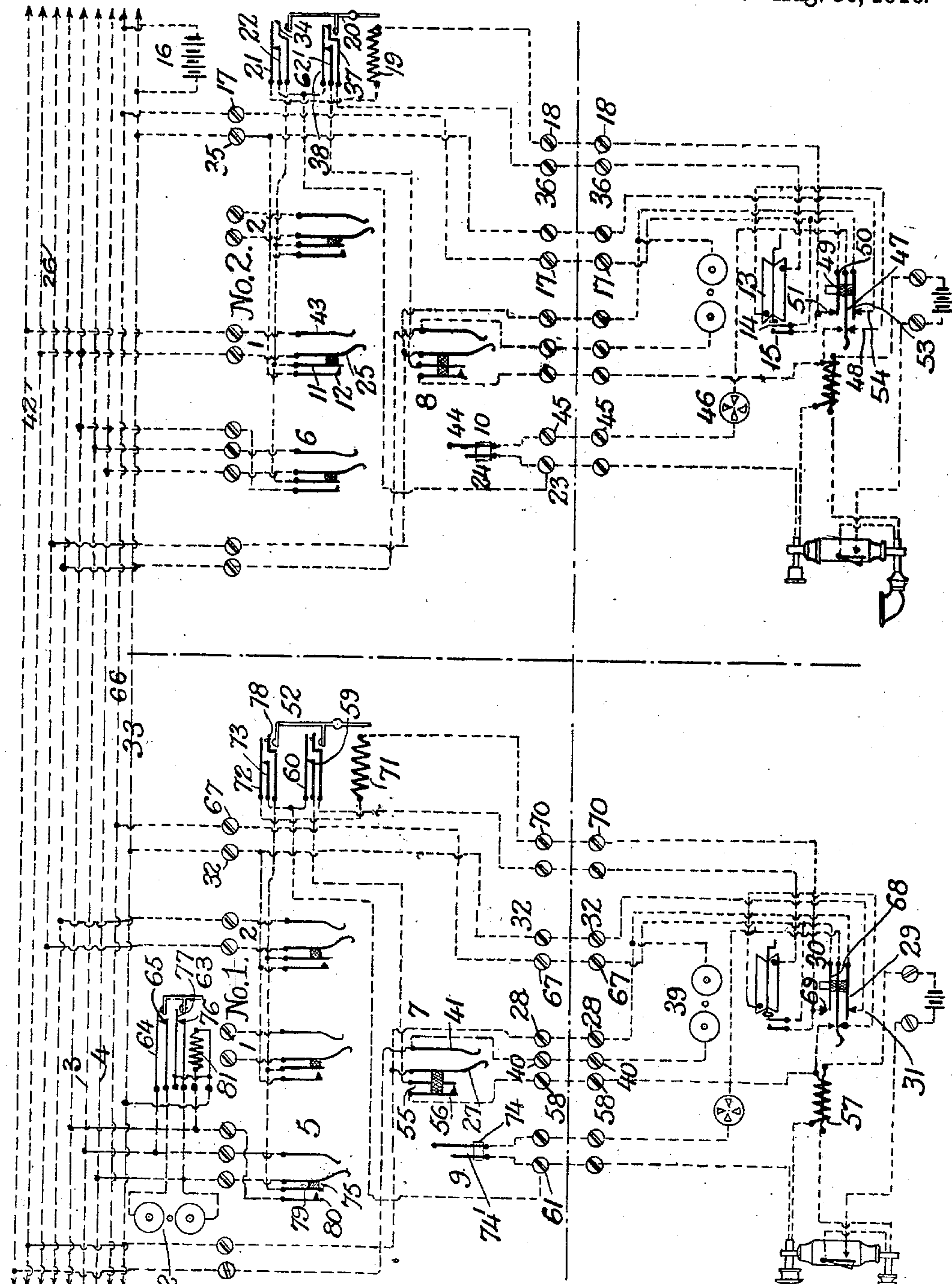


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INTERCOMMUNICATING TELEPHONE SYSTEM.
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Patented Aug. 30, 1910.



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To all whom it may concern:

Be it known that I, ALFRED EKSTRÖM, a subject of the King of Sweden, and resident of Stockholm, Sweden, have invented new and useful Improvements in Intercommunicating Telephone Systems, of which the following is a specification, reference being had to the drawings accompanying and forming a part hereof.

