

No. 860,902.

PATENTED JULY 23, 1907.

E. E. CLEMENT.
TELEPHONE EXCHANGE SYSTEM.
APPLICATION FILED NOV. 11, 1905.

2 SHEETS—SHEET 1.

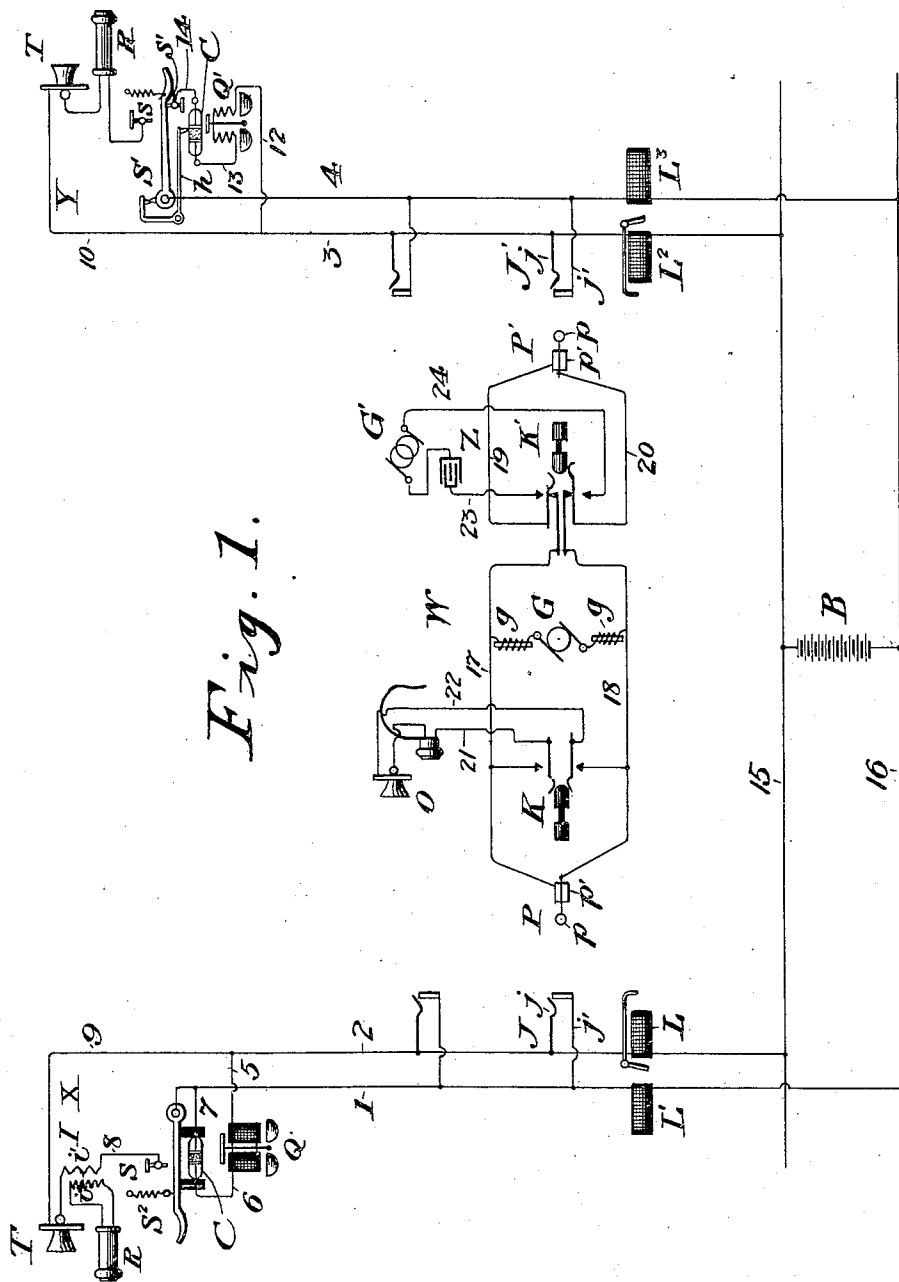


Fig. 1.

