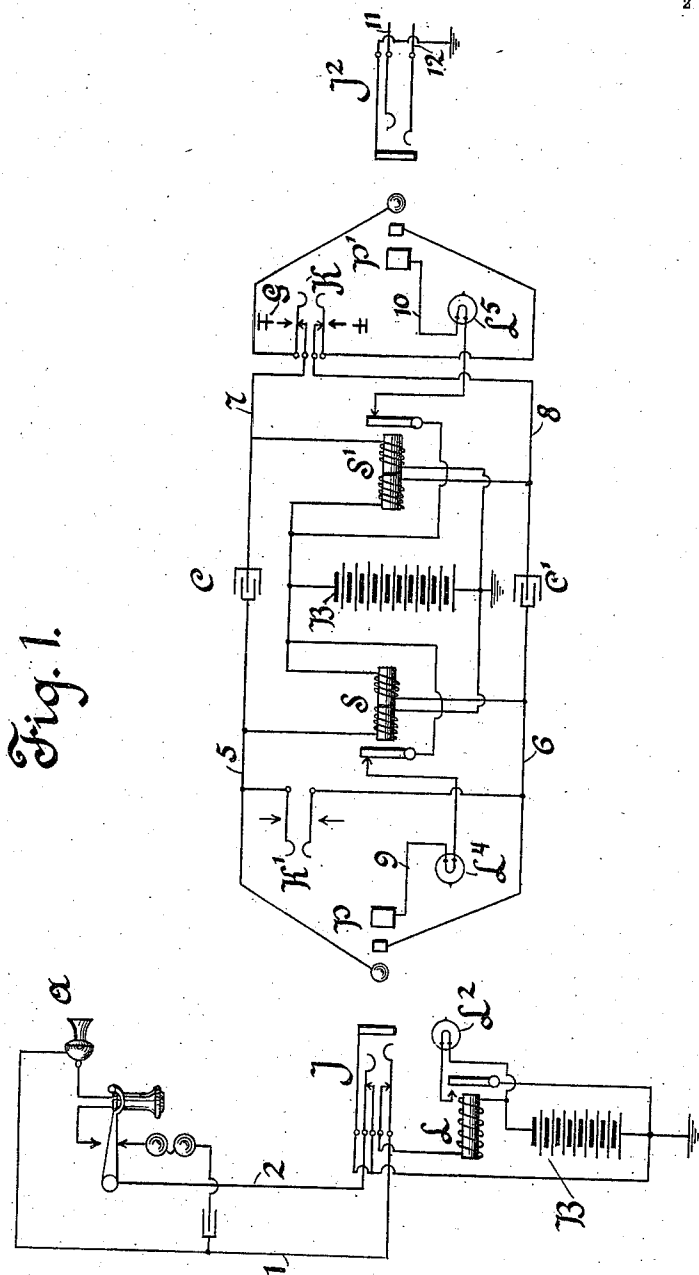


984,958.

J. G. MITCHELL.
TELEPHONE EXCHANGE SYSTEM.
APPLICATION FILED JULY 15, 1909.

Patented Feb. 21, 1911.
2 SHEETS—SHEET 1.



