

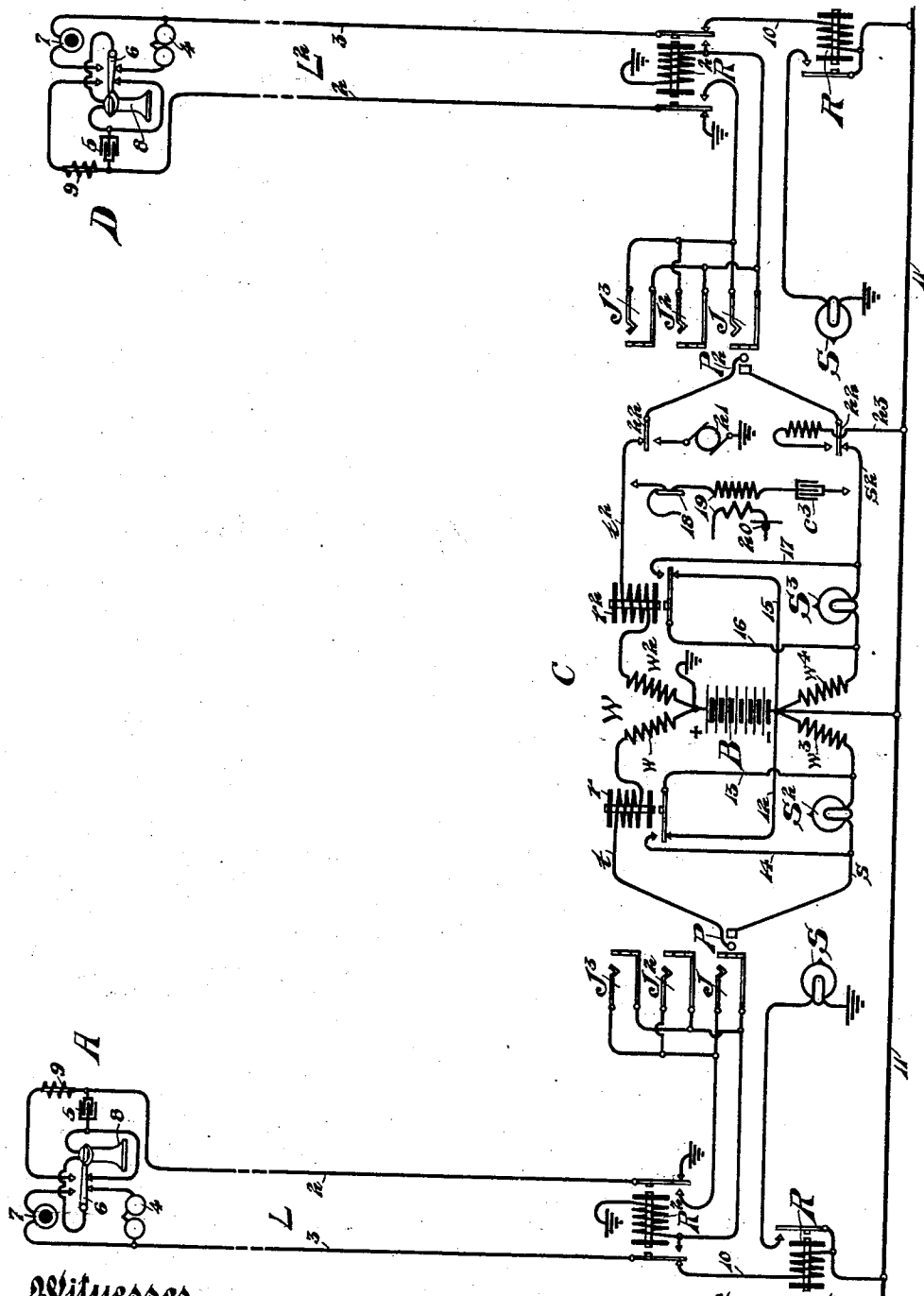
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W. W. DEAN.

SUPERVISORY SYSTEM FOR TELEPHONE LINES.

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Witnesses.

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SUPERVISORY SYSTEM FOR TELEPHONE-LINES.

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Specification of Letters Patent.

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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 Supervisory Systems for Telephone-Lines, of which the following is a specification.

My invention relates to supervisory systems for telephone lines.

