

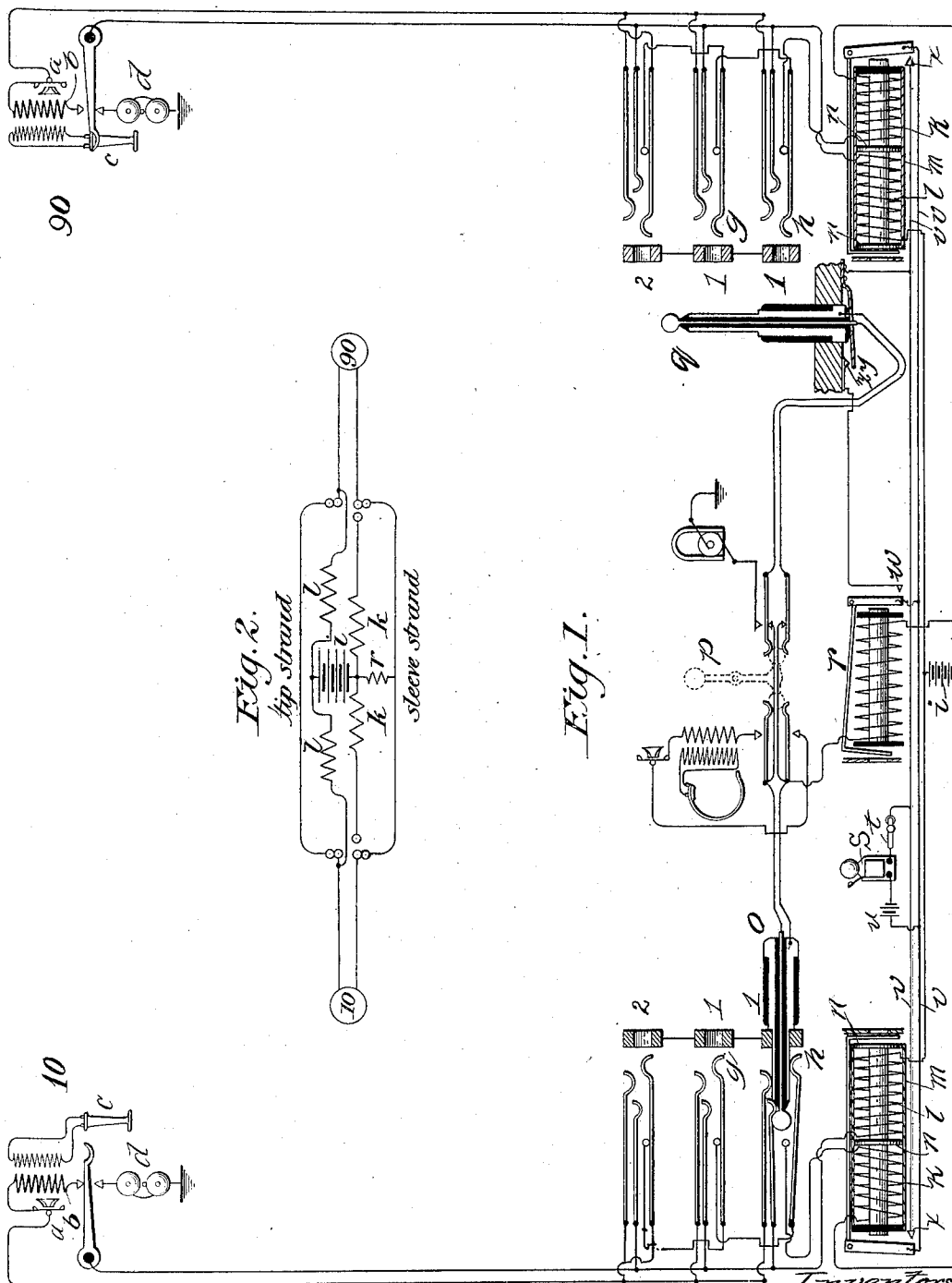
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A. STROMBERG & W. M. DAVIS.
TELEPHONE EXCHANGE SYSTEM.

(Application filed July 13, 1899.)

(No Model.)



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UNITED STATES PATENT OFFICE.

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ASSIGNORS TO THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, OF SAME PLACE.

TELEPHONE-EXCHANGE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 655,811, dated August 14, 1900.