• Witnesses

H. Löwenstein.

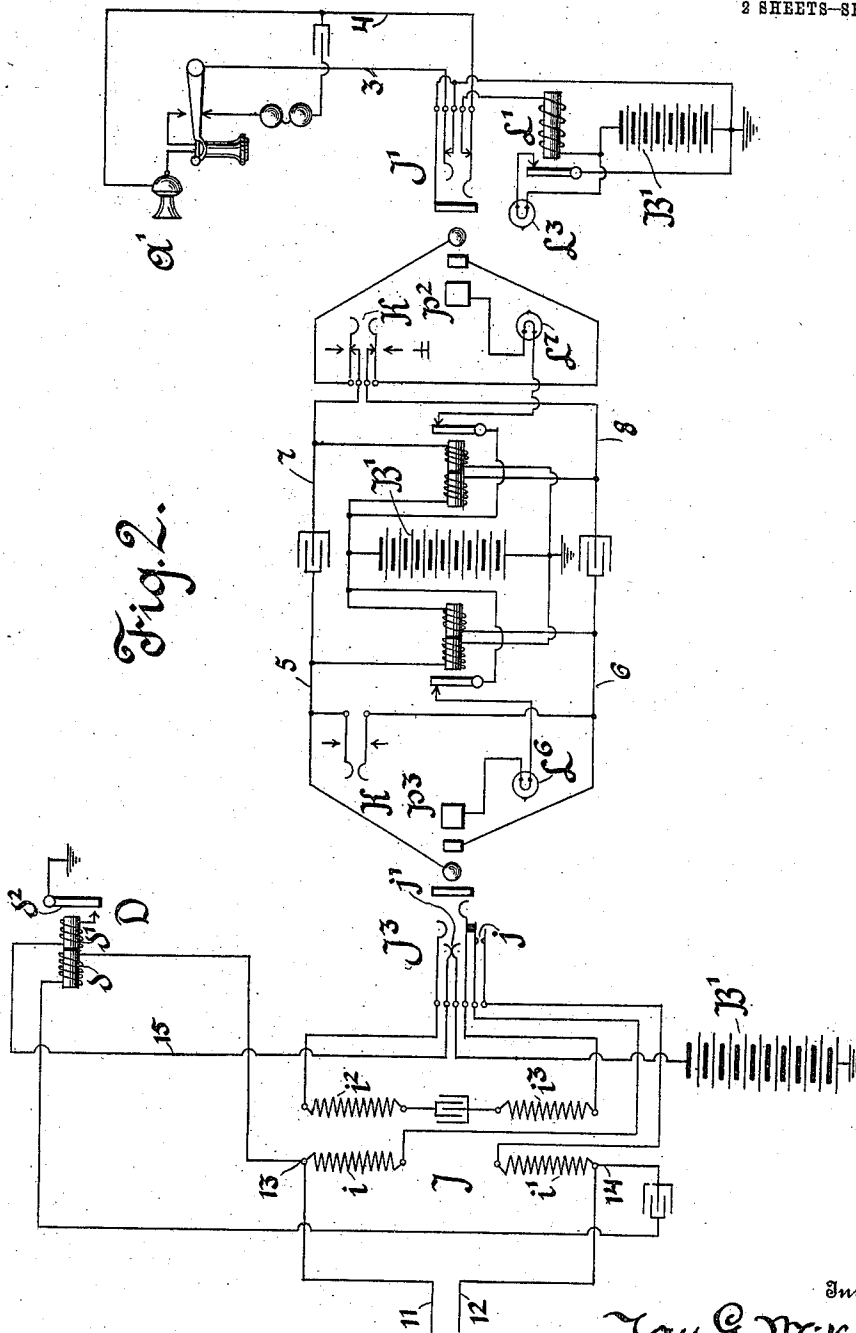
James A. Marr

Jay G. Mitchell ^{Inventor}
Edward E. Glenn

Attorney

984,958.

2 SHEETS--SHEET 2.



James H. Marr

Edward E. Benson

Attorney

UNITED STATES PATENT OFFICE.

JAY GORDON MITCHELL, OF CLEVELAND, OHIO, ASSIGNOR TO THE NORTH ELECTRIC COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF OHIO.

TELEPHONE-EXCHANGE SYSTEM.

984,958.

Specification of Letters Patent.

Patented Feb. 21, 1911.

Application filed July 15, 1909. Serial No. 507,827.

To all whom it may concern:

Be it known that I, JAY G. MITCHELL, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Telephone-Exchange Systems, of which the following is a specification, reference being had therein to the accompanying drawing.

My invention relates to trunking circuits for telephone exchange systems, and especially to those employed in connection with private branch exchanges.

It has for its object the improvement of said circuits in sundry particulars which will appear in the following description and the claims appended thereto.

