

No. 737,715.

PATENTED SEPT. 1, 1903.

W. M. DAVIS.
TELEPHONE EXCHANGE SYSTEM.
APPLICATION FILED DEC. 2, 1901.

NO MODEL.

2 SHEETS—SHEET 1.

Fig. 1-

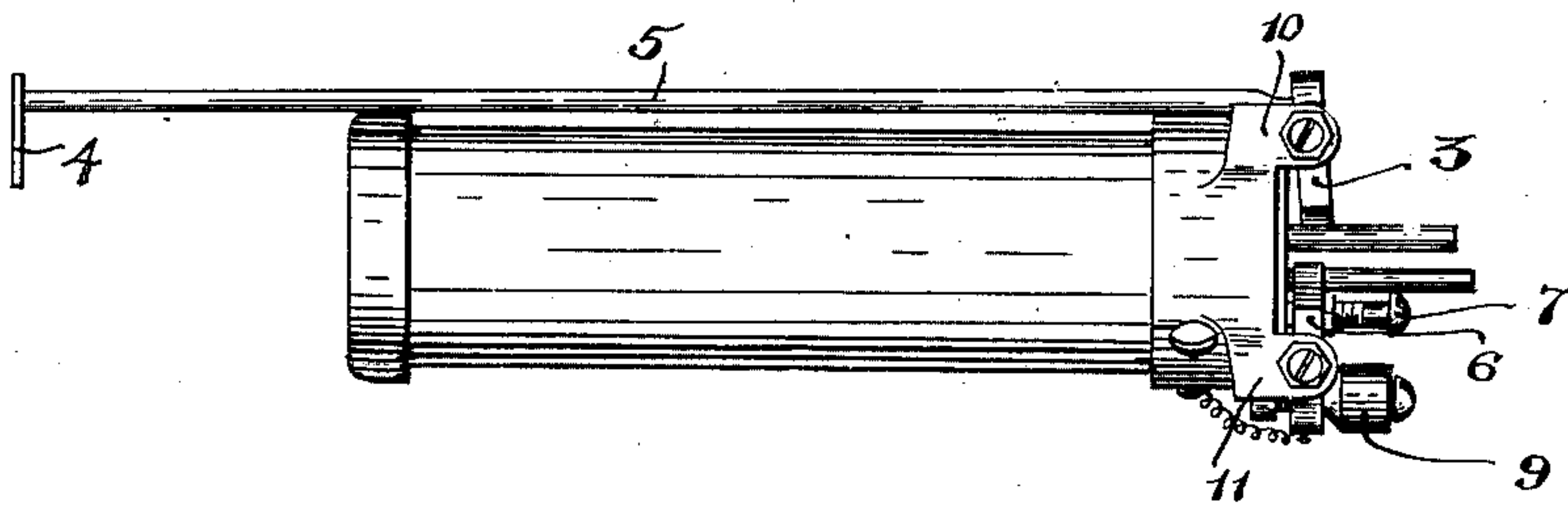


Fig. 2-

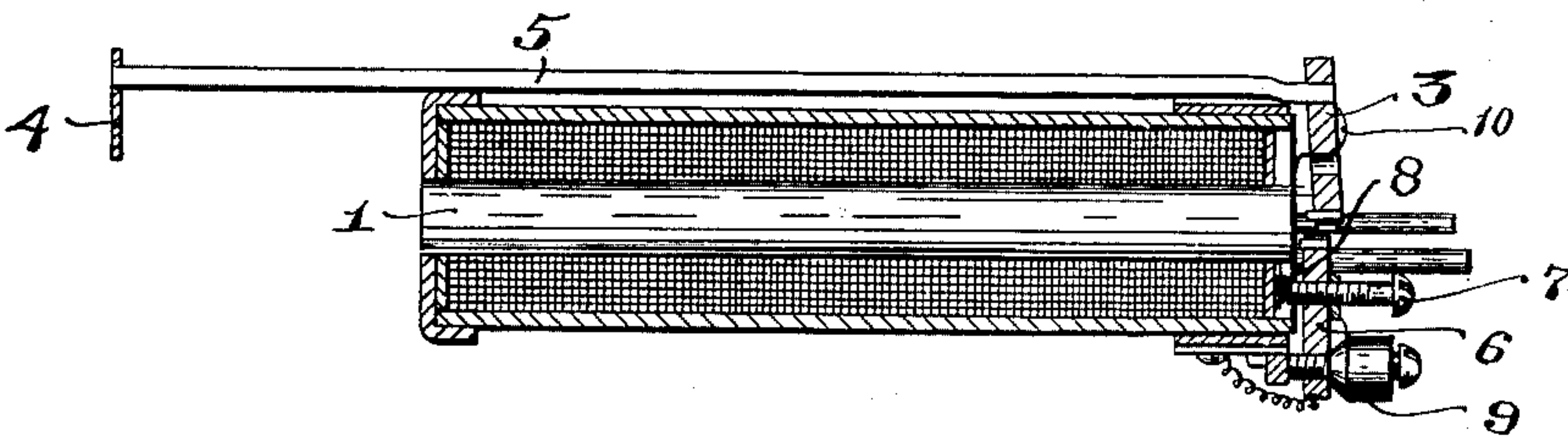


Fig. 3-

