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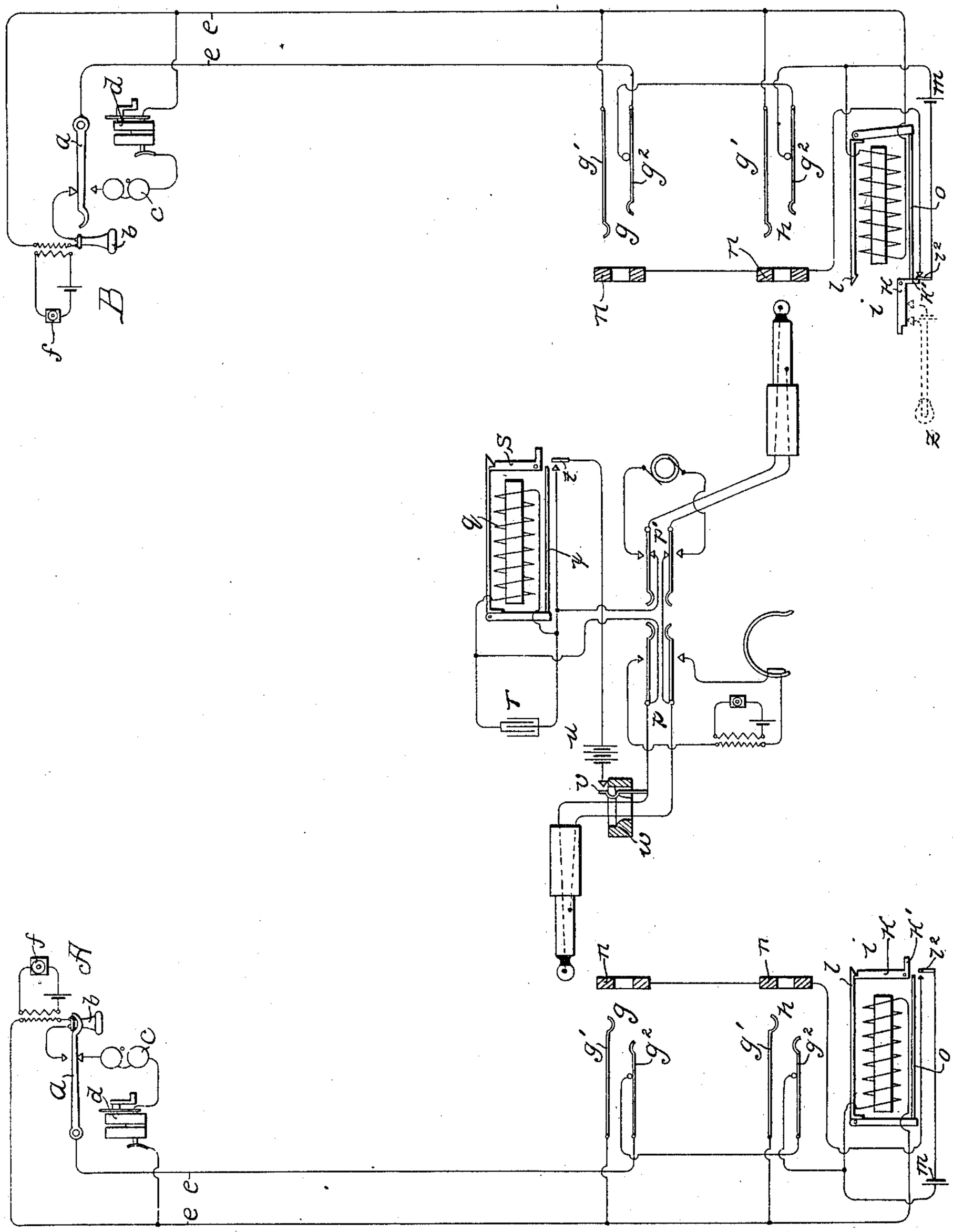
W. M. DAVIS.

