No. 669,366. Patented Mar. 5, 1901.

C. MALTHANER.

TELEPHONE SYSTEM.

(Application filed Mar. 16, 1900.)

(No Model.)

Fig. 1.

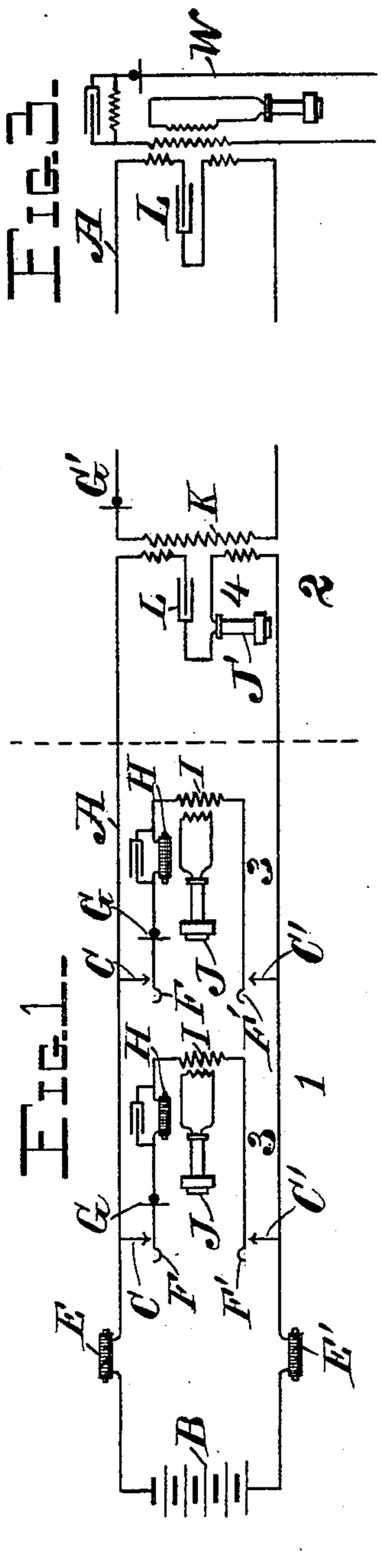
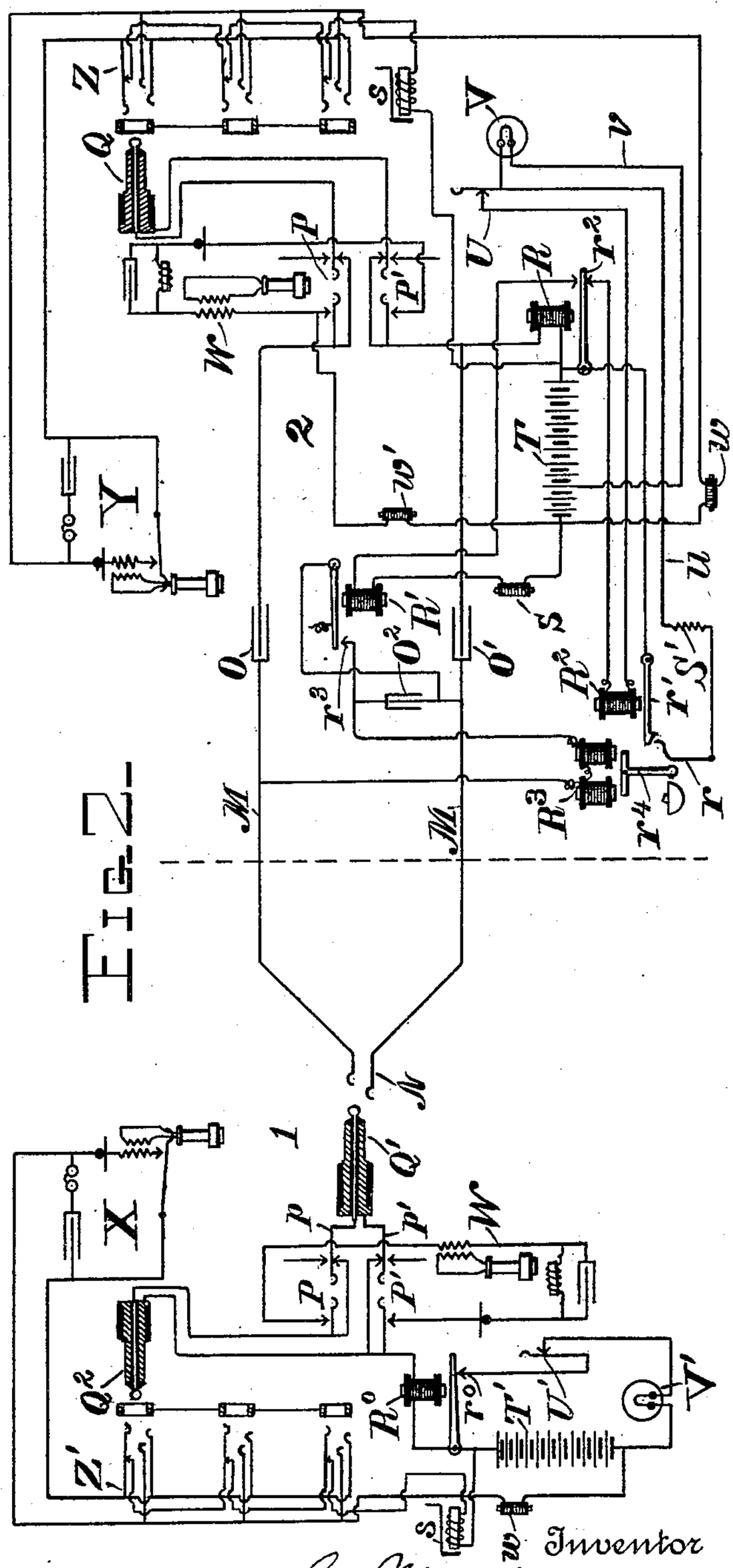