Application filed July 13, 1899. Serial No. 723,732. (No model.)

To all whom it may concern:

Be it known that we, ALFRED STROMBERG and WILLIAM M. DAVIS, citizens of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Telephone-Exchange Systems, (Case No. 2,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

Our invention relates to telephone-exchange systems, and more particularly to that class of telephone-exchange systems in which centralized batteries are employed for the purpose of operating signals at the exchange in response to the operation of the subscriber's apparatus, which batteries are usually employed also for the purpose of supplying transmitter-circuits at the subscribers' stations, certain features of our invention being adapted for use with the battery acting in either or both capacities. In systems of this class the battery in order to effect calling and clearing-out signals is normally connected with the line in such a manner that upon the proper operation of a subscriber's apparatus signals corresponding to the condition of use of the telephone-lines are effected. In order to prevent shutting off the voice-currents, impedance is required, which will permit the flow of the battery-current and prevent the flow of the voice-currents.

It is the object of our invention to employ as the impedance-winding the winding of an indicator in a manner to secure a proper balancing of the system to prevent the leakage of voice-currents and to counteract the effects of induction.

Our invention also relates to auxiliary alarm-circuits, commonly known as "night-bell" circuits, which are used when a reduced number of operators are employed, so that the operator's attention may be directed to any change in the condition of use of a telephone-line that may occur. Our invention in this particular connection consists in providing improved circuits and apparatus jointly controlled by an indicator, acting as

a clearing-out indicator, and the connecting apparatus, preferably the connecting-plug, employed for effecting connection between subscribers.

We will explain our invention more particularly by reference to the accompanying drawings, in which—

Figure 1 is a diagrammatic illustration of a telephone-exchange system equipped in accordance with our invention. Fig. 2 is a simplified diagrammatic view showing certain circuit arrangements when two subscribers are united for conversation.

Like characters indicate like parts in both views.

The apparatus at the substations 10 and 90 is well known to those skilled in the art. A transmitter *a*, with its coil *b* and the receiver *c*, is illustrated at each station, the secondary coil, in circuit with the receiver, being included in a local circuit therewith, while the primary coil, in circuit with the transmitter, is placed in circuit with both limbs of the corresponding telephone-line upon the removal of the receiver from its spring switch-hook. The transmitter primary winding of the induction-coil at station 10 is thus shown in series with the telephone-line, the telephone-receiver being removed from its hook. The transmitter-circuit at station 90 is open, the receiver at said station being upon its hook. There is also provided at each station a grounded call-bell *d*, preferably responsive to alternating current. The telephone-lines extend from the substation to the exchange and are connected with spring-jacks at sections 2 and 1.

We prefer to employ at the answering-sections of the switchboard a special answering-jack in connection with each line in addition to the usual line-jack, the jacks *g* at board 1 being the regular line-jacks, while the jacks *h* at said board are the answering-jacks. Each of the jacks is preferably equipped with two long and one short line spring, the longer springs being adapted for engagement with the sleeve of an inserted plug, while the shorter spring is adapted for connection with the tip of said plug. Test thimbles are shown

in connection with each of the jacks; but as they form no part of our present invention they will not be further mentioned. The lowest and in this instance the longest line-spring of each jack is provided with a back contact normally engaging the same, by means of which and the connections shown one of the limbs of each of the telephone-lines is normally extended to one pole of the common battery *i*, the extensions of the said limbs including the exciting-windings *k* of each line-indicator, circuits through which are opened upon the insertion of plugs in corresponding jacks. The remaining limb of each telephone-line is in this particular instance in permanent connection with the other pole of the common battery, each of the latter limbs being extended for this purpose beyond the spring-jacks, each of these extensions including a special impedance-winding *l*. The windings *k* and *l* associated with each telephone-line are preferably for the sake of convenience wound about the same magnetic core, in which event we provide tubes *m*, of magnetic material, which inclose the coils *k* and *l*, the extra impedance-winding upon each annunciator-core being inclosed by iron washers *n*, whereby when the said impedance-windings are alone excited the lines of force are short-circuited, and thereby prevented from causing the actuation of the indicator-armature.

