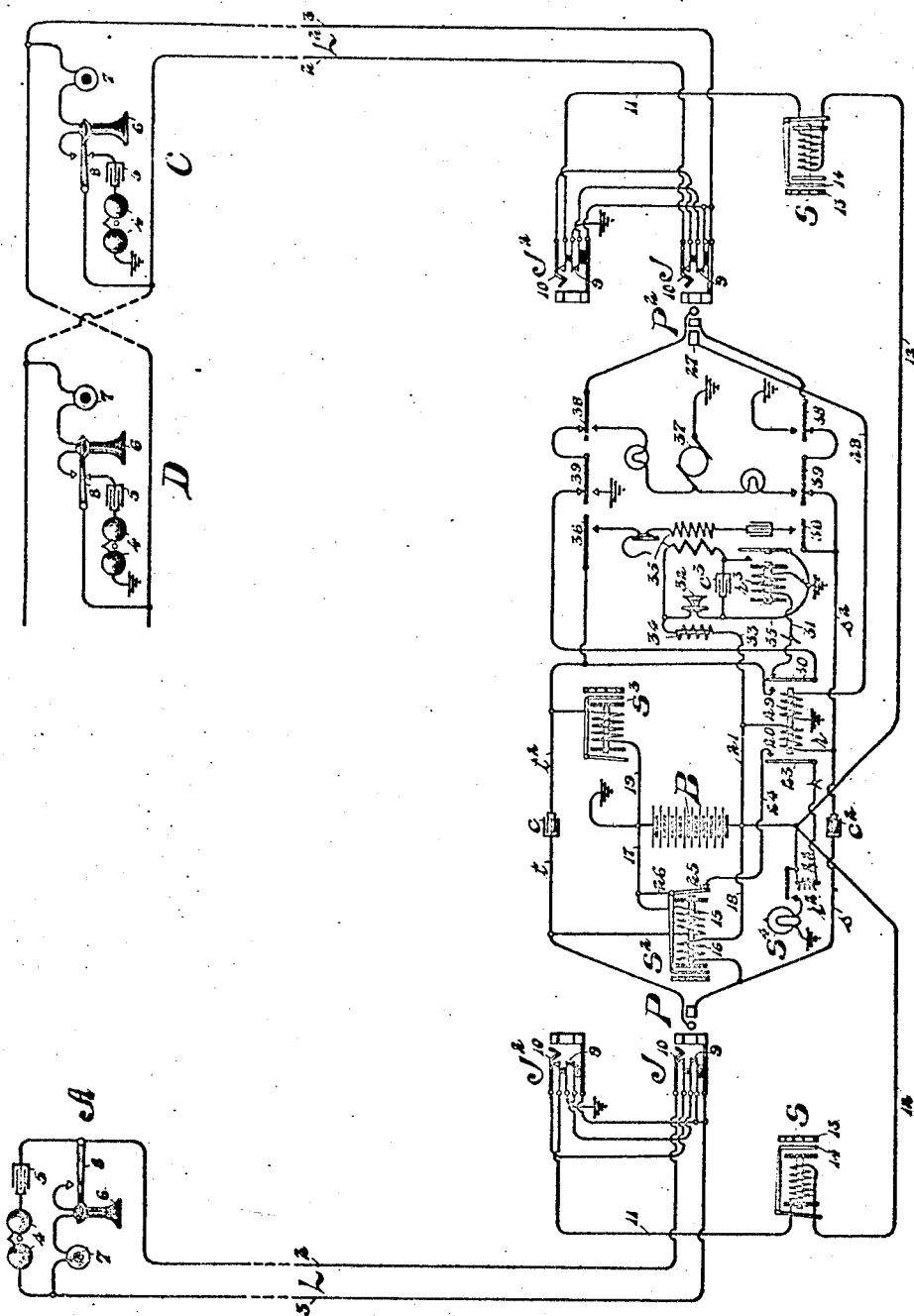


No. 895,166.

PATENTED AUG. 4, 1908.

W. W. DEAN.
TELEPHONE SYSTEM.
APPLICATION FILED DEC. 22, 1902.



Witnesses.
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Systems, Central,
Multiple switchboard,
Centralized energy,
Line signal control,
Spring jack cut-off.

UNITED STATES PATENT OFFICE.

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TELEPHONE SYSTEM.

No. 895,166.

Specification of Letters Patent.

Patented Aug. 4, 1908.

Application filed December 22, 1902. Serial No. 136,095.

To all whom it may concern:

Be it known that I, WILLIAM W. DEAN, a citizen of the United States, and residing at Chicago, in the county of Cook and State of Illinois, have invented new and useful Improvements in Telephone Systems, of which the following is a specification.

My invention relates to telephone systems and particularly to the supervisory apparatus associated with the multiple switch connections of the lines at the central office.

It is sometimes desirable to use supervisory signals that are negative in character, that is, such as are visible during conversation and are extinguished to give the disconnect indication. It is moreover desirable with such a signal to employ a pilot relay that is positive in character and which becomes lighted when the other signals are rendered inert.

