N. C. SCHELLENGER.

TELEPHONE SYSTEM.

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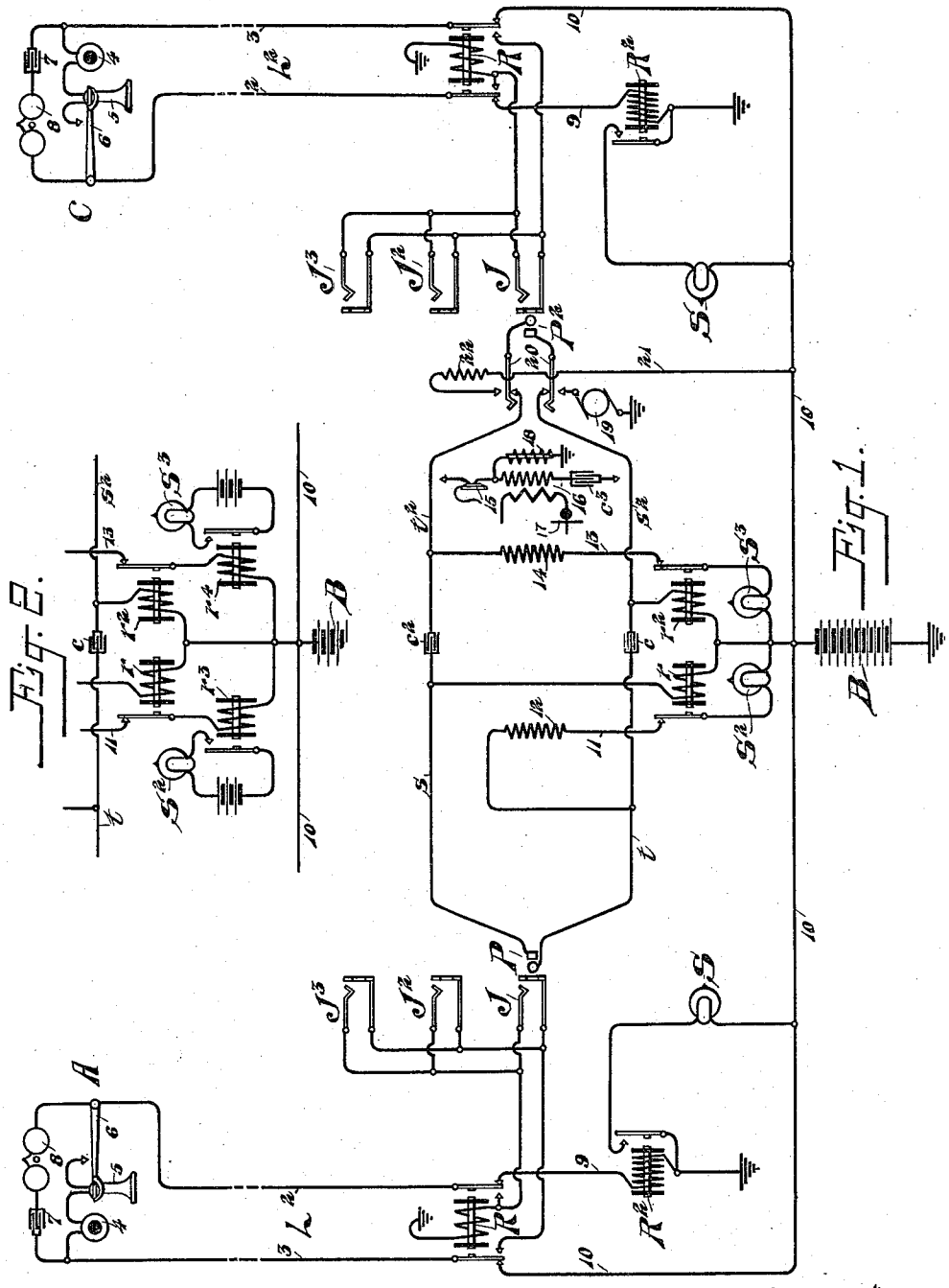
1,147,895. Patented July 27, 1915.



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TELEPHONE SYSTEM.

1,147,895. Specification of Letters Patent. Patented July 27, 1915.