TELEPHONE EXCHANGE SYSTEM.

(Application filed Dec. 7, 1900.)

(No Model.)



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UNITED STATES PATENT OFFICE.

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TELEPHONE-EXCHANGE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 697,989, dated April 22, 1902.

Application filed December 7, 1900. Serial No. 38,983. (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 Telephone-Exchange Systems, (Case No. 8,) 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 prime object the provision of a telephone-exchange system with which the annunciator disclosed in the application of Gustavus E. Hoglund and Carl M. Hedman, Serial No. 37,886, filed November 27, 1900, may be employed.

The invention has for its further object the provision of means for increasing the effectiveness of magneto-generators in operating annunciators.

The annunciator disclosed in the aforesaid application as embodied in commercial apparatus is usually provided with a single electromagnet and a single armature, a shutter, a retaining-lever adapted for actuation by the armature to release the shutter, a push-rod engaged by the armature and adapted for engagement with an extension of the shutter when the latter is lowered, whereby the said armature upon again being attracted may serve the additional purpose of effecting the restoration of the shutter. I have provided means whereby this form of annunciator may be made to work in conjunction with the switching appliances at an exchange, whereby the annunciators may be employed as line and clearing-out indicators, so that the annunciators may be operated from subscribers' stations in initiating calls and conveying clearing-out signals, while the switching appliances at the exchange may serve to effect the restoration of the line and clearing-out indicators, all of the various operations controlled at the subscribers' stations and at the exchange being by means of my invention accomplished in proper and orderly sequence.

In accordance with my invention the electromagnet of the line-indicator is connected or adapted for connection with an operating-circuit extending to the subscriber's station, so that the subscriber by any well-known means may effect the passage of current through the annunciator-magnet, and thereby effect a signal. A second circuit is also provided at the exchange, which includes the same helix of the electromagnet when but one electromagnet is employed for effecting the operation of the annunciator and its restoration. This second circuit is provided with two openings, one of which, as is set forth in the said copending application, is closed by the annunciator-shutter, while the second opening is closed through the agency of a plug inserted within the jack corresponding to the signaling subscriber. Thus the subscriber may effect a signal at the exchange, while the operator at the exchange by inserting an answering-plug may, in conjunction with the automatic operation of the shutter, effect a closure of the restoring-circuit and the restoration of the annunciator. After the annunciator-shutter is restored the restoring-circuit is opened by means of the shutter.

In employing the annunciator of the said copending application as a clearing-out indicator the annunciator may be connected in bridge of the telephonic circuit or in series with one side of the circuit, in which latter event a condenser is preferably placed in shunt of the annunciator in accordance with another feature of my invention, whereby the effectiveness of the magneto-generators at the substations, which are of low frequency, may be increased upon the clearing-out magnet. The condenser serves to impart sudden discharges to the annunciator, so that the magneto-generators at the substations may be rung through very large resistance, which would render the propagation of the clearing-out current ineffective or faulty but for the presence of the condenser. The helix of the clearing-out annunciator-magnet may thus receive current transmitted from either subscriber's station for the purpose of clearing out. The restoring-circuit is controlled in part by the shutter of the clearing-out indi-

cator, the control of this restoring-circuit being completely effected, preferably, through the agency of a switch that is actuated by a plug when restored to its idle position upon effecting disconnection between telephone-lines. I preferably employ a plug-seat switch that is operated by a plug when seated to close the restoring-circuit at one point. The restoring-circuit having been previously closed at another point by the shutter released upon the transmission of clearing-out signaling-current, the plug upon being withdrawn and seated completes the restoring-circuit and effects the reëlevation of the shutter.

I will explain my invention more fully by reference to the accompanying drawing, which illustrates the application of my invention to a multiple-switchboard system, although the invention is not to be limited to this application.