My invention consists in the several features of the line circuit and the supervisory apparatus hereinafter described and particularly pointed out in the appended claims.

In the accompanying drawing forming a part of this specification and in which the figure is a diagram of a telephone system embodying my improvements, the same reference characters are used throughout to indicate like parts.

L and L² represent telephone lines extending from their respective substations in two limbs 2 and 3 to the central office. At the sub-stations, station A for example, a call bell 4 and condenser 5 are preferably permanently connected between the line conductors, while the receiver 6 and transmitter 7 are in a bridge of the line normally open at the switch-hook 8. Any other arrangement or type of common battery sets may be employed. At the central office a plurality of jacks such as J and J² are provided for each of the lines, the line conductor 3 being extended through series contacts 9 in each of the jacks to ground while the tip conductor extends through the series contacts 10 thereof and thence by conductor 11 to the line signal S which is joined upon its other terminal by conductor 12 with the central and common battery B. The line signal shown is of the mechanical type preferably such as have a grating 13 in front of the target 14 of the signal. The target is provided with colored strips, preferably white, normally behind the bars of the grating 13 but which when the signal is actuated

are moved into line with the openings in the grating so as to be readily seen. With this arrangement a slight movement of the target serves to give a full and readily visible signal.

The cord circuit is provided with an answering plug P and a calling plug P² adapted to register with the contact surfaces of the jacks and when inserted to lift the tip springs thereof so as to open the contacts 9 and 10 and thereby cut-off the ground connection and the signal S. The tip contacts of the plugs are joined by strands *t* and *t*² connected together inductively through the plates of the condenser *c*, while the sleeve contacts of the plugs are inductively joined by the strands *s* and *s*² and the condenser *c*². A supervisory signal S² of the mechanical type just described has two balancing windings 15 and 16 connected in the conductors 17 and 18 leading respectively from the strands *t* and *s* to the grounded and live poles of the battery B. A similar supervisory signal for the calling end of the cord circuit is connected by means of conductor 19 between the strand *t*² and the grounded pole of the battery B. A relay *r* has winding 20 connected in a conductor 21 between the live pole of the battery B and the sleeve strand *s*² of the cord circuit. A pilot lamp or similar signal S³ has its circuit completed from the battery B, by conductor 22 through the pilot relay *r*², which conductor leads to the spring 23 of said relay *r*, the forward contact of which is joined by conductor 24 with the back contact or armature 25 of the signal S², which is connected by conductor 26 with the grounded conductor 17. A third contact 27 is provided upon the calling plug P² and which is adapted to be electrically connected with the ordinary sleeve contact of said plug by means of the test ring or sleeve contact of the jack of the line. A conductor 28 leads from said contact 27 through a retardation coil 29 which is preferably located upon the core of said relay *r*. The tip strand of the cord circuit is open at the front contact of spring 30 of relay *r* and the forward portion of said strand is connected through said spring and its back contact with a conductor 31 leading to the high impedance and high resistance test relay *r*³, the opposite pole of which is grounded. The operator's transmitter 32 is connected in a conductor 33 leading from the live pole of battery B through a retardation coil 34 to ground. The primary wind-

ing of the operator's induction coil 35 and the condenser c^3 are connected in a shunt of the transmitter 32. The operator's receiver, the secondary of her induction coil 35 and a condenser are adapted to be bridged across the cord circuit by the springs 36 of any suitable listening key. The generator 37 having one pole grounded is arranged to be connected with the tip side of the cord circuit by the springs 38 of a suitable ringing key while at the same time the sleeve cord is grounded. This connection of the generator serves to operate the call bell located at the station C while a depression of the springs 39 of the ringing key connects the said generator similarly with the other side of the cord circuit to ring the bell at the station D. Owing to the series contacts of the jacks, no cut-off relays are required for the lines.

In connecting subscribers for conversation the line signal S is actuated in the usual way by the removal of the receiver at the substation for conversation. Seeing the line signal the operator connects her cord circuit with the line, thereby cutting off the line signal and the ground connection and causing the operation of the supervisory signal S^2 through the medium of the current from the battery B which is now flowing over the calling line. The wanted line is tested in the usual way. If idle the test rings are connected to ground through the series contacts 9 of the jacks, but if busy such ground is cut-off and they are connected with the live pole of the battery, whereby the application of the tip of the testing plug permits a flow of current through the test relay r^3 thus energizing the same and causing it to complete a path for current through the primary winding of the operator's induction coil to cause a click in the operator's receiver.

