H. G. WEBSTER.

COMBINED TELEPHONE AND SERVICE SYSTEM.

APPLICATION FILED JAN. 6, 1908.

976,961.

Patented Nov. 29, 1910

2 SHEETS—SHEET 1.

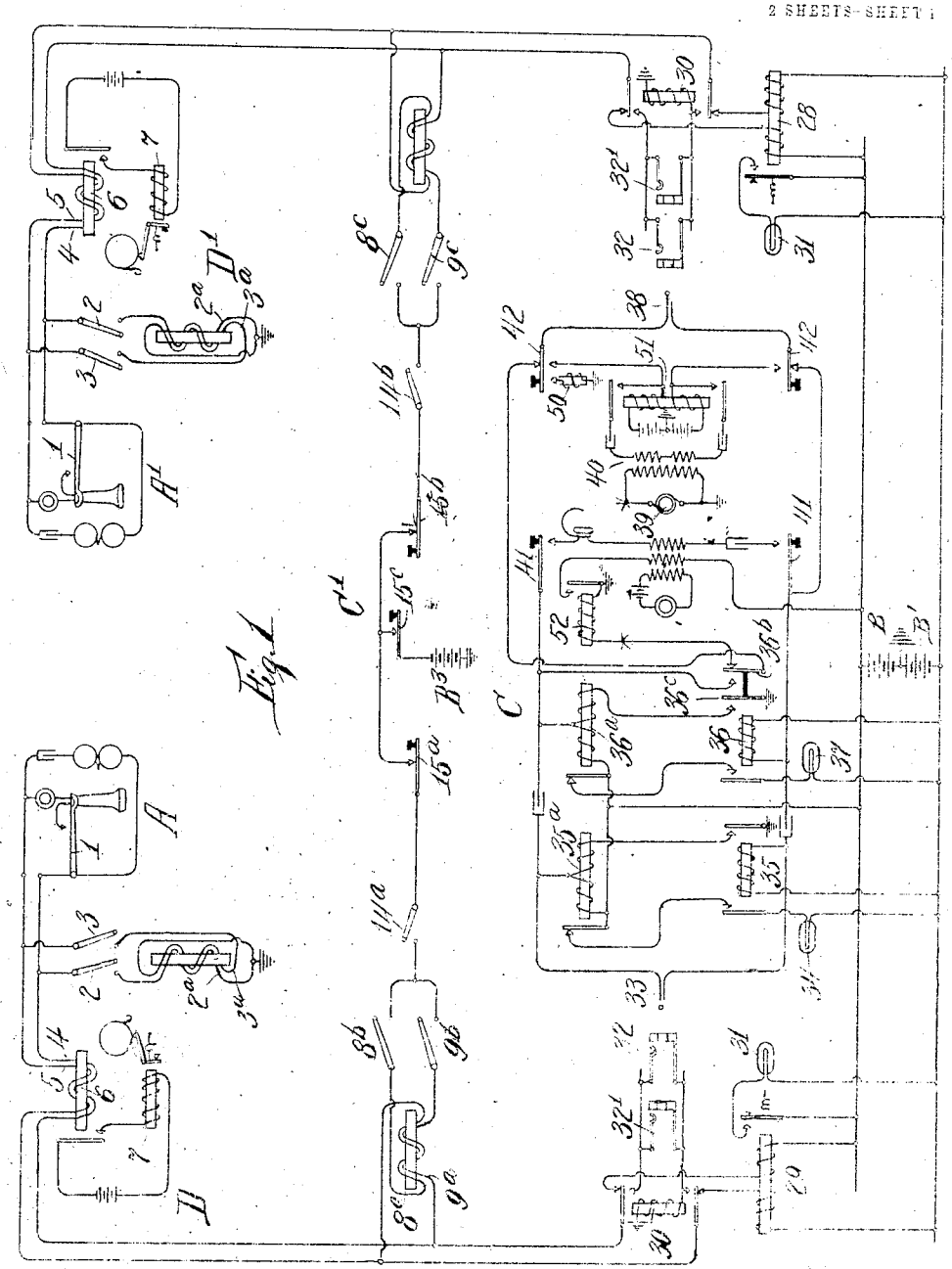

Fig. 1.

