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TELEPHONE SYSTEM.

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903,547. Patented Nov. 10, 1908.

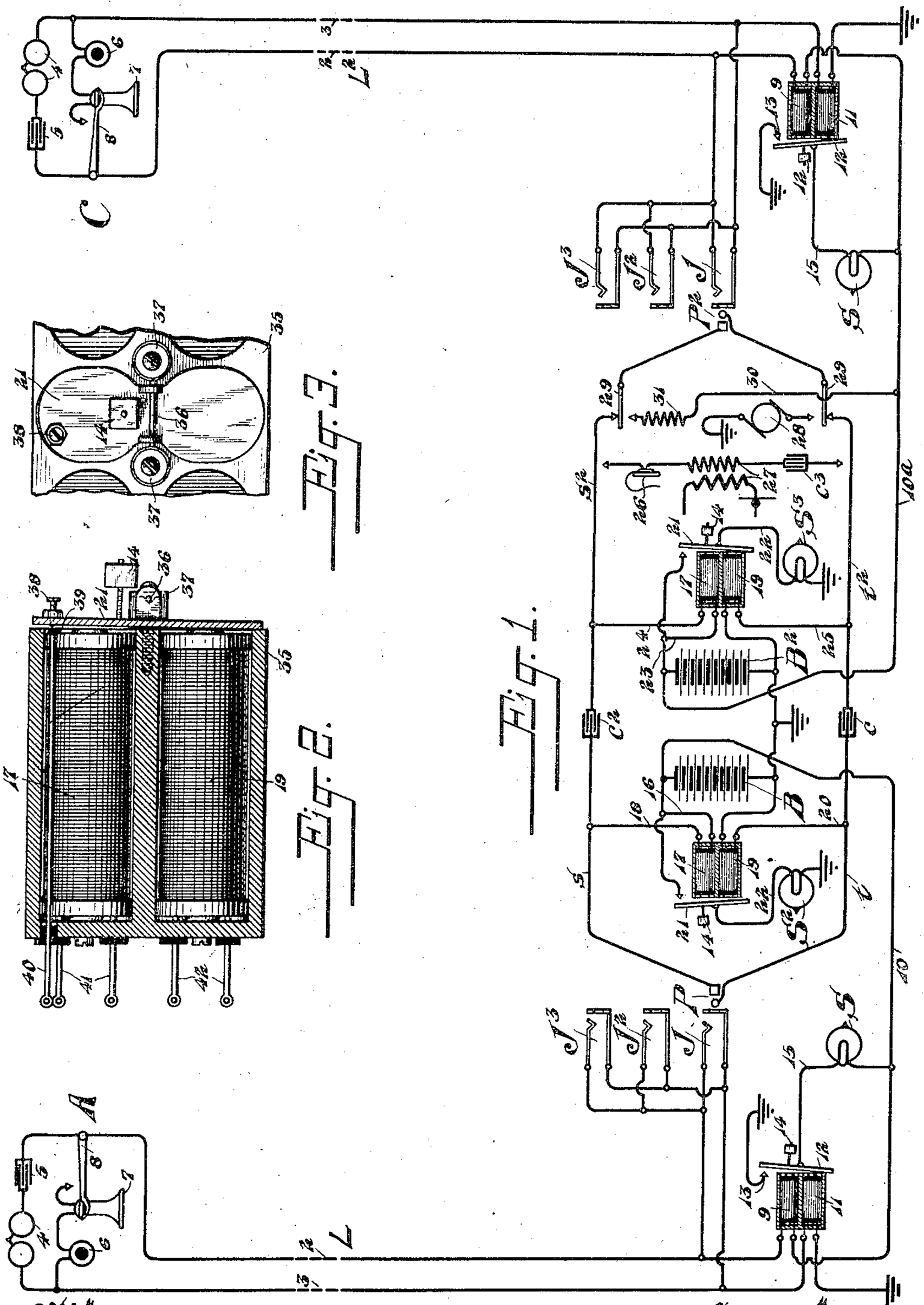

Fig. 1.