Finding the line idle the plug is inserted and the ringing key operated. As before pointed out, either party may be rung by the actuation of the proper springs of the ringing key, the opposite line conductor being grounded to provide a low resistance return path for current in case the subscriber responds during ringing or in case a single subscriber is being rung. After ringing and before the subscriber's response the relay r is actuated by current over the sleeve strand, through the winding 20, the sleeve contact, test ring of the jack, contact 27 of the plug and thence by way of conductor 28 and through the 500 ohm winding 29 of relay r to ground. This relay is therefore operated to close the spring 23 upon its forward contact to complete the circuit at one point of the pilot relay and to disconnect the test relay by means of the spring 30 and complete the tip strand of the cord circuit for talking. The supervisory signal S^3 has not yet responded since there is no current flowing over the metallic line. When the subscriber re-

sponds, a path for current is provided from the battery B over the called line to which current the supervisory signal S^3 responds and remains exposed during the continuance of the conversation. The 500 ohm winding of the relay r furnishes sufficient retardation to prevent the passage of the voice currents. The battery B furnishes current to both lines for transmission purposes and for the operation of the various relays. At the termination of the conversation the return of the receivers to the hooks deprives the signals S^2 and S^3 of operating current and the signals are retired. The restoration of signal S^2 completes the circuit of the pilot relay r^2 which is now energized to close the circuit of the pilot lamp S^4 , in response to which the operator takes down the connection and restores all parts to normal condition. It will thus be observed that a positive pilot signal is obtained with the negative supervisory signals. Of course, the mechanical signals may be replaced by relays and lamps.

Various modifications may be made in my invention and I do not therefore desire to be limited to the exact features shown and described except when such is made necessary by the specific limitations imposed herein.

I claim.

1. In a telephone system, the combination with a telephone line, of a cord circuit to establish conversational circuits therewith, a supervisory signal associated with each end of the cord circuit and adapted to be rendered inert at the termination of the conversation, and a supervisory signal common to a plurality of cord circuits displayed when the calling subscriber hangs up his receiver and again effaced when the calling plug is removed from its connection with the called line, substantially as described.

2. In a telephone system, the combination with a telephone line, of a central source of current, a pilot signal for the cord circuit, a cord circuit to establish conversational circuits therewith, a relay connected between the said source and one side of the cord circuit, said relay serving to control at one point the circuit of the pilot signal, and means operated when the subscriber replaces his receiver for closing said circuit at another point, substantially as described.

3. In a telephone system, the combination with a telephone line, of a cord circuit to establish conversational circuits therewith, a central battery connected between the strands of the cord circuit, a supervisory signal connected between said battery and one of said strands, a relay connected between said battery and the other of said strands, said relay serving to control the current path of said signal over its strand, substantially as described.

4. In a telephone system, the combination with a telephone line, of a cord circuit to es-

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 Spring jack cut-off.

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establish connection therewith, a supervisory signal connected with the answering end of the cord circuit and responsive to current over the line, said signal being visible during conversation, a relay actuated over the calling end of the cord circuit, and a pilot signal having its circuit controlled by said relay and said supervisory signal and adapted to be actuated when said signal is rendered invisible, substantially as described.

5. In a telephone system, the combination with a telephone line, of a cord circuit adapted to be connected therewith for conversational purposes, a supervisory signal associated with one end of said cord circuit and adapted to be actuated over the telephone line, a relay associated with the other end of said cord circuit and adapted to be actuated by current in a local circuit, a pilot signal adapted to be displayed when said supervisory signal is in its normal condition and when said relay is in its actuated condition, substantially as described.

6. In a telephone system, the combination with a pair of telephone lines, of a cord circuit adapted to connect said lines together for conversation, supervisory signals for said cord circuit, one under the control of each of the subscribers connected for conversation, a relay associated with the cord circuit and adapted to be actuated during the connection of the calling end of the cord circuit with the called subscriber's line, a pilot supervisory signal associated with the cord circuit and having its circuit normally open at contacts of said relay and normally closed at contacts of said supervisory signal, whereby said pilot signal is displayed only when said supervisory signal is inert and said relay is actuated, substantially as described.

7. In a telephone system, the combination

with a pair of telephone lines having jacks at the central office, of a cord circuit adapted to connect said lines together for conversation, a calling plug for said cord circuit a pair of supervisory signals associated with the cord circuit, one of said signals being controlled over the calling subscriber's line and the other over the answering subscriber's line, a pilot signal associated with one of said supervisory signals and adapted to be displayed only when said signal is inert, and means controlled through contacts of the plug and jack to prevent the display of said pilot signal when the connection is severed between the calling end of the cord circuit and the called telephone line, substantially as described.

8. In a telephone system, the combination with a pair of telephone lines, of a cord circuit adapted to connect said lines together for conversation, a pair of supervisory signals associated, one with each of said lines during the connection of the cord circuit therewith, said signals being adapted to be positively displayed during conversation and negatively displayed when the conversation has terminated, and a pilot signal associated with the cord circuit and adapted to be negatively displayed during conversation and positively displayed when the conversation has terminated, and means actuated by the removal of the calling plug from the jack for again effacing the pilot signal, substantially as described.

Signed by me at Chicago, county of Cook, State of Illinois, this 11th day of December 1902.

WILLIAM W. DEAN.

Witnesses:

ROBERT LEWIS AMES,
 GAZELLE BEDER.