED STATES PATENT OFFICE

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TELEPHONE SYSTEM

Application filed March 8, 1932. Serial No. 597,553.

This invention relates to telephone systems and more particularly to systems of this character provided with remote-controlled printing, recording or similar apparatus at the subscriber's stations, such for example as means for indicating or recording the numbers of calling lines for the benefit of a called subscriber who is absent when a call is received, or whose line is already busy.

The system disclosed and claimed herein is an improvement on that disclosed and claimed in my copending application, Serial No. 570,738, filed October 23, 1931.

One important application of the invention is for recording the numbers of calling lines, and for the purpose of explaining the invention, such a system will be described herein although obviously the invention is not limited to this particular application. At present, a called subscriber who is absent when a call is initiated to his telephone, or who is using the telephone at such time, 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 or the busy signal, thus wasting time and effort, and increasing the burden on the telephone exchange equipment.

In my prior application referred to above, I have disclosed a system adapted to automatically record the number of the calling line at the called subscriber's substation when no one is present to answer a call, so that the called subscriber may subsequently initiate a call to the calling subscriber upon his return to the telephone. One object of the present invention, in general terms, is to provide an improved system in which the number of a calling line may be recorded while the called line is busy, as well as when the called party does not answer. Since the printing or recording apparatus does not interfere with the use of the telephone at the associated substation, the apparatus may be utilized for other purposes, as will be pointed out hereinafter, which may be entirely independent of the ordinary functions of the telephone equipment.

A further object of the invention is to provide a system embodying means for controlling apparatus at a subscriber's substation while the substation is in use over a phantom circuit superimposed upon the talking circuit without interfering with telephonic communication therefrom.

A further object of the invention is to provide, in a system of the above-indicated character, means associated with a portion of a subscriber's circuit, individual to said subscriber's line, for controlling the flow of current in the circuit whereby when two substations are connected together during a call, apparatus at one of said substations may be operated in case of a call from a third line or telephone without operating the apparatus at the other substation.

A further object of the invention is to provide, in a system of the above-indicated character, means for rendering the busy-test apparatus non-effective except to prevent the closing of a talking circuit to the calling line in case the called line is busy and also to provide impedance and phantom coils in connection with the impulse-sender and recorder in order to create a phantom circuit over which the recorder may be selectively operated without interfering with the use of the telephone at the called or selected substation.

Other objects and advantages of my invention will appear from the following detailed description of the invention, an embodiment of which is shown in the accompanying drawings, wherein

Fig. 1 is a diagrammatic view of an automatic telephone exchange system embodying the invention; and

Fig. 2 is a diagrammatic view illustrating the manner in which recording apparatus at one substation may be operated when said substation is already connected to another subscriber, the controlling apparatus being omitted for the sake of clearness.

Referring to Fig. 1, 1 represents the substation of a calling line which includes a dial 2 for controlling selector switches 4 and 5 to extend a call in the usual manner to a called substation 6, the line finder or line

switch 3 being operated automatically to extend the circuit to selector switch 4 upon the removal of the receiver from the switch-hook at substation 1, as in prior automatic exchanges. The talking circuit includes a pair of contacts of each of the switches 3, 4 and 5, 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 drawings for the sake of simplicity. 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 suitable current-impulse or control device is provided at the exchange. When the invention is utilized for recording the numbers of calling lines, 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 whether the called line is idle or busy. Each impulse-sending device 10 is arranged to send a distinctive series of impulses corresponding to the designation of the calling line, said impulses being operative to actuate a recording device 15 associated with the called line to record the number of the calling line.

If the called line is busy, the telephone at the called substation is not affected by the impulse-sending device and the flow of current in the circuit is so controlled that while the recorder on the called line is operated, the recorder of the other line connected thereto is not operated. This is an important feature of the invention, because heretofore it has not been possible to operate recording apparatus at the called substation when the telephone at said substation was in use.

The foregoing brief summary of the operation will serve to differentiate the present system from the system disclosed in my prior application, where the recorder on a called line is only operated when the line is idle. In addition, the selective control of apparatus at a subscriber's station in accordance with the invention is particularly adapted to many other uses as it is unnecessary to determine that the telephone is not in use before the operation is initiated.

The recording device 15 associated with each called line 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 which responds to current impulses to effect an indication and record of the impulses and consequently the number of the calling line or other records or information which the system is designed to transmit. 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 substation 1, the switches 4 and 5 are controlled by the dial 2 to select the group of lines containing the called line and 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 switch-hook at the substation 1 and initiate the operation of the line switch 3. The talking circuit is closed through the contacts of the cut-off relay 31 as indicated. The operation of the cut-off relay 31 energizes the line relay 30 in the usual manner, but the relay 30 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.