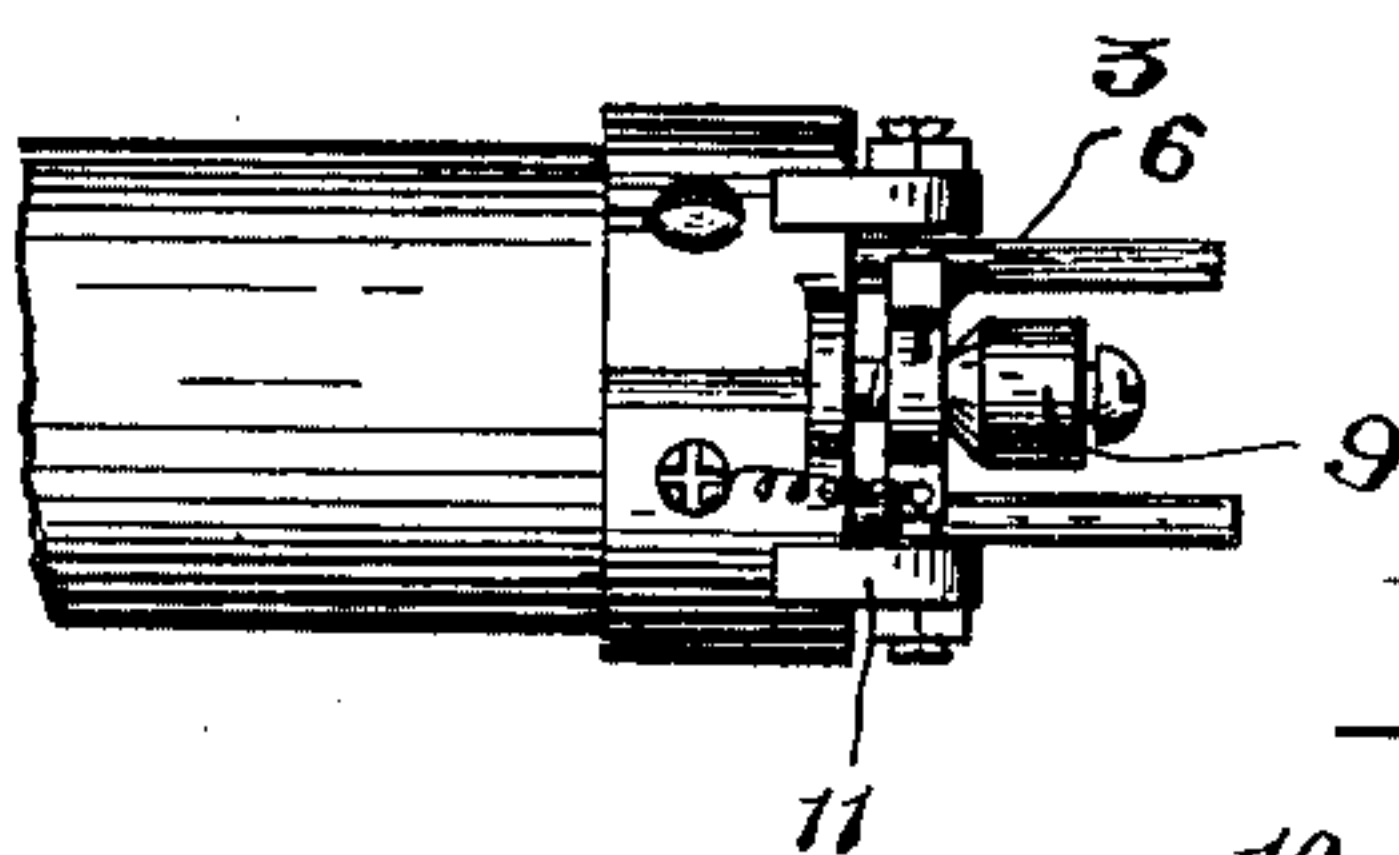


Fig. 4-

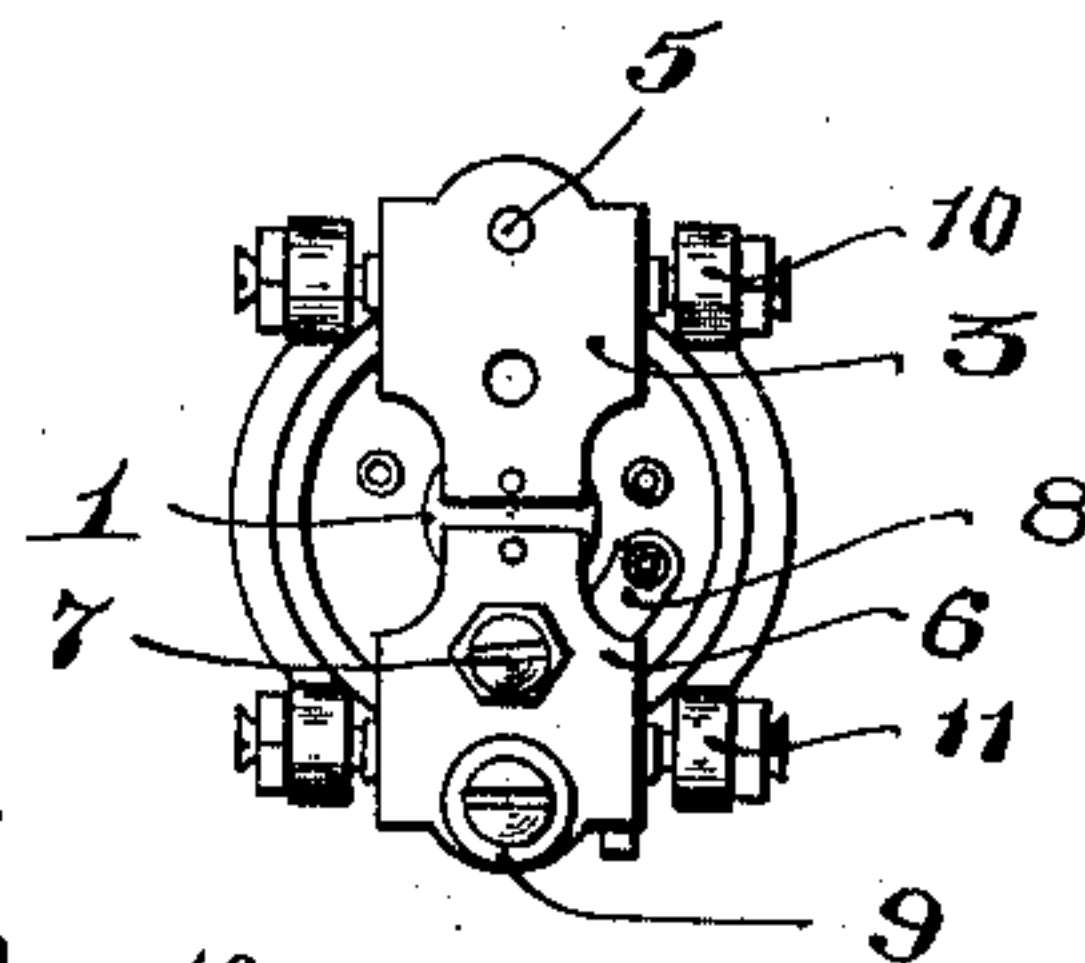
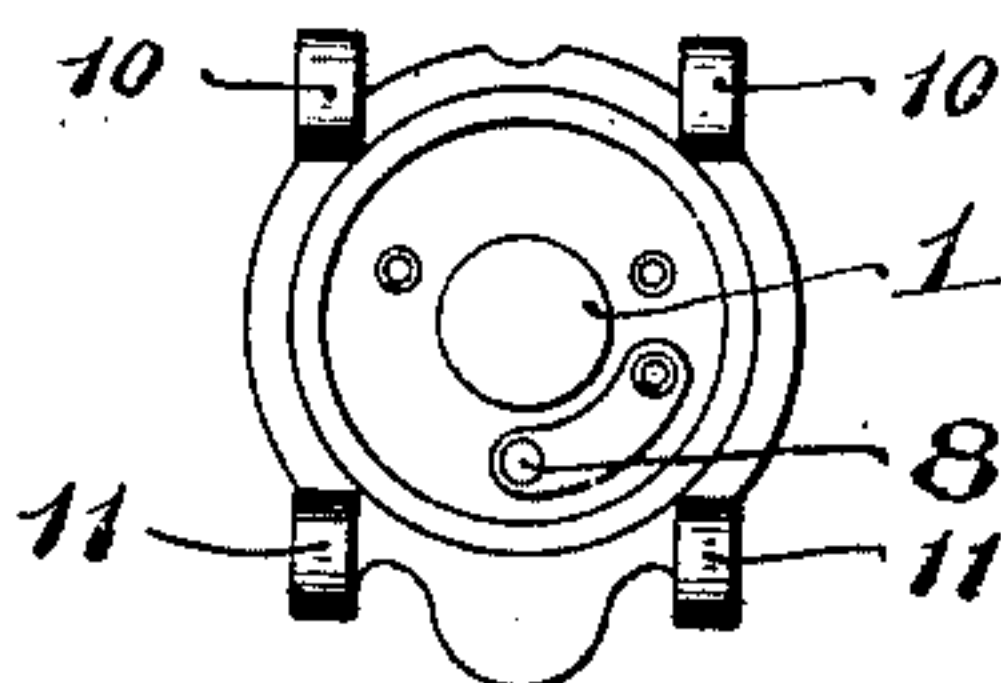


