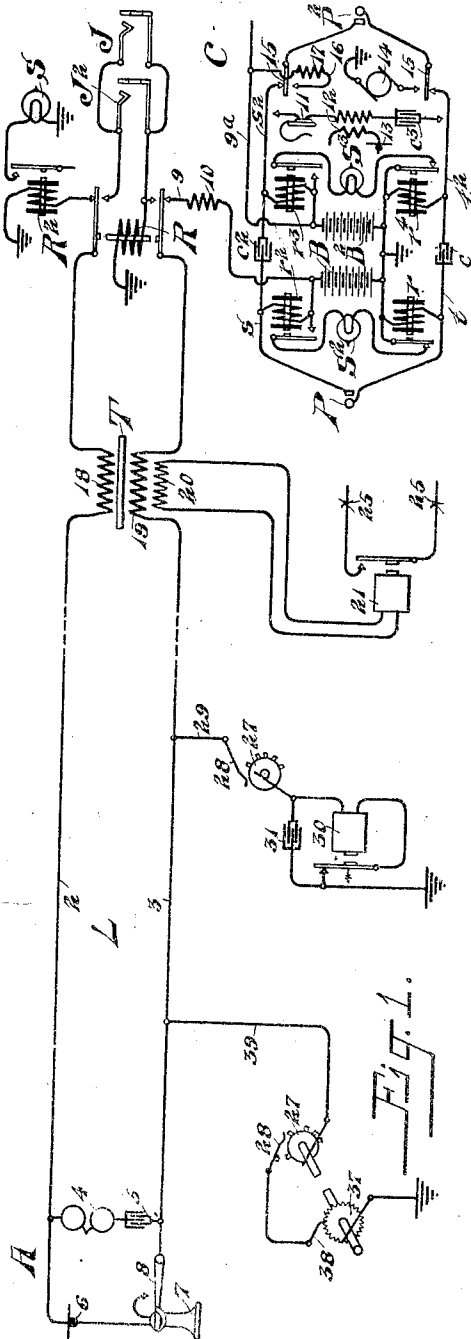


1,056,637.

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UNITED STATES PATENT OFFICE.

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CONSOLIDATED FIRE ALARM COMPANY, OF NEW YORK, N. Y., A CORPORATION OF
NEW YORK.

COMBINED TELEPHONE AND FIRE-ALARM SYSTEM.

1,056,637.

Specification of Letters Patent.

Patented Mar. 18, 1913.

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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 new and useful Improvement in Combined Telephone and Fire-Alarm or Kindred Service Systems, of which the following is a specification.

My invention relates more particularly to improvements in combination telephone and fire alarm or kindred service systems, although some of its features, as is hereinafter pointed out, are capable of somewhat wider application.

One of the main objects of the invention is to provide a receiving device in a subscriber's line circuit at the central office that is unaffected by the currents used for telephonic purposes but is responsive to the auxiliary currents sent over the telephone lines.

The invention further comprises a system of the class described in which a varying auxiliary current over one side of the telephone line is depended upon for the operation of the receiving device at the central office; also a system in which said varying currents are derived from the central common battery of the telephone exchange, and also the combination with a telephone line, of a transformer having differential windings interposed in the opposite sides of the metallic line and a tertiary winding connected in an auxiliary circuit whereby said transformer is unresponsive to telephone currents of any type but is responsive to varying currents sent over only one side of the line.

Other features and objects of the invention will more fully appear from the detailed description and claims, reference being had to the drawing forming a part of this specification in which the same reference characters are used to designate like parts throughout, and in which—

Figure 1 is a diagram of a system embodying my improvements, and Fig. 2 is a diagram of a system showing a different method of applying the same.

In Fig. 1, L indicates the telephone line extending in two limbs 2 and 3 from the substation A to the central office C. At the substation the usual signal bell 4 and a condenser 5 are shown located in a permanent bridge of the line conductors and a transmitter 6 and receiver 7 are located in a second bridge that is held normally open by the switch-hook 8 but is adapted to be closed when the receiver is removed from the hook. At the central office the line is fitted as usual with multiple jacks J and J² in any suitable number, and a line signal S. The line conductor 2 is normally connected through the contacts of a cut-off relay R with a grounded branch which in this instance includes the winding of the line relay R² that controls the local circuit of the line signal but which is adapted to be disconnected from said relay and connected with the tip side of the jack section of the line when the cut-off relay R is operated. The line conductor 3 is similarly connected by normal contacts of said cut-off relay with a conductor 9 including a suitable resistance and connected with the live pole of battery B that is common to all of the cord circuits of the exchange and a large number of the telephone lines. When the cut-off relay actuates said conductor 9 is disconnected to render the line signal inoperative and the conductor 3 is joined to the sleeve side of the jack section of the telephone line.

