

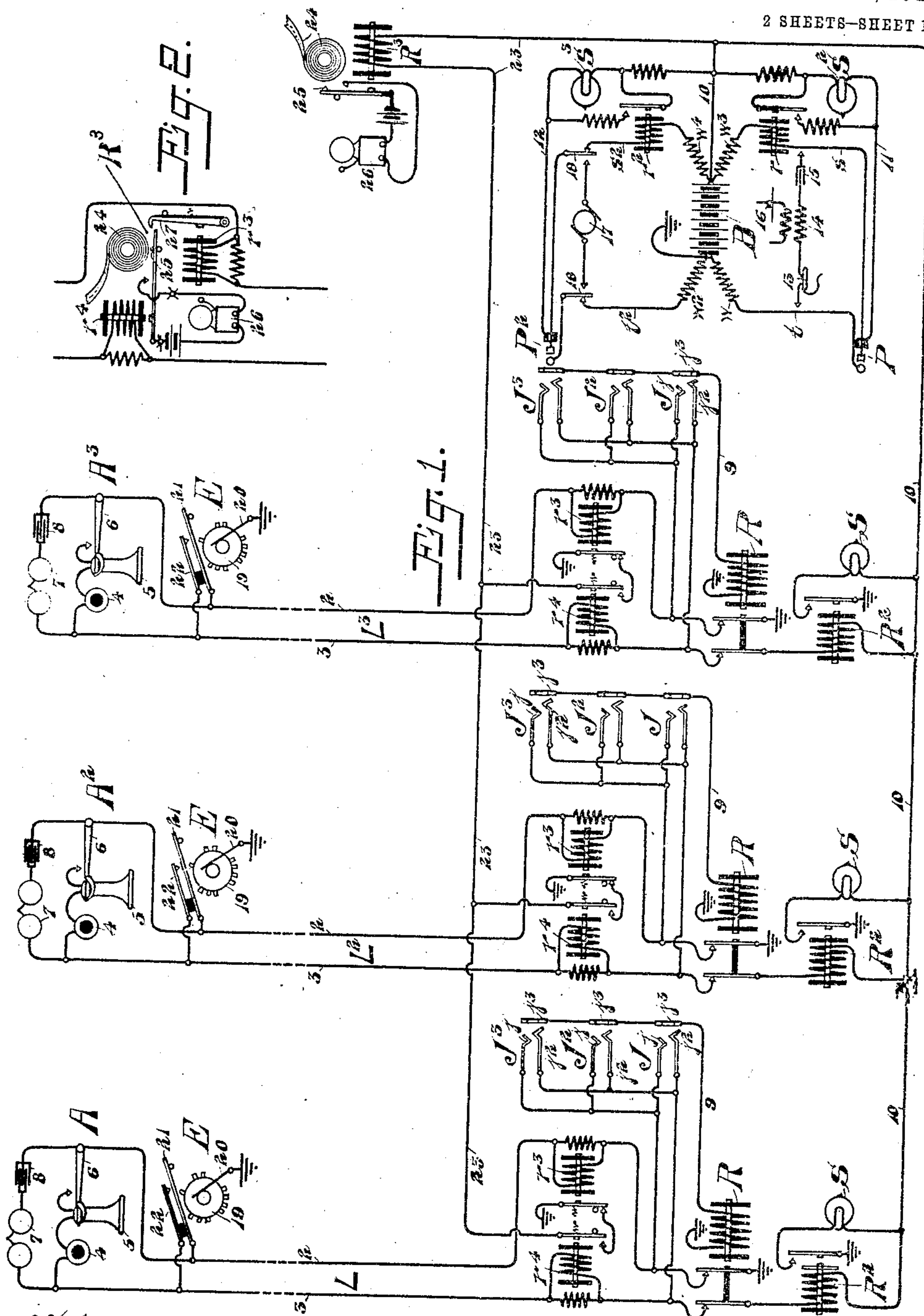
COMBINED TELEPHONE AND ALARM OR KINDRED SERVICE SYSTEM.

APPLICATION FILED APR. 30, 1903.

Patented Dec. 13, 1910.

2 SHEETS—SHEET 1.

978,709.



Witnesses.