Fig. 2.

Fig. 3.

Witnesses.

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TELEPHONE SYSTEM.

No. 903,547. Specification of Letters Patent. Patented Nov. 10, 1908.

Application filed June 29, 1903. Serial No. 163,611.

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 Ilinois, have invented a new and useful Improvement in Telephone Systems, of which the following is a specification.

My invention relates to improvements in telephone systems and apparatus and has for its object the provision of means whereby a reduction in the amount of the apparatus required for either the telephone line or the cord circuit or both over that of the ordinary system is secured.

In my invention I arrange in association with the telephone line a single magnetic device preferably in the form of a relay, which is provided with two magnet coils, one serving when operated singly to close the relay circuit and the other coil serving when actuated to overpower the other magnet and effect a change in the circuit or apparatus controlled by the said device. I may use such a device in connection with the telephone line circuit in place of the usual line and cut-off relays, the first coil mentioned serving when energized to operate the line signal and the other coil serving when sufficiently energized to overpower the first mentioned magnet and efface the said signal. This device may also be conveniently used in connection with the supervisory system of the cord circuit in which the first magnet coil is connected with the cord strand through which circuit is first established when connection is made with an idle telephone line, whereby the supervisory signal is operated, and the second magnet being in the path of current over the telephone line and therefore under the control of the subscriber and serving when the telephone is in use to overpower the first magnet and retire the said signal. It is also obvious that the two devices are particularly adapted for use in the same system and with a consequent reduction in both the line circuit and cord circuit apparatus.

My invention is illustrated in the accompanying drawing in which

Figure 1 is a diagram of a telephone system embodying my improvements; Fig. 2 is a sectional view through the two magnet coils, and Fig. 3 is a front view of the device.

In Fig. 1, L and L^2 indicate two subscribers' lines extending in two limbs 2 and 3 from their respective substations to the central office. At the substations they are provided with an ordinary bell 4 and a condenser 5 in a permanent bridge of the line and with a transmitter 6 and receiver 7 in a bridge whose normal discontinuity is maintained by the switch-hook 8. This apparatus is intended to typify any usual or desired common battery outfit.

At the central office the line is provided with answering and multiple jacks J, J^2 and J^3 having their two main line contacts permanently connected with the corresponding line conductors 2 and 3. The line signaling device consists of a magnet coil 9 of high resistance included in the extension of the line limb 2 over conductor 10 to the live pole of the central and common battery B, and a low resistance magnet coil 11 included in the sleeve conductor 3 of the telephone line. A suitable armature lever is pivoted between these magnet coils and is normally prevented from engaging the ground contact 13 by a weight 14, or equivalent device, and which armature is connected with the conductor 15 leading to the battery wire 10 through the line signal S of the telephone line. When the magnet 9 is energized therefore the signal S has its local circuit closed at the contact 13, and when the magnet 11 is energized said armature 12 is drawn away from said contact 13 and the circuit of the signal is opened.

The cord circuit includes the answering and calling plugs P and P^2 respectively, having their tip contacts connected together by the strands t and t^2 and the interposed condenser c, while their sleeve contacts are joined by contacts s and s^2 and the interposed condenser c^2. The live pole of the battery B is connected by means of conductor 16 with one terminal of the magnet coil 17, corresponding in this device to the magnet 9 of the line signaling device, and whose other terminal is joined by conductor 18 with the sleeve strand s of the cord circuit. In a similar manner the grounded pole of the battery is connected through the winding of the magnet 19 of said supervisory signal with the tip strand t of the cord circuit by means of conductor 20. The supervisory signal S^2 has its local circuit completed from the live pole of the battery B through the armature 21 of said magnets and the branch