This invention relates to improvements in intercommunicating telephone systems of the kind wherein each instrument or telephone apparatus is provided with a pair of home lines having extensions or forks whereby the said lines may be connected to jacks or other connecting devices at other instruments of the system. Systems of this kind heretofore known, in which communication between two persons cannot be overheard at other stations, are complicated, and the operation thereof is unsatisfactory.

One object of my invention is to construct an intercommunicating telephone system which is simple and easy to operate and in which the parts are arranged in the simplest possible manner and may therefore readily be kept in order.

Another object of the invention is to render it possible to establish an undisturbed connection between any station of the intercommunicating system and any station of another telephone-plant.

Any number of stations may be used in this system and as in other similar systems each station is provided with a switch-apparatus which may be constructed on the spring-jack principle or in any other suitable manner. The stations are preferably connected by means of multiple circuits passing parallel therethrough and are also connected to spring-jacks or contact pieces in the switches. The latter may be built as part of the telephone apparatus or may be separate and independent of the same.

For the purpose of establishing undisturbed connections in such systems it has heretofore been proposed to so arrange the circuit connections of the apparatus that the conversation-circuit, will ordinarily be idle, as by being short-circuited or open, so that the apparatus of a calling station will be unresponsive except when connected to an idle circuit. For this purpose a relay, or the like is provided at each station, which causes the circuit to become operative when connected to a line not in use.

A further object of my invention is to afford new conditions for the excitement of said relays, greatly simplifying the construction of the system. According to my invention the circuit of the relay at a calling station may be completed through any spring-jack of the switch-apparatus and through the corresponding line to any other station if the latter is not busy. If connection is made with a station already engaged, the apparatus of the calling station remains inoperative. At a called station the operator, however, can make his apparatus active, only by connection to his own circuit. If my intercommunicating system is connected to a central office or other telephone plant by one or more line circuits, which are connected to corresponding spring-jacks, or the like, in the switches of the different stations, similar arrangements are provided for rendering a connection with the central office line circuit active or inactive accordingly as this line is free or busy. For this purpose a relay, or the like is inserted in the line circuit, which, if the line is free, permits the excitement of the relays of the different stations, at the same time, however, being itself active so as to prevent active connection of more than one station with the same line.

In the accompanying drawing I have shown diagrammatically an embodiment of my invention.

No. 1 and 2 are two telephone stations with their switches.

Each station has two jacks 1, 2 either of which is plugged when a station is to be called; a jack 7 or 8, which is used for answering a call, and a plug 9 or 10, for insertion into the jacks to connect two stations as hereinafter described. A central office line circuit 3, 4 with jacks 5, 6 is arranged commonly to stations No. 1 and 2.

To explain the operation of the system it may be assumed that communication is desired between two stations in the present system. The operator at the calling station plugs the jack corresponding to the station that is to be called and sends a signaling current. To ascertain whether the current reaches the station wanted, *i. e.*, whether the calling circuit is completed or not, a suitable indicator 46 is inserted in this circuit in the well known manner. If the indications show the line to be free, the telephone is removed from the hook and an-

swer is waited for. At the station called, the corresponding jack 7 or 8 is plugged, the telephone is removed and answer given. When the conversation has ceased the tele-
 5 phones are replaced in the usual manner. No ringing-off signal is necessary in this instance, since the disconnection does not affect a third party. At the calling station the plug should be inserted into the home
 10 spring-jack when conversation ceases, so that the apparatus, when again called, may be used for speaking. This insertion is not indispensable however, since the calling signal is received at a called station independ-
 15 ently of whether the plug is inserted in a spring-jack or not. It is however impossible to answer if the home spring-jack is not plugged.

For affording communication between
 20 any station of the present system and the stations of a central office, one station in the present system is suitably adapted to receive signals coming from an outside source, such station being provided with a bell inserted
 25 in the line circuit so as to be acted upon by a signaling current flowing through said circuit. As usually, the greater number of calling signals sent to the said receiving station will probably come from the
 30 central office, the plug should preferably be ordinarily inserted in the central office jack. This insertion, however, is not indispensable, since the signaling is independent thereof. When the station adapted to receive calls
 35 from an outside source receives a call, say from a central office, the spring jack of such special station is plugged, and upon being informed of the party wanted, connects the
 40 desired station of the intercommunicating system with the central office enabling conversation between the latter and the called station of the system to be carried on. When at this latter station the spring-jack
 45 corresponding to the central office has been plugged, conversation may be carried on. After the conversation is ended, a ringing-off signal is given and the plug is re-inserted into the home or station spring-jack.