R. H. Burdick

A. E. Barker

Inventor:-

William W. Dean

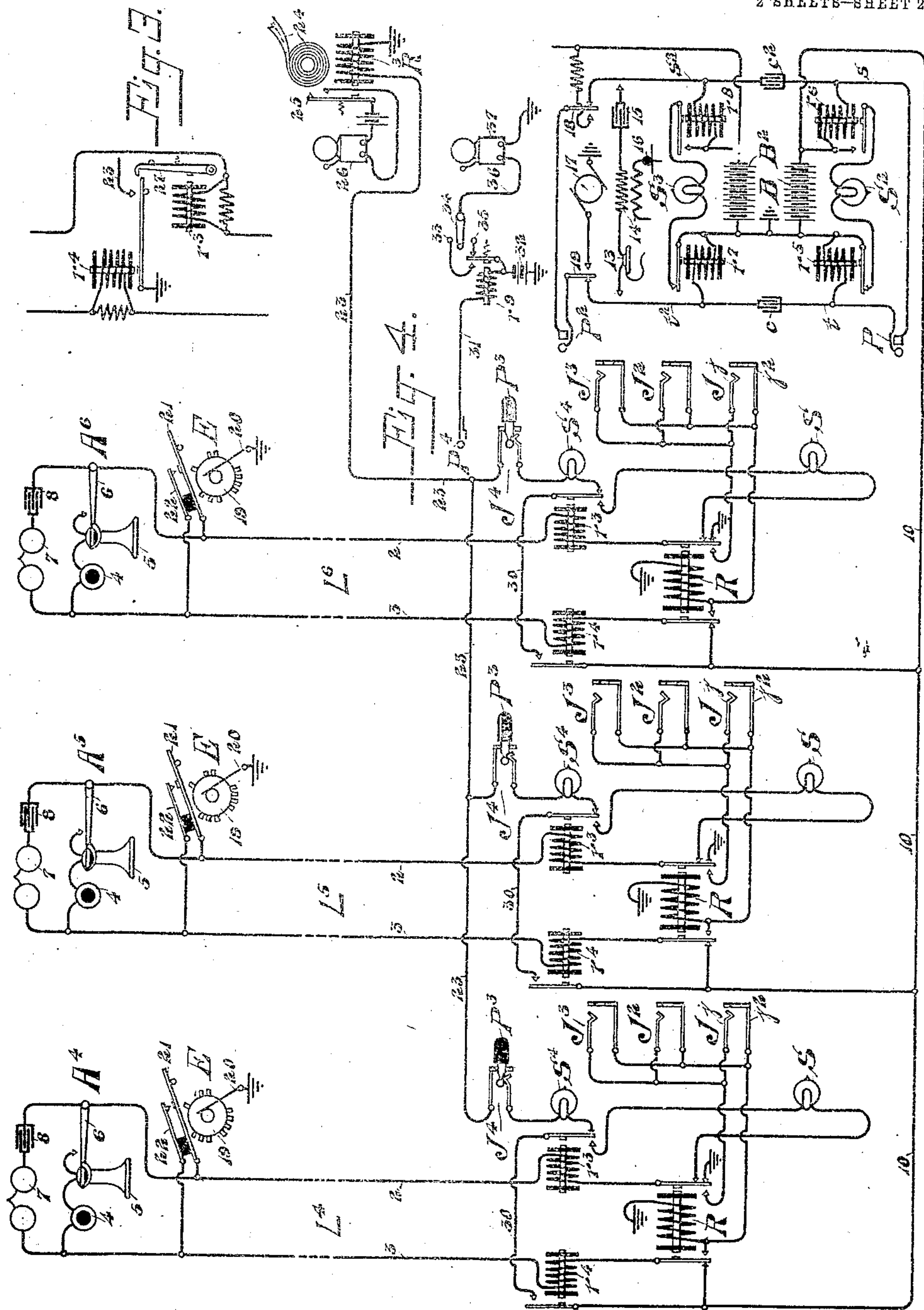
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Attorney.

W. W. DEAN.
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2 SHEETS—SHEET 2.



Witnesses.

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UNITED STATES PATENT OFFICE.

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COMBINED TELEPHONE AND ALARM OR KINDRED SERVICE SYSTEM.

978,709.

Specification of Letters Patent. Patented Dec. 13, 1910.

Application filed April 30, 1903. Serial No. 154,956.

To all whom it may concern:

Be it known that I, WILLIAM W. DEAN, a citizen of the United States of America, and resident of Chicago, county of Cook, and State of Illinois, have invented a certain new and useful Improvement in Combined Telephone and Alarm or Kindred Service Systems, of which the following is a specification.

My invention relates to improvements in combined telephone exchange and alarm or kindred service systems, and has for its objects, generally speaking, the provision of means whereby an alarm or kindred service system may be conveniently engrafted upon a modern telephone exchange system without hindrance to the latter in the performance of its accustomed functions. The successful carrying out of such a result is of importance since it gives an added earning capacity to the telephone plant without any or at least only a slight increased expense for the auxiliary instruments. This auxiliary use of the telephone lines and apparatus forms one of the most important "by-products" of the telephone business.

In my invention, I provide a magnet in each side of the metallic telephone lines, an alarm receiving apparatus to respond to the incoming alarm or kindred signal, and means controlled by said magnets to prevent the operation of the said apparatus when normal telephonic currents are present on the lines. In some cases this receiver may be merely an individual signal, a register, or both, and in any event is such as the particular type of auxiliary service demands. I also provide an efficient form of trouble test for the alarm system whereby trouble on any of the lines will be manifested by suitable signals and may be at once isolated from the remainder of the system to not disturb the same and is then attended to in due course. The use of the common central source of current for both telephonic purposes and alarm signal purposes is also of value since a separate power plant is avoided. In one form of my invention I also make use of the line relay of the telephone line for one of the alarm signal controlling magnets.

Other features and advantages of my invention will appear from the detailed description and the claims, reference being had

to the accompanying drawings in which the same reference characters designate like parts throughout the several views and in which—

Figure 1 is a diagram showing one form of my invention; Fig. 2 is a view showing a slightly different arrangement; Fig. 3 is a modification of the device of Fig. 2, and Fig. 4 is a diagram of a further modification.

Referring to Fig. 1, L , L^2 and L^3 designate subscribers' telephone lines extending in two limbs 2 and 3 from their respective substations A , A^2 and A^3 to the central office. At the substations any usual or desired telephone apparatus may be employed, but preferably such as is adapted for use in connection with a central common source of current. The apparatus shown comprises a transmitter 4 and a receiver 5 in a bridge of the line conductors whose normal discontinuity is maintained by the hook-switch 6, while a call bell 7 and a condenser 8 are included in a permanent bridge. At the central office the lines are as usual provided with an answering jack J and with a plurality of multiple jacks J^2 and J^3 , each of which is provided with tip and sleeve contacts j and j^2 connected respectively with the corresponding line conductors and with a third contact j^3 , the latter contacts of each line being connected together by a third conductor 9 which includes the winding of the cut-off relay R of the telephone line. The line conductors 2 and 3 are normally completed through the contacts of said cut-off relay R , the tip conductor being grounded, while the sleeve conductor includes the winding of the line relay R^2 which is thence connected by common lead or conductor 10 with the live pole of the central battery B . The said line relay controls the individual line signal S of the telephone line, which is preferably in the form of a small incandescent lamp.