In the drawing I have shown well-known subscribers' outfits at the substations A and B. There are illustrated at each station a gravity switch-hook a, a telephone-receiver b, adapted when in place upon the switch-hook to connect the call-bell c, and the magneto-generator b between the limbs $e\ e$ of the telephone-line, the telephone-switch hook when relieved of the influence of the receiver serving to connect the latter instead of the bell and generator in circuit with the limbs of the telephone-line. A transmitter f is also illustrated at each station included in a local circuit including a battery, which circuit is in inductive relation with the telephone-line. The limbs of each telephone-line extend to the exchange and are connected thereat with a line-jack g and an answering-jack h. Each jack is provided with a sleeve-spring g' and a tip-spring g^2. The tip-spring of each jack g is provided with a back contact connected with the spring g^2 of the jack h. The back contact of the latter spring is connected with one terminal of the operating-helix of the line-indicator i. The remaining terminal of the helix is connected with the remaining limb of the telephone-line. When a generator d is operated, the armature of the annunciator i is attracted and the shutter k is released by disengagement therefrom of the retaining-lever l. The shutter k is provided with an extension k', that serves to engage the contacts l of a restoring-circuit that includes a restoring-battery m and the same helix in the embodiment here shown of the magnet of the annunciator i. This restoring-circuit also includes the normally separated contact-spring g' and the thimble n. After the line-indicator is operated the shutter closes the local restoring-circuit in part at l^2. Upon the insertion of a plug within a jack the sleeve of the plug electrically connects the engaging spring g' and the thimble or contact part n, whereby the closure of the local restoring-circuit is completed, whereupon the armature of the electromagnet through the intervention of the push-rod o, engaging the said armature and the extension k', effects the restoration of the shutter, the armature being released upon the separation of the contacts l^2, resulting upon the elevation of the shutter. The cord-connecting apparatus may be of any suitable form. I have illustrated the plugs provided with tip and sleeve contact portions, tip-strands that include a spring-lever of a listening-key p and ringing-key p', and the helix of a clearing-out indicator q. The remaining strand of the cord-circuit includes the remaining spring-levers of the listening and ringing keys. A condenser r is included in shunt of the helix of the magnet q, so that this condenser may receive a large current from an operating magneto-generator d, which upon discharge may effect the operation of the clearing-out indicator q. This arrangement is of particular service where the generator might have to encounter great resistance in the line. The condenser may be of one microfarad capacity to secure the best results.

In the particular organization herein set forth the telephonic circuit established by the operator's cord-circuit is completely metallic, and the inductance over it by the helix of the clearing-out indicator q is avoided by means of the condenser r, through which the voice-currents pass. When a magneto-generator d is operated, signaling-current traverses the helix of an annunciator q to effect the release of its shutter s, which in falling closes the contact t of a restoring-circuit. This restoring-circuit includes a restoring-battery u and the contacts v of a plug-seat switch, which latter contacts are engaged when the plug is restored to its seat w, the base of the plug engaging one of the contacts v and forcing it against its companion contact. Thus the restoring-circuit is partially completed by the shutter when it falls and is wholly completed through the agency of the seated plug, whereupon the shutter may be restored through the agency of a push-rod x, that is forced against an extension of the shutter upon the attraction of the armature of the clearing-out indicator.

I have in some of the claims used the term "signal-revealing means." I do not wish to be limited by this expression to a shutter that may reveal a designating character, as a movable element may be employed in the annunciator for effecting another form of signal. If it is desired to employ glow-lamps, an element, such as the shutter k, may be employed to close circuit through the lamp, whereby another form of signal may be revealed. I have indicated such an arrangement in dotted lines, a signal z in the form of a lamp being included in a local circuit with a battery that is closed when the shutter or other signal-revealing means is actuated.