Witnesses
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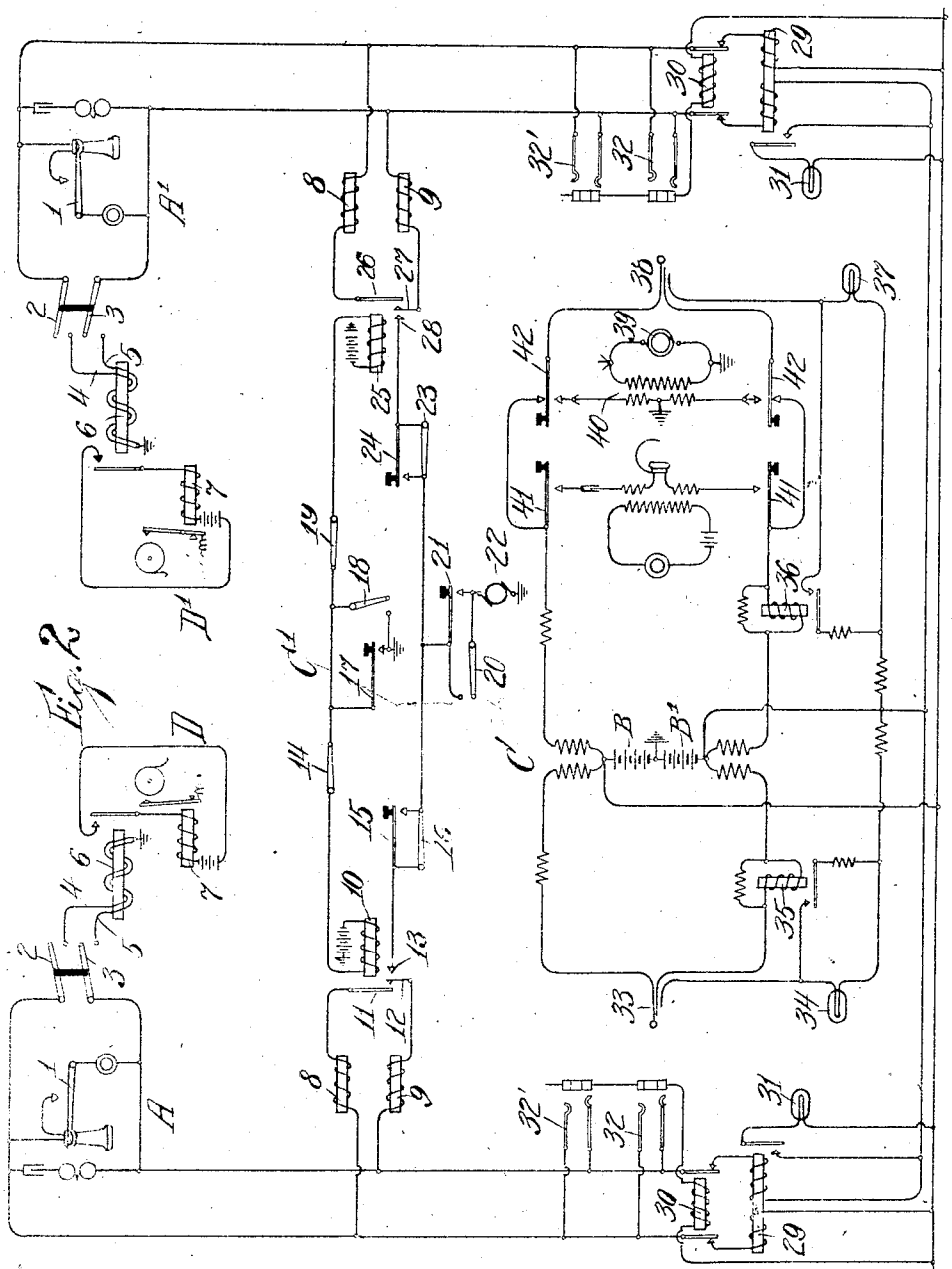

Fig. 2

Witnesses

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UNITED STATES PATENT OFFICE.

HARRY G. WEBSTER, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO KELLOGG SWITCHBOARD & SUPPLY COMPANY, A CORPORATION OF ILLINOIS.

COMBINED TELEPHONE AND SERVICE SYSTEM.