The operator's outfit comprises a plurality of cord circuits of the type shown in the drawing, each of which is provided with an answering plug P and a calling plug P^2 , each plug having tip and sleeve and ring contacts to cooperate respectively with the corresponding contacts in the spring jacks of the lines. The tip contacts of the two plugs are joined by flexible strands t and t^2

which include the windings w and w^2 of a repeating coil, the middle point of which is connected to the grounded pole of the battery B while the sleeve conductors of the plugs are joined by the similar strands s and s^2 which likewise include windings w^3 and w^4 of a repeating coil and which are joined to the live pole of the battery. These latter strands include respectively the windings of the supervisory relays r and r^2 which control normally open shunts of the supervisory lamps S^2 and S^3 associated with the answering and calling plugs and included in the third strands 11 and 12 of the two plugs leading from the ring contacts of said plugs to the live pole of the said battery B. The operator's receiver 13, the secondary of her induction coil 14 and a condenser 15 are adapted to be bridged across the answering end of the cord circuit by means of any suitable or usual listening key, while her transmitter 16 and the primary of her induction coil are charged from any suitable source of current and which may be the battery B. A ringing generator 17 is adapted to be connected with the calling end of the cord circuit by means of any suitable ringing key and represented by the springs 18, 18.

The apparatus so far described comprises one common form of telephone exchange system and its operation is well understood. In order to adapt such lines for fire alarm and kindred service the subscribers' stations or other outlying station must be provided with a transmitting device which may be of the type in common use for messenger call, fire alarm or other service that is capable of sending preferably distinctive signals to the central office. At the central office auxiliary receiving apparatus must be provided to respond to such distinctive signaling currents to receive and record the said call so that the same may be suitably attended to, and this without serious interruption of the telephone service. E designates conventionally such a transmitter of usual type, the rotating member or pin wheel 19 of which is provided with a grounded brush or spring 20, while the teeth of said member are arranged when it is rotated to engage spring 21 and intermittently connect it with ground through brush 20 and also lift it into engagement with the upper spring 22 which is likewise grounded. These springs are respectively connected with the line conductors 2 and 3. At the central office a pair of magnets r^3 and r^4 are interposed in the tip and sleeve line conductors and are suitably shunted by non-inductive resistances to permit the ready passage of the voice currents. The tip relay r^3 is provided with normally closed contacts one of which is grounded and the sleeve relay r^4 with normally open contacts, both sets of contacts

being included in a conductor 23 common to all or a desired number of lines of the exchange and including the winding of the register magnet R^3 from whence it leads to the live pole of battery B. When the magnet r^4 in any of the telephone lines is energized, it is apparent that a path for current is completed from the battery B over conductor 23, through the register magnet R^3 , and thence through the contacts of both relays r^3 and r^4 to ground; but when both magnets r^3 and r^4 are deenergized or both energized—and these are their conditions of use when the line is used for telephonic purposes—it is likewise apparent that the said path for current over conductor 23 is disrupted so that the register R^3 is not actuated.

The register R^3 may be of any suitable type and is preferably provided with a tape 24 upon which the message is recorded by the point or pencil 25 actuated by the magnet of the register R^3 , and which likewise controls the circuit of an audible or other signal 26. The register is, of course, provided with a suitable driving mechanism which may be of any desired kind. When it is desired to actuate the alarm signal at the central office the wheel E is set in operation in the usual manner and serves to intermittently connect springs 21 and 22 to ground. Magnet r^3 will not now be actuated since the line conductor 2 is grounded at the central office and since the line conductor is thus short circuited through the earth no current will flow thereover. Magnet r^4 , however, is actuated since the line conductor 3 is connected with the live pole of the main battery B at the central office. Relay magnet r^4 serves, therefore, to close the path for current over conductor 23, through the magnet of the register R^3 and from the battery B. This register is, therefore, actuated according to the impulse sent over the line and since each device E sends a distinctive signal, the record on the tape shows which station is sending in the alarm. The line signal may be flashed at this time but the operators at the exchange are instructed to disregard such intermittent action of the signal. The particular object in grounding both sides of the line at the substation at the time of sending in the call is to guard against disarranging the alarm system by the transposition of the line conductors when installing or repairing the telephone system. It is also apparent that the normal operation of the exchange for telephonic purposes will not actuate the alarm register for the reason that at all times during the connection both relays are energized or both are deenergized so that the conductor 23 cannot be closed. For example, if the subscriber A desires a connection with the central office, he removes his receiver and there-

by closes a circuit from battery B over conductor 10, through line relay R^2 , thence over sleeve conductor 3, through the substation devices and back to the central office over line conductor 2 and ground. This serves to actuate the line signal S, upon observing which the operator inserts the answering plug P of her cord circuit thereby completing a path for current over the third strand 11 of said circuit and conductor 9, through the cut-off relay R of the line. The actuation of the cut-off relay serves to render the line signal inert and to connect the battery B in the metallic circuit of the telephone line. Then connecting her instrument with the cord circuit the operator receives the order for the connection and completes the same with the calling plug P^2 . The supervisory relay r is now operated to shunt the supervisory lamp S^2 so that the latter remains dark. The idle or busy condition of the wanted line is determined by touching the tip of the calling plug P^2 to the test ring j^2 of the multiple jack of the wanted line before her. If the line is idle the test rings are grounded and inasmuch as the tip of the testing plug is likewise grounded no flow of current results and no click is received. If, however, the line is busy the said test rings are connected over the third strand of the inserted cord with the live pole of the battery B so that when the tip of the testing plug is brought into contact with one of said rings, a flow of current results through the repeating coil winding w^2 and inductively causes a click in the operator's receiver. Assuming that the line is found idle said plug P^2 is inserted and the ringing generator 17 operated. The insertion of this plug operates the cut-off relay R of the called line in the manner specified with reference to the calling line, but before the subscriber responds and after he has been called supervisory relay r^2 is unactuated so that the supervisory lamp S^3 is lighted. The response of the called subscriber energizes the relay r^2 and shunts the lamp S^3 to extinguish it. During conversation the battery B is feeding current out over the two connected telephone lines and should it become necessary on said lines to send in a call by means of the transmitting device E, it is apparent that the same operation of the relays r^3 and r^4 will result as before described, for the reason that the live pole of the battery is still connected with the sleeve side of the line and that current will be cut-off from the tip side of the line by the ground at the substation, thereby energizing relay r^4 and deenergizing relay r^3 which is the necessary condition for the operation of the call register. This would interrupt conversation, but as the duration of the alarm signal is short and its occurrence unlikely and since if sent it is apt to be of

more importance than the telephonic conversation, such arrangement is deemed preferable.

