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W. A. FRICKE.
TELEPHONE EXCHANGE APPARATUS.

APPLICATION FILED MAR. 8, 1907.

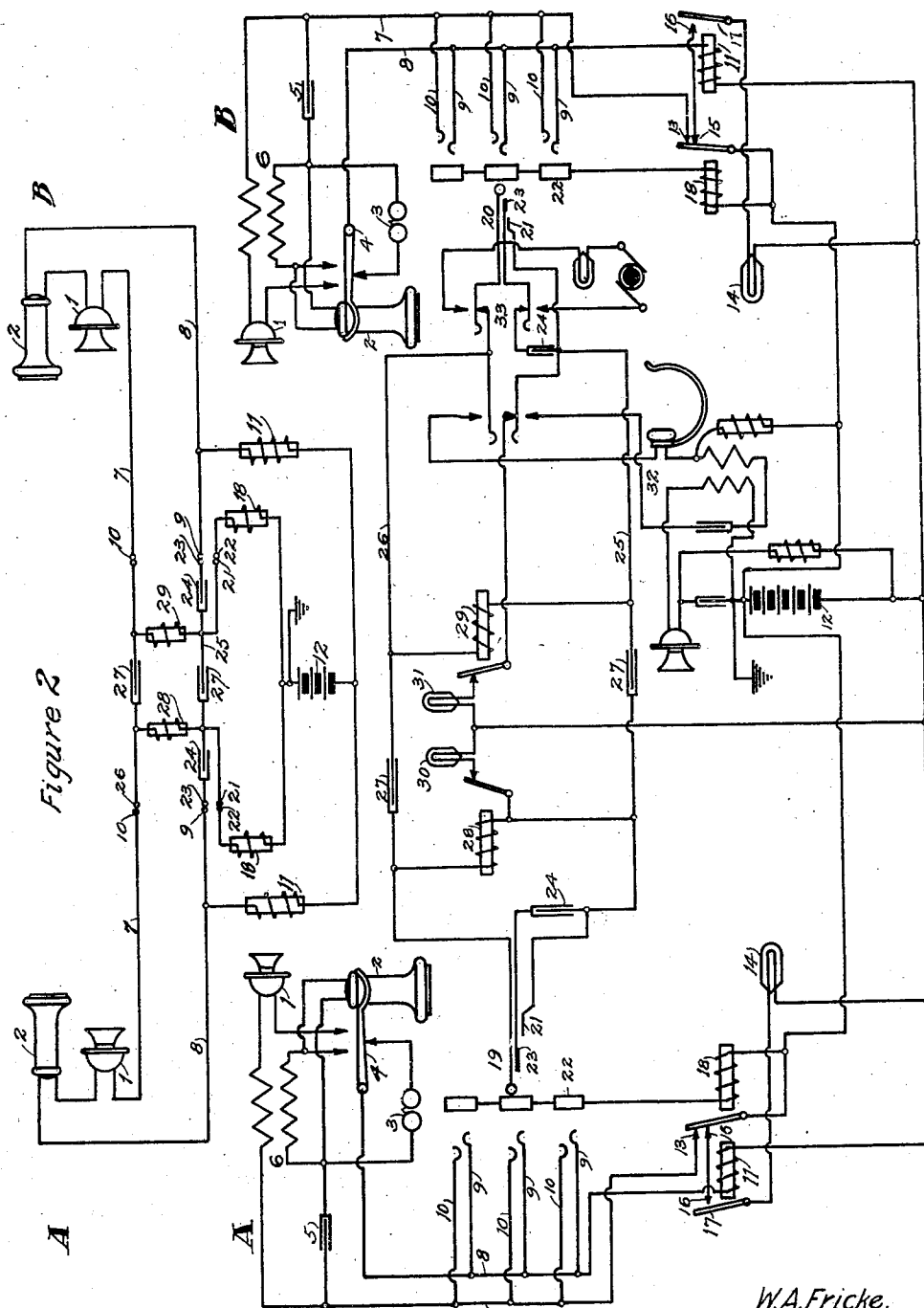


Figure 2

Figure 1

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TELEPHONE-EXCHANGE APPARATUS.

No. 879,454.

Specification of Letters Patent.

Patented Feb. 18, 1908.

Application filed March 8, 1907. Serial No. 361,299.

To all whom it may concern:

Be it known that I, WILLIAM A. FRICKE, citizen 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 Apparatus, 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.