If a station in the present intercommuni-
 50 cating system is to be connected to a central office station, the central office spring-jack at the calling station is plugged and a signaling current sent. If the line circuit to the central office is not engaged the
 55 calling station will be placed in communication with the central office and the latter will establish the further connection with the station wanted. The rest of the operation is the same as above described.

60 The arrangement and operation of the system will be more easily understood by the following examples.

Let it be assumed that station No. 2 sig-
 nals station No. 1. The plug 10 of station

No. 2 is inserted in jack 1. The contact-
 65 pieces of the plug are thereby brought into contact with the corresponding springs of the jack 1, and the jack-spring 11 contacts simultaneously with the contact-piece 12. The generator 13 is then turned and is so
 70 constructed that when rotated it causes the contact piece 14 to engage the contact-piece 15. Thus the following circuit is completed. From the battery 16 by the binding-screws
 75 17, through spring 14, contact-spring 15 of generator 13, binding screws 18, coil 19 of relay 20 of the station No. 2, springs 21 and 22 of said relay, binding screws 23, sleeve
 80 24 of plug 10, long spring 25 of jack 1, thence through conductor 26 to the station No. 1, the long spring 27 of jack 7 at this station, binding screws 28, spring 29 of the
 85 automatic switch 30, contact 31, binding screws 32, conductor 33 (ground circuit) and back to the battery 16. At the station signaled this circuit is closed independently
 90 of whether the plug 9 of said station is inserted into a jack or not. It is thus possible to signal any unengaged station in the system, irrespective of whether or not its plug
 95 is inserted. If, however, the station signaled be engaged, said circuit is not closed, because the hook switch 30 of the signaled station is in such position that no contact between 29 and 31 exists. By closing the bat-
 100 tery circuit the relay 20 of station No. 2 will attract its armature, so that the circuit will be closed from relay coil 19, spring 21, contact 34, spring 11 and contact 12 of jack 1, binding screws 35 and line 33 to the battery
 105 16. The signaling current passes from generator 13 by binding screws 36, contact 37 of relay 20, spring 38, binding screws 23, sleeve 24, of plug 10, the long spring 25 of jack 1 and thence through line 26 to the
 110 long spring 27 of the jack 7 at station No. 1 by the binding-screws 28, bell 39, binding-screws 40, the short spring 41 of jack 7, thence through line 42 to the short spring
 115 43 of jack 1 at the calling station, plug tip 44, binding screws 45, indicator 46, spring 47, and contact 48 of switch 49 back to generator 13. The signal circuit is closed when the relay 20 is in active position, therefore, the signaling-current can be sent only when
 120 said relay is excited, *i. e.*, when the station to be called is not engaged. As the bell of the signaling station is not rung by the local generator-current, as will be seen from the signaling circuit above traced, the indi-
 125 cation whether the station called is engaged or idle is ascertained from the indicator 46, which is acted upon, when the generator-current passes therethrough. Instead of the indicators shown in the drawing, which consists of a star disk, any other suitable signal may be used.

When the turning of the generator 13

ceases, the relay-circuit between 14 and 15 is opened, so that the relay 20 returns to its idle position. If now the telephone is removed at the signaling station, the relay-circuit will again be closed, viz., by spring 50 and contact 51 of the hook switch 49, these being connected in parallel to the spring 14 and contact 15, respectively. The circuit may then be traced thus: from the battery 16 by binding-screws 17, spring 50 and contact 51 of the switch 49, binding screws 18, coil 19 of the relay 20, spring 21, contact 22, binding screws 23, sleeve 24 of the plug 10, the long spring 25 of the jack 1 and thence through line 26, the long spring 27 of jack 7 at the called station, binding screws 28, spring 29 and contact 31 of the switch 30, binding-screws 32 and line 33 back to the battery 16. When the relay 20 has attracted its armature, the current will flow from the relay-coil 19 through spring 21, contact 34, spring 11 and contact 12 of the jack 1 and binding-screw 35 back to the battery.

Instead of contact-pieces 14, 15 and 50, 51 at the generator 13 and switch 49 respectively, other suitable devices for closing the relay circuit may be substituted. At station No. 1, which has been called, the plug 9 is now inserted into the jack 7 and the telephone is removed. The relay 52 of this station will, however, not be excited by reason of the connection, because at station No. 2 the spring 53 does not engage the contact 54, provided the operator at station No. 2, has already removed his telephone from its hook. By plugging the jack 7 the contact between spring 55 and contact 56 of the jack is broken; the insulation between 56 and 27 passes through the spring 55, the latter being immovable, while 56 and 27 are designed to move simultaneously. This interrupts the short-circuit, which generally exists, viz. from the one terminal of the induction coil 57, by the binding-screws 58, contact 56 and spring 55 of the jack 7, contact 59 and spring 60 of the relay 52 to binding-screw 61. At the signaling station this short-circuit was broken by the spring 38 and the contact 62¹ of the relay 20, when the latter attracted its armature.