It is desirable in connecting subscribers' lines for conversation, that the operator shall be enabled to entirely supervise each connection; that is, that she shall be informed at all times of the condition of the subscribers' telephones. The preferred form of signal for supervisory purposes is a small incandescent lamp, which is adapted to be lighted whenever a connection exists with the telephone line and the subscriber's telephone is not in use, but is extinguished when the subscriber's telephone is in use. Thus when a connection is established with an idle line, the signal lamp is lighted until the subscriber responds, so that the operator is informed that the subscriber has not yet taken up his telephone. Upon the response of the subscriber the lamp is extinguished, and the operator is informed that the subscriber has responded. When a conversation is terminated and the subscriber hangs up his telephone, the lamp is lighted a second time and the operator is thus informed that the conversation has terminated, when the connection is taken down and the lamp again extinguished. This control of the lamps is usually accomplished by supervisory relays associated with the cord circuit employed to establish the connection. In one type of line circuit known as the three-wire type, the said signal lamps are placed in third conductors connected with the cord circuits and an associated relay is placed in one of the talking strands of the cord circuit to suitably control the said lamp. In a second type of line, namely the two-wire type, only the two talking strands are employed in the cord circuit, and hence a pair of relays is associated with each end of the cord circuit, one relay of the pair being used to place the lamp in condition to operate as soon as the cord circuit is connected with the line and the other being responsive to the current over the telephone line and serving to render said signal inert whenever the subscriber's telephone is in use.

My invention is particularly adapted for use in connection with the latter type of line, namely the two-wire type, and in connection with the same I provide means for dispensing with the additional relay that is employed to place the lamp in condition to operate upon the initial connection of the cord circuit with the telephone line. In the former type of line, that is the three wire type, repeating coils are preferably used in the cord circuit with the middle points of their windings on each side connected directly to the central common battery. In the latter type of line, that is the two-wire type, it is not common to so employ repeating coils but condensers are utilized in each of the talking strands to conductively separate but inductively unite the two ends of the same.

In my invention I make use of the repeating coil, the same as in the three wire type, and at the same time the supervisory signals are independently controlled by the two subscribers.

In carrying out my invention in one specific embodiment which has been worked out for commercial purposes, I place the said signal in the path of current over one of the talking strands of the cord circuit. I may also arrange to remove the resistance of the corresponding winding of the repeating coil from said strand, under normal conditions and to insert said resistance and at the same time retire the signal lamp when the subscriber's telephone is in use and current is flowing over the telephone line. I prefer in thus carrying out my invention to place the lamp directly in one strand of the cord circuit and the controlling supervisory relay in the opposite strand, the said relay being provided with normally closed contacts which shunt the winding of the repeating coil that is in series with the said lamp, and the forward contacts of said relay being adapted to close a shunt about the said lamp. When connection is established with a line, therefore, the line being so arranged that a local path for current is completed over said talking strand including the signal lamp, the said lamp is lighted and the corresponding winding of the repeating coil is cut out of circuit; and when the subscriber responds the said winding is cut into circuit and the lamp removed.

My invention is illustrated in the accompanying drawing in which the figure is a

diagram of a telephone system embodying my improvements.

In said figure, L and L^2 indicate subscriber's lines extending in two limbs 2 and 3 from their respective substations A and D to the central office C. Each substation is provided with a signaling bell 4 and a condenser 5 in a bridge of said conductors that is normally closed by the switch-hook 6, a transmitter 7 and a receiver 8 together with a retardation coil 9 being adapted to be suitably included in circuit with said conductors when the receiver is removed from the said hook. This apparatus is intended merely to indicate any suitable or desired common battery outfit.

At the central office each line is provided with a line signal S, an answering jack J, and multiple jacks such as J^2 and J^3 in any desired number. The line conductor 3 is normally connected with conductor 10 including the winding of the line relay R and is connected to the battery lead 11 extending from the live pole of the central common battery B; but when the cut-off relay R^2 , which is legged to ground from the sleeve side of the jack section of the telephone line is energized, the said line conductor 3 is disconnected from said conductor 10 and is connected with the sleeve side of said jack section. The line conductor 2 is normally grounded through a spring of said cut-off relay R^2 , but is adapted to be disconnected from ground when a connection is established with any of the said jacks and to be connected with the tip side thereof.