Witnesses:
O. W. Edelin.
Jos. L. Knight

Inventor:
Edward E. Clement

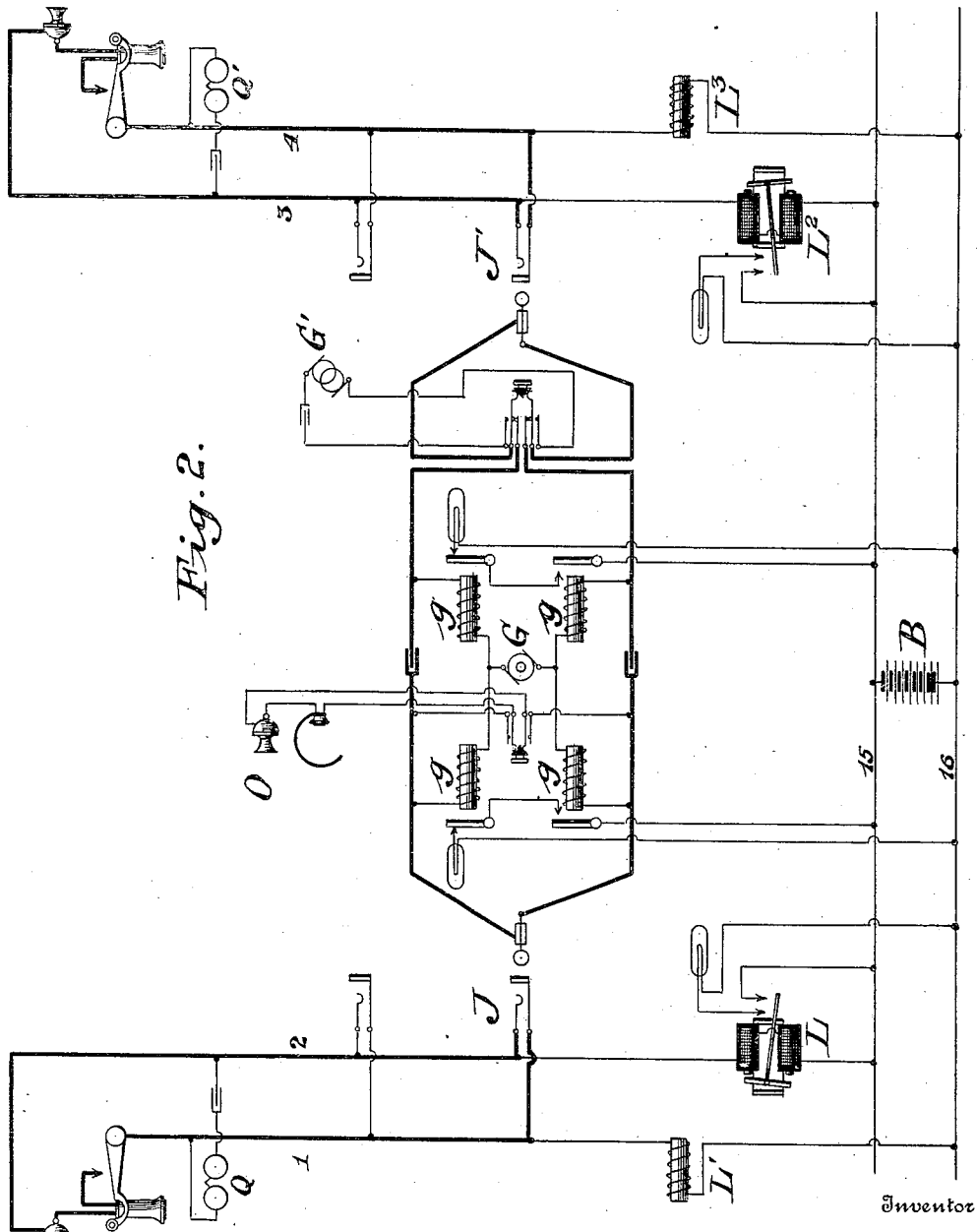
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Witnesses

A. R. Whiting

James H. Mann

Edward E. Clement

Inventor

UNITED STATES PATENT OFFICE.