Until the switch wipers of the connector 5 have selected the terminals of the called line 6, the operation of the connector is normal and requires no detailed description. The connector includes certain control relays as well understood by those skilled in the art, the only relays which are affected by the application of the present invention to the exchange shown being the wiper-closing relay 40, the ringing cut-off relay 41 and the busy relay 42. The operation of these relays is modified first, to initiate the operation of the impulse-sender 10 when connection is made to the called line, and second, to permit the operation to proceed normally even if the called line is busy as a phantom circuit is employed which permits control of the number recorder 15 without interfering with telephonic communication over the talking circuit from the exchange to the called substation 6.

In case the called line is not busy, the wiper-closing relay 40 is energized as usual and closes through its lower armature and front contact a momentary circuit for energizing the right-hand winding of the stepping magnet 26 of the side switch 20, thereby causing the switch members 21—25 to move into engagement with their second con-

tacts. A circuit is now closed from the ringing generator 35 through the switch member 21, left-hand condenser 50, lower conductor of the talking circuit, choke coil 85, inductance 86, condenser 87 and winding of solenoid 36 to ground at the contacts 32 of latched relay 30. The solenoid 36 is energized and causes one complete revolution at a slow and uniform speed of rotation of the plates 11, 12 and 13 of the impulse-sender 10.

In case the called line is busy, the operation of the connector is not interfered with and the impulse-sender is initiated in operation as if the line had been idle, except that the operation of the busy relay 42 closes a circuit from the busy-tone generator BT to the telephone at the calling substation 1 while the solenoid 36 of the impulse-sender is energized as before, and the busy relay 42 further closes an energizing circuit for the wiper-closing relay 40 and opens the circuit of the ringing cut-off relay 41. Therefore the talking circuit is maintained open at the contacts of the ringing cut-off relay 41 so that the substation 1 is not placed in communication with the busy line, which is already connected to a third line. The energization of the busy relay 42 results as usual from the presence of ground potential on the test contact 43 corresponding to the terminals of the called line when said contact is engaged by the private wiper of the connector switch. While only one connector is shown, it is understood that groups of connector switches in multiple are employed, the test contacts being connected in multiple and grounded as soon as a line is seized by one connector through the circuit shown including the uppermost contacts of relays 40 and 42. It is to be further noted that the operation of the busy relay 42 also prevents the application of ringing current to the busy called line, as the ringing-current circuit includes the second armature and back contact of this relay.

From the foregoing, it will be apparent that the operation of the impulse-sender 10 is initiated as soon as connection is made to the called line whether said line is idle or busy. Thereupon the number recorder 15 is selectively operated by the impulse-sender to record the number of the calling line without interfering with telephonic communication over the talking circuit extending to said called line in accordance with the invention, first, by the use of a phantom or balanced circuit superimposed upon the talking circuit and, second, by the provision of a short-circuiting arrangement comprising condensers 75 and a relay 76 having contacts bridging said condensers, said short-circuiting arrangement being connected to each line of the exchange between the multiple connector contacts and the contacts of the line finder 3 individual to each line. The necessity for the elements 75, 76 arises from the requirement that the controlling impulses from the impulse-sender 10 should only affect the recorder 15 associated with the called line.

The relay 76 is responsive to alternating current although not affected by the voice currents traversing the circuit, and when the relay becomes energized, the talking circuit is short-circuited at that point. The arrangement has been found extremely effective for the described purpose without materially affecting the efficiency of the circuit for speech transmission and, although it is not new, it is thought that the provision of such an arrangement at a point in the circuit which is not traversed by alternating current during normal operation of the telephone equipment is original and this is an important feature of the present invention. It should be noted that the ringing current does not traverse the point in the circuit where the relay 76 is connected.

The phantom or superimposed control circuit includes bridging condensers 80, a grounded condenser 81, choke coils 82 and phantom or balancing coils 83 in series with each of the control circuits at the impulse-sender. The circuit of the motor magnet 55 of the recorder 15 likewise includes similar condensers 90 and 91, choke coils 92 and balancing coils 93 so arranged that when alternating current is applied to the circuit by the contacts 44 of the impulse-sender, the magnet 55 becomes energized while the telephone at the called substation 6 is not affected by such current. The circuit between the impulse-sender and the recorder includes the lowermost contacts of the contact set 44, balancing coil 83, choke coil 82, the lower armature and front contact of cut-off relay 31, condenser 47, contacts 46, the upper armature and front contact of cut-off relay 31, the upper contacts of switches 3 and 4, upper condenser 51, right-hand condenser 50, switch arm 24 of side-switch 20, third upper armature and front contact of relay 40, lower contact of switch 5, condenser 52, balancing coils 93, choke coils 92, magnet 55, upper contact of switch 5, second upper armature and front contact of relay 40, switch arm 23 of side-switch 20, left-hand condenser 50, lower condenser 51, lower contacts of switches 4 and 3, right-hand choke coil 82 and right-hand balancing coil 83, the side-switch 20 having been actuated to the third position by the first long contact 48 of the impulse plate 11 over a circuit including the condensers 51 and 50, the left-hand winding of the stepping magnet 26 and the switch-arm 25 of the side-switch.