My invention relates to telephone exchange systems, and has for its object the improvement upon that class of telephone exchange systems in which condensers are employed in talking sides of telephone lines for the purpose of maintaining the continuity of the telephonic circuits while at the same time permitting of the separation of signal-controlling circuits that may be supplied from a common battery. Such a system is shown in United States Letters-Patent No. 827,787, patented August 7, 1906, to E. R. Corwin. In this patent, there is disclosed a system including a plurality of telephone lines extending from substations to an exchange, connecting means at the exchange for uniting lines in conversation, line and supervisory or disconnect signal circuits, and condensers in talking sides of said telephone lines serving to separate said signaling circuits. Said condensers also serve to separate line signal and cut-off relay circuits. In the embodiment of the invention shown in the aforesaid patent, each line has a condenser permanently included in circuit therewith for the purpose of the invention of the patent, there being thus required as many condensers as there are telephone lines, according to the embodiment of the invention shown in the patent.

By means of my invention, the condensers need not be permanently included in talking sides of the telephone lines, but are only included in said talking sides when connections are put up between telephone lines. To this end, the link circuits that unite the telephone lines for conversation are provided with these condensers, one condenser being disposed at each end of each link circuit. Where each link circuit terminates in plugs at both ends, said plugs are provided with three contact elements, two of which are joined directly, a condenser being included in the connection between the same so that the link circuits, though being provided with

plugs having three contacts, have only two strands extending between the plugs. Two contacts of each plug are thus connected in multiple through a condenser, a single strand terminating in these multiply connected plug contacts. The line jacks are provided with suitable contacts for connection with the terminals of the plugs thus united through condensers, which jack contacts are permanently in the line and are engaged by said plug contacts, by which arrangement talking sides of the line circuits are completed through the condensers when plugs are inserted, the condensers thus serving to effect the continuity of the talking conductors while at the same time separating the circuits including certain of the relays entering into the exchange equipment. In the embodiment of my invention as actually practiced, the relay circuits that are to be separated by the condensers are the supervisory and the line relay circuits and also cut-off and line relay circuits.

I will explain my invention more fully by reference to the accompanying drawing, showing the preferred embodiment thereof, in which—

Figure 1 is a diagrammatic view illustrating a multiple switch-board telephone exchange system. Fig. 2 is a view that is more diagrammatic than Fig. 1, illustrating more clearly the essential characteristics of my invention.

Like parts are indicated by similar characters of reference throughout both figures.

There are indicated two of many substations, A, B, each in the embodiment of the invention shown, having a transmitter, 1, a receiver 2, a call bell 3, a switch-hook 4, a condenser 5, and an induction coil 6, together with suitable contacts and circuit connections whereby when the telephone receivers 2 are upon their switch-hooks, the bells 3, together with the condensers 5, are bridged across the sides of the telephone lines 7 and 8, and whereby when the telephone receivers are removed from their hooks, the bridges including said signaling bells are opened, and the transmitters are thrown into conductive connection with the lines, whereby battery may be fed thereto, and whereby voice currents may be impressed upon the lines at the substations at the transmitters or may be received at the receivers. I do not wish to be limited to the precise sub-station circuits in-

licated. The limbs 7 and 8 of the telephone lines are, in multiple switch-board practice, multiplied to sleeve contact springs 9 and tip contact springs 10, respectively, of multiple spring jacks, though the invention may be useful in connection with switch-boards that are not multiple switch-boards, in which case but one spring jack need be supplied to a line. In multiple switch-board practice, one of the jacks may act as an answering jack, the answering jacks, as is understood, being suitably distributed among the different sections of the switch-board, multiple jacks being multiplied to the several sections of the switch-board, which grouping arrangement, or any other preferred grouping, is well understood.

In the embodiment of the invention shown the line relays 11 have their windings desirably permanently associated with the corresponding telephone lines and the common talking battery 12, the circuit of this talking battery being desirably normally closed at each cut-off relay switch 13, so that when a subscriber removes his telephone the line relay 11 may become energized, whereby circuit through the line signal 14 of the calling subscriber may become closed by way of a companion cut-off relay switch 15 and the line relay contacts 16, 17. In the embodiment of the invention shown, one of a number of cord or link circuits is illustrated, and as the system shown is one wherein connection is manually made with both calling and called lines, the link circuit is shown as provided with a plug at each end thereof. Each cut-off relay 18 is included in a local circuit that is normally open, the battery 12 being common to the cut-off relay circuits. The cut-off relay circuits are closed when the link circuits are connected with the lines, for which purpose the plug 19 (which may be considered the answering plug) and the plug 20 (which may be considered the connecting plug) are provided with local contacts 21 adapted for engagement with local jack contacts, such as the thimbles 22, the thimbles 22 and the contacts 21 constituting terminals of the cut-off relay circuits, which terminals are joined when the plugs are inserted in the corresponding jacks. The plugs 19, 20 are provided with talking contacts, the sleeve contacts 23, that are designed for engagement with the line springs 9 and which are connected with the contacts 21 through the condensers 24, in order that the talking sides of the telephone circuit established between calling and called subscribers may be complete. The sleeve strand 25 of the link circuit terminates at each end in the corresponding contacts 21, 23, the condensers 24 being interposed serially between the ends of the sleeve strand and the corresponding sleeve contacts. If it were not for the presence of the condensers 24, the circuits for the relays