EDWARD E. CLEMENT, OF WASHINGTON, DISTRICT OF COLUMBIA.

TELEPHONE-EXCHANGE SYSTEM.

No. 860,902.

Specification of Letters Patent.

Patented July 23, 1907.

Application filed November 11, 1905. Serial No. 286,889.

To all whom it may concern:

Be it known that I, EDWARD E. CLEMENT, a citizen of the United States, residing at Washington, in the District of Columbia, have invented a certain new and useful Improvement in Telephone-Exchange Systems, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to telephone exchange systems, and has for its object the improvement of such systems in general, and of common battery systems in particular.

Briefly stated, the invention comprises a system in which the normal supply for signaling over lines is furnished by a secondary battery, which maintains a constant potential across the central office ends of all the lines. Connection terminals are provided in open multiples of the line, and signal devices are included therebetween the connection terminals and the battery. The operators' cord-circuits are all bridged on to the main generator, through impedance coils, the direction of forces in the generator being such that when a connection is made with a line, like poles of the generator will be opposed to like poles of the secondary battery, whereby a balance of potentials is produced on the line-signal, and the battery is kept constantly charged. Since the battery is floated across the terminals of the generator during all conversations, the inequalities in electromotive force due to the commuting of the generator current, are smoothed out and do not interfere with conversation.

My invention is illustrated in the accompanying drawings, in which

Figure 1 is a diagram of a central station and two subscribers' stations. Fig. 2 is a diagram of a modification.

In Fig. 1 of the drawings, X—Y are the two subscribers' stations, and W is the central office. I have shown at each subscriber's station the usual transmitter T, receiver R, switch-hook and ringer, and instead of a condenser in series with each ringer I have shown a coherer, in accordance with the design set forth in my Patents, 719,998 and 719,999.

At station X the transmitter is connected directly to the line-wire 2 through the branch 9, on one side, and on the other side through the primary $\frac{1}{2}$ of the induction coil I and by wire 8 to the up-contact S of the switch-hook S². The secondary i of the induction coil is connected to the receiver R. The switch-hook is connected to the line-wire 1, and the ringer Q is connected in a bridge 5—6—7 through the coherer C. This coherer as shown is a glass tube mounted and insulated from the switch-hook, with a filling of active material composed of a mixture of fine hard carbon or very hard steel filings or broken needles or the like.

At station Y, the transmitter and receiver are shown connected in series between the line-wire 3, through branch 10 to the contact s, the induction coil being

omitted. A coherer C is employed in series with the ringer Q', in the bridge 13—14, but instead of being mounted on the switch-hook, this coherer is fixed and is adapted to be tapped by a hammer h actuated by a cam stud on the hook lever S' when the latter rises. The coherer and ringer are cut off during conversation by the opening of the bridge 12—13—14 at the contact s'.

At the central office, the lines are provided with contacts J, J', each having a spring and sleeve j, j' , bridged in open multiple. Pairs of plugs, P, P' are employed for interconnecting lines, their tips p and sleeves p' being connected respectively through the cord-conductors 18—20 and 17—19. A key K when actuated serves to connect operator's set O through the wires 21—22 across the cord conductors 17—18. A ringing key K' when actuated, serves to separate the conductors 19—20 leading to the calling-plug P', from those, 17—18 leading to the answering-plug P, and to put them on the wires 23—24 leading to the ringing generator G'. I preferably include a condenser Z in the circuit of this ringing generator, because of the added effect thereby produced upon the coherers.

The cord-conductors 17—18 are permanently bridged on the main generator G, which has an output ample for the entire exchange load at all times, in order to obviate any danger of overflow from the battery B. Between the generator and the cord-conductors I include the impedance coils g , which are preferably of very low ohmic resistance, but so wound and with magnetic circuits so designed, that each will have a very high coefficient of self-induction. These coils serve the double purpose of choking out voice currents from the generator mains, and of smoothing out inequalities in the generator current conveyed to line. A similar function is performed in each line by the coils L, L', the former of which is the coil of the line-signal.