Fig. 2 shows a similar arrangement in which the two magnets r^3 and r^4 directly control the calling register R^3 , which is shown individual to the line and adapted to actuate a common pilot signal 26. The register R^3 is actuated by the energization of magnet r^4 as in Fig. 1, and is prevented from operation by the magnet r^3 , also as in Fig. 1, but which in this instance operates the catch 27 to mechanically lock and prevent the operation of said register R^3 . In other words, Fig. 1 illustrates an electrical lock for the register controlled by the two magnets in the line, while Fig. 2 illustrates a mechanical lock for the device controlled by the same magnets.

Fig. 3 illustrates the use of the mechanical lock of Fig. 2 in which the individual register is dispensed with and the armature of magnet r^4 employed to control the circuit of conductor 23 leading to the common register as in Fig. 1. Magnet r^4 serves when energized to close the said conductor, while the actuation of relay r^3 or simultaneous energization of both relays locks the conductor 23 open. In both Figs. 2 and 3, the time-constant of the locking magnet r^3 is less than that of r^4 , this being accomplished in any usual or desired manner.

Fig. 4 designates a similar alarm apparatus but with a different type of line circuit, and one in which the special line relay is dispensed with and the functions thereof accomplished by means of one of the fire alarm magnets. In this type of line the jacks J , J^2 and J^3 are provided with only tip and sleeve contacts which are connected with the front contacts of the springs of the cut-off relay R, the winding of the latter being connected to ground from the sleeve side of the jack section of the line. The tip conductor 2 of the line is normally grounded and also normally completes at one point the local circuit of the line signal S, while the conductor 3 is normally connected with the conductor 10 leading to the live pole of the battery B. The relay r^4 is provided with normally open contacts, one of which is connected with the said conductor 10 leading to the live pole of the battery, and the other of which is joined by conductor 30 with the movable contact of relay r^3 , the latter being normally in contact with the conductor 23 leading to the common register R^3 which is grounded at its other terminal. The forward contact of said movable member of relay r^3 is in the local circuit of the line signal S. When the subscriber calls for a connection at the central office, he completes a path for current from battery B over the two sides of the telephone line and both relays r^3 and r^4 are

actuated with the result that the local circuit of the signal S is completed. The insertion of the plug P of the cord circuit permits current to flow over the sleeve conductor of the jack section of the line to operate the cut-off relay R which serves to open the circuit of and render said line signal inoperative and to connect the switchboard section of the line with the external line circuit. The cord circuit for use with this type of line comprises the tip and sleeve conductors t and t^2 inductively joined by condenser c , while the sleeve contacts are similarly united through the strands s and s^2 and the condenser c^2 . Supervisory relays r^5 and r^6 are connected together with the battery B between the strands t and s , said relays suitably controlling through their contacts the circuit of the supervisory signal S^2 . Similarly relays r^7 and r^8 together with the second battery B^2 are connected across the calling end of the cord circuit and control the supervisory lamp S^3 . The operator's receiver 13 together with her other apparatus may be connected between the strands of the calling end of the cord circuit by the operation of any suitable listening key, while a calling generator 17 is suitably connected with the calling plug P^2 by the operation of the springs 18, 18 of the usual ringing key. The insertion of the answering plug also energizes the supervisory relay r^6 to close the local circuit of supervisory lamp S^2 but owing to the fact that the subscriber's receiver is in use, the cooperating supervisory relay r^5 is actuated and said lamp is prevented from operation. The wanted line is tested by touching the tip of the calling plug to one of the test rings of the line wanted. If idle said lines are grounded and since the tip of the plug is likewise grounded no flow of current results, but if the line is busy the sleeve contacts are connected through the sleeve contact of the inserted plug with the live pole of one of the batteries B or B^2 so that when the grounded tip of the testing plug is brought into contact with one of said rings, a flow of current takes place and the operator receives a busy "click." If the line is found idle, the calling plug P^2 is inserted and the ringing key 18, 18 operated. The sleeve spring of said key when depressed permits current from the battery B^2 to flow through the cut-off relay of the line during ringing to maintain the same actuated. Supervisory relay r^5 is actuated after the subscriber has been called but before his response to close the local circuit of supervisory signal S^3 which is accordingly lighted, but upon the response of the called subscriber the cooperating tip supervisory relay is actuated to render the said signal inert. During conversation the batteries B and B^2 are sending current out over the

telephone lines for the operation of the subscribers' transmitters and the various relays associated with the cord and line circuits. Should an alarm signal be sent in during a connection it will be duly received for the tip relay r^3 would be deenergized while sleeve relay r^4 would alone be energized and the register R^3 would therefore be actuated. I have shown in this figure the individual signal lamps S^4 associated with the alarm circuits. These lamps are responsive to the alarm signaling currents from their own particular lines. In case of a ground upon one of the lines which would cause current to flow over the line conductor 3 from the battery B or B^2 the said lamp S^4 will be lighted and the attention of the attendant or operator will be at once attracted to the particular line. The continued operation of the common alarm 26 would also indicate that there was trouble on the line. In order to test for the trouble and to correct the same, I provide in each one of the individual branches of the alarm circuit a suitable jack J^4 into which a metallic plug P^3 is normally inserted and by which both contacts of the jack are electrically connected and the signal circuit thereby maintained intact. In order to test for trouble on the lines in connection with the alarm service I provide a testing plug R^4 to the tip contact of which a conductor 31 is connected which leads to a test relay r^9 , the opposite terminal of which is connected through a suitable battery 32 to ground. The forward contact of said relay is connected by a conductor with one of the contacts 33 of a switch 34, while the back contact is joined through another conductor to another contact 35 of said switch. The switch lever 34 is joined by a conductor 36 to the alarm 37, the other terminal of which is grounded. In case one of the lines is grounded and the signal S^4 is displayed, the metallic plug P^3 is removed and the plug P^4 is inserted. This disconnects the line from the register and connects the conductor 31 with the tip spring of the jack J^4 and by placing the switch lever 34 upon contact 33 it is definitely ascertained that a ground is present on the line by the continued ringing of the bell 37. Now placing the switch lever 34 upon contact 35 and permitting the plug P^4 to remain in the jack J^4 , the said bell will again ring when the trouble is removed from the line and the armature of the relay drops back to its normal contact. This will indicate to the attendant that the trouble has been remedied when the plug P^4 is removed and the metallic plug P^3 again inserted. The signaling circuit is thus restored to normal position, the trouble having been removed without affecting the remainder of the alarm service system.