Fig. 2.



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UNITED STATES PATENT OFFICE.

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TELEPHONE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 669,366, dated March 5, 1901.

Application filed March 16, 1900. Serial No. 8,944. (No model.)

To all whom it may concern:

Be it known that I, CLARENCE MALTHANER, a citizen of the United States, residing at Minneapolis, in the county of Hennepin and State of Minnesota, have invented certain new and useful Improvements in Telephone Systems; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in telephone systems, and more especially to trunk-circuits for such systems, by means of which two or more telephone-exchanges having independent switchboards may be connected together.

My said invention comprises also an improved instruction-circuit which may or may not be used in connection with the trunk-circuit.

According to my invention the attention of the called operator is attracted by the ringing of a bell and at the same time by the lighting of a supervisory lamp indicating which trunk to answer and doing away with the extra lamp and buzzer at present employed in a local circuit, the supervisory signal at the calling-operator's exchange being controlled over the same wires that are used for talking, no third wire or ground being employed.

The trunk-circuit according to my present invention also overcomes the fault of subscribers being disconnected by either operator before they are through talking, as the called subscriber controls the supervisory lamps or signals at both exchanges, thereby giving a "disconnect" signal to both operators simultaneously, instead of one of the operators having to wait for a "disconnect" signal until the other operator disconnects, all of which enables the connections to be made, supervised, and disconnected much more rapidly and satisfactorily than has to my knowledge been generally attained.

My invention, moreover, embodies other novel features and advantages, which will hereinafter more fully appear.

In order to more fully describe my said invention, reference will be had to the accompanying drawings, forming a part of this specification, and in which—

Figure 1 represents a diagram of the separate instruction-circuit. Fig. 2 is a diagram of the trunk-circuit, and Fig. 3 is a diagram showing the instruction-circuit receiver at exchange 2 mounted on the trunk-circuit-operator's set.

Similar letters and numerals refer to similar parts throughout the several views.