In the embodiment shown on the drawing, the impulse sender 10 comprises the plates 11, 12 and 13 mounted to rotate together when the solenoid 36 is energized.

The impulse plate 11 is provided with a plurality of groups of lugs or projections corresponding to the successive digits or letters of the designation of the calling line 1, and between each of said groups of projections, a projection on the impulse plate 12 is adapted to actuate the contacts 61, thereby operating the printing magnet 57. The circuit of the printing magnet 57 includes the contacts 61, condenser 87, balancing coil 86, choke coil 85, the talking-circuit conductors, switch-arm 23 of the side-switch 20, balancing coil 96 and choke coil 95. At the end of the cycle of operation of the impulse-sender 10, the projection or cam 45 closes the contacts 34 to open the contacts 32 and clear the solenoid 36 from the circuit.

While a specific type of impulse-sender and recorder have been shown and described by way of example, any known or suitable selectively controlled printing, indicating or recording apparatus at the subscriber's station and any known or suitable apparatus at the exchange for controlling the same may be used. For example, code impulses of variable length may be utilized or radio-frequency or carrier currents may be superimposed on the circuit for controlling the mechanism at the subscriber's station, and so far as applicant is aware, no practical method of applying such systems to the control of a printer or recorder has been known or used because of the difficulty of limiting the flow of current to the desired portion of the circuit where two or more substations may be connected together at the same time through the exchange. Obviously any selectively controlled mechanism, such as a teletypewriter, may be substituted for the number recorder 15 if control mechanism therefor is provided at the exchange.

Fig. 2 is a diagram illustrating the method of controlling the flow of current in the circuit, whereby the recorder at a called substation is operated without affecting either the recorder at the calling substation or the recorder of the third substation if the called party is already connected to another line. It is assumed that substations A and B are interconnected in the usual manner through the line finder 3 individual to substation A and one of the sets of contacts in the connector switch multiple 70′ corresponding to the designation of substation B.

If substation C initiates a call to substation B, the circuit is completed in the usual manner through the line switch 3″ and another set of contacts in the connector switch multiple 70′. Upon the operation of the impulse-sender 10″ of substation C, the stepping magnet 55′ and printing magnet 57′ of substation B will be controlled as described above to record at substation B the number of the calling line extending to substation C. The current impulses from the impulse-sender 10″ are prevented from affecting the recorder at substation A which is connected to substation B because of the relay 76 which is operated by such impulses to place a condenser short-circuit across the conductors extending to the stepping magnet 55 and printing magnet 57 of said recorder. On the other hand if the party at substation C had called substation A, the connection would have been established through the contacts 70 of the connector switch multiple corresponding to said line and the relay 76′ associated with substation B would be operated to prevent the impulse-sender 10″ for actuating the recorder at substation B.

The system shown and described herein may be modified, as has been pointed out above, without departing from the scope of the invention, the disclosure being merely for the purpose of illustrating the invention, and such modifications as come within the scope of the appended claims are to be considered within the scope of the invention.

I claim:

1. A telephone exchange system comprising calling and called lines, switching means for interconnecting said lines, a recorder associated with the substation telephone on each of said called lines, a controlling device associated with each calling line and means including one of said controlling devices for actuating a recorder on a busy called line in accordance with the designation of the calling line individual to said one of said controlling devices.

2. A telephone exchange system comprising calling and called lines, automatic switching means for interconnecting said lines, a recorder associated with each of said called lines, means for controlling said recorders to effect a record of the number of a calling line, said means being operative whether the respective called lines are idle or busy, and means for initiating the operation of said controlling means automatically when a call is extended to one of said called lines.

3. A telephone exchange system comprising an exchange, calling and called lines, means in said exchange for interconnecting said lines, an electrical printing device associated with each of said called lines and means for selectively operating each of said printing devices from said exchange, said last-mentioned means being operable whether the associated line is idle or busy.

4. A telephone exchange system comprising an exchange, calling and called lines terminating in said exchange, means in said exchange for interconnecting said lines, an electrical printing device associated with each of said lines and means for selectively operating each of said printing devices from said exchange without interfering with telephonic

communication between the associated line and another of said lines.