11 and 18 to which the battery 12 is common would not be separated to enable these relays to be controlled respectively by subscriber and operator. In the embodiment of the invention shown, the sleeve strand 25 and the tip strand 26 include condensers 27, supervisory signal-presenting relays 28, 29 corresponding, say, to the calling and called subscribers, respectively, being bridged between the sections of the cord strands to the left of the condensers and the sections of the cord strands to the right of the condensers, respectively. The devices that are preferred for presenting the signals are small incandescent lamps 30, 31 that are adapted to be included in local circuits with the battery 12 when the armatures of the supervisory relays are normal and the corresponding plugs are inserted within jacks, this condition of the parts being brought about when the receivers at the sub-stations are upon the switch-hooks, as is well understood. It is also well understood that when the receivers are removed from their hooks, the corresponding supervisory relays are energized, so that the supervisory lamps 30, 31 remain out of circuit during the time the said receivers are off their hooks. As these characteristics are well understood by those skilled in the art, I do not deem a further description thereof to be essential.

Inasmuch as the same battery 12 controls the line and supervisory signals, the condensers 24 are also employed to separate the circuits of the line and supervisory signal relays, which may be done in accordance with my invention with great saving in the number of condensers employed, as the condensers 24 are supplied directly to the link circuits and are included in the talking sides of the telephone lines only when said lines are connected for conversation.

Fig. 2 very clearly indicates how the condensers 24 separate the connection between the line and supervisory relays and between the line and cut-off relays, so that these relays may be included in circuit with the same battery 12 and be properly controlled by the apparatus that is used to govern the same.

I use the term "relays" in the broad sense of signal-controlling and signal-presenting electro-magnets, and I do not, therefore wish to be limited to the precise functions performed by these relays herein specifically set forth.

Where I use the term "battery" I mean any suitable source of current for supplying the transmitters and relay circuits.

The manner of operating a telephone exchange system equipped in accordance with my invention will be readily apparent to any one skilled in the art, and it is, therefore, not necessary to burden this specification with a detailed description thereof.

The cord circuit is shown as being provided

with a well known operator's equipment 32 and a ringing circuit outfit 33 whose purposes and functions are so well understood as to require no mention.

5 The embodiment of the invention shown has a method of operation which will be readily apparent to those skilled in the art. For example, if the subscriber at sub-station A desires communication with the subscriber at sub-station B, the subscriber at sub-station A removes his telephone from its switch-hook, whereupon circuit is closed through the associated line relay 11, thereby establishing a circuit through the associate line signal device 14. The operator, in response to this signal, inserts the answering plug into the jack of the calling subscriber, thereby placing the condenser 24 at the answering end of the cord circuit in a circuit relation to afford a proper separation of the signal circuits that has been specified. The operator, after having inserted the answering plug, depresses her listening key and ascertains the want of the calling subscriber, whereafter she inserts the connecting plug into the jack of the called subscriber's line, thereby bringing the condenser 24 at the connecting end of the cord circuit into the desired circuit relations with the signaling circuits. The operator thereafter depresses the ringing key and signals the called subscriber, who establishes complete telephonic communication between himself and the calling subscriber when said called subscriber removes his telephone from the switch-hook. There are other steps in the operation of the system that are well known to those skilled in the art, and I do not deem a further description of the operation of the system to be essential.

40 While I have herein shown and particularly described the preferred embodiment of my invention, I do not wish to be limited to the precise construction and arrangement herein shown, as changes may readily be made without departing from the spirit of my invention but,

Having thus described my invention, I claim as new and desire to secure by Letters-Patent:—

50 1. A telephone exchange system including a plurality of telephone lines extending from sub-stations to an exchange, line and supervisory circuits, relays or magnets in said circuits, condensers, and connecting means at the exchange permanently associated with said condensers and adapted to connect said condensers in talking sides of the telephone lines, each of said connecting means serving to include a condenser in talking sides of united telephone lines and between the relays or magnets of a line circuit and its associated supervisory circuit.