Assuming that subscriber No. 10 is the calling subscriber and that he desires to communicate with subscriber No. 90, the calling subscriber removes his receiver from its hook, thereby closing the circuit from the battery *i* through the actuating-coil *k* of his line-indicator and the limbs of the telephone-line. The operator in response to the signal conveyed by the indicator *k* inserts the answering-plug *o* of one of her cord-plugs into the answering-jack of the calling subscriber and thereupon manipulates her key *p* to throw her telephone into circuit with a calling-subscriber's telephone. Upon ascertaining that the said subscriber desires communication with the called subscriber 90 the operator inserts the connecting-plug *q* into the line of the jack *g* of the called subscriber to complete connection between the telephone-lines, whereupon the operator signals the called subscriber in the well-known way. In this instance the tips of the plugs *o* and *q* are connected by means of a cord-strand, as are also the sleeves.

A clearing-out indicator *r* is in this instance connected with the sleeve-strand of the cord-circuit, whereby the said indicator is connected in a bridge between the sides of a united telephone-line, the battery *i* being included in the same bridge between the clearing-out indicator and the extra impedance-coils *l*. We preferably interpose the battery between the clearing-out indicator and the two extra impedance-windings *l*, the latter being connected in parallel with each other and included in the same bridge containing

the battery and clearing-out indicator. Thus we are enabled to employ extra impedance-windings, one associated with each subscriber's line, and the winding of an indicator also acting in the capacity of an impedance-winding. This feature of our invention is illustrated most clearly in Fig. 2. It will be observed that one terminal of each impedance coil or winding *l* is connected with one side of its associated telephone-line, preferably outside of the cord-strands uniting the metallic part of the plugs, these terminals of the impedance-coils being preferably permanently connected each with a side of the telephone-line associated with the same. The remaining or inner terminals of these impedance-windings are connected, preferably permanently, with one pole of the common battery *i*. The other pole of the common battery is preferably permanently connected with one terminal of the clearing-out indicator, the remaining terminal of the clearing-out indicator being connected with a strand of the cord-circuit, in this instance the sleeve-strand.

The spring-jacks are preferably so constructed that upon the establishment of connection between subscribers both of the line-indicators are cut out of circuit.

It will be apparent from the foregoing description, and particularly by reference to Fig. 2, that when two telephone-lines are united by the connecting plugs and cords into a single telephonic circuit a bridge conductor is connected between the sides of the telephonic circuit, which includes a common or centralized battery, a pair of impedance-windings in parallel relation with each other between the battery and one side of the telephonic circuit, and an indicating-winding, also acting as an impedance-winding, between the battery and the other side of the telephonic circuit.

We will now describe that feature of our invention relating to the auxiliary alarm-circuits designed to be brought into service when a reduced number of operators are employed.

We associate a night-bell switch *t* and a battery *u*, these instrumentalities being included in a branch conductor between conductors *v v*, connected with the armatures of a number of clearing-out and line indicators, and the back contacts *w x*, associated with said armatures. When the night-bell switch is closed, the armatures of the line-indicators upon being attracted are adapted to close circuit through the night-bell. This operation of the night-bell only occurs when a call is initiated, as upon the insertion of plugs in the spring-jacks. The actuating-coils of the line-annunciators are cut out of circuit with the common battery. The armature of the clearing-out indicator, however, is normally attracted during an established connection with a subscriber's line, so that the contact associated therewith should

be placed in a position to prevent the night-bell from being operated during such established connection. When the subscribers are through conversation, their telephone-receivers are restored, whereby the bridge, including the common battery and the clearing-out indicator, is broken, the armature of the clearing-out indicator thereupon being released and in this position serving to close circuit through the night-signal, whereupon the operator withdraws the plugs from the jacks in which they are inserted. The back contact of the clearing-out indicator armature thus being in position normally to be engaged with said armature when the clearing-out indicator is deenergized, we provide means for preventing the night-bell signal from being operated, which preferably comprises a switch *y*, adapted, through the agency of the connecting apparatus, to open or close the branch conductor, including the armature of the clearing-out indicator and its back contact *w*.

We preferably employ a connecting-plug *q* as the particular part of the connecting apparatus to be used in controlling the switch *y*, which switch for this purpose is disposed beneath the seat-socket of the plug, which plug, through its weight, is adapted to effect the removal of the said spring-switch from its contact *z* to keep the night-bell circuit normally open at this point. It is obvious that other portions of the cord connecting apparatus might be employed in coöperation with the clearing-out indicator to effect the control of the night-bell circuit, and we do not therefore wish to be limited to the particular arrangement shown, nor do we wish to be limited to the precise form of switch *y* shown for effecting the control of the night-bell circuit in conjunction with the clearing-out indicator, nor do we wish to be limited in all cases to the employment of a special clearing-out indicator in connection with our improved night-bell apparatus.