5. A telephone exchange system comprising an exchange, calling and called lines terminating in said exchange, means in said exchange for interconnecting said lines, an electrical printing device associated with each of said lines and electrically connected thereto and means for selectively operating said printing devices over the talking circuits from the exchange without interfering with telephonic communication over said circuits.

6. A telephone exchange system comprising an exchange, calling and called lines terminating in said exchange, means in said exchange for interconnectig said lines, a number recorder associated with each of said called lines and electrically connected thereto and means for actuating said recorders over the talking circuits from the exchange in accordance with the designation of a calling line without interfering with telephonic communication over said circuits.

7. A telephone exchange system comprising an exchange, calling and called lines terminating in said exchange, a subscriber's substation on each of said lines, means in said exchange for interconnecting said lines for telephonic communication between said substations, selectively operable mechanism associated with each of said substations and means for actuating said mechanism from the exchange over a phantom circuit superimposed upon the lines extending from the exchange to each of said substations.

8. A telephone exchange system comprising an exchange, calling and called lines terminating in said exchange, a subscriber's substation on each of said lines, means in said exchange for interconnecting said lines for telephonic communication between said substations, a number recorder associated with each of said substations and means for actuating said recorders from the exchange over a phantom circuit superimposed upon the lines extending from the exchange to each of said substations in accordance with the designation of a calling line.

9. A telephone exchange system comprising an exchange, calling and called lines terminating in said exchange, a subscriber's substation on each of said lines, means in said exchange for interconnecting said lines for telephonic communication between said substations, a number recorder associated with each of said substations and automatic means operative as soon as a call is extended to a substation on a called line for actuating the recorder associated with said substation over a phantom circuit superimposed upon the line extending thereto in accordance with the designation of the calling line.

10. A telephone exchange system comprising an exchange, calling and called lines terminating in said exchange, a subscriber's substation on each of said lines, means in said exchange for interconnecting said lines for telephonic communication between said substations, a number recorder associated with each of said substations and automatic means operative as soon as a call is extended to a substation on a called line for actuating the recorder associated with said substation in accordance with the designation of the calling line irrespective of the busy or idle condition of the called line.

11. A telephone exchange system comprising an exchange, calling and called lines terminating in said exchange, a subscriber's substation on each of said lines, means in said exchange for interconnecting said lines for telephonic communication between said substations, a number recorder associated with each of said substations, an impulse-sending device individual to each calling line and means including said device for actuating said recorder over a phantom circuit superimposed upon the lines extending from the exchange to each of said substations as soon as connection is made to a called line.

12. A telephone exchange system comprising an exchange, calling and called lines terminating in said exchange, a subscriber's substation on each of said lines, means including a line finder switch having a contact individual to each calling line for interconnecting said lines, a number recorder associated with each of said substations, an impulse-sending device individual to each calling line and associated with the line finder switch thereof, said device being arranged to send a series of current impulses corresponding to the designation of the corresponding calling line, and means including said device for actuating said recorder from the exchange over a phantom circuit superimposed upon the lines extending from the exchange to each of said substations in accordance with the designation of the calling line.

13. A telephone exchange system comprising an exchange, calling and called lines terminating in said exchange, means in said exchange for interconnecting said lines, selectively operable mechanism associated with each line, control means for said mechanism for electrically operating said mechanism from the exchange and means associated with each of said lines for controlling the flow of current in the system whereby only the mechanism associated with a selected line is operated by the controlling means if the last-mentioned line is already connected in the exchange to another line.

14. A telephone exchange system comprising an exchange, calling and called lines terminating in said exchange, subscriber's substations on said lines, means in said exchange for interconnecting said lines, said means including a line finder switch having contacts individual to each line and connector switches

having multiple contacts constituting terminals of said lines, selectively operable mechanism associated with each of said substations, means for supplying alternating current to said lines to control said mechanism from the exchange and means for short-circuiting each line to alternating currents between the connector switch contacts and the line finder switch contacts.

15. A telephone exchange system comprising an exchange, calling and called lines terminating in said exchange, means in said exchange for interconnecting said lines, means for supplying alternating current to said lines, means on said lines for printing or recording information responsive to said alternating current and means associated with said lines for balancing the circuit with reference to said alternating currents, so that the telephones on said lines are not affected thereby.

16. A telephone exchange system comprising an exchange, calling and called lines terminating in said exchange, subscriber's substations on said lines, means in said exchange for interconnecting said lines, a ringing generator in said exchange for signalling a subscriber on an idle called line, recording mechanism associated with said substations, control means for said mechanism, means including said ringing generator for initiating the operation of said control means and means for connecting said generator to the system when connection is made to a called line whether idle or busy.

In testimony whereof, I hereto affix my signature.

ARTHUR B. ELKINS.