976,961. Specification of Letters Patent. Patented Nov. 29, 1910.

Application filed January 6, 1908. Serial No. 409,523.

To all whom it may concern:

Be it known that I, HARRY G. WEBSTER, residing at Chicago, in the county of Cook and State of Illinois, have invented new and useful Improvements in Combined Telephone and Service Systems, of which the following is a specification.

My invention has to do with means for rendering available in connection with the local lines of the subscribers to an exchange, which may be of the ordinary common battery type, an auxiliary service, without interfering with the telephonic employment of the lines. I am enabled to send distinctive signals, by my invention, over a subscriber's line while conversation is taking place thereover to operate the relay of a telegraphic instrument, for example, which may be connected in the line at any point.

I am aware that simultaneous telephony and telegraphy over the same conductors is not novel, but so far as I am aware, systems have not hitherto been provided wherein double service is employed in connection with telephone lines which receive their current supply from a centralized source.

In Figure 1, I have illustrated telephone circuits with mechanism associated therewith for supplying auxiliary service in accordance with my invention. In Fig. 2, I have shown a somewhat varying application of my invention in connection with a telephone system of a different character from that illustrated in Fig. 1.

While I have elected to illustrate my invention as for giving telegraph service in connection with telephone service, it is to be understood that the invention is not limited to the specific services referred to, but that it may be employed for various uses as conditions may require.

Referring first to Fig. 1, I show at A and A′, two telephone stations each connected with its appropriate line circuit at the exchange by its telephone line. At C, I have illustrated an operator's cord-circuit adapted to be employed to telephonically connect the two telephone substations. The line circuits of the two lines are alike and a description of that of substation A will suffice for both. It comprises the double wound line relay 29 controlling the circuit of the call signal lamp 31. The line is provided also with the multiple spring-jacks 32, 32′, the customary cut-off relay 30 being connected to the sleeve contacts of the spring-jacks and adapted for actuation to operatively disconnect the line relay 29 from the line and to connect the line conductors with the spring-jack contacts. The cord-circuit C comprises answering plug 33 to whose sleeve contact the supervisory relay 35 is connected, the opposite terminal of said relay being connected to the negative side of the grounded battery B′. The tip supervisory relay 35^a is provided with two windings, that at the left being of relatively low resistance, say one hundred ohms, while that at the right is of relatively high resistance, say five hundred ohms, to the end to be hereinafter explained. The calling end of the cord C, is provided with the plug 38 whose tip contact is normally connected with the test relay 52 through normal contact 36^b in the usual manner, while the calling supervisory relays 36 and 36^a correspond to the relays 35 and 35^a of the answering end of the cord. The calling end of the cord has associated with it the listening key levers 41, 41, to connect in the operator's telephone circuit, and the ringing key levers 42, 42 for placing the ringing generator 39 in operative relation with a called-for line. Each substation A or A′ is provided with a well known arrangement of substation circuits including a condenser and call-bell in permanent bridge of the line limbs while the hook-lever 1 is arranged to establish a conductive bridge of the limbs of the line including the transmitter and receiver, when the receiver is removed, in the usual manner.

A telegraphic local circuit associated with the line of A is indicated as a whole at D including a suitable battery and a local magnet 7 whose armature controls a printing member which is normally operatively engaging the customary roll of paper ribbon indicated. For controlling the local circuit, a relay is provided in the telephone line indicated as a whole at 6 and having the two windings 4 and 5 so connected as to be differential to the rapidly varying voice currents, the relay thus causing practically no distortion of the values of the talking currents. The windings of said relay are so disposed that when connected in series with a source of current, the core will be neutral. Associated with the telegraphic station D, are the levers 2, 3, of a double pole switch which, as illustrated, are in their inoperative

positions. When the telegraphic station is to be used, the said levers are to be thrown to their alternate positions thus connecting the windings 2^a and 3^a of the impedence coil illustrated with the two limbs of the telephone line. This coil, on account of its high inductive capacity and high ohmic resistance, effectually prevents undue short-circuiting of the voice alternations, and by the said ohmic resistance, prevents sufficient flow of current from the telephone battery to in any way affect the operative substation control of the telephone relays.