The alarm transmitter E at the substa- 130

tions may be operated in any desired manner either manually or by automatic means as in case of fire, burglary, etc. I have not shown this feature because it is well understood by those skilled in the art and would have to be modified to meet the requirements of each particular case. As is well understood this device may be placed at any outlying point on the line.

The invention is applicable to line circuits of various types and to systems of different arrangements.

As pointed out in all the figures, the normal operation of the telephone line for telephonic purposes causes the operation of magnet r^3 which serves to prevent the operation of the signal receiving means. When no current is present on the line such receiving means also remains unoperated for it requires the excitation of magnet r^4 to accomplish that result.

It will be understood that the visual signals and the alarm testing feature of Fig. 4 may be applied to the systems of the other figures or any other system for the same purpose but for the sake of simplification is not shown. The battery 32 having the same pole grounded may obviously be either battery B or B².

I claim:—

1. In a telephone exchange, the combination with a telephone line leading from a subscriber's station to a central station; of a telephone set at the substation and telephonic apparatus at the said central station including a line signal, a source of current and an operator's connective outfit, to cooperate with said line and set for conversational purposes; alarm signal transmitting apparatus at an outlying point adapted to transmit distinctive signaling currents over the telephone line, and alarm signal receiving apparatus at the central station including an electro-magnet in each side of the line in the path of current therein, said receiving apparatus being responsive to said distinctive signaling currents through one of said magnets only but unresponsive to the telephone signaling and talking currents flowing from said source through both magnets, substantially as described.

2. In a telephone exchange, the combination with a telephone line leading from a subscriber's station to a central station, of a telephone set at the substation and telephonic apparatus at the said central station to cooperate with said line and set for conversational purposes, alarm signal transmitting apparatus at an outlying point adapted to transmit distinctive signaling currents over the telephone line, and alarm signal receiving apparatus at the central station including an electro-magnet in each side of the line, one of said magnets serving when energized alone to actuate said receiver and

the other serving when energized to prevent the operation of said receiver, substantially as described.

3. In a telephone exchange, the combination with a telephone line leading from a subscriber's station to a central station, of a telephone set at the substation and telephonic apparatus at the said central station to cooperate with said line and set for conversational purposes, alarm signal transmitting apparatus at an outlying point adapted to transmit distinctive signaling currents over the telephone line, alarm signal receiving apparatus at the central station having a magnet in each side of the line, and means whereby when any one of said magnets is energized alone by said signaling currents said receiver is actuated, and when both magnets are deenergized or are both energized as by the telephone currents said receiver is prevented from operation, substantially as described.

4. In a telephone exchange, the combination with a telephone line leading from a subscriber's station to a central station, of a telephone set at the substation and telephonic apparatus at the said central station to cooperate with said line for conversational purposes, alarm signal transmitting apparatus at an outlying point adapted to transmit distinctive signaling currents over the telephone line, alarm signal receiving apparatus at the central station including a magnet in each side of the line and an operating circuit, one of said magnets serving when operated by the said signaling currents to close said operating circuit to actuate the said receiving apparatus, and the other magnet serving when actuated by the telephone currents to prevent the closing of said operating circuit, substantially as described.

5. In a telephone exchange, the combination with a telephone line leading from a subscriber's station to a central station, of a telephone set at the substation and telephonic apparatus at the said central station to cooperate with said line and set for conversational purposes, alarm signal transmitting apparatus at an outlying point adapted to transmit distinctive signaling currents over the telephone line, alarm signal receiving apparatus at the central station including a relay in each side of the line, and an operating circuit controlled by said relays in such manner that the operation of one of said relays alone by the signaling currents serves to actuate the receiver and the operation of the other relay by the telephone currents prevents the actuation of the same, substantially as described.

6. In a telephone exchange, the combination with a telephone line leading from a subscriber's station to a central station, of a telephone set at the substation and telephonic apparatus at the said central station to co-

operate with said line and set for conversational purposes, alarm signal transmitting apparatus at an outlying point adapted to transmit distinctive signaling currents over the telephone line; alarm signal receiving apparatus at the central station including a relay in each side of the line, and an operating circuit controlled by said relays, one of said relays when energized serving to close said circuit and the other to open said circuit, substantially as described.

7. In a common battery telephone exchange, the combination with a telephone line leading from subscribers' stations to a central station, of telephonic apparatus including a common source of current at the said central station to cooperate with said line for conversational purposes, a telephone set at the substation adapted for use with said telephonic apparatus and common source of current, alarm signal transmitting apparatus at an outlying point, alarm signal receiving apparatus at the central station having a magnet in each side of the telephone line, means controlled by said transmitting apparatus for sending alarm signaling currents over one side of the line and through one of said magnets to operate the receiver, and means controlled by the other magnet when energized by current from said common source flowing over the line during its use for telephonic purposes to prevent the operation of said receiver, substantially as described.

8. In a common battery telephone exchange, the combination with a telephone line leading from a subscriber's station to the central station, of telephonic apparatus including a common source of current at the said central station to cooperate with said line for conversational purposes, a telephone set at the substation adapted for use with said apparatus and central source of current, an alarm signal transmitting apparatus at an outlying point adapted to cause a flow of signaling current over one side of the line from said central source of current, alarm signal receiving apparatus at the central station having a magnet in each side of the line, the magnet in one side of the line being operated by said alarm signaling currents and serving when so operated to actuate the receiver, and the other magnet being in the path of current over the other side of the line and operated by said source when the line is used for telephonic purposes, and serving when so operated to prevent the operation of the receiver, substantially as described.