The operation of the system shown in Fig. 1 is as follows: Normally there is no current flow in the lines, although the battery B maintains a constant potential difference between the terminals. When a subscriber, as X, calls he takes down his receiver, the hook rises, and line-signal L is energized by the current flow from battery B. The operator inserts the answering-plug P, and thereby connects the generator G across the line through the conductor 17—18, in parallel with the battery B. The signal L is thus exposed to equal potentials on both sides, and the flow of current through it from the battery stops. It is to be observed that the battery B is kept charged to its point of highest efficiency all the time, because the instant its potential falls, and an operator is answering a call anywhere in the office, the generator G will be connected back to it, and will charge it to the maximum. The generator supplies current to the line for talking, but the battery is in parallel with it, and in conjunction with the coils g smooths out the inequalities. After ascertaining the

number wanted, through manipulation of the key K, the operator inserts plug P', and actuates ringing key K' in the usual way. The sharp alternations of current thus produced on the line 3—4 cause the coherer C to set, and its resistance to drop from its normal point of 140,000 ohms or more to less than 100 ohms, whereupon the ringer Q' will be efficiently actuated. When the subscriber Y answers the tapper h is raised and falls upon the coherer to shake apart its particles.

Fig. 2 is a diagram of a modified arrangement in which the magnets L and L² are relays, and their associated magnets L' and L³ may be relays, while the coils g already described are also the windings of relays which control the signals and are duplicated, the cord conductors being broken by condensers, so as to give double supervision in a well known manner.

The substation apparatus is the same as in Fig. 1 except that I have substituted condensers for the coherers in the ringer branches, this being a common and well known arrangement. Other changes can be made without departing from the invention.

Obviously, if the voltage of the battery B has fallen at any time, so that there is a back flow of charging current through the magnet L, the signal may remain actuated unless special means are provided for its retirement. To avoid this liability I prefer to make the magnet L polarized, as indicated in Fig. 2 and in that event it is sure to be properly restored when a plug is inserted, for there is always sure to be a small fractional difference of potential between the generator and the battery terminals.

Having thus described my invention, what I claim is:—

1. In a telephone system, a line circuit, a secondary battery supply, and controlling means for current in the circuit, a translating device between the controlling means and the battery, a charging generator, and means to con-

nect the same during conversation between the controlling means and the translating device, substantially as described.

2. In an electrical system, a line circuit, a secondary battery for supplying current thereto, a circuit closer, a connection terminal and means associated therewith to connect it with other circuits for transmission purposes, said terminal being located between the circuit closer and the signal device, and a charging generator adapted to be connected to said connection terminal by the act of connecting it with another circuit, substantially as described.

3. In a telephone exchange system, a subscriber's metallic line circuit, a substation and switch, a storage battery and a line signal device with a permanent central office connection from the line through the signal device to the battery, a connection terminal for the line between the substation and the signal device, a coöperating connective circuit for connecting the line with other circuits, and a charging generator bridged across the same so as to be brought into parallel with the storage battery and to produce a balance of potential across the terminals of the signal device while the line circuit is connected, and to recharge the battery through the signal device at such time while maintaining the signal inoperative, substantially as described.

4. In a telephone exchange system, a storage battery, a plurality of subscribers' lines and signal controlling magnets therefor, each line terminally connected at a central office through its signal magnet to said storage battery, subscribers' station apparatus including telephones and switches, a spring-jack or jacks for each line constituting open multiples thereof outside of the signal controlling magnet, operators' plugs and cord circuits, and a common charging generator connected in parallel across said cord circuits, whereby the subscribers will be supplied with talking current through the cord circuits, the signal controlling magnets will be deenergized, and the common storage battery will be maintained fully charged, all substantially as described.

In testimony whereof I have affixed my signature in presence of two witnesses.

EDWARD E. CLEMENT.

Witnesses:

HUGH M. STERLING,
J. L. WRIGHT.