Associated with the telegraphic transmitting station C', I have illustrated a switch 14^a adapted to be shifted to engage its contact, the double pole switch comprising levers 8^b and 9^b being also provided to be thrown to engage their respective contacts whereby the high voltage battery B^s may be connected with the limbs of the line of substation A through the windings 8^a and 9^a of the impedance coil indicated, the said winding being preferably of high inductance and resistance, so that the voice currents will not be shunted to ground through the battery B, and so that the rise of potential in the telephone line may be very gradually produced when the source B^s is applied to the line so as not to produce disturbing noises in the telephone receiver if conversation is proceeding at the time.

I will now describe the method of establishing telephonic connection between two substations such as A and A' and thereafter point out more particularly the manner in which the telegraphic apparatus is operated in connection with the telephone circuits.

Assuming that the subscriber at A desires to converse with the subscriber at A', the removal of the receiver at substation A allows the elevation of the hook-lever 1 whereon current will flow from positive battery at B, right winding of line relay 29, over the telephone line, winding 4, hook-lever 1, winding 5, returning through the left winding of relay 29 to negative battery at B' whereby relay 29 will be energized and lamp 31 lighted in the usual manner to indicate the call. The operator answering, will insert plug 33 within an answering jack 32 of the calling line, current then flowing from negative battery at B' through sleeve plug and jack contact to ground through the cut-off 30 whose armatures are attracted to engage their alternate contacts, deënergizing relay 29 and putting out lamp 31. As soon as this occurs, a path for the flow of current is completed from battery B through the left winding of relay 35^a, through the tip plug and jack contact, attracted upper armature of relay 30, current thence passing out over the line and through the substation, returning through the lower attracted armature of relay 30, whereon the current divides, a part flowing to ground through said relay, the remainder flowing through the sleeve plug and jack contact and relay 35 to negative battery at B'. This flow through the left winding of relay 35^a is of sufficient volume to cause the energization of the relay whereby its armature is attracted and a display of answering supervisory signal 34 prevented. As soon as the operater plugged in, the relay 35 was energized by current through cut-off relay 30 and attracted its armatures, the attraction of its right armature providing a path for the flow of current from positive battery at B, and through the two windings of relay 35^a in series to ground.

It may be stated that the relay 35^a has its two windings so disposed and proportioned that they oppose one another when serially included with a current source to leave the relay core substantially neutral, so that when the hook-lever at the substation is depressed, the relay will be deënergized while the raising of the substation hook-lever, producing a heavier flow of current through the left-hand winding enables the subscriber to control the display of the supervisory lamp 34 in the customary manner. The calling supervisory relay 36^a is in these respects similar to 35^a.

It may be stated at this point that for a satisfactory operation of the system of my invention, a well balanced telephone line is preferably provided to the end that the application of the telegraph service current may not render the line noisy and so interfere with conversation. To this end the winding of relay 35 and the left-hand winding of relay 35^a are preferably of substantially like impedance and may be of one hundred ohms resistance each. As the winding of the cut-off relay 30, which is preferably of about five hundred ohms resistance, is connected to ground from the sleeve of the telephone line, I have provided the right-hand winding of relay 35^a in such relation that when an answering plug is connected with a calling line, the said winding, which is preferably of similar impedance to that of the cut-off relay 30, is connected from the tip side of the line to ground, whereby a properly balanced circuit at the exchange is secured. To a similar end, the windings 2^a and 3^a of the impedance coil at D are desirably of equal impedance.

The operator having answered, now actuates levers 41, 41, to include her talking set in connection with the calling substation and ascertains the number of the wanted subscriber, battery being supplied to energize the transmitter at A over the circuit already traced. Having ascertained the number, the operator will touch the tip of calling plug 38 to the sleeve contact of a spring-jack 32 of the wanted line to ascertain its idle or

