

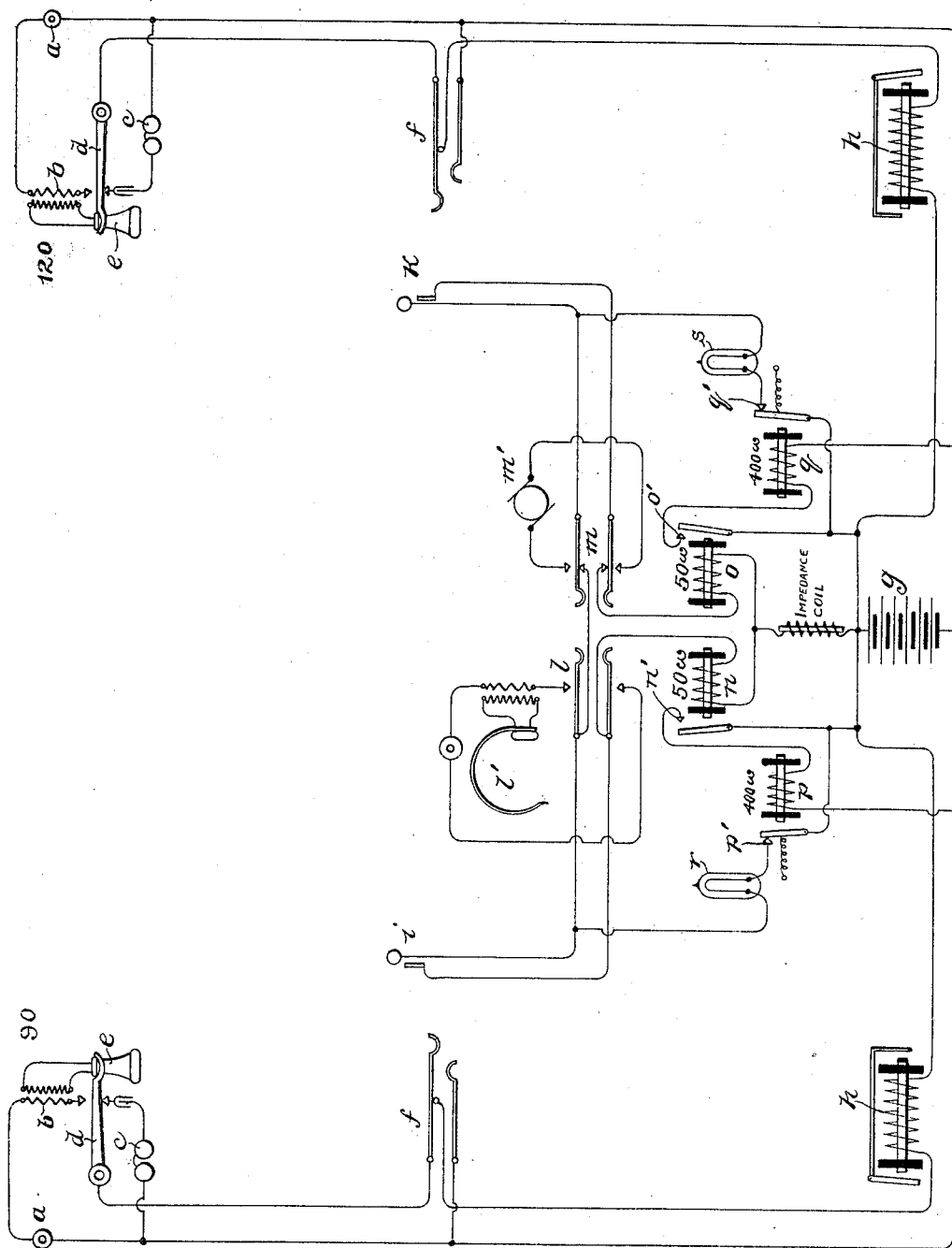
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W. M. DAVIS.
TELEPHONE EXCHANGE SYSTEM.

(Application filed Aug. 5, 1901.)

(No Model.)



Witnesses:
Max W. Label.
Harvey L. Hanson.

Inventor:
William M. Davis,
By Charles A. Brown, Craig & Belfield
Attorneys.

UNITED STATES PATENT OFFICE.

WILLIAM M. DAVIS, OF CHICAGO, ILLINOIS, ASSIGNOR TO STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

TELEPHONE-EXCHANGE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 697,992, dated April 22, 1902.

Application filed August 5, 1901. Serial No. 70,925. (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. 21,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

My invention relates to telephone-exchange systems, and has for its object the provision of improved means for supplying the operator with supervisory signals, each signal corresponding to a connected subscriber.