Referring first to Fig. 1, 1 and 2 represent, respectively, a portion of the connections of the switchboard of two telephone-exchanges connected by the metallic circuit A, supplied with current from the battery B, the vertical dotted line separating exchange 1 from exchange 2. At exchange 1 the line-wires A run the entire length of the switchboard, and at each operator's set 3 each wire A is connected to the springs C and C′ of the order-switches, the construction of which are too well known in the art to need further description. Inductive resistances E and E′ are connected in each side of the circuit A between the battery and the last operator's set. The springs F and F′ of the order-switches at each operator's set are connected with transmitter G, inductive resistance H, shunted by condenser, and primary of induction-coil I, while the receiver J is connected to the secondary of said induction-coil. At exchange 2 or receiving-operator's exchange the wires A connect directly with the outer terminals of the secondary of the induction-coil K, while the inner terminals of the secondary are connected to a condenser L and receiver J′ in series, by which direct currents from station 1 are prevented from traversing the receiver and by which a more perfect balance is obtained than would be otherwise the case. This secondary may also be mounted on the induction-coil of operator's set W, exchange 2, when it forms practically one and the same set, as shown in Fig. 3. The transmitter G′ of the receiving operator's set 4 is connected in series with the primary of the induction-coil K, as shown.

The trunk-circuit and connections are shown in Fig. 2, where M M represent trunk-line conductors connecting the switchboard of exchange 1 with that of exchange 2. These

switchboards are provided with cord-circuit and multiple-switchboard connections comprising the plugs Q Q′ Q², keys P P′, operators' sets W, supervisory relays R R⁰, and supervisory signals V V′, multiple jacks Z Z′, socket-switches U U′, local batteries T T′, and line indicators or signals S. The line-jacks Z Z′ are shown equipped with two long and one short line-spring, the longer springs engaging the sleeve of the plugs, while the short spring engages the tip thereof. The upper line-spring of each jack is normally in engagement with a back contact through which the circuit is completed to the line-indicator and exchange-battery. The lower line-springs of the jacks of each switchboard connect to a common wire which connects with one arm of the subscriber's circuit, as shown.

The special arrangement of switchboard-jacks, line-indicators, test-thimbles, and other well-known parts of multiple switchboards forms no part of my invention and may be replaced by any other switchboard connections which may be adapted to the trunking system herein described.

X and Y represent subscribers' instruments connected by suitable substation-circuits to the switchboards, and *w w* represent impedance-coils connected in the substation-circuits.

In the trunk-line M M, I connect two condensers O O′ and across the trunk-line at exchange 2 I connect the coils of a high-resistance polarized ringer R³ in series with a condenser O². The forward contact r^3 and tongue of a relay R′ are connected in shunt around the condenser O² to the polarized ringer-circuit, and the coil of this relay is connected in series with the battery T, inductive resistance S, and forward contact of the relay R. The back-stop contact of the relay R is connected to one of the terminals of the coil of a relay R², and the other terminal of the said relay is connected to one side of the socket-switch U. The other side of the socket-switch is connected in the supervisory-lamp circuit *v*. A wire *u* connects to the supervisory-lamp circuit between the lamp V and socket-switch U and forms a part of a circuit including the resistance S′, spring-contact *r*, and tongue *r′* of relay R². The tongue *r′* of this relay is connected to the tongue r^2 of the relay R, and thence to the wire which leads from the plus-pole of the battery T to the coil of the relay R.

The trunk-circuit connected as above described may be used in two ways. It may be used with an extra order or instruction circuit or without it, in which latter case the trunk-circuit becomes a combined signaling and conversation circuit.

I shall first describe the operation of the system when used with the separate-order circuit shown in Fig. 1.