busy condition. If the line be idle, the sleeve contact tested will be of the potential of ground, no actuation of the common test relay will be produced and the armature of said relay will not be attracted to cause the busy click in the operator's head telephone. If, however, the called line be busy, the insertion of some plug within a spring-jack of the line will have produced a potential other than at ground at the sleeve contact tested, which potential developing into current, will circulate through the common test relay 52 causing its actuation and the customary click. Assuming that the line wanted, tested idle, the operator inserts a calling plug 38 within the tested spring-jack and actuates the levers 42, 42, of her ringing key to project ringing current over the called line to signal the subscriber. It will be seen that as soon as the said levers are actuated, the relay 51 will be energized by current to ground through the sleeve plug and jack contact and through the cut-off relay 30 of the called line and also by current through the upper lever 42 and to ground through the impedance coil 50 which is preferably similar in resistance and inductance to the cut-off relay 30, the line being thus maintained balanced while the operator is ringing. Current from the grounded alternator 39 will now be transmitted by means of the induction coil 40 and its associated condensers through the attracted armatures of relay 51 and out over the called line causing the substation bell to ring as usual. The operator will now restore the levers of her ringing key and the relay 36 will be operated in series with the cut-off relay 30, attracting armatures 36^b and 36^c, connecting the right-hand winding of relay 36^a to ground, disconnecting the test relay 52 from the tip strand of the cord and completing the talking circuit of the tip cord strand whereby the calling supervisory relay 36^a is operatively connected with the called-for line. Current will thus flow from battery B through the left winding of said relay 36^a, alternate contact 36^b, tip plug and jack contact, attracted upper armature of relay 30 over the calling line and through the raised hook-lever, as soon as the subscriber responds, returning through the lower attracted armature of relay 30, lever 42 and relay 36 to negative battery at B′. Thus, as soon as the called subscriber answers, the calling supervisory signal lamp 37, displayed on the energization of relay 36, will be put out and the operator will know that a response has been made. Since the right-hand winding of relay 36^a is of like impedance to that of the cut-off relay 30 of the called-for line, it will be seen that the circuit of the called line will be balanced in a manner similar to that of the calling line.

The two subscribers may now converse and when, at the conclusion of conversation, they replace their receivers, the act at substation A will reduce the current flow through the left winding of relay 35^a to such an extent that the right winding will substantially balance the left one and the relay's armature will be retracted and the supervisory lamp 34 displayed, while the act at substation A′ will similarly affect the windings of relay 36^a whose armature will be also retracted and the calling supervisory lamp 37 displayed. Observing the display of the two signals, the operator will withdraw plugs 33, 38, and the telephonic apparatus will be in its normal quiescent condition.

I will now describe briefly the operation of the telegraphic circuit mechanism. Assuming that a message is to be transmitted to station D, the levers 2, 3, will have been thrown to connecting position with the windings 2^a, 3^a. The operator at C′ being ready to transmit a message will throw the levers 14^a, 8^b and 9^b to their connecting positions, when current will flow from the negative side of the high voltage battery B^3 through the contacts 15^c, 15^a, 14^a, in parallel through contacts 8^b, 9^b, windings 8^a, 9^a, the line limbs of substation A, windings 5 and 4, contacts 2, 3, windings 2^a, 3^a, to ground. This flow of current in parallel through the windings 4, 5, will be in such direction that the windings will produce magnetism of the relay core (which, it may be remarked, was not produced by them by the transmitter supply current, the winding being then in series so that the telephone current produced no attraction of the armature of relay 6) but the said windings will cumulatively magnetize the core of relay 6 so that its armature will be attracted and the relay 7 be energized to attract its armature whereby the printing member is removed from the periphery of the rotating roll of paper ribbon. The operator at C′ may now actuate the transmitting key 15^a to open and close the circuit of battery B^3, deënergizing and energizing the relay 6 to open and close the local circuit, the telegraphic message being recorded in the customary manner by the printing member.

It will be seen that when the battery B^3 is connected with the two limbs of the telephone line, the right-hand winding of line relay 29 will receive some current, assuming the line is idle, because the batteries B^3 and B will then be connected in series, but the relay 29 is sufficiently insensitive not to attract its armature in response to the small amount of current then passing through it, the current being limited by the high resistance of the winding 9^a. The resistance 9^a is such that the current flowing to line therethrough does not affect the operation of the relay 35^a, so that the operation of the tele-

phone signals is entirely unaffected and distinct from the service system and independent thereof, independent simultaneous operation of the two systems being provided for.

