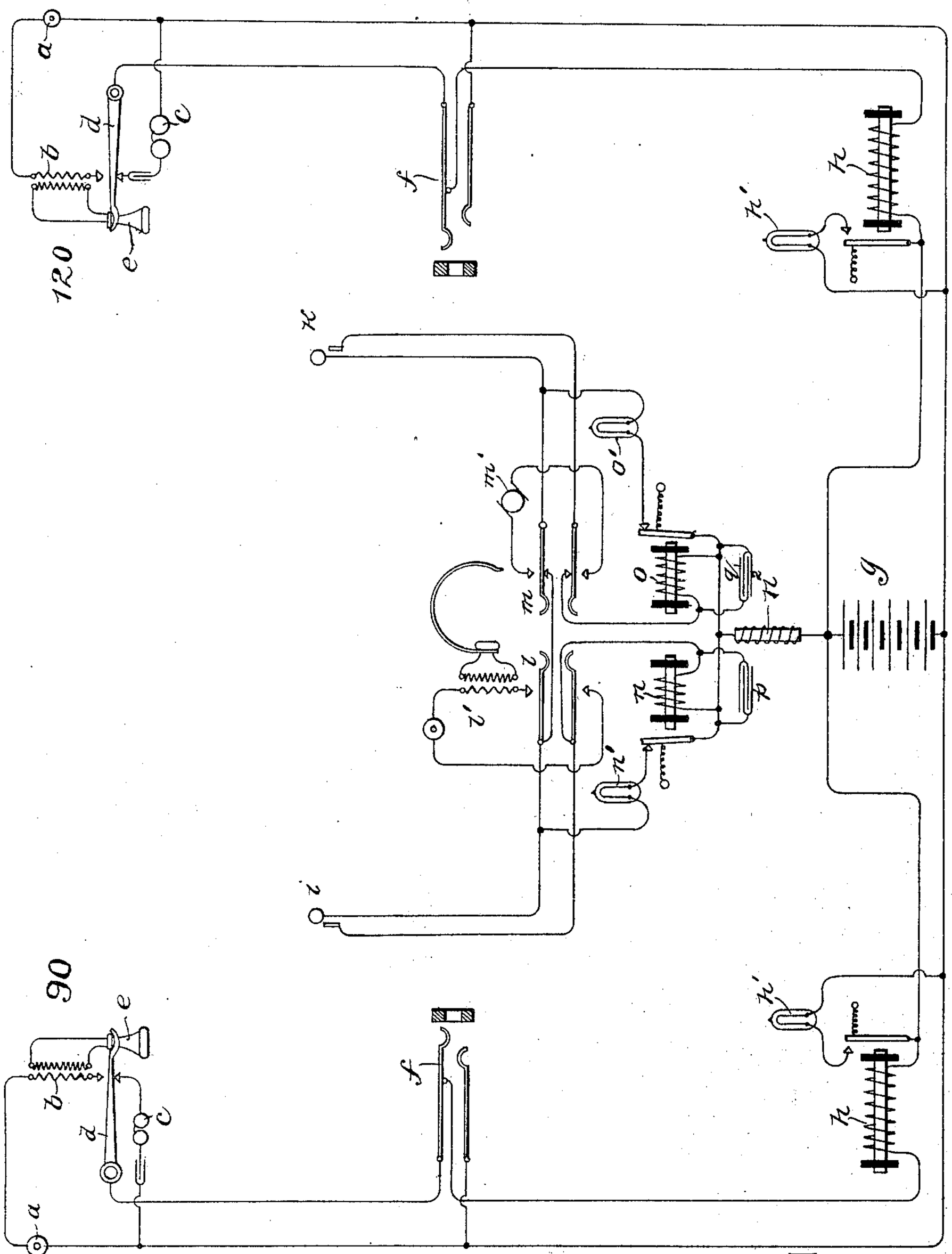
No. 697,993. Patented Apr. 22, 1902.

W. M. DAVIS.

TELEPHONE EXCHANGE SYSTEM.

(Application filed Aug. 16, 1901.)

(No Model.)



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UNITED STATES PATENT OFFICE.

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TELEPHONE-EXCHANGE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 697,993, dated April 22, 1902.

Application filed August 16, 1901. Serial No. 72,256. (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. 22,) 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 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 receiver of the calling subscriber upon the discharge of the condenser occurring when the called subscriber removes his telephone.

I also aim to accomplish by means of my invention the avoidance of the objection arising upon the connection of long lines with short lines, which where double supervision is employed may in some systems create a shunt relation between the subscribers' lines, the short line constituting a shunt of low resistance, preventing the effective operation of the supervisory signals.