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To all whom it may concern:

Be it known that I, NEWTON C. SCHELLENGER, a citizen of the United States of America, and residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Telephone Systems, of which the following is a specification.

My invention relates to telephone systems, particularly of the two-wire type or those in which the cut-off relays are actuated over circuits involving a portion of the talking circuit.

It has for its main object the provision of a system of the class described in which current is fed from the central battery through the cut-off relay of the telephone line and over the line circuit for conversational purposes, whereby there are no leaks or shunts across the line so that all current used, except that in the local circuits of the lamps or other signals must go out over the line. The cut-off relays act as retardation coils to prevent the short circuiting of the voice currents through the battery.

A further object of my invention is to provide a thoroughly balanced talking circuit when the lines are connected together for conversation, whereby transmission is carried out in the most efficient manner.

My invention is illustrated in the accompanying drawing in which—

Figure 1 represents a diagram of two subscribers' lines and a central office apparatus for connecting lines together for conversation, and Fig. 2 is a diagram of a slight modification.

In Fig. 1, L and L^2 indicate subscribers' lines extending in two limbs 2 and 3 from their respective substations A and C to the central office. At the substations a transmitter 4 and receiver 5 are placed in a bridge of the line conductors whose normal discontinuity is maintained by the switchhook 6, a condenser 7 and bell 8 being located in a permanent bridge of the said conductors. This apparatus is intended to typify any usual or desired common battery outfit.

At the central office the line is fitted with an answering jack J and with a plurality of multiple jacks J^2 and J^3, which are normally disconnected from the external line circuit through the contacts of a cut-off relay R, the winding of which is legged to ground from the tip conductor of the switchboard section of the said jacks. The line conductor 2 is normally connected with conductor 9 leading to the line relay R^2 which is grounded upon its other terminal and which controls through its normally open contacts, the local circuit of the individual line signal S. Line conductor 3 normally connects with a conductor 10 extending to the live pole of the central common battery B.

The operator's apparatus comprises a cord circuit having an answering plug P and a calling plug P^2 provided with tip and sleeve contact surfaces adapted to register with the corresponding contacts of the jacks when inserted therein. The tip contact of plug P is joined by flexible strand *t*, condenser *c* and strand s^2 with the sleeve of plug P^2, while the sleeve contact of plug P is united through flexible strand *s*, condenser c^2 and strand t^2 with the tip of plug P^2. A supervisory signal S^2 associated with the answering plug P has its circuit completed from the tip strand *t* over conductor 11 containing resistance 12 and the normal contacts of a supervisory relay *r* which is also connected with the live pole of said battery upon one side, and with the sleeve strand *s* of the cord circuit upon the other side. A similar supervisory signal S^3 is associated with the calling plug P^2 and has its circuit completed through the normal contacts of supervisory relay r^2 and branch conductor 13 containing a resistance 14 and leading to the tip strand t^2 of the cord circuit. The said relay r^2 is connected between the live pole of battery B and the sleeve strand s^2 of the cord circuit.

The operator's head telephone 15, the secondary of her induction coil 16 and a condenser c^3 are adapted to be bridged across the calling end of the cord circuit by means of any suitable key, while her transmitter 17 and the primary winding of her induction coil are included in a local circuit with any suitable source of current, and which may be the battery B. A retardation coil 18 is legged to ground from a point on the operator's bridge between the receiver 15 and the secondary winding of her induction coil.

A ringing generator 19 is adapted to be connected between ground and the sleeve

contact of calling plug P^2 by the springs 20 of any suitable ringing key while at the same time the tip strand is connected by conductor 21 containing resistance 22 with the live pole of the battery B.

In the operation of the system the subscriber A for example takes up his receiver and completes a path for current from the battery B over the conductor 10, the sleeve line conductor 3, through the substation instruments and back to the central office over line conductor 2 and branch conductor 9 containing line relay R^2 to ground. The current in this path actuates line relay R^2 and the signal S is lighted to indicate the subscriber's call. Upon observing the signal the operator inserts the answering plug P in the jack J of the line with the result that current from the battery B is first permitted to flow through lamp S^2, over conductor 11 and through resistance 12, thence over tip strand *t* and the tip conductor of the jack section of the line and thence through the winding of cut-off relay R to ground. The current in this path actuates relay R to sever the connection of the line conductors with branch conductors 9 and 10, thus rendering the line signal inoperative and at the same time connecting the external line circuit with the switchboard section. As soon as this is accomplished and owing to the fact that the subscriber's telephone is off its hook the path for current from battery B is completed through the supervisory relay *r*, over the sleeve strand *s* of the cord circuit, the sleeve side of the telephone line, through the sub-station devices, and back to the central office over line conductor 2 and thence through the cut-off relay R to ground. The supervisory relay *r* is actuated by current over this path and serves to open the circuit of supervisory signal S^2 thus rendering the same inert.

