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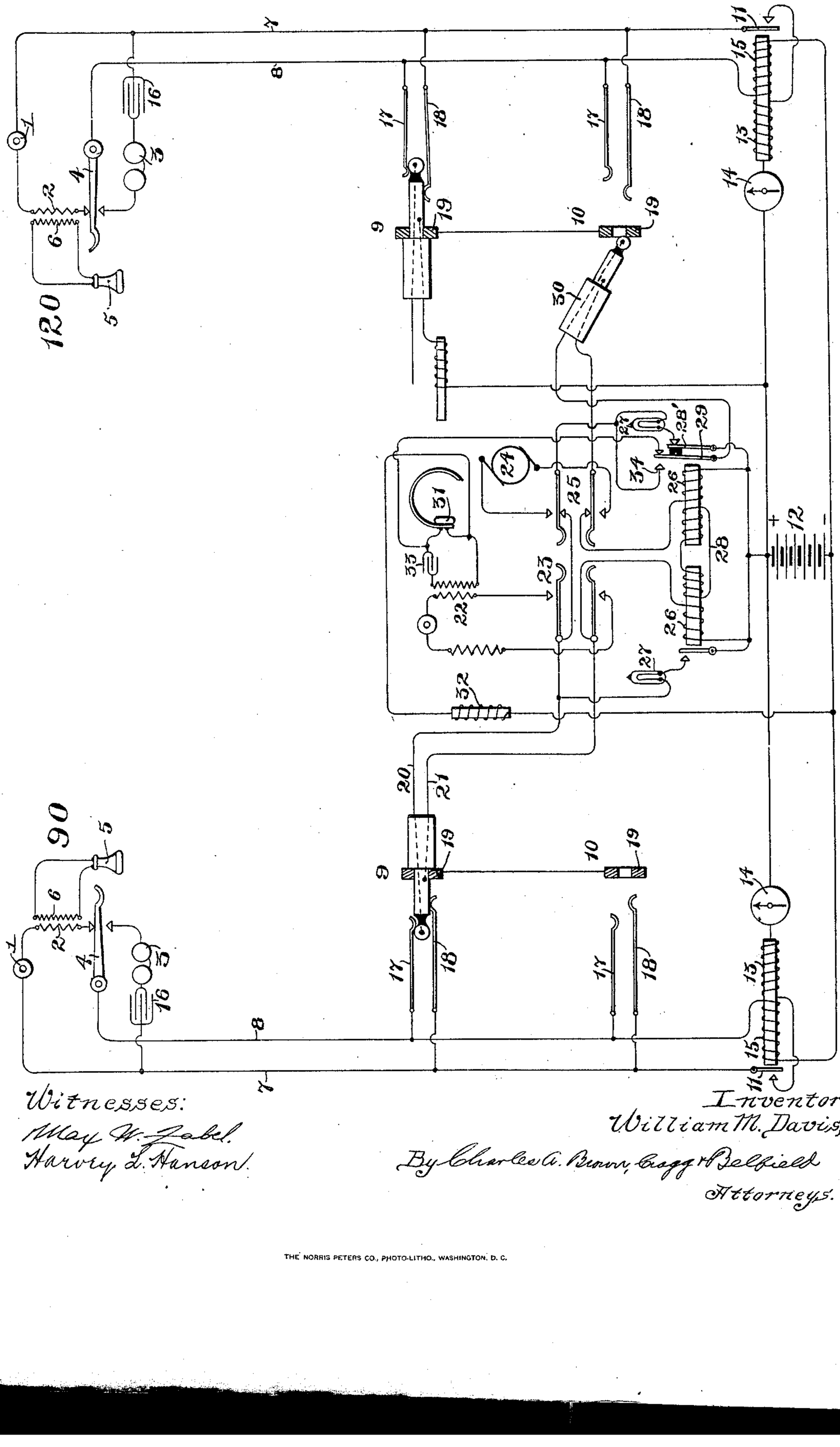
W. M. DAVIS.

MULTIPLE SWITCHBOARD TELEPHONE EXCHANGE SYSTEM.

(Application filed June 17, 1901.)

(No Model.)



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UNITED STATES PATENT OFFICE.