I avoid both of the objections above pointed out by including the supervisory signals directly in the sides of the circuit including the telephone-lines, bridge a source of current across the circuit, the bridge being located between the supervisory signals, and provide individual shunts about each supervisory-signal magnet, each shunt containing a condenser. The magnets of the surpervisory signals are preferably wound sufficiently high to avoid the difficulty that heretofore arose upon the connection of long and short telephone-lines, while the provision of separate condensers avoids the objectionable click in the calling-subscriber's ear.

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 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 contacts of the spring-jacks and the operating-magnet *h* of the line-indicator.

I do not wish to be limited to the character of the line-indicator, as any line-indicator may be employed without departing from the spirit of my present invention. I have indicated small incandescent lamps *h'*, however, to act in this capacity.

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 a 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 these

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 a 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. The battery bridge connection also includes an impedance-coil n^2 to prevent the shunting of voice-currents across this bridge. The magnets *n* and *o* may serve to control the supervisory signals in any preferred manner. I prefer to have these magnets control the supervisory signals electrically, for which purpose I preferably use supervisory indicating-lamps *n'* *o'* as the supervisory signals whose circuits are controlled by the armatures of the magnets or relays *n* and *o*. There are thus established when a connection is put up between subscribers two circuits in multiple connection, the bridge including a battery and impedance being common to these two circuits. In order to prevent one circuit from acting as a shunt of low resistance to the other, the supervisory relays or electromagnets *n* and *o* are each made of sufficiently high resistance, one hundred ohms being usually sufficient for each electromagnet.

The supervisory magnets *n* and *o* are shunted by means of condensers *p* and *q*, each magnet having its own shunt-circuit, terminating directly at the terminals thereof, so that the condenser corresponding to the calling-subscriber's telephone-line will not be discharged upon the removal of the receiver at the called-subscriber's station. The windings of the supervisory relays are such as preferably to be of low impedance, so that the voice-currents may pass through these windings and through the condensers in parallel, so that if the condensers were in effect not present or were disconnected conversation could still be carried on, though obviously this arrangement is not so satisfactory.

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

1. In a telephone 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 bridge placing the telephone-lines when connected in shunt-circuit relation, two supervisory signals, each of said telephone-circuits including the operating-magnet of a supervisory signal, a condenser directly in shunt of each supervisory magnet, and a source of current in circuit with the said bridge, substantially as described.

2. In a telephone 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 bridge placing the telephone-lines when connected in shunt-circuit relation, two supervisory signals, each of said telephone-circuits including the operating-magnet of a supervisory signal, a condenser in shunt of each supervisory magnet, and a source of current in the said bridge, substantially as described.

3. In a telephone 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 bridge placing the telephone-lines when connected in shunt-circuit relation, two supervisory signals, each of said telephone-circuits including the operating-magnet of a supervisory signal, a condenser directly in shunt of each supervisory magnet, and a source of current in circuit with the said bridge, the said electromagnets being included in the same side of the combined circuit, substantially as described.

4. In a telephone 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 bridge placing the telephone-lines when connected in shunt-circuit relation, two supervisory signals, each of said telephone-circuits including the operating-magnet of a supervisory signal, a condenser directly in shunt of each supervisory magnet, and a source of current in the said bridge, the said electromagnets being included in the same side of the combined circuit, substantially as described.

5. In a telephone 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 bridge placing the telephone-lines when connected in shunt-circuit relation, two supervisory signals, each of said telephone-circuits including the operating-magnet of a supervisory signal, a condenser directly in shunt of each supervisory magnet, a source of current in circuit with the said bridge, and an impedance in the said bridge, substantially as described.

6. In a telephone 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 bridge placing the telephone-lines when connected in shunt-circuit relation, two supervisory signals, each of said telephone-circuits including the operating-magnet of a supervisory signal, a condenser directly in shunt of each supervisory magnet, a source of current in the said bridge, and an impedance in the said bridge, substantially as described.

7. In a telephone 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 bridge placing the telephone-lines when connected in shunt-circuit relation, two supervisory signals, each of said telephone-circuits including the operating-magnet of a supervisory signal, a condenser directly in shunt of each supervisory magnet, a source of current in circuit with the said bridge, the said electromagnets being included in the same side of the combined circuit, and an impedance in the said bridge, substantially as described.

8. In a telephone 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 bridge placing the telephone-lines when connected in shunt-circuit relation, two supervisory signals, each of said telephone-circuits including the operating-magnet of a supervisory signal, a condenser directly in shunt of each supervisory magnet, a source of current in the said bridge, the said electromagnets being included in the same side of the combined circuit, and an impedance in the said bridge, substantially as described.

9. Cord-connecting apparatus, comprising the two strands of a cord-circuit, a bridge, two supervisory relays, one included on each side of said bridge, and a condenser directly in shunt of each relay-winding, substantially as described.

In witness whereof I hereunto subscribe my name this 12th day of August, A. D. 1901.

WILLIAM M. DAVIS.

Witnesses:
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GEORGE L. CRAGG.