Fig. 5-



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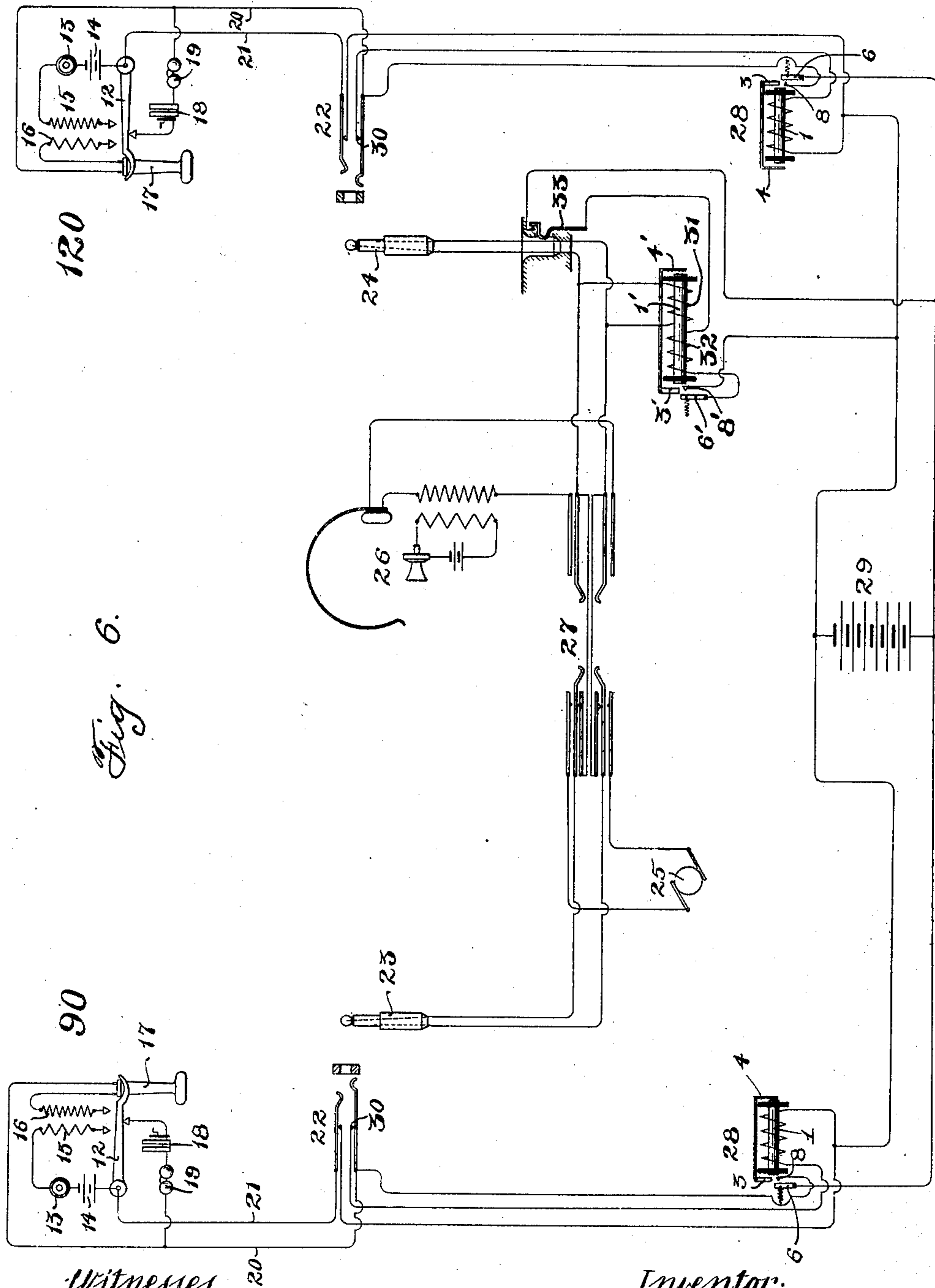
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2 SHEETS—SHEET 2.