While we have herein employed the clearing-out indicator to act as impedance, we do not wish to be limited in all embodiments of the invention to the particular indicator employed in this capacity. While we have herein shown one particular type of switch-board and a special construction for the line and answering spring-jacks, we do not wish to be limited to the precise embodiments of these features shown nor to the precise circuits shown; but,

Having described our invention, we claim as new and desire to secure by Letters Patent—

1. The combination with two united telephone-lines, of switching apparatus for uniting and disconnecting the same, an indicator associated with the united telephone-lines, an auxiliary alarm-circuit, and apparatus jointly controlled by the said indicator and switching apparatus for controlling the said alarm-circuit, substantially as described.

2. The combination with two united telephone-lines, of plug connecting apparatus for uniting and disconnecting the same, an indicator associated with the united telephone-lines, an auxiliary alarm-circuit, and apparatus jointly controlled by a switching-plug and the said indicator for controlling the said alarm-circuit, substantially as described.

3. The combination with a telephone-line, of a second telephone-line, cord connecting apparatus for uniting the said lines for conversation, a special clearing-out indicator associated with said cord connecting apparatus, an auxiliary alarm-circuit, and apparatus jointly controlled by the cord connecting apparatus and the said clearing-out indicator for controlling the said alarm-circuit, substantially as described.

4. The combination with a telephone-line, of a second telephone-line, cord connecting apparatus for uniting the said lines for conversation, a plug forming a part of said cord connecting apparatus, a special clearing-out indicator associated with said cord connecting apparatus, an auxiliary alarm-circuit and apparatus, and a switch controlled by the said plug acting in coöperation with said clearing-out indicator to control said auxiliary alarm-circuit and apparatus, substantially as described.

5. The combination with a telephone-line, of a second telephone-line, cord connecting apparatus for uniting the said lines for conversation, a plug forming a part of said cord connecting apparatus, a special clearing-out indicator associated with said cord connecting apparatus, an auxiliary alarm-circuit and apparatus, and a mechanical switch adapted to be operated by the plug for controlling the said alarm-circuit, substantially as described.

6. In a telephone-exchange system, the combination with two telephone-lines, of a cord switching apparatus adapted to unite the said telephone-lines into a single telephonic circuit, an impedance-coil associated with each telephone-line, each impedance-coil being permanently connected at one end with its telephone-line, a centralized battery, the remaining ends of the impedance-coils being connected with the said centralized battery, a line-indicator magnet associated with each telephone-line, switching mechanism operated by the cord connecting apparatus for disconnecting the line-indicator magnets from the telephone-lines upon the establishment of connection between the same, and a special clearing-out indicator connected at one end with a strand of the cord-circuit and at the other end with the centralized battery, the said clearing-out indicator, battery and impedance-coils being included across the telephonic circuit formed by the united telephone-lines and the cord-circuit, substantially as described.

7. The combination with a telephone-line, of a second telephone-line, cord connecting apparatus for uniting the said lines for con-

versation, a plug forming a part of said cord
connecting apparatus, an indicator, an aux-
iliary alarm-circuit and apparatus, a plug-
seat switch operated by the plug when idle
5 and within its seat to open or render ineffect-
ive the auxiliary alarm-circuit, said cord con-
necting apparatus serving to associate said
indicator with two united telephone-lines,
and means whereby said indicator may effect
10 the operation of the auxiliary alarm apparatus
when two lines are connected for conversa-
tion, substantially as described.

8. The combination with a telephone-line,
of a second telephone-line, line-indicators
15 therefor, cord connecting apparatus for unit-
ing the said lines for conversation, a plug
forming a part of said cord connecting appa-

ratus, a special clearing-out indicator, an
auxiliary alarm-circuit and apparatus, a plug-
seat switch operated by the plug when idle 20
and within its seat to open the alarm-circuit,
said switch serving to close said alarm-circuit
at one point when the said plug is in use, and
means whereby the said indicator may com-
plete the said auxiliary alarm-circuit, sub- 25
stantially as described.

In witness whereof we hereunto subscribe
our names this 11th day of July, A. D. 1899.

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