22 to ground. It is obvious that the operation of magnet 17 closes the said local circuit of said supervisory signal, while the energization of magnet 19 overpowers said magnet 17 and opens said circuit. In a similar manner the supervisory lamp S^3 associated with the calling plug P^2 has its circuit controlled by a similar device in which the magnet 17 is connected by conductors 23 and 24 between the live pole of a central common battery B^2 and the sleeve strand s^2 of the cord circuit, while the magnet 19 is connected by conductor 25 from the ground pole of the battery B^2 to the strand t^2 of the cord circuit. The operator's head telephone 26, the secondary of her induction coil 27 and a suitable condenser c^3 are adapted to be bridged across the calling end of the cord circuit by means of any suitable listening key, preferably one in which the operation of a single lever simultaneously connects the operator's bridge with the two strands t and s of the cord circuit. A suitable calling generator 28 is adapted to be connected between ground and the tip strand t^2 of the cord circuit by means of the tip spring 29 of the ringing key, the sleeve spring simultaneously connecting the forward portion of the sleeve strand s^2 of the cord circuit with the conductor 30 including a resistance 31 and the battery lead 10^a extending to the live pole of the battery B^2, which latter battery is common preferably to all of the cord circuits and a large number of telephone lines.

In the particular system shown the two coils 9 and 11 of the line signaling device are placed in series in the path of current over the telephone line so that when the subscriber takes up his receiver, current will flow from the battery B over conductor 10, through coil 9 of the device, over tip conductor 2 through the substation devices and thence back to the central station over line conductor 3 and through the magnet coil 11. The coil 9 is of sufficiently high resistance and the coil 11 of sufficiently low resistance so that the magnet 9 is now actuated and serves to close the local circuit of the line signal S through its forward contact 13. These coils may have various resistances to adapt them to the particular system in which they are used, but in the system shown it is found desirable to make the coil 9 of 1000 ohms resistance, and the coil 11 of 100 ohms resistance. The line coil 9 is thus made sensitive to the calling current and readily operates to cause the operation of said signal.

Upon observing the signal the operator inserts the answering plug P in the jack J of the telephone line, which permits current to flow from the live pole of said battery B over conductor 16, coil 17 of the supervisory device, conductor 18, sleeve strand s of the cord circuit, through the sleeve conductor of the jacks of the line and the coil 11 of the line signaling device to ground. This circuit is directly in shunt of the line with its high resistance so that the coil 11 receives sufficient current to operate the same, causing it to attract its armature thus overpowering the coil 9 and opening the local circuit of the line signal S which is accordingly effaced. Owing to the fact that the subscriber's telephone is off its hook current will now also circulate over the metallic telephone line and through the cord strand t and conductor 20 including the winding 19 of said supervisory device. The resistance of each of the coils 17 and 19 may be 100 ohms. These coils and the weight 14, or equivalent means, are so adjusted that the coil 19 is energized sufficiently under these conditions to attract its armature and overpower the magnet 17 and prevent the closing of the local circuit of the signal S^2 which accordingly remains inert.

Connecting her instrument with the cord circuit the operator receives the order from the calling subscriber and proceeds to test the idle or busy condition of the line. If idle the test rings of the jacks of the line are connected to ground through the coil 11 of the line signaling device, and since the tip of the testing plug is likewise normally grounded no flow of current results when the line is tested and no click is received. Should the line be connected for conversation, however, the test rings are connected with the live pole of either the battery B or B^2 through the sleeve strand of the inserted cord and the application of the grounded tip of the testing plug thereto results in a flow of current over the strand t^2 of the testing cord and a change of potential at the terminals of the operator's bridge which causes a surge of current through the operator's instrument and produces a click. The operator is thus informed that the line is busy.