65 2. A telephone exchange system including a plurality of telephone lines extending from sub-stations to an exchange, line and cut-off

relay circuits, condensers for separating said circuits, and connecting means at the exchange permanently associated with said condensers and adapted to connect said condensers in talking sides of the telephone line and between the relays in said circuits. 70

3. A telephone exchange system including a plurality of telephone lines extending from sub-stations to an exchange, line and supervisory circuits, relays or magnets in said circuits, condensers, connecting means at the exchange permanently associated with said condenser and adapted to connect said condensers in talking sides of the telephone lines, each of said connecting means serving to include a condenser in talking sides of united telephone lines and between the relays or magnets of a line circuit and its associated supervisory circuit, and a battery common to the telephone lines and said circuits. 85

4. A telephone exchange system including a plurality of telephone lines extending from sub-stations to an exchange, line and cut-off relay circuits, condensers for separating said circuits, connecting means at the exchange permanently associated with said condensers and adapted to connect said condensers in talking sides of the telephone line and between the relays in said circuits, and a battery common to the telephone lines and said circuits. 95

5. A telephone exchange system including a plurality of telephone lines extending from sub-stations to an exchange, line and supervisory or disconnect signal circuits, condensers for separating said signaling circuits, connecting means at the exchange permanently associated with said condensers and adapted to connect said condensers in talking sides of the telephone lines and between the relays in said line and supervisory circuits, said connecting means including double stranded link circuits, connecting devices at the termini of said strands, each of said connecting devices including two elements connected through one of said condensers, a strand of the link circuit being connected at each end with the said elements of a corresponding connecting device, a condenser being serially interposed between one of said elements and said strand, and line contacts adapted for connection with the said connecting elements of the connecting devices, one of the latter contacts of each line constituting a line relay terminal and the other contact of each line constituting a cut-off relay terminal. 110 115 120

6. A telephone exchange system including a plurality of telephone lines extending from sub-stations to an exchange, line and supervisory or disconnect signal circuits, condensers for separating said signaling circuits, connecting means at the exchange permanently associated with said condensers and adapted to connect said condensers in talking 130

sides of the telephone lines and between the relays in said line and supervisory circuits, a battery common to the telephone lines and said circuits, said connecting means including double stranded link circuits, connecting devices at the termini of said strands, each of said connecting devices including two elements connected through one of said condensers, a strand of the link circuit being connected at each end with the said elements of a corresponding connecting device, a condenser being serially interposed between one of said elements and said strand, and line contacts adapted for connection with the said connecting elements of the connecting devices, one of the latter contacts of each line constituting a line relay terminal and the other contact of each line constituting a cut-off relay terminal.

7. A telephone exchange system including a plurality of telephone lines extending from sub-stations to an exchange, line and cut-off relay circuits, condensers for separating said circuits, connecting means at the exchange permanently associated with said condensers and adapted to connect said condensers in talking sides of the telephone line and between the relays in said circuits, said connecting means including double stranded link circuits, connecting devices at the termini of said strands, each of said connecting devices including two elements connected through one of said condensers, a strand of the link circuit being connected at each end with the said elements of a corresponding connecting device, a condenser being serially interposed between one of said elements and said strand, and line contacts adapted for connection with the said connecting elements of the connecting devices, one of the latter contacts of each line constituting a line relay terminal and the other contact of each line constituting a contact with which the strand of the link circuit companion to the aforesaid strand is adapted to connect.

8. A telephone exchange system including a plurality of telephone lines extending from sub-stations to an exchange, line and cut-off relay circuits, condensers for separating said circuits, connecting means at the exchange permanently associated with said condensers and adapted to connect said condensers in talking sides of the telephone line and between the relays in said circuits, a battery common to the telephone lines and

said circuits, said connecting means including double stranded link circuits, connecting devices at the termini of said strands, each of said connecting devices including two elements connected through one of said condensers, a strand of the link circuit being connected at each end with the said elements of a corresponding connecting device, a condenser being serially interposed between one of said elements and said strand, and line contacts adapted for connection with the said connecting elements of the connecting devices, one of the latter contacts of each line constituting a line relay terminal and the other contact of each line constituting a contact with which the strand of the link circuit companion to the aforesaid strand is adapted to connect.

9. A telephone exchange system including a plurality of telephone lines extending from sub-stations to an exchange, line and cord signal-controlling circuits, relays or magnets therefor, condensers, and connecting means at the exchange permanently associated with said condensers and adapted to connect said condensers in talking sides of the telephone lines, each of said connecting means including a plug serving to include a condenser in talking sides of united telephone lines and between relays or magnets in the line and cord signal-controlling circuits brought into direct association by the plug.

10. A telephone exchange system including a plurality of telephone lines extending from sub-stations to an exchange, line and cord signal-controlling circuits, relays or magnets therefor, condensers, connecting means at the exchange permanently associated with said condensers and adapted to connect said condensers in talking sides of the telephone lines, each of said connecting means including a plug serving to include a condenser in talking sides of united telephone lines and between relays or magnets in the line and cord signal-controlling circuits brought into direct association by the plug, and a battery common to the telephone lines and said circuits.

In witness whereof, I hereunto subscribe my name this 1st day of March A. D., 1907.

WILLIAM A. FRICKE.

Witnesses:

G. L. CRAGG,

LEON G. STROH.