Heretofore it has been proposed to employ supervisory signals each associated with a telephone-line and so arranged in each cord-circuit in combination with a condenser that the apparatus at each of the two connected subscribers' stations is adapted to effect the control of the corresponding supervisory relay or signal, each signal serving accurately to indicate the condition of the corresponding line independently of any other apparatus than the apparatus at the corresponding substation, the two signals thus associated with each cord-circuit indicating to the operator the exact conditions of the respective lines, so that the operator may make no false moves and will not prematurely disconnect connected lines. There are many objections to this form of supervisory signaling apparatus, among which may be mentioned the disagreeable clicking manifested in the receivers upon discharge of the condensers during the various manipulations and operations of the instrumentalities entering into the system.

In accordance with my invention I employ a low-wound magnet for each signal, the windings being included each in circuit with a telephone-line, a source of current, and a switch at the substation of the said line, whereby upon the operation of the switch the operative condition of the magnet may be changed and the signal controlled thereby operated. The windings of the electromagnets are preferably included serially in the telephonic circuit and in order to reduce the im-

pedance thereof are made of very low resistance.

In practicing my invention I preferably remove the springs, which render the operation of the armatures of these magnets faulty, so that the armatures may be attracted with sufficient force by the magnets to close circuits, including higher-wound supplemental magnets whose armatures are provided with back contacts constituting the terminals of signaling-circuits, including the clearing-out signals, which contacts are forcibly engaged with the armatures by retractile springs when the supplemental magnets are deenergized. The armatures of the main magnets are restored, preferably, by gravity when the said magnets are deenergized to open the circuits including the supplemental magnets. The circuits including the supplemental electromagnets are preferably local, as are also the circuits including the incandescent lamps controlled thereby. The relays in the telephonic circuit are preferably included in the cord-circuit and may be each wound, for example, to fifty ohms. The supplemental relays may be wound to four hundred ohms to secure their effective operation.

I will explain my invention more fully by reference to the accompanying drawing, illustrating the preferred embodiment thereof as applied to a single switchboard, though the invention is readily adaptable to telephone-exchange systems of other types.

I have shown well-known telephone substation apparatus at the substations 90 and 120, at each of which is a transmitter *a*, a primary winding *b*, a call-bell *c*, and a telephone switch-hook *d*, adapted to complete the bell-circuit or the telephone-circuit under the influence of the receiver *e*. Each telephone-line extends by its limbs to the exchange, each line in this instance being connected with a spring-jack *f*. The limbs of the telephone-lines terminate at the common battery *g*, which is preferably in parallel with the lines, one of the limbs of each line passing through the separable contact of the spring-jacks and the operating-magnet *h* of the line-indicator. The cord-circuit comprises an answering-

plug *i* and a connecting-plug *k*, united by tip and sleeve strands, with which are connected the springs of the listening-key *l* and a ringing-key *m* for including the operator's telephone set *l'* in bridge with the telephone-lines and for connecting the calling-generator *m'* in circuit with the bell at the called subscriber's station. One terminal of the common battery *g* is permanently connected with those sides of the telephone-lines that are in this instance connected with the tip line springs of the spring-jacks. The other terminal of the common battery is connected with the remaining side of the telephone-lines through the line-indicators when the spring-jacks are free of plugs and is also connected at a point between the magnets *n* and *o* with the strand of the cord-circuit—in this instance the sleeve-strand—that unites the long line-springs of the spring-jacks when subscribers are connected for conversation, the helices of these magnets being thus included in series in the sleeve-strand, one upon each side of the bridge connection including the battery. To avoid the impedance that these magnet-windings might impose upon the telephonic circuit, I make the same of very low resistance, preferably fifty ohms. Each magnet is provided with an armature, so pivoted with relation to the contacts *n'* and *o'* that when the magnets *n* and *o* are deenergized these armatures are removed from the contacts by gravity. The armatures of the electromagnets and their corresponding contacts *n'* and *o'* are included in circuits including the supplemental magnets *p* and *q*, preferably wound to four hundred ohms, the battery *g* being common to these circuits, which are local. When the magnets *n* and *o* are deenergized, the corresponding local circuits including the magnets *p* and *q* are opened, permitting the armatures of the latter electromagnets to engage contacts *p'* *q'* to close local circuits including the supervisory indicators *r* and *s*, together with the tips of the connecting-plugs, the short-line springs, and the portion of the line conductors permanently connected with the battery. By this arrangement the armatures of magnets *n* and *o* will be relieved of spring attachment to effect their removal from engagement with the contacts *n'* and *o'*, as these armatures have no service to perform after disengagement with their contacts. The armatures of magnets *p* and *q*, however, may be provided with sufficiently-strong springs to insure a proper closure of the circuits including the clearing-out indicators *r* and *s*.