9. In a telephone exchange, the combination with a plurality of telephone lines leading from subscribers' stations to the central station, of telephone sets at the substations and telephonic apparatus at the central station to cooperate with said lines and sets

for conversational purposes, alarm signal transmitting apparatus at outlying points adapted to transmit distinctive signaling currents over the telephone lines, an electro-magnet in each side of each line at the central station, a common register for said lines, the said magnets of each line serving when the said signaling currents are sent over the line to close the circuit of said common register and when telephone signaling and talking currents are present on the line to prevent the closing of said register circuit from that line, substantially as described.

10. In a telephone exchange, the combination with a plurality of telephone lines leading from subscribers' stations to the central station, of telephone sets at the substations and telephonic apparatus at the said central station to cooperate with said lines and sets for conversational purposes, alarm signal transmitting apparatus at outlying points adapted to send distinctive signaling currents over the said lines, alarm signal receiving and registering apparatus at the central station comprising an electro-magnet in each side of each telephone line, and a common register having its operating circuit controlled by said magnets of each line, one of said magnets in each line being operated by the said alarm signaling currents and serving when so operated to actuate the said register, and the other magnet of each line being operated by the telephone signaling and talking currents and serving when so operated to prevent the operation of said register from the corresponding line, substantially as described.

11. In a common battery telephone exchange, the combination with a metallic circuit telephone line leading from a subscriber's station to a central station, of telephonic apparatus including a line signal, a common battery and a cord circuit at the central station to cooperate with said line for conversational purposes, a telephone set at the substations adapted for use with said telephonic apparatus and common battery, alarm signal transmitting apparatus at an outlying point adapted to cause distinctive signaling currents to flow from said central source over the telephone line without operating said line signal, and a visual alarm receiving apparatus at the central station responsive to said distinctive signaling currents, but becoming temporarily disabled upon the passage of telephone signaling currents but normally disconnected for telephone talking currents, said common battery having one terminal normally grounded and having its other terminal normally connected with one side of said line, said side being grounded at the signal transmitting mechanism when the signal is being transmitted, substantially as described.

12. In a common battery telephone ex-

change, the combination with a metallic circuit telephone line leading from a subscriber's station to the central station, of telephone apparatus including a common source of current at the said central station, a telephone set at the sub-station adapted for use with said telephonic apparatus and common source of current, and an alarm signal transmitting apparatus at an outlying point adapted to cause a flow of distinctive signaling currents over one side of the line from said central source of current, visual alarm signal receiving apparatus at the central station provided with a magnet winding in each side of the line, the winding in the one side of the line only being energized by said alarm signaling currents and serving to actuate the visual signal, and the other winding being in the path of current over the other side of the line only when the line is used for telephonic purposes and serving at such times to disrupt the circuit controlling the visual signal, substantially as described.

13. In a common battery telephone exchange, the combination with a plurality of telephone lines leading from subscribers' stations to the central station, of telephonic apparatus including a common source of current at the said central station to cooperate with said lines for conversational purposes, telephone sets at the substations adapted for use with said telephonic apparatus and common source of current, alarm signal transmitting apparatus at outlying points, visual alarm signal receiving apparatus at the central station individual to each line and having a magnet in each side of the line, means controlled by said transmitting apparatus for sending alarm signaling currents over one side of each line from said source through one of said magnets to operate the said visual signal, and means controlled by the other magnet when energized by current from said common source flowing over the line during its use for telephonic purposes to prevent the operation of said visual signal, substantially as described.

14. In a telephone exchange, the combination with a plurality of telephone lines leading from subscribers' stations to the central station, of telephone sets at the substations and telephonic apparatus including line signals and a common source of current at the central office to cooperate with said lines for conversational purposes, alarm signal transmitting apparatus at outlying points adapted to transmit distinctive signaling currents over the telephone lines, a visual alarm signal other than the line signal individual to each line at the central office, a common register for the plurality of lines, said visual signals and common register being responsive to the alarm signaling cur-

rents over the telephone lines but unresponsive to the telephone signaling and talking currents, substantially as described.

15. In a telephone exchange, the combination with a plurality of telephone lines leading from subscribers' stations to the central station, of telephone sets at the substations and telephonic apparatus at the central station to cooperate with said lines and sets for conversational purposes, alarm signal transmitting apparatus at outlying points adapted to transmit distinctive signaling currents over the telephone lines, an alarm signal receiving apparatus at the central station common to the plurality of lines, individual devices responsive to signaling currents over the lines to actuate said receiver and unresponsive to the telephone signaling and talking currents to prevent the operation of said receiver by the telephonic currents, means for disconnecting the individual devices from said common receiving apparatus, and auxiliary apparatus adapted to be connected with said individual devices when so disconnected to cooperate therewith and the lines to which they belong.

16. In a telephone exchange, the combination with a plurality of telephone lines leading from subscribers' stations to the central station, of telephone sets at the substations and telephonic apparatus at the central station to cooperate with said lines and sets for conversational purposes, alarm signal transmitting apparatus at outlying points adapted to transmit distinctive signaling currents over the telephone lines, an alarm signal receiving apparatus at the central station common to the plurality of lines, individual devices for the lines responsive to the distinctive signaling currents to actuate the receiver and unresponsive to the telephone signaling and talking currents to prevent the operation thereof by the telephone currents, means for disconnecting said individual devices from the said common receiver, and a special testing apparatus adapted to be connected with said individual devices when so disconnected to cooperate therewith and with the lines to which such individual devices belong, substantially as described.