The operator's outfit includes the usual cord circuit which is provided with an answering plug P and a calling plug P² having tip and sleeve contacts adapted to register with the corresponding contacts of the spring jacks of the lines. The tip contacts of said plugs are connected by the flexible strands t and t² and the interposed condenser c, while the sleeve contacts are similarly joined by the strands s and s² and the interposed condenser c². Supervisory relays r and r² are connected across the answering end of the cord circuit upon opposite sides of the battery B and together control the local circuit of the supervisory lamp S² associated with the plug P, while similar supervisory relays r³ and r⁴ are located across the calling

end of the cord circuit upon opposite sides of a second common battery B^2 and together control the local circuit of the supervisory signal S^2 associated with the plug P^2 . The operator's head receiver 11, the secondary of her induction coil 12 and a suitable condenser c^3 are adapted to be bridged across the calling end of the cord circuit through the medium of any suitable listening key, her transmitter 13 and the primary of her induction coil 12 being charged from any suitable source of current. A ringing generator 14 of ordinary type is adapted to be connected with the forward portion of the tip strand t^2 of the cord circuit by the corresponding spring of the ringing key 15, the sleeve strand s^2 being simultaneously connected in a similar manner through the conductor 16 including resistance 17 and the conductor 9^a with the live pole of battery B^2 .

Conversation is carried out in the ordinary manner in the telephone exchange thus typified. For example, a subscriber wishing a connection takes up his receiver and thereby completes a path for current over the metallic circuit of his line from the battery B and including the line relay R^2 upon the other side of the circuit. This relay being operated closes the circuit of the line signal S which is preferably connected with the battery B in the ordinary manner. Upon observing this signal the operator inserts the answering plug P of her cord circuit in one of the jacks of the line and upon receiving the number of the party wanted, tests that line in the usual manner to determine its idle or busy condition; and, if found idle, the calling plug of the same cord circuit is connected with one of the spring jacks of that line and the ringing keys operated to call the subscriber. The insertion of either plug of the cord circuit energizes the corresponding sleeve supervisory relay r^2 or r^3 together with the cut-off relay R of the line with which connection is established, the cut-off relay serving as before pointed out to render the line signal inoperative and to place the line in condition for conversation. The actuation of the said supervisory relays closes the local circuits of the supervisory lamps, but whether said lamps are lighted or not depends upon the condition of the subscriber's telephone, since the supervisory relays r^2 and r^3 , which serve when actuated to open said lamp circuits, are in the path of the current over the metallic telephone lines. During the connections therefore the supervisory lamps inform the operator at all times of the condition of the subscriber's telephones.

The alarm receiving apparatus at the central office includes a transformer T having differential windings 18 and 19 placed in the

line conductors 2 and 3 respectively and a tertiary winding 20 that is included in a normally closed current path including the winding of the magnet 21 that controls the local circuit of the alarm signal register. The windings 18 and 19 of said transformer are preferably superposed or otherwise intermittently associated so that the rapidly varying voice currents in the metallic telephone line neutralize each other and suffer no impedance. The battery current flowing in the metallic line likewise does not affect the transformer and the ringing current also is without effect upon the third winding 20. The telephone currents, therefore, in flowing over the metallic circuit produce no effect upon the winding 20 and are not impeded by the presence of the transformer in the telephone line. The alarm registering circuit is not shown in this figure, but in Fig. 2 I have shown the same in full. Said circuit includes an audible signal 22, the register magnet 23 and a suitable battery 24, these parts being preferably common to all of the lines of the exchange as indicated by the branching conductors at the points 25. The signal is registered upon the tape 26 in the ordinary manner. Any other registering or recording mechanism may obviously be employed. In order to operate said alarm signal receiving apparatus I place upon the line a call or alarm box of any desired construction which includes a suitable make-and-break wheel 27, together with its brush 28 and in this instance I connect said brush by means of a conductor 29 with the line conductor 3, (see Fig. 1) which at the central office is connected with the live pole of the battery B. The said make-and-break wheel is connected with the magnetic interrupter 30 which may be of ordinary construction and which is preferably adapted to rapidly interrupt the path for steady current that is completed by the make-and-break wheel from the line conductor 3 to ground. A condenser 31 may be placed upon the contacts of said interrupter for the purpose of preventing sparking. It will thus be observed that when the make-and-break wheel is rotated, and its projections come in contact with the brush 28, a path for current will be completed from ground at the central office over the battery B, line conductor 3, including the winding 19 of the transformer T, conductor 29, brush 28, wheel 27, and thence through the magnet of the interrupter 30 and its normal contacts to ground. This circuit, as is well understood will be rapidly made and broken by the magnet 30 and the impulses produced thereby through the winding 19 of the transformer will induce in its tertiary winding 20 a corresponding alternating current which will