It will be apparent that since the windings 8^a, 9^a and 3^a are of very high inductance and also of very high ohmic resistance, the opening and closing of the key 15^a will have very slight disturbing effect, assuming that the telephone is being used for conversational purposes at the time the telegraphic message is being transmitted, and that furthermore, as the circuit of the line is accurately balanced, the current sent from battery B^3 in parallel over the line limbs will flow to ground over each line limb with substantially equal facility so that no telephonic disturbance can result.

It is apparent that by throwing the proper keys 14^b, 8^c and 9^c, the operator at C' may, by the key 15^b, transmit a message telegraphically to the station at D', while by throwing the proper keys and actuating the key 15^c, it is obvious that the same telegraphic message may be simultaneously transmitted from station C' to a plurality of stations D, D'.

In Fig. 2, I have indicated a pair of telephone stations A, A', extending by their telephone lines to an exchange and there providing the well known three-wire multiple line circuits, the circuit differing from that generally employed by the licensees of the American Telephone & Telegraph Company in that the line relay 29 is provided with a double winding. The cord-circuit C is also similar to that customarily employed by the said licensees, except in that a split battery comprising the parts B, B', having the intermediate point grounded, is provided and that, in the tip cord strand of the answering and calling plugs, resistances are inserted to balance those of the customary shunted supervisory relays 35 and 36. The connections of the grounded generator 39, include the inductance coil 40 having an intermediate point of its secondary winding connected to earth. The method in which the line signals and supervisory signals, and generally the operation of the described systems, are so well known that a more specific reference to the telephone apparatus of Fig. 2 is considered unnecessary. The telegraphic mechanism illustrated at D and D' in Fig. 2 for substation A and A' are similar and a description of that for D only will be given. The double pole switch 2, 3, is provided to connect the windings 4, 5, of the relay 6 to the limbs of the telephone line, the said windings being preferably of very high resistance so as to prevent shunting of the voice currents when the line is being used for conversation, and their inductance and resistance very high so that the telephone service apparatus is operatively unaffected by their connection to line. It is apparent that when the switches 2, 3, are thrown to their operative positions and the batteries B and B', having their center point grounded, are connected with the line limbs, the current flowing through the windings 4 and 5 will be of opposite polarity so that the core of the relay 6 will remain neutral. The mechanism at the transmitting station C' in the present figure comprises a high voltage direct current generator 22 associated with which are suitable switches and keys for controlling its connection with the contacts 13 and 28 respectively.

Assuming that while conversation is proceeding over line A, and that a telegraphic message is to be transmitted to station D, the lever 20 may be thrown to connecting position and the key 17 operated to energize and deënergize the relay 10 which, by its armature 11, will first connect together the two limbs of the telephone line of A through the impedances 8, 9, and then simultaneously connect the two said limbs with generator 22 from which current will flow in parallel through windings 8, 9, and through windings 4, 5, of relay 6 to ground, energizing the relay to attract its armature and close the local circuit of relay 7, whose armature will be attracted to cause the printing member to engage the rotating roll of paper ribbon. As in the case of Fig. 1, the high resistances and impedances employed for the telegraphic mechanism at 5, 6 and 8, 9, and the careful balancing of the line will prevent interference with the existing conversation and the telephone signaling. At C', I show varying arrangements of switches and keys adapted for employment to transmit messages telegraphically over one or a plurality of lines. For instance, the key 18 might be thrown to engage its contact in which case the relays 10 and 25 would be simultaneously energized, then, assuming that at stations D and D', switches 2, 3, had been thrown to connecting position, the operator might, by key 21, directly connect the generator 22 with the two telephone lines and transmit the desired message. The various combinations that may be secured are obvious and will not be particularly described.

It will be understood that my invention may be applied to various purposes such as alarm clock or ticker systems, and is not limited in these respects.

In carrying out my invention, it is only necessary that the special service currents, which are transmitted to actuate the special service mechanism, should be such as to cause the operation of a controlling electromagnet or relay of the character commonly employed in the art in such mechanisms. In the appended claims, I have used the term "steady" to define currents of this character.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. A combined telephone and service system including a telephone line, a central source of current, means for causing a steady flow of current from said source in series over the limbs of said line, means for causing a flow of steady current in parallel over the limbs of said line, a device for said line responsive to said flow of current in series but unresponsive to said flow of current in parallel, a second device for said line responsive to said flow of current in parallel but unresponsive to said flow of current in series, and means rendering said devices simultaneously and independently operable.