17. In a telephone exchange, the combination with a plurality of telephone lines leading from subscribers' stations to the central station, of telephone sets at the substations and telephonic apparatus at the central station to cooperate with said lines and sets for conversational purposes, alarm signal transmitting apparatus at outlying points adapted to transmit distinctive signaling currents over the telephone lines, alarm signal receiving apparatus at the central station common to the plurality of lines, individual devices for the lines responsive to the distinctive signaling currents thereover to actuate said receiver but unresponsive to the telephone

signaling and talking currents, a spring jack between each such individual device and the common receiver, a plug normally inserted in said jack to connect the contacts thereof together and thereby complete the circuit of the said receiver, a second connecting plug adapted to be inserted in said jack when the former plug is removed, said latter plug serving to separate the contacts of the jack, and testing apparatus connected with the contact of said latter plug that connects with the contact of the said jack leading to the individual device of the line to enable the said device and corresponding line to be tested without interference with the remainder of the alarm signaling system and apparatus, substantially as described.

18. In a telephone exchange, the combination with a plurality of telephone lines leading from subscribers' stations to the central station, of telephone sets at the substations and telephonic apparatus at the central station to cooperate with said lines and sets for conversational purposes, alarm signal transmitting apparatus at outlying points adapted to transmit distinctive signaling currents over the telephone lines, an alarm signal register at the central station common to the plurality of lines, individual devices for the lines responsive to the distinctive signaling currents thereover to actuate said register but unresponsive to the telephone signaling and talking currents to prevent the operation thereby of said register, a signal included in each said individual device and adapted to be operated in case of trouble on the line, a testing apparatus, means for disconnecting the said individual device from the said register and for connecting said testing apparatus with the said device, said testing apparatus being also responsive to current on the line in case of trouble and also responsive to the absence of current on the line when the trouble has been removed, substantially as described.

19. In a telephone exchange, the combination with a plurality of telephone lines leading from subscribers' stations to the central station, of telephone sets at the substations and telephonic apparatus including line signals and a common source of current at the central office to cooperate with said lines for conversational purposes, alarm signal transmitting apparatus at outlying points adapted to transmit distinctive signaling currents over the telephone lines, an alarm signal receiving device common to said lines and responsive to the alarm signaling currents but unresponsive to the telephone signaling and talking currents, and an individual signal for each line independent of the said line signal arranged to be continuously operated in case of an accidental ground or similar connection upon the line whereby the line

upon which there is trouble is readily located, substantially as described.

20. In a telephone exchange, the combination with a plurality of telephone lines leading from subscribers' stations to the central station, of telephone sets at the substations and telephonic apparatus at the central station to cooperate with said lines and sets for conversational purposes, said apparatus including a common battery connected with said lines, alarm signal transmitting apparatus at outlying points adapted to transmit distinctive signaling currents over the telephone lines, an alarm signal register at the central station common to the plurality of lines, individual devices for the lines responsive to the distinctive signaling currents thereover to actuate said register but unresponsive to the telephone signaling and talking currents to prevent the operation thereby of said register, said individual devices being operated by accidental grounds or similar connections on the lines by current from said battery, a testing device adapted to be readily connected with and disconnected from any of said individual devices and having a suitable source of current and signal associated therewith whereby when connected with the line in trouble current flows from said source through the said testing device and out to the line and over the accidental ground to cause the operation of said testing signal, substantially as described.

21. In a telephone exchange, the combination with a plurality of telephone lines leading from subscribers' stations to the central station, of telephone sets at the substations and telephonic apparatus at the central station to cooperate with said lines and sets for conversational purposes, said apparatus including a common battery connected with said lines, alarm signal transmitting apparatus at outlying points adapted to transmit distinctive signaling currents over the telephone lines, an alarm signal register at the central station common to the plurality of lines, individual devices for the lines responsive to the distinctive signaling currents thereover to actuate said register but unresponsive to the telephone signaling and talking currents to prevent the operation thereby of said register, said individual devices being operated by accidental ground or similar connections on the lines by current from said source flowing through such accidental connections, a testing device adapted to be interposed between the individual device of each line and the common register to electrically separate the same, a relay and a current source connected with or included in said testing device, said relay being energized from said current source until the said ground connection is removed, a signal in a

local circuit controlled both by said relay and a switch in such manner that when the relay is first energized the signal is operated and when next deenergized is again operated, substantially as described.

22. In a telephone exchange, the combination with a telephone line leading from a subscriber's station to a central station, of a telephone set at the substation and telephonic apparatus at the said central station to cooperate with said line and set for conversational purposes, said apparatus including a line signal, alarm signal transmitting apparatus on the line adapted to transmit distinctive signaling currents over the telephone line, an alarm signal receiver at the central station other than and separate from said line signal, electro-magnetic mechanism in the line at the central station, said line signal and said alarm receiver being both controlled through the medium of said mechanism, substantially as described.

23. In a telephone exchange, the combination with a telephone line leading from a subscriber's station to a central station, of a telephone set at the substation and telephonic apparatus at the said central station to cooperate with said line and set for conversational purposes, said apparatus including a line signal, alarm signal transmitting apparatus on the line adapted to transmit distinctive signaling currents over the telephone line, an alarm signal receiver at the central station, other than and separate from said line signal, electro-magnetic mechanism in the line at the central station, said line signal and said alarm receiver being both controlled through the medium of said mechanism and dissimultaneously operated, substantially as described.

24. In a telephone exchange, the combination with a telephone line leading from a subscriber's station to a central station, of a telephone set at the substation and telephonic apparatus at the said central station to cooperate with said line and set for conversational purposes, said apparatus including a line signal transmitting apparatus on the line adapted to transmit distinctive signaling currents over the telephone line, alarm signal receiving apparatus other than and separate from said line signal at the central station including electro-magnetic mechanism in the line, and means for controlling said line signal also through the medium of said mechanism, substantially as described.

25. In a telephone exchange, the combination with a telephone line leading from a subscriber's station to a central station, of a telephone set at the substation and telephonic apparatus including a line signal at the said central station to cooperate with said line and set for conversational purposes, alarm signal transmitting apparatus

at an outlying point adapted to transmit distinctive signaling currents over the telephone line, and alarm signal receiving apparatus other than said line signal at the central station including an electro-magnet in each side of the line, one of said magnets serving when energized alone to actuate said receiver and both serving when simultaneously energized to actuate said line signal, substantially as described.