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UNITED STATES PATENT OFFICE.

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TELEPHONE-EXCHANGE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 737,715, dated September 1, 1903.

Application filed December 2, 1901. Serial No. 84,377. (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, 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 provision of improved signaling apparatus therefor by which two main results are accomplished.

I am enabled to secure by means of my invention an effective automatic restoration of the indicators.

Another and very important object gained by the invention is the provision of means whereby the annunciators or indicators that may ordinarily be ineffective in response to the signaling-current may be made very effective by the provision of supplemental actuating means. This latter feature of my invention is of particular service, for example, in connection with telephone-exchange systems wherein magneto-electric generators are employed at the subscribers' stations for transmitting signaling-current over telephone-lines in initiating calls and in operating the clearing-out indicators, where either by reason of the great length of the telephone-lines or where the resistance is otherwise great the current emanating from the generators is reduced to such an extent that it will be unable to operate the annunciators. This objection has particularly been found where annunciators employing armatures, annunciator-levers, and targets are used, which elements frequently present such a load to the electromagnet of the annunciator as to prevent the weak currents emanating from the magneto-generators from operating the indicators. I supplement the main signal mechanism of each annunciator by an armature that is preferably delicately pivoted, so as to be responsive to very small currents, which armature in turn is adapted to effect the operation of the main signal-presenting ele-

ments. This function is preferably accomplished by including the supplemental armature in circuit with the annunciator coil and battery and a contact which is engaged by the armature upon the passage of the magneto signaling-current. When the supplemental armature responds to the signaling-current, circuit is closed through the helix of the annunciator, which circuit includes a battery of sufficient strength to properly operate the main armature and retain it in its operated position until the annunciator is restored. In order that the annunciator may be restored, this circuit, which is preferably a subsidiary circuit, also includes an operator's switching appliance, so that the operator may open the circuit, and thereby restore the annunciator. This operator's switching appliance when employed in connection with a line-indicator preferably forms a part of the line-jack, the subsidiary circuit including continuity contacts that are separated upon the insertion of a plug, thereby automatically effecting the restoration of the line-signal.

My invention is also adapted for use in the operation of clearing-out indicators. For this purpose I prefer to provide the clearing-out-annunciator magnet with two coils, though I do not wish to be limited to this arrangement. One of the coils is included in circuit with the connected telephone-lines, preferably by being bridged across the same, while the second coil is included in circuit with a battery and an operator's switch. This circuit, being thus a subsidiary circuit, also includes a supplemental armature and a contact, so that when the ringing-current traverses the winding-in circuit with the telephone-lines this supplemental armature is brought into engagement with its contact, thereby effecting an energization of the core of the clearing-out magnet, which as a consequence causes an attraction of the main armature, thereby causing the presentation and maintenance of the clearing-out signal until the said operator's switch is actuated. This switch is preferably in the form of a plug-seat switch which is so arranged that the

contacts are brought into engagement when the corresponding plug is elevated from its seat, so that the subsidiary circuit of the clearing-out indicator is placed in condition to be operated upon the passage of clearing-out signaling-current. After the clearing-out signal has been presented the plug is placed within its seat, thereby forcing a separation of the contacts that are included in circuit with the subsidiary circuit, thus causing an automatic restoration of the clearing-out signal.

I will explain my invention more fully by reference to the accompanying drawings, in which—

Figure 1 is a side elevation of an annunciator constructed in accordance with the invention. Fig. 2 is a longitudinal sectional elevation of the structure illustrated in Fig. 1. Fig. 3 is a top view of the rear portion of said structure. Fig. 4 is a rear view of the structure. Fig. 5 is a rear view of the structure with the armatures removed, and Fig. 6 is a diagrammatic view of a telephone-exchange system illustrating the application of the invention.