While I have herein shown and particularly described the preferred type of annunciator that may be employed in connection

with my invention, I do not wish to be limited to the precise disclosure herein set forth; but,

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

1. In a telephone-exchange system, the combination with a telephone-line extending from a subscriber's station to an exchange, of a line-indicator at the exchange provided with signal-revealing means, means whereby the said line-indicator may be operated to effect a signal, restoring means for restoring the signal-revealing means, means controlled by the signal-revealing means for governing the operation of the restoring means in part, and a switching appliance for connecting the said telephone-line in telephonic communication with another telephone-circuit, said switching appliance serving in conjunction with the signal-revealing means to jointly control the operation of the restoring means, substantially as described.

2. The combination with a telephone-line extending from a subscriber's station to an exchange, of a line-indicator having signal-revealing means, means whereby the subscriber may effect the operation of the signal-revealing means, an electromagnet provided with an armature adapted for engagement with the signal-revealing means when the latter is actuated to reveal a signal, a restoring-circuit including the electromagnet provided with two openings, means whereby the signal-revealing means, when actuated, may close one of the said openings, and a switching appliance for connecting the said telephone-line with another telephone-circuit adapted also to close the second opening in the restoring-circuit to restore the signal-revealing means, substantially as described.

3. In a telephone-exchange system, the combination with subscribers' telephone-lines extending from subscribers' stations to an exchange, of switching apparatus at the exchange for connecting the said lines, a clearing-out indicator having signal-revealing means connected in the circuit between the subscribers' stations, means for restoring the signal-revealing means, means governed by the signal-revealing means for partially controlling the operation of the restoring means, and means governed by the said switching apparatus acting in coöperation with the means governed by the signal-revealing means to jointly control the operation of the restoring means, substantially as described.

4. In a telephone-exchange system, the combination with subscribers' telephone-lines extending from subscribers' stations to an exchange, of switching apparatus at the exchange for connecting the said lines, a clearing-out indicator having signal-revealing means connected in circuit between the subscribers' stations, an electromagnet provided with an armature adapted for engagement with the signal-revealing means when the latter is operated to reveal a signal, a restoring-circuit provided with two openings, means whereby the signal-revealing means when actuated may close one of the said openings, and means governed by the said switching apparatus for closing the remaining opening in the restoring-circuit, substantially as described.

5. In a telephone-exchange system, the combination with subscribers' telephone-lines extending from subscribers' stations to an exchange, of switching apparatus having a connecting-plug at the exchange for connecting the said lines, a clearing-out indicator having signal-revealing means connected in circuit between the subscribers' stations, an electromagnet provided with an armature adapted to restore the signal-revealing means after the latter is operated to reveal a signal, a restoring-circuit provided with two openings, means whereby the signal-revealing means when actuated may close one of the said openings, and a plug-seat switch operated by the plug when seated to close the remaining opening in the restoring-circuit, substantially as described.

6. In a telephone-exchange system, the combination with subscribers' telephone-lines connected for conversation, of an indicator included in series in the telephonic circuit, a condenser in shunt of the winding of the indicator, and a magneto-generator at a subscriber's station for propagating signaling-currents, the generator serving to charge the condenser which, upon discharge, serves to operate the indicator, substantially as described.

7. In a telephone-exchange system, the combination with telephone-lines, of switching apparatus for connecting the same for conversation, a clearing-out indicator associated with the telephone-lines by the said switching apparatus and included in series with the telephonic circuit between the subscribers' stations, a magneto-generator at a subscriber's station, and a condenser in shunt of the clearing-out indicator, the generator serving to charge the condenser which, upon discharge, serves to operate the indicator, substantially as described.

8. In a telephone-exchange system, the combination with subscribers' telephone-lines connected for conversation, of an indicator, a condenser in shunt of the winding of the indicator, and a magneto-generator at a subscriber's station for propagating signaling-currents, said magneto-generator serving to charge the condenser, which, upon discharge, is adapted to effect the operation of the indicator, substantially as described.

In witness whereof I hereunto subscribe my name this 24th day of November, A. D. 1900.

WILLIAM M. DAVIS.

Witnesses:
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HERBERT F. OBERGFELL.