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 , having tip and sleeve contacts adapted to register with the corresponding contacts of the spring jacks of the line. The tip contact of the answering plug P is connected by a flexible conductive strand t with the winding w of the repeating coil W, while the corresponding contact of the calling plug is joined by a similar strand t^2 with the associated winding w^2 of said repeating coil. The sleeve contacts of said plugs are joined by the similar strands s and s^2 with the windings w^3 and w^4 respectively, of said repeating coil, and the inner ends of said repeating coil windings are connected to the opposite poles of the central common battery B, as shown, the positive pole of said battery being also grounded as indicated in the drawing. A supervisory lamp S^2 associated with the answering plug P is located in the strand s of the cord circuit and is suitably controlled by the supervisory relay r placed in the opposite strand of said cord circuit. The branch conductors 12 and 13 are normally connected together through the back contacts of said supervisory relay r and serve

when so connected to short circuit the winding w^3 of the repeating coil. A conductor 14 is adapted to be connected in shunt of the said lamp S^2 together with the conductor 13 when the said supervisory relay is energized. A similar supervisory signal S^3 is associated with the answering plug P^2 , and is controlled in the same manner by the supervisory relay r^2 , whose winding is connected in the opposite strand t of the cord circuit. This relay serves to control through the branch conductors 15, 16 and 17, the short circuits of both the repeating coil winding w^4 and the lamp S^2 .

The operator's telephone set includes the head receiver 18, the secondary of her induction coil 19 and a suitable condenser c^3 adapted to be bridged across the calling end of the cord circuit by means of any suitable listening key, while her transmitter 20 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 21 is adapted to be connected by the ringing key 22 with the tip strand of the cord circuit, while the sleeve strand is simultaneously connected through the branch 23 by the sleeve contact of said key with the battery lead 11.

In the operation of the invention the subscriber at station A, for example, takes up his receiver and thereby completes a path for current from said battery B over conductors 11 and 10, including the winding of the line relay R, line conductor 3, through the substation devices and back through conductor 2 to ground. Current in this path suffices to actuate the line relay R to cause it to close the local circuit of the line signal S thus lighting the same to attract the attention of the operator, who upon seeing the signal inserts the answering plug P of her cord circuit in the answering jack J and depresses her listening key to connect her receiver with the said cord circuit. The insertion of the plug P closes a path for current from the live pole of the battery B over the sleeve strand s and the sleeve conductor of the jack section of the telephone line and through the winding of the cut-off relay R^2 to ground. This relay is actuated to disconnect conductor 10 from the line conductor 3 and ground from line conductor 2, and to connect said conductors with the jack portion of the line. The winding w^3 of the repeating coil W is at this time short circuited by the conductors 12 and 13 through the normal contacts of the supervisory relay r and the resistance of the cut-off relay R^2 and the lamp S^2 is such that the latter would be lighted under these circumstances were it not for the fact that the subscriber's telephone is off its hook, and therefore, as soon as the cut-off relay R^2 is energized current is permitted to flow over the metallic line and through the supervisory

relay r in its return to the grounded pole of said battery. This relay r is therefore actuated and the lamp S^2 is prevented from lighting at this time. Upon learning the

5 order of the calling subscriber, the wanted line is tested in the usual manner by touching the tip of the calling plug to one of the test rings of the multiple jacks of the line. It will be observed that said test rings are normally grounded through the winding of the cut-off relay and since the tip of the calling plug is likewise grounded through the winding w^2 of the repeating coil no flow of current takes place when an idle line is tested, and no click is received by the operator, who is thus informed that the line is idle. If the line is engaged, however, said test rings are connected through the sleeve strand of the inserted cord circuit with the live pole of said battery B and hence the application of the ground tip of the plug to a test ring of the line completes a path for current from said battery through the tip strand of the testing cord and a click is received by the operator.

25 Assuming that the line is found idle, the calling plug is inserted and the subscriber is called by depressing the ringing key. The operation of the ringing key provides a path for steady current from the battery B, through conductors 11 and 23 to maintain the cut-off relay of the wanted line actuated during ringing.

After the subscriber has been called but before his response the supervisory signal S^3 is lighted, the resistance of the winding w^4 of the repeating coil being cut out of circuit to increase the margin of operation of said lamp and the operator is thus notified of the condition of the called subscriber's telephone. When the subscriber responds, the relay r^2 is actuated and the lamp S^3 is short circuited and retired, and the operator knows that the parties are in conversation. At the termination of the conversation, the return of the receivers to their hooks de-energizes the relays r and r^2 in the cord circuit and permits said lamps S^2 and S^3 to glow, upon observing which the operator takes down the connection and restores all parts to normal condition. The electrical dimensions of the various parts may be those ordinarily employed or such as are desired to accomplish the various results sought.

55 While various modifications and arrangements may be made without departing from the spirit and scope of my invention, what I claim and desire to secure by Letters Patent is:

60 1. In a telephone system, the combination with telephone lines, of a cord circuit to establish connections for conversation with said lines, said cord circuit having two strands included one in each side of the talking circuit, a non-inductive supervisory sig-

nal in one of the strands, and a supervisory relay in the opposite strand to deprive said signal of operating current, substantially as described.