The operator connects her telephone with the cord circuit and receives the order from the calling subscriber and then proceeds to test the condition of the wanted line. Normally the test rings of the jacks are insulated from ground and from battery so that no current flows when the tip of a testing plug is touched thereto and the operator knows that the line is idle. As soon as the connection is established, however, the test rings are connected with the live pole of battery B through the inserted cord circuit, and when the tip of a testing plug is brought into contact with one of said rings a path for current is provided through the operator's receiver and the retardation coil 18 to ground causing a click in the operator's receiver. She will thus be notified that the line is busy.

Assuming that the line L^2 is found idle the operator inserts the plug P^2 and actuates the ringing key 20. The insertion of the plug operates the cut-off relay over the conductor containing supervisory lamp S^3 and the actuation of the ringing key 20 maintains the said relay operated by current over conductor 21, and through resistance 22. The path for ringing current is over the sleeve conductor of the telephone line through the bell at the substation, and thence back to the central office over the tip side of the line and through the conductor 21, lead 10, and battery B to ground.

As soon as the subscriber has been called and before his answer the supervisory lamp S^3 is lighted over the path just described including the cut-off relay R. Upon his response the supervisory relay r^2 is actuated to render the supervisory signal inoperative and the cut-off relay is now energized by the return current over the telephone line as explained with reference to the line L. The subscribers are now in communication and the current from the battery B is fed out through the supervisory relays over the sleeve side of the line with return over the tip sides of the lines and through the cut-off relays to ground and thence to the grounded pole of the battery B. The cut-off relays, as is evident, must present sufficient retardation together with that of the supervisory relays to prevent the passage through the battery B of the voice currents. With this arrangement there are no leaks or shunts across the line so that all the battery current except that used in local circuits of the lamps is fed out to the lines.

During conversation it will be noted that owing to the transposed or diagonally connected cord circuit the cut-off relays R are legged to ground from the opposite sides of the metallic talking circuit, and that the supervisory relays are connected from the live pole of the battery B to the opposite sides of the cord circuit. This results in a thoroughly balanced talking circuit. A connection from each end of the battery, it will be understood, is thus made to the opposite sides of the metallic talking circuit and upon opposite sides of the condensers interposed in each side of said circuit.

Fig. 2 shows a slight modification in that the lamps S^2 and S^3 of Fig. 1 are replaced by the relays r^3 and r^4 which control the local circuits of the supervisory lamps S^2 and S^3 shown lighted from separate batteries, although the main battery B may be and in practice preferably is employed. The relays r^3 and r^4 are preferable under some conditions of use, such as in connection with very long lines.

The several grounds mentioned may and in practice usually are one and the same or they may be the common office return.

Various modifications may be made in the details of the invention without departing from the scope or principle of the same.

Having thus described my invention what I claim and desire to secure by Letters Patent is:—

A telephone system including telephone lines terminating in two conductor jacks, a central source of battery current, a cut-off relay for each line having one terminal connected to the tip of the jack and its other terminal connected to a grounded pole of the battery, a link circuit having tip and sleeve talking conductors with interposed condensers uniting the plug terminals thereof, a single-winding supervisory relay for each end of the link circuit having one terminal connected to the sleeve conductor and the other terminal direct to an ungrounded pole of the battery, a supervisory lamp connected through a normally closed contact of each relay between the corresponding tip conductor and the ungrounded pole of the battery whereby when connection is made between a link circuit and a line the cut-off relay is first energized followed by the energization of the supervisory relay and a talking battery supply bridge is provided in which all of the talking current for each line passes through the associated supervisory and cut-off relays.

Signed by me at Chicago, county of Cook, State of Illinois, this 20th day of February 1903.

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