Assuming that the line is found idle, the calling plug P^2 is inserted in one of the multiple jacks of the calling line at the operator's section and the ringing key operated. The ringing current finds a path out over the tip side of the telephone line, through the calling device at the substation and back to the central office and through the forward portion of the sleeve strand s^2, conductor 30, resistance 31, lead 10^a and battery B^2 to ground. The flow of steady current over the sleeve conductor of the cord circuit tends to maintain the magnet 11 actuated but even if the ringing current passes through the cut-off magnet 11 no great harm results.

After the subscriber has been called but before his response current is flowing over the sleeve conductor s^2 of the cord circuit and through the winding 11 of the line signaling device to ground. The current through the coil 17 of the supervisory de-

vice is sufficient to close the local circuit of the supervisory signal S^3 which is lighted to indicate that the called subscriber has not yet responded. At the same time the cut-off magnet 11 of the called line is energized so that the line signal belonging to that line does not operate. Upon the response of the called subscriber current is allowed to flow over the tip strand t^2 and magnet 19 of the supervisory signaling device. This results, as before explained, in overpowering the effect of magnet 17 on the armature which results in opening the local circuit of the supervisory signal S^3 to retire the same, thus indicating to the operator that the subscriber has responded.

During conversation the batteries B and B^2 are sending current out over the telephone lines for talking purposes and for the operation of the various magnet coils. At the termination of the conversation when the subscribers return the recivers to the hooks current is cut off from the coils 19 of the supervisory signaling devices with the result that the coils 17 immediately close the local circuits of said signals which are lighted to indicate the fact of the termination of the conversation to the operator, and the operator accordingly takes down the connection and restores all parts to normal.

It is obvious that my invention is not limited to the exact construction shown and that it may be embodied in various forms and the coils may be varied in their electrical and other dimensions to suit the requirements of the particular system in which it is desired to use the same.

In Figs. 2 and 3 I show one practical embodiment for the signaling device. In these figures 35 represents a casing or shell of cast iron or other magnetic material, in which a pair of magnet coils, for example the coils 17 and 19, are located, and acting upon the opposite ends of the armature 21 pivoted upon the pin 36, supported at its ends in the studs 37 secured to the front face of the bar 35 in which said coils are located. The upper end of the armature 21 carries an adjustable contact 38 which is adapted to engage the stationary contact 39 mounted upon the front end of the spool of the upper magnet coil 17 and connected by the terminal 40 through the rear of the magnet bar. The other terminals 41 and 42 are likewise projected from the rear of the magnet bar and are suitably connected with the ends of the coils 17 and 19. An adjustable weight 14 is carried by the armature 21 by means of which the proper adjustment of the armature for the particular system in which the device is to be used, may be secured.

Having described my invention, what I claim is:

1. In a telephone system, the combination with a telephone circuit, of a common source of current at the central office, an electromagnetic mechanism including two magnet coils both operable over circuits including portions of the talking circuit, one of said coils being energized to attract its armature and the other coil being energized at another time to attract its armature, the latter armature being operated against the force of said first mentioned coil, both of said coils receiving current simultaneously from said common source, and telephone apparatus controlled by said armatures, substantially as described.

2. In a telephone system, the combination with a telephone circuit, of a common source of current at the central office, an electromagnetic mechanism including two magnet cores both energized over circuits including portions of the talking circuit, a signal controlled by the magnetism in said cores, one of said cores being magnetized at one time to affect the said signal and the other core being magnetized at another time to affect said signal, said second core operating in affecting said signal against the magnetic force of said first core, both of said cores being energized simultaneously by current from said common source, substantially as described.

3. In a telephone system, the combination with a telephone circuit, of a common source of current at the central office, an electromagnetic mechanism including a pair of magnet coils, a signal controlled by said coils, one of said coils serving at one stage of the operation to be energized to cause said signal to be exposed, and the other coil serving at another stage of the operation to be energized and cause said signal to be effaced, said second mentioned coil operating in effacing said signal against the force of said first mentioned coil without annulling the magnetic force of said first coil, both of said coils receiving current simultaneously from said common source over a portion of the talking circuit, substantially as described.