My invention is illustrated in the accompanying drawings wherein—

Figure 1 shows a subscriber's line, an answering or A operator's cord circuit, and a trunk jack. Fig. 2 shows the trunk wires leading from the jack in Fig. 1, the B end of the trunk, a B operator's cord circuit, and another subscriber's line.

Referring to the drawings, A and A' are two subscribers' stations, each connected with central by line wires 1—2, and 3—4 respectively, said wires passing to the spring jacks J and J', which are cut-off jacks, having connections through their anvil contacts to the line relays L and L', which are supplied from the main batteries B and B', and respectively control the line signal lamps L² and L³. The batteries are spoken of in the plural because they may be located in different central offices. If the trunk were very short, these might be united in a single battery.

The operators' cord circuits in Figs. 1 and 2 are identical, and a description of one will therefore suffice for both.

Referring to Fig. 1, P and P' are the answering and calling plugs respectively, each having tip, ring and sleeve contacts, the first two going to the cord conductors 5—6, and 7—8, while the third is connected to the supervisory lamp in each case. These lamps are marked L⁴ and L⁵ and are controlled by the supervisory relays S and S', which have their windings split, and the main battery B connected between them. The cord is conductively divided but inductively completed by the condensers C and C', and I provide the usual ringing key K, which is

associated with the plug P', opening the cord conductors 7—8, and connecting the ringing generator to said plug when actuated. The trunk jack is marked J² and has a sleeve connected to ground, and a pair of springs connected respectively to the trunk wires 11 and 12. The ground connection for the sleeve is to complete the circuit of the supervisory lamp when a plug is inserted, line jacks, it will be noted, being similarly arranged.

In Fig. 2 the trunk wires 11 and 12 pass to opposite ends of the divided windings *i*, *i'* of the repeating coil L. The circuit through these windings is normally broken for direct current at the contacts *j* of the terminal trunk jack J³. Connected across the terminal points 13 and 14, I bridge one winding *d* of the double wound magnet of the self-locking target signal D. The locking wire 15 of this magnet passes from windings *d'* through normally closed contacts *j'* of the jack J³ and so to battery B'.

The operation of my system is as follows: Subscriber A desiring to talk with subscriber A', removes his receiver, closing the line circuit 1—2, thereby energizing relay L which lights lamp L². The operator inserts plug P, uses the listening key K', ascertains the number, and as it is a trunk call inserts the plug P' in trunk jack J² from which lines 11—12 pass to the desired point. The ringing key K is then actuated and alternating current thrown upon the wires 11—12, passing therefrom through the winding *d* of the signal D. The armature *d'* is immediately attracted and closes the circuit of the locking winding *d'* from ground to battery through the contact *j'* in the incoming trunk jack. The B operator in Fig. 2, perceiving that the signal D is set, inserts the answering plug P³, thereby connecting the repeating coil windings *i*² and *i*³ with her cord circuit, closing the contacts *j*, and opening the contacts *j'*. The closing of contacts *j* completes a battery circuit through the winding *i*, *i'* and the trunk wire, so that current from the main battery B in Fig. 1 will flow through the following path: B, S', 8, 12, 14, *i'*, *j*, *i*, 13, 11, 7, S' and back to battery. This energizes the relay S' and puts out the supervisory lamp L⁵, so that the A operator is apprised that her call has been answered. The B operator then ascertains the number wanted in her exchange either

by speaking direct to the subscriber A or from the listening A operator. Having ascertained the number wanted she inserts plug P² in the corresponding line jack, and signals the wanted subscriber A' in the customary way. It will be observed that there is no circuit for the answering supervisory lamp L⁶ of the cord circuit in Fig. 2, because the ring of the trunk jack is not grounded. Consequently this lamp never lights on a trunk call. The lamp L⁷, however, gives the B operator supervision over the subscriber A'.

It is to be noted that while I have shown the trunk terminal J³ as a jack, and an ordinary cord circuit with answering and calling plugs for connecting the trunk with any subscriber's line, I may of course substitute the common and well known single cord plug terminal, which would directly connect its trunk with any of the jacks J', thereby doing away with the necessity for the separate cord circuit. This substitution of the trunk terminal plug for the terminal jack shown I have not illustrated because these are recognized equivalents, which makes it unnecessary as well as undesirable to complicate the drawings.