2. A combined telephone and service system including a telephone line, a central source of current, telephone signaling mechanism operable by steady current from said source over said line, means for transmitting special service signals by steady currents over said line, and means for preventing interference with said mechanism by said signal currents.

3. A combined telephone and service system including a telephone line, a central source of current for supplying energy to said line, and means for transmitting special service impulses by steady current over said line while preventing operative interference with the telephone service currents thereby.

4. A combined telephone and service system including a telephone line, a central source of current adapted to energize said telephone line for telephone service, means for transmitting special service signals over said line by completing an additional path for the flow of steady current over said line, and means for preventing interference between the telephone currents and the service currents when simultaneously flowing over said telephone line.

5. A combined telephone and service system including a telephone line, a central source of current, telephone signaling mechanism operable by steady current from said source over said line, means for transmitting special service signals by steady currents over said line, and means preventing interference between said mechanism and the service signals when simultaneously operating.

6. A combined telephone and service system including a telephone line, telephone signaling mechanism at the exchange, means for transmitting special service signals over said line by the use of steady current, and a substation hook-switch adapted to operatively control said mechanism while said service signals are being transmitted.

7. A combined telephone and service system including a telephone line, telephone signaling mechanism at the exchange, means for transmitting special service signals over said line by the use of steady current, a central source of current, a switch at the substation of said line adapted to control the flow of current from said source to operate said signaling mechanism independently of, and while said service signals are being transmitted, and means whereby interference with said service signals by the operation of said mechanism is prevented.

8. A combined telephone and service system including a telephone line, telephone signaling mechanism at the exchange, a central source at the exchange for supplying current to said line to control said mechanism, means for transmitting special service signals over said line by the use of steady current, and apparatus adapted to control said mechanism independently of said service signals and while the same are being transmitted.

9. A combined telephone and service system including a telephone line, a special service relay having a pair of windings, one connected with each limb of said telephone line, a central source of current, telephone signals controllable by current from said source flowing in series over the limbs of said telephone line, special service means for transmitting steady currents in parallel over said line limbs and through said relay windings, and means preventing interference between said telephone and service signals when simultaneously operating.

10. A combined telephone and service system including a telephone line extending from a substation by its two limbs to an exchange, a central source of current, telephone signals controllable by current from said source flowing through said substation in series through said line limbs, a third conductor, a special service relay having windings connected to said conductor, one from each limb of said line, said relay being unresponsive to the telephone signaling currents, apparatus for causing a flow of steady current in parallel over said line limbs to actuate said special service relay, and means preventing interference between said telephone and special service signals when simultaneously operating.

11. A combined telephone service system including a telephone line, a substation therefor, a central source of current, telephone signals operable from said source, special service means for transmitting steady current over said telephone line, a special service section on said line having mechanism responsive to said service current but unresponsive to the telephone signal currents, a switch at said substation for controlling current from said source to operate said telephone signals, said signals being unresponsive to said service current, and means

for simultaneously operating said telephone signals and said mechanism independently and without interference.

12. A signaling system comprising a metallic circuit extending between two points, a grounded source of alternating current for producing current in the metallic circuit, means for simultaneously transmitting direct current impulses over the conductors of said metallic circuit, a signal receiving instrument responsive to current from said alternating source, but not responsive to said direct current impulses, and a signal receiving instrument responsive to said direct current impulses but not responsive to said alternating current.

13. A combined telephone and service system including a telephone line, a telephone transmitter and a special service relay conductively connected in circuit with the limbs of said telephone line, a central source of alternating current, telephone signaling mechanism controllable by current from said source flowing over the limbs of said telephone line, means for transmitting special service currents over said line limbs and through the windings of said relay, said relay being unresponsive to current from said alternating source, and means for energizing said transmitter over said line limbs.

14. A combined telephone and service system including a telephone line, a source of current, service mechanism, and telephone mechanism operable by steady current from said source over said line, means for transmitting telephone signaling currents over said line, and means for preventing the operation of said mechanism by said signaling currents.

In witness whereof, I hereunto subscribed my name this 3rd day of Jan., 1908.

HARRY G. WEBSTER.

Witnesses:
BESSIE SKINNER,
CAROLYN WEBER.