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

Figs. 1 to 5, inclusive, illustrate a construction of annunciator that is adapted for use both for line and clearing-out signals. The annunciator there illustrated is provided with a core 1, that is wound with one or two helices of wire, according to the employment of the device as a line or clearing-out annunciator, and which has a main armature 3, that carries a target 4 or other suitable signal-presenting device. This armature 3, owing to the load imposed thereon by the target 4 and the indicator-arm 5, that unites said target with the armature, may not respond to all signaling-currents passing over the line, and I therefore supplement this armature by a second armature 6, that is delicately pivoted, so as to be nicely balanced to readily respond to a weak magnetization of the core 1. This armature 6 is included in circuit with the battery and the winding or a winding of the annunciator, this circuit being normally open when the supplemental armature 6 is unattracted and closed when attracted, the armature carrying for this purpose a contact-screw 7 in electrical connection therewith and adapted for engagement with a terminal contact 8 when said armature is attracted. An adjusting-weight 9, carried by the armature 6, is provided for holding the said armature out of electrical connection with the contact 8 when said armature is unattracted. As indicated in Fig. 5, I prefer to employ two pairs of trunnions 10 and 11, between which the armatures 3 and 6 are supported by means of trunnion-screws constituting pivots for the armatures.

The telephone-exchange system illustrated in Fig. 6 to show the application of the in-

vention employs well-known substation apparatus at the substations 90 and 120, at each of which stations there are provided a switch-hook 12, a transmitter 13, a local battery 14, the primary 15 of an induction-coil, the secondary 16 of said induction-coil, a receiver 17, a magneto-generator 18, and a magneto-bell or other suitable signal-receiver 19. The switch-hook, as is well known, serves when depressed by the receiver to cut in the signaling branch, including the magneto-generator and the signal-receiver, and to open the conductors, including the transmitter and receiver. The substations are connected with the exchange in this instance by metallic circuits whose sides 20 and 21 are connected with the line-springs of the spring-jacks 22. Cord connecting apparatus employing well-known instrumentalities for connecting subscribers for conversation is illustrated, there being shown a connecting-plug 23 and an answering-plug 24, united by the tip and sleeve strands, a calling-generator 25, an operator's telephone set 26, and a switch 27, serving to include either the calling-generator or the operator's telephone appliance in circuit. Each telephone-line is provided with a line-indicator 28, that preferably has the features of mechanical construction illustrated in Figs. 1 to 5, inclusive, parts of the annunciators 28, that are similar to parts shown in Figs. 1 to 5, inclusive, having similar characters of reference. The supplemental armatures 6 and their contacts 8 are adapted for inclusion in circuit with a battery 29, there being also included in circuit with each supplemental armature and its contact the longer line-spring of the corresponding spring-jack and the back contact 30 of the said line-spring.

In initiating a call the calling subscriber operates his generator 18; but supposing that the current emanating from this generator is insufficient to actuate the line-indicator it will prove sufficient to operate the delicately-adjusted armature 6, which thereupon engages its contact 8 to close a circuit that includes the battery 29, the winding of the line indicator or annunciator, the supplemental armature with its contact, and the long line-spring of the spring-jack with its back contact. The current from battery 29 is strong enough to energize the magnet of the actuated line-indicator sufficiently to present a line-signal. The operator in response to the call inserts an answering-plug—as, for example, the plug 24, assuming subscriber 120 to be the calling subscriber—which separates the contact 30 from its long line-spring, thereby opening the circuit, including the line-indicator magnet, the battery 29, and the supplemental armature, thereby automatically restoring the line-signal. Having ascertained the called subscriber, the operator completes the connection by inserting the cord connecting-plug within the jack of the called subscriber. The cord-circuit is provided with

an improved form of clearing-out annunciator, which also preferably possesses the same general mechanical characteristics of the structure illustrated in Figs. 1 to 5, inclusive. This clearing-out annunciator or indicator, however, is preferably provided with a magnet that has two helices. The main helix 31 is preferably included in bridge between the strands of the cord-circuit, while the supplemental helix 32 is included in circuit with the supplemental armature 6', the contact 8' for the said supplemental armature, the battery 29, and the plug-seat switch 33, whose contacts are engaged when the plug 24 is removed from its seat. When the subscribers are through conversation, signaling-current from a magneto-generator is passed over the line through the helix 31, which current, however, may be strong enough to operate only the supplemental armature 6' without effecting an actuation of the main armature 3'. When the supplemental armature 6' is operated, however, it engages its contact 8', thereby including the battery 29 in closed circuit with the supplemental helix 32, whereupon the clearing-out signal is manifested to the operator. The operator thereupon restores the plugs 23 and 24 to their seats, the plug 24 effecting a separation of the contacts forming the plug-seat switch 33, thereby opening the circuit including the supplemental helix 32 and effecting an automatic restoration of the clearing-out annunciator.

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

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

1. In a telephone-exchange system, the combination with the subscriber's line extending from a telephone-substation to an exchange, of a line-indicating magnet at the exchange in circuit with the telephone-line, a second armature in addition to the main armature of the said magnet, a subsidiary circuit for the magnet controlled by the second armature and closed thereby upon the passage of signaling-current over the telephone-line, and an operator's restoring-switch included in and governing the subsidiary circuit, substantially as described.