It will be assumed that X represents the calling subscriber, and Y the called subscriber. When the subscriber at X removes his receiver from its support, the called operator at station 1 will receive a signal from the said subscriber in the usual way—that is, a circuit will be completed from the battery T′ through the line-indicator. The called operator then inserts her plug Q² in jack Z′ and answers the call from the subscriber at X. Having obtained the number desired by the calling subscriber, the operator at exchange 1 then throws her order-key and repeats the number to the operator at exchange 2, who then orders the operator at exchange 1 to put connection on a specified trunk-line. This she does by inserting the plug Q′ in the jack N. The supervisory lamp V′ will, however, during this time remain extinguished, since its circuit will be broken at the contact r^0, as the circuit will be completed from the battery T′ through the relay R⁰, subscriber's set X, and plug Q². When the operator at exchange 2 receives the subscriber's number from the operator at exchange 1, she lifts the plug Q from its switch-socket U and inserts it in the jack Z for the called subscriber. When the plug Q is thus lifted from its seat or switch-socket U, the supervisory lamp V will immediately light up, the circuit being completed through the said lamp, as follows: from the plus pole of the battery T, through the tongue and lower contact of the relay R, through the coil of the magnet R², and through the switch U and lamp V back to the battery again. The called subscriber then takes down his receiver to answer. This, as is well understood in the art, completes the subscriber's line-circuit through the cord-circuit of the plug Q. The current starting from the plus pole of the battery T will then take the following course: through the coil of relay R, key P′, plug Q, jack Z to subscriber's set Y and back through the said jack, touching the tip of plug Q, and through the impedance-coil *w* to the battery again. The relay R will thus become energized and attract its armature and break the circuit through the supervisory lamp V at the lower relay-contact, which will extinguish the light. The relay R then completes, through its upper contact, a circuit through the coil of the relay R′. When this takes place, the tongue of the relay R′ will close its contact r^3, and thus connect a shunt around the condenser O², which will complete the trunk-line circuit through battery T′ and relay R⁰, exchange 1. The supervisory lamp V′ will therefore remain extinguished after the subscriber at X hangs up his receiver, both supervisory lamps being thus under the control of the called subscriber. The current which energizes the relay R⁰ at the time above stated takes the following course: from the plus pole of the battery T′ through coil of relay R⁰, spring *p′*, plug Q′, jack N, trunk-line M, shunt-circuit around the condenser O², including contact r^3 and tongue of relay R′, coil of ringer R³, back through trunk-line M, jack N, plug Q′, spring *p*, plug Q², jack Z′, impedance-coil *w* back to

the negative pole of the battery T'. When the called subscriber has finished and hangs up his receiver, the circuit through the coil of the relay R will be broken. This will complete the circuit through the lamp V and will break the circuit through the coil of the relay R', and this in turn causes the last-named relay to break the circuit through its contact r^3, which controls the relay R^0. The relay R^0 will thus become deënergized and complete the supervisory-lamp circuit at exchange 1. The lamps at both exchanges will therefore light up simultaneously.

The impedance-coil w' enables the operator at station 2 to use her transmitter when the cam of key P is thrown in the listening position without first inserting the plug Q in the jack.

The operation of the trunk-line when used for both instruction and trunking circuits is as follows: The operator at exchange 1 receiving a call from the subscriber and making the proper switchboard connection through plug Q^2 and jack Z', as described, inserts plug Q' in jack N and rings on the trunk-line. This operates the polarized ringer R^3 at exchange 2 and causes its striker r^4 to press the spring r into engagement with the armature r', which the said spring catches. This completes the circuit from the battery T to the supervisory lamp V, which immediately lights. The operator at exchange 1 then repeats the number to the operator at exchange 2, who, upon receiving the number, inserts plug Q into the jack corresponding to that number. As soon, however, as the plug Q is raised from its socket-switch U the relay R^2 becomes energized and causes its tongue r' to break connection with the spring r. Then when the called subscriber answers the relay R will become energized (the circuit through its coil being completed, as hereinbefore described,) and will open its lower contact, breaking the supervisory-lamp circuit and completing the shunt-circuit around the condenser O^2, which will complete the circuit of the battery T' through the relay R^0. Therefore when the calling subscriber has finished and hangs up his receiver the lamp V' will not light up immediately. When, however, the called subscriber puts up his receiver after the calling subscriber has put up his, the supervisory lamps at both stations will light up just as described with reference to the first case, where the separate instruction-circuit was used, thus giving a "disconnect" signal to both operators simultaneously instead of one of the operators having to wait for a "disconnect" signal until the other operator disconnects and both signals under the control of the called subscriber.

Obviously I may substitute other signals, such as bells, for the supervisory lamps if found more convenient, and it is furthermore obvious that I may make alterations and changes in the connections herein shown without departing from the spirit of my invention; but

What I claim, and desire to secure by Letters Patent of the United States, is—

1. In a telephone system, an instruction-circuit comprising a metallic line-circuit connecting the switchboards of two exchanges, a source of current-supply connected to said circuit, an operator's set at one of said exchanges comprising an induction-coil having its secondary coil connected in series with the line-circuit, a condenser and telephone-receiver connected in series between the two sections of the said secondary, and a telephone-transmitter, connected in series with the primary of said induction-coil, substantially as described.