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MULTIPLE-SWITCHBOARD TELEPHONE-EXCHANGE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 697,991, dated April 22, 1902.

Application filed June 17, 1901. Serial No. 64,853. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM M. DAVIS, a 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 Multiple-Switchboard Telephone-Exchange Systems, (Case No. 17,) 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 multiple-switchboard telephone-exchange systems, and has for its object the provision of means whereby test-circuits may be completed by an operator testing a busy line without causing a diversion of current from the test-battery over the telephone-line of the calling subscriber's station.

In practicing my invention I associate with the cord-circuit a relay that controls the continuity of one of the cord-strands, preferably that strand which leads to the tip of the connecting-plug, which tip is the contact portion of said plug. This relay is provided with an armature which preferably in its normal idle position serves to divide the tip-strand of the cord-circuit into its sections, limiting the testing-battery to a connection with that section of the tip-strand leading to the connecting-plug. This strand by means of the switch controlled by the said relay has normally included in circuit therewith the operator's receiver, which is thus connected with one pole of the testing-battery. The other pole of the testing-battery is connected with the test contacts or thimbles of a busy line by its connection with the sleeve-strand of the cord-circuit and the sleeve of the plug inserted within the busy line. The connection between the latter pole of the test-battery and the sleeve of the inserted connecting-plug includes the helix of the relay, circuit through which is alternately completed by way of the subscriber's line back to the remaining pole of the battery, so that when an operator completes connection between subscribers by inserting a connecting or testing plug within the called subscriber's jack the relay is energized to unite the normally separated sections of the tip-strand.

I will explain my invention more fully by reference to the accompanying drawing, illustrating one type of a multiple-switchboard telephone-exchange system to which the apparatus of my invention may be applied, two substations being illustrated in connection with the exchange.

At the substations 90 and 120 are illustrated well-known types of substation apparatus, comprising a transmitter 1, with its primary winding 2, a signal-bell 3, and a switch-hook 4 for including the transmitter with the primary winding in circuit with the line when the receiver 5 is off the hook and for including the call-bell 3 in circuit with the line when the receiver is on the hook. The receiver may be included in a closed local circuit with the secondary winding 6. The telephone-lines extend by their limbs 7 and 8 to the various boards 9 and 10 of the exchange, the limbs 7 each terminating in an armature 11 in engagement with its normal contact when the lines are disconnected at the exchange. Each limb 7 is continued to the positive side of the common battery 12 through a helix 13 and an indicator 14. The limbs 8 each extend to the negative side of the said battery through a helix 15. The helices 13 and 15 are oppositely wound, so that the core by which they are surrounded is not operatively energized, so that when a subscriber removes his telephone from its hook current from the battery 12 will flow through the limbs of the telephone-line, the armature 11 and its back contact, whereupon the corresponding line-indicator 14 may be operated. A condenser 16 is included in circuit with its pole 3, so that when the receivers are upon their hooks current from the battery 12 will not flow over the lines. The spring-jacks at boards 9 and 10 comprise short and long line-springs 17 and 18 and test-thimbles 19, the test-thimbles of each line being electrically connected. The cord-circuit employed for connecting the subscribers for conversation comprises in the preferred embodiment of the invention a pair of plugs having tips and sleeves, the tips being

connected by the tip-strand 20 and the sleeves by sleeve-strand 21. An operator's telephone appliance 22 may be included in bridge of the cord-strands by a listening-key 23, as well known to those skilled in the art, while a calling-generator 24 may be included in circuit with the called subscriber's line by the manipulation of a ringing-key 25. The sleeve-strand of the cord-circuit in this instance includes the helices 26 26 of relays that control the operation of supervisory signals 27, as indicated in a copending application, Serial No. 57,596, filed April 26, 1901, where is also shown the closed secondary 28, provided for the purpose of overcoming the impedance due to the windings 26 in series in the sleeve-strand and also serving as a repeating-coil, all as set forth in my said copending application.