26. In a common battery telephone exchange, the combination with a telephone line leading from subscribers' stations to a central station, of telephonic apparatus including a line signal and a common source of current at the said central station to cooperate with said line for conversational purposes, a telephone set at the substation adapted for use with said telephonic apparatus and common source of current, alarm signal transmitting apparatus at an outlying point, alarm signal receiving apparatus other than the said line signal at the central station having a magnet in each side of the telephone line, means controlled by said transmitting apparatus for sending alarm signaling currents from said source over one side of the line and through one of said magnets to operate the receiver, and means controlled by both magnets when energized by current from said common source flowing over the line during its use for calling the central office to prevent the operation of said receiver, and to cause the operation of said line signal, substantially as described.

27. In a telephone exchange, the combination with a telephone line leading from a subscriber's station to a central station, of a telephone set at the substation and telephonic apparatus including a line signal at the said central station to cooperate with said line and set for conversational purposes, alarm signal transmitting apparatus at an outlying point adapted to transmit distinctive signaling currents over the telephone line, and alarm signal receiving apparatus other than said line signal at the central station including an electro-magnet in each side of the line, one of said magnets serving when energized alone to actuate said receiver and the other serving when energized to prevent the operation of said receiver, and close at one point the circuit of the said line signal, substantially as described.

28. In a telephone exchange, the combination with a telephone line leading from a subscriber's station to a central office, of a telephone set at the substation and telephonic apparatus at the central station, alarm signal transmitting apparatus connected with the line adapted to transmit distinctive signaling currents over the telephone line, and alarm signal receiving ap-

paratus including an electromagnet in each side of the line, one of said magnets serving when energized alone to actuate said receiver and the other serving when energized to prevent the operation of said receiver.

29. In a telephone exchange, the combination with a telephone line leading from a subscriber's station to a central office, of a telephone set at the substation and telephonic apparatus at the central station, alarm signal transmitting apparatus connected with the line adapted to transmit distinctive signaling current over the telephone line, and alarm signal receiving apparatus including an electromagnet in each side of the line, and an operating circuit, one of said magnets serving when operated to close said operating circuit to actuate the said receiving apparatus, and the other magnet serving when actuated by the telephone currents to prevent the closing of said operating circuit.

30. In a telephone exchange, the combination with a telephone line of telephonic apparatus at each end thereof adapted for transmission of voice currents and telephonic signaling currents over the metallic circuit, alarm signal transmitting apparatus connected with the line adapted to transmit distinctive signaling currents over one side thereof, and alarm signal receiving apparatus having a relay responsive to said distinctive signaling currents, means separate from said relay associated with the line for disabling the alarm receiving apparatus, and other means responsive to telephonic signaling current only.

31. A combined telephone and signaling system comprising the following instrumentalities: a telephone line, telephonic apparatus connected therewith for transmitting voice and telephone signaling currents thereover, alarm signal transmitting apparatus associated with the line and adapted to transmit distinctive signaling currents thereover, alarm signal receiving apparatus also associated with the line, means responsive to all currents in the line for rendering said alarm signal receiving apparatus operative, and other separate means responsive to telephone signaling currents only, for disabling said alarm signal receiving apparatus.

32. A combined telephone and alarm system comprising a circuit extending from a substation to a central station, a central source of current having a grounded terminal, telephone signal receiving means having an energizing winding included in said circuit between said grounded terminal and said substation, means under the normal control of the subscriber for causing said telephone signal receiving means to display its signal, means for holding conversation over said circuit between said stations, alarm

signal receiving means associated with said circuit, means for causing said alarm signal receiving means to display its signal without causing a display of said telephone signal.

33. A combined telephone and alarm system comprising a circuit extending from a substation to a central station, a central source of current having a grounded terminal, telephone signal receiving means having an energizing winding included in said circuit between said grounded terminal and said substation, means under the normal control of the subscriber for causing said telephone signal receiving means to display its signal, means for holding conversation over said circuit between said stations, alarm signal receiving means associated with said circuit, means for causing said alarm receiving means to display its signal in response to the grounding of said circuit at a point outside of the central station, whereby a false display of the telephone signal is prevented.

34. A combined telephone and alarm system comprising a circuit extending from a substation to a central station, telephone signal transmitting and receiving means associated with said circuit, means for holding conversation over said circuit between said stations, alarm signal transmitting and receiving means for indicating an alarm without causing the operation of said telephone signal receiving means and means associated with said alarm receiving means for indicating a ground on said circuit.

35. A combined telephone and alarm system comprising a circuit extending from a substation to a central station, a central source of current having a grounded terminal, telephone signal receiving means having an energizing winding included in said circuit between said grounded terminal and said substation, means under the normal control of the subscriber for causing said telephone signal receiving means to display its signal, means for holding conversation over said circuit between said stations, alarm signal receiving means associated with said circuit, means for causing said alarm signal receiving means to display its signal without causing a display of said telephone signal, and means associated with said alarm receiving means for indicating a ground on said circuit.

36. A combined telephone and alarm system including a telephone line, a telephone signal therefor, a pair of alarm signal relays serially connected one to each limb of said line, a local circuit controlled by said relays, means for operating said relays when the line is in use for telephone purposes to maintain said local circuit in its normal electrical condition, an alarm receiving device controlled by said local circuit, and an alarm sending device serving, when oper-

ated, to operate one of said relays and maintain the other in its normal condition whereby the normal condition of said local circuit is changed and said alarm receiving device is
5 actuated.

37. A combined telephone and alarm system including a telephone line, a pair of alarm relays serially connected one to each limb of said line, a local circuit controlled
10 by said relays and in a definite electrical condition when both of said relays are energized, means for simultaneously energizing said relays, switch contacts controlled by

said relays holding said local circuit in said definite electrical condition when both relays are energized, means for actuating one of said relays to alter the electrical condition of said local circuit, and a receiving device actuated in response to the altered electrical condition of said local circuit. 15 20

Signed by me at Chicago, county of Cook, State of Illinois, this 27th day of April, 1903.

WILLIAM W. DEAN.

Witnesses:

ROBERT LEWIS AMES, _____
E. A. GARLOCK.