operate the magnet 21 and cause it to close a local circuit of the alarm signal register. Magnet 21 is of course designed to suitably respond to such rapidly varying current and to close the local circuit of the register in accordance with the closing of the main circuit by the make-and-break wheel 27.

I have not shown in this figure a mechanism for controlling a make-and-break wheel but it will be understood that any ordinary method for controlling the same may be employed. In Fig. 2 for example I have shown one method for controlling the make-and-break wheel which includes the magnet 32 connected in a house circuit that includes a suitable battery 33, closed circuit thermostats 34 and a manually operated key 35. When said house circuit is opened, either automatically or by the key 35, the armature 36 of said magnet 32 releases the spring driven mechanism of the make-and-break wheel, which is accordingly actuated for a suitable length of time or number of rotations to send in the alarm signal.

In place of the magnetic interrupter which is described I may use the rotary interrupter 37 shown connected with the line conductor 3 at a second point to rapidly make and break the circuit established through its brush 38, the make-and-break wheel 27 and a suitable conductor 39, and the line conductor 3 from the battery B. The transformer T is thus actuated to operate the alarm signal receiver.

In Fig. 2 a telephone line L^2 is shown which is of the same type as line L of Fig. 1, except that the line relay R^2 is located in the normal connection of said line conductor of the live pole of the battery B, the opposite line conductor 2 being grounded directly in the ordinary manner. The same arrangement of a differentially wound transformer is provided at the central station to respond to the signaling currents but at the substation I connect the brush 28 of the make-and-break wheel with the line conductor 2 by means of a suitable branch conductor 40, and the make-and-break wheel itself is connected by a conductor 41 with the secondary winding 42 of a suitable magnetic interrupter 43. The primary winding 44 of said interrupter is included in a local circuit containing the normal contacts 45 of said interrupter, a suitable battery 46 and normally open contacts adapted to be closed by armature 36 of said magnet 32. When, therefore, the magnet 32 is deenergized, said local circuit is completed and the make-and-break wheel 27 is released. The primary circuit of said magnetic interrupter is thus rapidly made and broken, the secondary impulses are induced in the winding 42 of the same and are

transmitted to the line over the wire 41, wheel 27, brush 28 wire 40, and line conductor 2 to ground at the central office. These alternating currents affect the tertiary winding 20 of said transformer T and the register at the central office is duly operated.

The transformer T may be employed for various purposes other than that specifically described. Various modifications may be made in the invention without departing from its scope or principle. The alarm transmitter may be located at any point upon the line.

Having thus described the principle of the invention and several ways of carrying the same into effect, what I claim and desire to secure by Letters Patent is:

1. In a telephone exchange, the combination with a telephone line, of a subscriber's set at the substation of the line, telephonic apparatus associated with the line at the central office adapted to cooperate with said line and set for conversational purposes, means on the line for sending a varying current over one side of the line, a transformer at the central office having differential windings in the opposite sides of the telephone line, a tertiary winding for said transformer and registering apparatus connected with said tertiary winding, the arrangement of the windings being such that the transformer is unresponsive to telephone currents in the metallic line, but is responsive to said varying current over one side of the line, and the registering apparatus is actuated thereby, substantially as described.

2. In a telephone exchange, the combination with a telephone line, of a subscriber's set at the substation of the line, telephonic apparatus associated with the line at the central office adapted to cooperate with said line and set for conversational purposes, an alarm signal transmitting device on the line to cause the flow of varying signaling current over one side of the line, a transformer in the central office having a differential winding placed in each side of the telephone line whereby it is unresponsive to currents in the metallic line circuit, a tertiary winding for said transformer, and alarm registering apparatus connected with said tertiary winding whereby when the alarm signaling currents are sent over one side of the line, said transformer is actuated and the register is operated, substantially as described.