That feature of the apparatus entering into my present invention consists in the provision of what may for convenience be the relay 26 upon the right that corresponds to the connecting end of the cord-circuit and is controlled by the called subscriber, which relay serves to normally separate the tip-strand of the cord-circuit into discontinuous sections, whereby the flow of current from the testing-battery is limited to the connecting-section of the tip-strand, so that the calling subscriber will not be annoyed by a click in his ear. Before connection is completed the switch-contacts 28' 29, controlled by the corresponding relay 26, are in engagement with their normal contacts, so that the section of the tip-strand leading to the connecting and testing plug 30 is normally connected with the negative pole of the test-battery 12 through the contact-arm 29, the normal contact in engagement therewith, the operator's receiver 31, constituting the perferred form of test-indicator, and the impedance-coil 32. The test-thimbles are connected with the positive pole of the battery through the energizing-windings of the relays 26. Obviously upon the application of a test-tip to a test-thimble circuit through the test-battery 12 is completed. I may employ a condenser 33 for preventing the battery-current from flowing through the secondary of the operator's outfit, thus confining the current to a path through the operator's receiver. The impedance-coil 32 is provided for the purpose of preventing the shunting of voice-currents. The arm 29 thus constitutes one terminal of the calling-section of the tip-strand, the corresponding terminal of the remaining or answering tip-strand section being in the form of an alternate contact 34. When subscribers are united for conversation, the relays 26 are energized, current flowing from the positive terminal of the battery 12 through the relays, then following particularly the circuit through the called subscriber's apparatus and the relay 26, corresponding thereto, the sleeve-strand of the connecting-plug, the long line-spring of the spring-jack, the substation apparatus of the called subscriber, thence through the winding 15 to the negative terminal of the battery, whereupon the terminals 29 and 34 of the normally disconnected tip-strand sections are brought into contact, thereby completing the cord-circuit and opening the test-circuit.

While I have herein shown and particularly described the preferred embodiment of my invention, it is obvious that changes may be made without departing from the spirit thereof, and I do not, therefore, wish to be limited to the precise disclosure of the invention herein set forth; but,

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

1. In a multiple-switchboard telephone-exchange system, the combination with telephone-lines extending from subscribers' stations to the line-jacks upon the different boards or sections of a multiple switchboard, of test-thimbles for the said jacks, cord-connecting apparatus at each board or section of the exchange, including a connecting-plug for connecting a calling with a called subscriber, a switch provided with a normal and an alternate contact, a testing-conductor terminating in the normal contact, a test-indicator in circuit with the test-conductor, a test-battery connected at the remaining terminal of the said test-conductor while the alternate contact constitutes the terminal of the answering end of the tip-strand, a connection between the remaining terminal of the test-battery and the sleeve-strands of the cord-circuits, whereby the test-thimbles may be connected with the said remaining terminal of the test-battery and circuit through the testing appliance completed upon the application of the connecting-plug to a test-thimble of a busy line, a relay in the conductor extending between the test-battery and the sleeve of the connecting and testing plug, and means controlled by the connecting-plug and the called-subscriber's jack for closing circuit through the said relay, whereby the said switch may be thrown from its normal test-contact to the alternate contact that is a terminal of the answering-section of the tip-strand, whereby the cord-circuit is completed, substantially as described.

2. In a multiple-switchboard telephone-exchange system, the combination with telephone-lines extending from subscribers' stations to the line-jacks upon the different boards or sections of a multiple switchboard, of test-thimbles for said jacks, cord-connecting apparatus at each board or section of the exchange, including a connecting-plug for connecting a calling with a called subscriber, a switch provided with a normal and an alternate contact, a testing-conductor terminating in the normal contact, a test-indicator in circuit with the test-conductor, a test-battery connected at the remaining terminal of the said test-conductor while the alternate contact constitutes the terminal of

the answering end of the tip-strand, a connection between the remaining terminal of the test-battery and the sleeve-strands of the cord-circuits whereby the test-thimbles may be connected with the said remaining terminal of the test-battery and circuit through the testing appliance completed upon the application of the connecting-plug to a test-thimble of a busy line, and a relay in the conductor extending between the test-battery and the sleeve of the connecting and testing plug, the called-subscriber's telephone-line, in coöperation with his spring-jack and the connecting-plug inserted therein, serving to complete circuit through the relay to disconnect the terminal of the connecting or testing plug section of the tip-strand and to complete the cord-circuit, substantially as described.

In witness whereof I hereunto subscribe my name this 23d day of May, A. D. 1901.

WILLIAM M. DAVIS.

Witnesses:
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