2. In a telephone system, the combination 70 with telephone lines, of a cord circuit to establish connections therewith for conversation, a repeating coil and a source of current bridged across said cord circuit, a supervisory signal in the path of current over one 75 strand of the cord circuit, a supervisory relay in the opposite strand; said relay serving to normally short circuit the winding of the repeating coil that is in series with said signal, and during conversation to open the 80 short circuit about said winding and to establish a second short circuit about the said signal, substantially as described.

3. In a telephone system, the combination with a telephone line, of a cord circuit for es- 85 tablishing connections therewith for conversation, said circuit having a strand included in each side of the talking circuit, a supervisory lamp in one of said strands and a supervisory relay in the other strand, said re- 90 lay being adapted when operated to complete a shunt path about said lamp, substantially as described.

4. In a telephone system, the combination with a telephone line, of a cord circuit to es- 95 tablish connections therewith for conversation, a supervisory signal and a resistance in the path of current over a talking strand of the cord circuit energized when a connection is established with the line, a supervisory 100 relay associated with said circuit, energized over another strand thereof and operated during conversation by current over the telephone line to place a shunt around said signal and thereby render it inert, substantially 105 as described.

5. In a telephone system, the combination with a telephone line, of a cord circuit to connect therewith for conversation, a source of current for the cord circuit, a resistance and 110 a signal adapted to be placed in a circuit with said source when the cord is connected with a line, means for shunting said resistance when the line is open at the substation, whereby the signal receives sufficient current 115 to display it and for shunting said signal when the line is closed at the substation, whereby the signal is effaced, substantially as described.

6. In a telephone system, the combination 120 with a cord circuit, of a source of current associated therewith, a signaling device actuated by current in one of the talking strands of said cord circuit, a relay actuated by current in another strand of said cord circuit, and means to shunt said signal to deprive the same of operating current by the actuation of said relay, substantially as described.

7. In a telephone system, the combination 130

- with a cord circuit, of a signaling device actuated by current in one of the talking strands of said cord circuit, a relay actuated by current in another talking strand of said cord circuit, and means to shunt said signaling device to complete a path for battery current about said signal by the actuation of said relay, substantially as described.
8. In a telephone system, the combination with a telephone line, of a cord circuit to connect therewith, a signaling device actuated by current in a local circuit including a portion of one of the talking strands of the cord circuit, a relay actuated by current in the line and over a portion of another talking strand of the cord circuit, and means to complete a path for battery current about said signaling device by the actuation of said relay whereby said signaling device becomes inoperative, substantially as described.
9. In a telephone system, the combination with a telephone line, of a cord circuit to connect therewith, a cut-off relay having its coil permanently connected with one of the line contacts, a signaling device included in a talking strand of the cord circuit and adapted to be displayed by current through said cut-off relay, and means actuated by current in the telephone line for closing a shunt about said signaling device, whereby it becomes inoperative, substantially as described.
10. In a telephone system, the combination with a telephone line, of a cord circuit adapted to be connected therewith for conversation, a source of current associated with the cord circuit and adapted to furnish current to the line over the limbs of the cord circuit, a resistance and a signal in the path of said current, means to short circuit the resistance when the cord is connected to a line open at the substation, whereby sufficient

current will flow to display the signal, said means being adapted to short circuit the signal when the line is closed at the substation, whereby sufficient current will flow for the operation of the substation transmitter, substantially as described.

11. In a telephone system, the combination with a cord circuit, of a central source of current, a signal lamp and a resistance adapted to be connected in a circuit including said source and a portion of the talking circuit, a shunt circuit normally in parallel with said resistance whereby the signal lamp receives sufficient current to actuate it, and means for removing said shunt and completing a shunt about the signal lamp, whereby the signal becomes effaced, substantially as described.

12. In a telephone system, the combination with a telephone line, of a cord circuit to connect therewith for conversation, a source of current associated with the cord circuit and adapted to furnish energization current to the line when the cord is connected therewith, a resistance and a signal in the path of such energization current, a relay for the cord circuit under the control of the subscriber during the connection of the cord with the line, a normally closed shunt about said resistance and a normally open shunt about said signal, said relay being adapted when actuated to open the shunt about said resistance and to close the shunt about said signal, substantially as described.

Signed by me at Chicago, county of Cook, State of Illinois, this 29th day of October 1903.

WILLIAM W. DEAN.

Witnesses:

GAZELLE BEDER,
ROBERT LEWIS AMES.