3. In a telephone exchange, the combination with a telephone line, of a subscriber's set at the substation of the line, telephonic apparatus associated with the line at the central office adapted to cooperate with said line and set for conversational purposes, said apparatus including a common source of

current normally connected with one side of the telephone line, an alarm signal transmitting device on the line adapted to complete the circuit of said source over said line conductor and to also rapidly interrupt the said circuit, and alarm signal receiving apparatus at the central office comprising a transformer having differential windings placed in opposite sides of the metallic line whereby it is unresponsive to currents in the metallic line circuit, and a tertiary winding, together with alarm registering apparatus connected to said tertiary winding, whereby when said transmitting device is actuated, the transformer will respond thereto and the signal will be received and recorded, substantially as described.

4. In a telephone exchange, the combination with a telephone line, of a subscriber's set at the substation of the line, telephonic apparatus associated with the line at the central office adapted to cooperate with said line and set for conversational purposes, an alarm signal transmitting device on the line adapted to send signaling currents over one side thereof only, a transformer also at the central office having two differential windings in the metallic line circuit, and a tertiary winding, and an alarm registering apparatus associated with said tertiary winding whereby when said signaling currents are sent over the line the transformer is responsive thereto and the apparatus is actuated, substantially as described.

5. In a telephone exchange, the combination with a telephone line, of a subscriber's set at the substation of the line, an alarm signal transmitter upon the line and means associated with the transmitter to break up the signaling current into distinctive signals, a transformer at the central office having differential windings in the opposite sides of the telephone line whereby a balanced or neutral condition is maintained for currents in the metallic line circuit, a tertiary winding for said transformer, alarm signal receiving apparatus connected with said tertiary winding for operation by current induced therein, and telephonic apparatus associated with said alarm signal receiving apparatus and adapted to cooperate with said line and subscriber's set for conversational purposes, said alarm signal transmitter adapted to unbalance the line when in operation, whereby when the alarm signaling currents are sent over the line the said transformer is actuated and the receiving device is operated, substantially as described.

6. In a telephone exchange, the combination with a telephone line, of a subscriber's set at the substation of the line, telephonic apparatus associated with the line at the

central office adapted to cooperate with said line and set for conversational purposes, said apparatus including a common source of current normally connected with the telephone line, an alarm signal transmitting device on the line adapted to complete the circuit of said source over the line, means to rapidly interrupt said circuit, an alarm signal receiving apparatus at the central office including a relay inductively connected with the line whereby it is responsive to said signaling currents, said relay being unresponsive to telephone signaling and talking currents, substantially as described.

7. In a telephone exchange, the combination with a telephone line, of a subscriber's set at the substation of the line, telephonic apparatus associated with the line at the central office adapted to cooperate with said line and set for conversational purposes, said apparatus including a common source of current connected with the line at the central office, an alarm signal transmitting device on the line adapted to complete the circuit of said source over the line, means to rapidly interrupt said circuit, alarm signal receiving apparatus at the central office, said apparatus including a transformer connected with the line which is responsive to the alarm signaling currents but unresponsive to the telephonic signaling and talking currents, and a signal inductively connected with the line through said transformer, substantially as described.

8. In a telephone exchange, the combination with a metallic circuit telephone line, of a subscriber's set at the substation of the line, means on the line for sending a varying current over one side of the line only, a transformer also on the line having differential windings in the opposite sides thereof, whereby it is unresponsive to currents in the metallic line but responsive to the varying current over one side, a tertiary winding for said transformer, telegraphic receiving apparatus connected thereto for operation therefrom which is irresponsive to telephone currents, and telephonic apparatus associated with said receiving apparatus and adapted to be directly connected with said substation line for conversational purposes, but actuated by the varying currents, substantially as described.

9. In a telephone exchange, the combination with a telephone line, of a subscriber's set at the substation of the line, telephonic apparatus associated with the line at the central office adapted to cooperate with said line and set for conversational purposes, an alarm signal transmitting device on the line to cause the flow of varying signaling current over one side of the line, a transformer having a differential winding included in

each side of said line whereby it is unresponsive to currents in the metallic line circuit, but responsive to signaling current over one side thereof, and having also a tertiary winding, and alarm registering apparatus connected with said tertiary winding whereby when the alarm signaling currents are sent over said side of the line, said transformer is actuated and the register is operated, substantially as described.