Having thus described my invention what I claim and desire to secure by Letters Patent is—

1. In a telephone exchange system, a plurality of subscribers' lines terminating upon relatively distant switchboard sections, answering operators' cord circuits provided with battery supply and supervisory signals adapted to be controlled by connected subscribers through the cord conductors, a trunk circuit extending between the respective switchboard sections, and terminating at both ends in switching means adapted to be connected with the cord circuits, a repeating coil included in the called end of the trunk, so as to inductively divide the same, normally open contacts associated with the trunk terminal and included in series with the outside line windings of the repeating coil, and a shunt around said windings containing the winding of a signal device, together with means to render the shunt impassable for continuous current.

2. In a telephone exchange system, subscribers' lines and terminals, operators' connecting cord circuits therefor, a trunk line passing from the A operator's position to the B operator's position and having connective terminals at both ends, a repeating coil included in the B end of the trunk so as to inductively divide the same into A and B portions, normally open contacts associated with the B terminal and adapted to be closed in the use thereof, said contacts included in series with the A or line windings of the repeating coil, a trunk sig-

naling device having its magnet connected in series with a condenser around the said line windings, and self-locking means for the said signal.

3. In a telephone exchange system, subscribers' lines and terminals, operators' connecting cord circuits therefor, a trunk line passing from the A operator's position to the B operator's position and having connective terminals at both ends, a repeating coil included in the B end of the trunk so as to inductively divide the same into A and B portions, normally open contacts associated with the B terminal and adapted to be closed in the use thereof, said contacts included in series with the A or line windings of the repeating coil, a trunk signaling device having its magnet connected in series with a condenser around the said line windings, and self-locking means for the said signal, together with means actuated in the use of the trunk terminal to unlock the same.

4. In a telephone exchange system, subscribers' line terminals located at different switchboard positions, connective devices at each position, a trunk line interconnecting the positions and terminating at one end in a connective device directly accessible to the operator, and at the other end in normally inoperative talking connections, a self-locking signal with means to permit the passage of alternating ringing current through the bridge but to impede the passage of either direct current or high frequency voice currents, and means controlled by the operator at the second position for unlocking the said signal when set by ringing current from the first position, and for simultaneously completing the talking connections of the trunk at her own position.

5. In a telephone exchange system, subscribers' line terminals located at A and B operators' positions respectively, a trunk line interconnecting the said positions, connective devices at both positions, a terminal device for the trunk at the A position, a trunk terminal at the B position, and a pair of bridges for the trunk also at the B position, one bridge normally closed containing a condenser and the windings of a self-locking signal responsive to alternating ringing current only, the other bridge normally open and containing windings of a repeating coil, of which the opposite windings are connected to the B terminal of the trunk, and means controlled by the B operator for unlocking said signal when set by the A operator, and for closing the repeating coil bridge so as to bring the trunk into operative talking connection with its B terminal.

6. In a telephone exchange system, operators' positions and a trunk line interconnecting them, said trunk having a direct

connected terminal at one position and an inductively connected terminal at the second position, a self locking signal at said second position connected to the trunk in a path
5 passable for alternating ringing current only, and means normally disabling the inductive terminal connection of the trunk, but adapted to be controlled by an operator to render said connection operative. 20

10 7. In a telephone exchange system, operators' positions and a trunk line interconnecting them, said trunk having a direct connected terminal at one position and an inductively connected terminal at the second
15 position, a self locking signal at said second

position connected to the trunk in a path passable for alternating ringing current only, and means normally disabling the inductive terminal connection of the trunk, but adapted to be controlled by an operator to render said connection operative, together with means simultaneously controllable by the operator for unlocking the signal.

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

JAY GORDON MITCHELL.

Witnesses:

G. W. JACOBS,
E. H. WILLIAMS.