2. In a telephone-exchange system, the combination with the subscriber's line extending from a telephone-substation to an exchange and terminating at the exchange in a line-jack switch, of a line-indicating magnet at the exchange in circuit with the telephone-line, a second armature in addition to the main armature of the said magnet, a subsidiary circuit for the magnet controlled by the second armature and closed thereby upon the passage of signaling-current over the telephone-line, and jack-switch contacts included

ed in said subsidiary circuit at the line-jack switch adapted to be operated by insertion of a plug to effect the restoration of the magnet, substantially as described.

3. In a telephone-exchange system, the combination with the subscriber's line extending from a telephone-substation to an exchange, of a line-indicating magnet at the exchange in circuit with the telephone-line, a second armature in addition to the main armature of the said magnet, a subsidiary circuit for the magnet controlled by the second armature and closed thereby upon the passage of signaling-current over the telephone-line, an operator's restoring-switch included in and governing the subsidiary circuit, and a magneto-generator at the substation for directing current through the said magnet to effect the attraction of the aforesaid second or added armature, substantially as described.

4. In a telephone-exchange system, the combination with the subscriber's line extending from a telephone-substation to an exchange and terminating at the exchange in a line-jack switch, of a line-indicating magnet at the exchange in circuit with the telephone-line, a second armature in addition to the main armature of the said magnet, a subsidiary circuit for the magnet controlled by the second armature and closed thereby upon the passage of signaling-current over the telephone-line, jack-switch contacts included in said subsidiary circuit at the line-jack switch adapted to be operated by insertion of a plug to effect the restoration of the magnet, and a magneto-generator at the substation for directing current through the said magnet to effect the attraction of the aforesaid second or added armature, substantially as described.

5. In a telephone-exchange system, the combination with telephone-lines extending from substations to an exchange, of cord-connecting apparatus at the exchange for uniting subscribers for conversation, a clearing-out indicating-magnet at the exchange adapted for inclusion in the cord-circuit, an added armature for said electromagnet, a circuit controlled by the added armature to thereby govern the actuation of the main armature, and an operator's restoring-switch for governing the said circuit, substantially as described.

6. In a telephone-exchange system, the combination with telephone-lines extending from substations to an exchange, of cord connecting apparatus at the exchange for uniting subscribers for conversation, a clearing-out indicating-magnet at the exchange adapted for inclusion in the cord-circuit, an added armature for said electromagnet, a circuit controlled by the added armature to thereby govern the actuation of the main armature, and a plug-seat switch adapted to be operated by a plug when seated to open the said circuit and thereby effect the restoration of the clearing-out indicating-magnet, substantially as described.

7. In a telephone-exchange system, the combination with subscribers' lines extending from substations to an exchange, of a cord-circuit at the exchange for uniting subscribers for conversation, a clearing-out magnet provided with a main winding adapted for inclusion in circuit with the telephone-line, a supplemental winding adapted for inclusion in a subsidiary or independent circuit, an added armature for the clearing-out indicating-magnet, a circuit controlled by the added armature and including the supplemental winding, and an operator's switch for opening the circuit including the supplemental winding to effect the restoration of the clearing-out indicating-magnet, substantially as described.

8. In a telephone-exchange system, the combination with subscribers' lines extending from substations to an exchange, of a cord-circuit at the exchange for uniting subscribers for conversation, a clearing-out magnet provided with a main winding adapted for inclusion in circuit with the telephone-line, a supplemental winding adapted for inclusion in a subsidiary or independent circuit, an added armature for the clearing-out indicating-magnet, a circuit controlled by the added armature and including the supplemental winding, and a plug-seat switch included in the supplemental circuit adapted to be operated by the corresponding plug when seated to open the supplemental circuit and thereby effect a restoration of the clearing-out indicating-magnet, substantially as described.

9. In a telephone-exchange system, the combination with telephone-lines extending from substations to an exchange, of cord connecting apparatus at the exchange for uniting subscribers for conversation, a clearing-out indicating-magnet at the exchange adapted for inclusion in the cord-circuit, an added armature for said electromagnet, a circuit controlled by the added armature to thereby govern the actuation of the main armature, an operator's restoring-switch for governing the said circuit, and a magneto-generator at each of the substations for transmitting signaling-current through the main winding of the clearing-out indicating-magnet, substantially as described.