10. In a telephone exchange, the combination with a telephone line, of a subscriber's set at the substation of the line, telephonic apparatus associated with the line at the central office adapted to cooperate with said line and set for conversational purposes, said apparatus including a common source of current normally connected with one side of the telephone line, an alarm signal transmitting device on the line adapted to complete the circuit of said source over said line conductor and to also rapidly interrupt the said circuit, an alarm signal receiving apparatus also on the line comprising a transformer having differential windings placed in opposite sides of the metallic line whereby it is unresponsive to currents in the metallic line but responsive to those over one side only, and having also a tertiary winding connected with alarm registering apparatus whereby when said transmitting device is actuated, the transformer responds thereto and the signal is received and recorded, substantially as described.

11. In a telephone exchange, the combination with a telephone line, of a subscriber's set at the substation of the line, an alarm signal transmitting device on the line to send signaling currents over one side of the line only, a transformer having two differential windings in the metallic line circuit, and a tertiary winding for said transformer, a telegraphic signal receiving apparatus connected with said tertiary winding for operation directly therefrom, whereby when said signaling currents are sent over the line the transformer is responsive thereto and the apparatus is actuated, and telephonic apparatus associated with said telegraphic signal receiving apparatus and adapted to be connected with said line and subscriber's set for conversational purposes, substantially as described.

12. In a telephone exchange, the combination with a metallic circuit telephone line, of a subscriber's set at the substation of the line, an alarm signal transmitter upon the line to send signaling currents over one side thereof only, means associated with the transmitter to break up the signaling current into distinctive signals, a transformer having two differential windings in the opposite sides of the telephone line whereby it is

unresponsive to currents in the metallic line circuit, a tertiary winding, telegraphic alarm signal receiving apparatus connected with said tertiary winding for operation by currents induced therein and irresponsive to telephone currents but responsive to said distinctive signals, whereby when the alarm signaling currents are sent over the line the said transformer is actuated and the receiving device is operated, and telephonic apparatus associated with said alarm signal receiving apparatus and adapted to become associated directly with said substation line and set for conversational purposes, substantially as described.

13. In a telephone exchange, the combination with a telephone line, of a subscriber's set at the substation of the line, telephonic apparatus associated with the line at the central office adapted to cooperate with said line and set for conversational purposes, said apparatus including a common source of current normally connected with the telephone line, an alarm signal transmitting device on the line adapted to complete the circuit of said source over the line, means to rapidly interrupt said circuit, an alarm signal receiving apparatus also on the line and including a relay inductively connected with the line whereby it is responsive to said signaling currents, said relay being unresponsive to telephone signaling and talking currents, substantially as described.

14. In a telephone exchange, the combination with a telephone line, of a subscriber's set at the substation of the line, telephonic apparatus associated with the line at the central office adapted to cooperate with said line and set for conversational purposes, said apparatus including a common source of current connected with the line at the central office, an alarm signal transmitting device on the line adapted to complete the circuit of said source over the line, means to rapidly interrupt said circuit, and alarm signal receiving apparatus also on the line, said apparatus including a transformer connected with the line which is responsive to the alarm signaling currents, and a signal inductively connected with the line through said transformer, substantially as described.

15. In a telephone exchange, the combination with a metallic telephone line, of a subscriber's set at one station on the line, an alarm signaling transmitting device upon the line capable of causing a flow of alarm signaling current over one side only of the telephone line and of a character differing from the telephone currents, a transformer having a plurality of windings on one side connected in both sides of the line so as to balance each other in magnetic effect for telephone talking currents, a telegraphic sig-

nal receiving apparatus connected to wind-
ings on the other side of said transformer
for operation by currents induced in said
windings only, said receiving apparatus
5 adapted to be inductively affected by the
alarm signaling currents but unaffected by
telephone currents, and telegraphic appara-
tus associated with said signal receiving ap-
paratus and adapted to cooperate directly
10 with said substation line and set for con-

versational purposes, substantially as de-
scribed.

Signed by me at Chicago, county of Cook,
State of Illinois, this 12th day of August,
1903.

WILLIAM W. DEAN.

Witnesses:

ROBERT LEWIS AMES,
EVA A. GARLOCK.