2. In a telephone system, a combined trunk and instruction circuit connecting the two telephone-exchanges, subscribers' circuits and means at both exchanges for connecting the trunk-circuit to the subscribers' circuits, means for operating call-signals from one exchange to the other over said trunk-line, supervisory signals operated simultaneously with the said call-signals and indicating the trunk-line to be connected and means controlled by the called subscriber for operating the supervisory signals, substantially as described.

3. In a telephone system, a trunk-circuit connecting two exchanges, subscribers' circuits and means at both exchanges for connecting the trunk-circuit to the subscribers' circuits, a polarized ringer bridged across said trunk-circuit and a condenser in series with said ringer, a supervisory-lamp circuit, a relay controlling the supervisory-lamp circuit and controlled by the called subscriber, a shunt-circuit connected around said condenser, a relay controlling said shunt-circuit around said condenser and operated by the aforesaid relay, and means operated by said polarized ringer for completing the supervisory-signal circuit, substantially as described.

4. In a telephone system, a trunk-circuit connecting two exchanges, subscribers' circuits and means at both exchanges for connecting the trunk-circuit to the subscribers' circuits, a polarized ringer bridged across said trunk-circuit, and a condenser in series with said ringer, a supervisory-lamp circuit, a relay controlling the said supervisory-lamp circuit and controlled by the called subscriber, a shunt-circuit connected around said condenser, a relay adapted to make or break said shunt-circuit and operated by the aforesaid relay, and means operated by the polarized ringer for completing the supervisory-lamp circuit, substantially as described.

5. In a telephone system, a trunk-circuit connecting two exchanges, subscribers' circuits and means at both exchanges for connecting the trunk-circuit to the subscribers' circuits, a polarized ringer bridged across said

trunk-circuit, and a condenser in series with said ringer, a supervisory lamp and lamp-circuit, a relay, means operated by said polarized ringer for completing the supervisory-lamp circuit through the armature of said relay, a second relay operated by the called subscriber and operating the aforesaid relay to break the lamp-circuit, means operated by the second relay for shunting the said condenser, and an operator's conversation set connected to the trunk-circuit, substantially as described.

6. In a telephone system, a trunk-circuit connecting two exchanges, a high-resistance polarized ringer bridged across the said trunk-circuit, a condenser in series with said ringer, a shunt around said condenser and a relay acting to make or break said shunt, a supervisory lamp and lamp-circuit, a relay controlled by the called subscriber and operating to make and break the circuit through said supervisory lamp and first relay, means operated by the said polarized ringer for making the circuit through said supervisory lamp and an operator's set connected to the trunk-circuit whereby the said circuit may be used as a conversation-circuit between the two operators, substantially as described.

7. In a telephone system, a trunk-circuit comprising two conductors connecting two exchanges, subscribers' circuits at each exchange for connecting the trunk to the subscribers' circuits, a polarized ringer at one of said exchanges bridged across the said trunk-circuit, a condenser in series with said polarized ringer, a shunt and means for completing it around said condenser, a relay connected to the trunk-circuit and controlled by the called subscriber, a supervisory lamp and lamp-circuit controlled by said relay, a spring-contact device located in said lamp-circuit and operated by the said polarized ringer, a switch-socket in the lamp-circuit, an electromagnetic device operated from said socket and an operator's conversation set connected to the trunk-line, substantially as described.

8. In a telephone system, a trunk-circuit comprising two conductors connecting two exchanges, subscribers' circuits at each exchange for connecting the trunk to the subscribers' circuits, a polarized ringer at one of said exchanges bridged across the said trunk-circuit, a condenser in series with said polarized ringer, a shunt and means for completing it around said condenser, a relay connected to the trunk-circuit and controlled by the called subscriber, a supervisory lamp and lamp-circuit controlled by said relay, a spring-contact device located in said lamp-circuit and operated by the said polarized ringer, a switch-socket in the lamp-circuit, an electromagnetic device operated from said socket, condensers in series with the main trunk-line circuit, and an operator's conversation set connected to the trunk-line, substantially as described.

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

CLARENCE MALTHANER.

Witnesses:
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LEW PHILLIPS.