10. In a telephone-exchange system, the combination with telephone-lines extending from substations to an exchange, of cord connecting apparatus at the exchange for uniting subscribers for conversation, a clearing-out indicating-magnet at the exchange adapted for inclusion in the cord-circuit, an added armature for said electromagnet, a circuit controlled by the added armature to thereby govern the actuation of the main armature, a plug-seat switch adapted to be operated by a plug when seated to open the said circuit and thereby effect the restoration of the clearing-out indicating-magnet, and a magneto-generator at each of the substations for transmitting signaling-current through the main

winding of the clearing-out indicating-magnet, substantially as described.

11. In a telephone-exchange system, the combination with subscribers' lines extending from substations to an exchange, of a cord-circuit at the exchange for uniting subscribers for conversation, a clearing-out magnet provided with a main winding adapted for inclusion in circuit with the telephone-line, a supplemental winding adapted for inclusion in a subsidiary or independent circuit, an added armature for the clearing-out indicating-magnet, a circuit controlled by the added armature and including the supplemental winding, an operator's switch for opening the circuit including the supplemental winding to effect the restoration of the clearing-out indicating-magnet, and a magneto-generator at each of the substations for transmitting signaling-current through the main winding of the clearing-out indicating-magnet, substantially as described.

12. In a telephone-exchange system, the combination with subscribers' lines extending from substations to an exchange, of a cord-circuit at the exchange for uniting subscribers for conversation, a clearing-out magnet provided with a main winding adapted for inclusion in circuit with the telephone-line, a supplemental winding adapted for inclusion in a subsidiary or independent circuit, an added armature for the clearing-out indicating-magnet, a circuit controlled by the added armature and including the supplemental winding, a plug-seat switch included in the supplemental circuit adapted to be operated by the corresponding plug when seated to open the supplemental circuit and thereby effect a restoration of the clearing-out indicating-magnet, and a magneto-generator at each of the substations for transmitting signaling-current through the main winding of the clearing-out indicating-magnet, substantially as described.

13. In a telephone-exchange system, the combination with telephone-lines extending from subscribers' stations to an exchange, of a cord-circuit at the exchange for uniting subscribers for conversation, an electromagnetic signaling appliance associated with said cord-circuit having two helices, a main armature and an additional armature therefor, one of the said helices being adapted for inclusion in circuit with the telephone-line to attract said additional armature upon passage of current, and a switching appliance controlled by said additional armature for governing a circuit including the second helix whereby the actuation of said main armature is controlled, substantially as described.

14. In a telephone-exchange system, the combination with telephone-lines extending from subscribers' stations to an exchange, of a cord-circuit at the exchange for connecting subscribers for conversation, an electromagnetic signaling device associated with said cord-circuit, a main armature, two helices,

one of said helices being adapted for inclusion in circuit with the main line, a subsidiary circuit including the second helix, an additional armature actuated upon the passage of current through the first helix, and a switching appliance controlled by the said additional armature for controlling the subsidiary circuit including the second helix whereby to control the actuation of said main armature, substantially as described.

15. In a telephone-exchange system, the combination with telephone-lines extending from subscribers' stations to an exchange, of a cord-circuit at the exchange for uniting subscribers for conversation, an electromagnetic signaling appliance associated with said cord-circuit having two helices, a main armature and an additional armature therefor, one of the said helices being adapted for inclusion in circuit with the telephone-line to attract said additional armature upon passage of current, a switching appliance controlled by said additional armature for governing a circuit including the second helix whereby the actuation of said main armature is controlled, and a switch, operated by a connecting-plug, included in the circuit containing the second helix, substantially as described.

16. In a telephone-exchange system, the combination with telephone-lines extending from subscribers' stations to an exchange, of a cord-circuit at the exchange connecting subscribers for conversation, an electromagnetic signaling device associated with said cord-

circuit, a main armature, two helices, one of said helices being adapted for inclusion in circuit with the main line, a subsidiary circuit including the second helix, an additional armature actuated upon the passage of current through the first helix, a switching appliance controlled by the said additional armature for controlling the subsidiary circuit including the second helix whereby to control the actuation of said main armature, and a switch operated by a connecting-plug included in the circuit containing the second helix, substantially as described.

17. In a telephone system, the combination with telephone-lines extending from subscribers' stations to an exchange, of a cord-circuit for connecting the subscribers for conversation, an electromagnetic signaling appliance at the exchange provided with two armatures, two circuits for said appliance, one adapted for being included in the telephone-line and adapted to be controlled by the subscribers' apparatus, the other being included in a supplemental or subsidiary circuit, and a switch controlled by one of the armatures and included in the said subsidiary circuit to thereby effect the control of the other armature, substantially as described.

In witness whereof I hereunto subscribe my name this 27th day of November, A. D. 1901.

WILLIAM M. DAVIS.

Witnesses:

MAX W. ZABEL,

HARVEY L. HANSON.