It will be seen that the magnet *n* is subject only to the control of the switch-hook at the substation 90, while the magnet *o* is subject only to the control of a switch at the substation 120, it being assumed that these two stations are united for conversation through the agency of the plugs *i* and *k*. This is so because the battery is connected at one terminal to a point between the windings of the

said magnets, the other terminal of the battery being constantly connected with sides of the telephone-lines companions to those sides united by the cord-strand including the magnets. The magnet *n* therefore is adapted to effect a control of the magnet *p*, this magnet *p* being totally independent of the magnet *o*. In like manner the magnet *q* is controlled by the magnet *o* and is totally independent of the magnet *n*. When the subscribers restore their telephones, circuits including the magnets *n* and *o* are opened, or if the called subscriber has not responded or but one telephone-receiver has been restored to its switch-hook but one electromagnet *n* or *o*—that corresponding to the substation where the receiver has been restored—is deenergized. As a result the magnets *p* and *q*, or either of them, as the case may be, are also deenergized, the local circuits including the same having been opened upon the release of the armatures of magnets *n* and *o* to close circuit through the clearing-out or supervisory signals *r* and *s*, or either of them.

It will be observed that the circuits including the clearing-out or supervisory signals *r* and *s* also include contact portions of the switch-plugs and line-springs of the spring-jacks engaging the same, whereby these signals are restored or rendered inert when the plugs are withdrawn from the spring-jacks.

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 disclosure herein set forth; but,

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

1. The combination with telephone-lines extending from substations to an exchange, of a cord-circuit at the exchange, electromagnets included serially in the cord-circuit, a source of current in circuit with the telephone-lines, a bridge connection across the telephone-circuit and in circuit with the said source of current and connected between the windings of the said electromagnets, whereby each electromagnet may be controlled by the corresponding telephone-substation independently of the other, the armatures of the said electromagnets being provided with contacts that are engaged by the armatures when said electromagnets are energized, supplemental electromagnets included independently of each other in energizing-circuits, these energizing-circuits including each the armature and contact of the first aforesaid electromagnets, the armatures of the supplemental electromagnets being provided with springs to effect their retraction when the said supplemental electromagnets are deenergized, contacts for the latter armatures engaged thereby when retracted, supervisory signals and circuits for the same including the armatures

and contacts of the supplemental electromagnets, substantially as described.

2. The combination with telephone-lines extending from substations to an exchange, of a cord-circuit at the exchange, electromagnets included serially in the cord-circuit, a source of current in circuit with the telephone-lines, a bridge connection across the telephone-circuit and in circuit with the said source of current and connected between the windings of the said electromagnets, whereby each electromagnet may be controlled by the corresponding telephone-substation independently of the other, the armatures of the said electromagnets being provided with contacts that are engaged by the armatures when said electromagnets are energized, supplemental electromagnets included independently of each other in energizing-circuits, these energizing-circuits including each the armature and contact of the first aforesaid electromagnets, the armatures of the supplemental electromagnets being provided with springs to effect their retraction when the said supplemental electromagnets are deenergized, contacts for the latter armatures engaged thereby when retracted, supervisory signals and circuits for the same, including the armatures and contacts of the supplemental electromagnets, the circuits including the supervisory or clearing-out indicators being formed in part by the portion of the cord-circuit and line-springs of the spring-jacks, whereby the said supervi-

sory signals are restored or rendered inert when the cord-circuit is disconnected from the telephone-lines, substantially as described. 35

3. The combination with telephone-lines extending from substations to an exchange, of a cord-circuit at the exchange for uniting the telephone-lines, an electromagnet included in the cord-circuit, a contact engaged by the armature of the electromagnet when the said armature is attracted, a supplemental electromagnet included in an energizing-circuit which contains the armature and contact of the aforesaid electromagnet, the armature of the supplemental electromagnet being provided with a spring for retracting the same when the said supplemental magnet is deenergized, a contact engaged by the armature of the supplemental magnet when retracted, a clearing-out signal included in a circuit which contains the armature and contact of the supplemental electromagnet, the clearing-out-indicator circuit being composed in part by a portion of the cord-circuit, and a line-spring in circuit therewith, whereby upon a disconnection of the cord-circuit the clearing-out signal is restored or rendered inert, substantially as described. 60

In witness whereof I hereunto subscribe my name this 13th day of July, A. D. 1901.

WILLIAM M. DAVIS.

Witnesses:

GEORGE L. CRAGG,
HERBERT F. OBERGFELL.