4. In a telephone system, the combination with a telephone circuit, of a common source of current at the central office, an electromagnetic mechanism including two magnet coils both operable over circuits including portions of the talking circuit, a signal having its circuit controlled by said coils, the operation of one of said magnet coils serving to close the circuit of said signal thus causing the signal to be exposed and the operation of the other magnet coil serving to open the circuit of said signal whereby said signal is effaced, said second mentioned coil operating to overpower the magnetic pull of the first coil without annulling it, both of said coils receiving current simultaneously from said common source, substantially as described.

5. In a telephone system, the combination with a telephone circuit, of a common source

of current at the central office, a signal adapted to be displayed from said source, an electro-magnetic mechanism including a pair of coils both operable over circuits including portions of the talking circuit and acting upon a single armature, one of said coils serving to operate said armature in one direction and the other coil serving to move said armature in the reverse direction, to control the connections of said source with said signal, said second mentioned coil operating in moving said armature against the power of said first mentioned coil, both of said coils being adapted to receive current simultaneously from said common source, substantially as described.

6. In a telephone system, the combination with a telephone line, of a cord circuit for making connection with the line for conversation, a supervisory signal associated with the cord circuit, a common source of current at the central office for energizing the telephonic apparatus, and an electro-magnetic mechanism having two coils and a single armature controlled thereby for controlling the circuit of said signal, both of said coils being adapted to receive current from said common source, one of said coils being adapted to cause the operation of said signal by attracting said armature when a connection is made with a line for conversation, the other of said coils being adapted to overpower and attract said armature away from said first mentioned coil when the subscriber's telephone is removed from its hook, whereby said signal is effaced, substantially as described.

7. In a telephone system, the combination with a telephone line, of a cord circuit for making connection with the line for conversation, a signal for supervising said connection, a common source of current at the central office for energizing telephonic apparatus, and an electro-magnetic mechanism having two coils for controlling the circuit of said signal, both of said coils being adapted to receive current from said source, one of said coils being adapted to cause the operation of said signal when a connection is made with a line for conversation over a path local to the central office, the other of said coils being adapted to overpower said first mentioned coil over a path including the substation apparatus when the subscriber's telephone is removed from its hook, whereby said signal is effaced, substantially as described.

8. In a telephone system, the combination with a telephone line, of a cord circuit for making connection therewith for conversation, a suitable signal for supervising said connection, a common source of current located at the central office and an electro-magnetic mechanism having two coils for controlling said signal, both of said coils being adapted to receive current from said source, one of said coils being adapted to cause the operation of said signal by the attraction of an armature when a connection is made with a line for conversation, said coil being under the control of the operator, the other of said coils being adapted to overpower and to attract said armature away from said first mentioned coil, said second mentioned coil being under the control of the subscriber, whereby said signal is effaced, substantially as described.

9. In a telephone system, the combination with a telephone line, of a cord circuit for making connection therewith for conversation, a supervisory signal associated with the cord circuit, a common source of current at the central office, an electro-magnetic mechanism having two magnet coils for controlling said signal, said coils being adapted to receive current from said source and having different magnetic circuits, a single pair of contacts for said mechanism, one of said coils being adapted to cause the operation of said signal when a connection is made with a line for conversation, the other of said coils being adapted to overpower said first mentioned coil when the subscriber's telephone is removed from its hook, whereby said signal is effaced, substantially as described.

10. In a telephone system, the combination with a telephone line, of a cord circuit for making connection therewith for conversation, a supervisory signal associated with the cord circuit, an electro-magnetic mechanism for controlling said signal, said mechanism having two magnet coils and two magnetic circuits, one of said coils being adapted to cause the operation of said signal, the other of said coils being adapted to overpower said first coil to efface said signal, substantially as described.

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

WILLIAM W. DEAN.

Witnesses:
ROBERT LEWIS AMES,
EVA A. GARLOCK.