From the above it will be noted that when a station is connected with stations already engaged, no conversation will be heard at the first station, because its telephone remains short-circuited, so that the conversation currents, which by such connection are branched off from the plugged line, will find their way through this short-circuit, and have no perceptible influence upon the telephone.

It has been heretofore stated that one of the stations of the system is suitably provided with a special signaling device or bell 62 for receiving the calls from the central

office. This station is intended to distribute the calls on the system. Further a relay 63 or the like is connected to the central office line circuit which relay is associated with a circuit closer, similar in function to that of the switches 30 and 49, respectively, of the individual stations. When the central office line-circuit is engaged this relay will be excited so as to open the circuit closer and prevent operative connection from other stations. The relay 63 is preferably connected to the bell 62 in such a manner that the bell is disconnected by the excitement of the relay when the central office line circuit is connected with a station of the present intercommunicating system, thus preventing ringing of the bell when a signal is sent to the central office.

The bell 62 and relay 63 are shown in the drawing in connection with station No. 1. When a signaling current is sent from the central office through the line 3, 4 it flows through line 3, spring 64 and contact 65 of the relay 63, bell 62 and line 4, and the bell rings. The jack 5 corresponding to the circuit 3, 4 should then be plugged and the number of the station called is received. The operator receiving this call from the central office should then plug the jack corresponding to the station called and signal this station to announce the call. The operator of the station signaled moves his plug from the home or local jack to that corresponding to the central office, 6 and thus makes connection to the signaling station, thus enabling conversation to be held.

By plugging the jack corresponding to the central office the following circuit is closed at the station No. 1. From the battery 16 through line 66, binding screws 67, spring 68 and contact 69 of the switch 30, binding screws 70, coil 71 of the relay 52, spring 72 and contact 73, binding screws 61, sleeve 74' of the plug 9, the long spring 75 of the jack 5, contact 76 and spring 77 of the relay 63 and thence through line 33 back to the battery 16. When the relay 52 has attracted its armature the current will flow from the relay coil 71 through spring 72, contact 78, spring 79 contact 80 of the jack 5, coil 81 of the relay 63 and thence through line 33 back to the battery 16. The circuits are essentially the same, when any other station connects with the line circuit 3, 4. The relay 63 of the bell 62 now attracts its armature, thereby breaking contacts within the relay and disconnecting the bell. In order to connect a station to the central office line, the circuit of the relay 52 of the station must be closed through contacts 76, 77 of the relay 63. These contacts, however, are opened as soon as a station is connected to the central office line. It is thus evident, that a second station cannot connect with

the said line and the telephone user hear the conversation going on. This obviously holds true also with regard to the call from a station to the central office, when the line
5 of the latter is already engaged.

When the conversation has ceased the telephones are replaced and the clearing-out-signal given by means of the generator. During the turning of the generator at a
10 station of the system the relay 63 is excited and the bell 62 disconnected, the contacts 14, 15 being brought into contact by turning the generator.

If the intercommunicating system above
15 described is used without a central office connection, the calling signals may be given by battery current, otherwise generator current is preferred. In the first instance no drop signal is necessary, in the latter in-
20 stance the drop signal is produced by the generator as usual when communicating through a central office.

Having now described my invention, what I claim as new and desire to secure by Let-
25 ters Patent is:

1. In an intercommunicating telephone system comprising a plurality of interconnected stations, the combination at each sta-
tion of a telephonic apparatus including a
30 transmitter and a receiver, a relay which is normally inert and when inert has its actuated contacts included in a local closed circuit with the receiver, and a source of signaling current in circuit with the relay, said
35 source of signaling current when operated being adapted, when connection is made between unengaged stations, to energize the relay at the calling station to thereby break the said local circuit and place the telephonic
40 apparatus of the calling station in circuit with the telephonic apparatus of the called station.

2. In an intercommunicating telephone system comprising a plurality of intercon-
45 nected stations and a suitable source of current, the combination at each station of a telephonic apparatus including a transmitter and a receiver, a source of signaling current, and a relay which is normally inert and
50 when inert has its actuated contacts included in a local closed circuit with the receiver, the hook switch of said telephonic apparatus and the source of signaling current being connected in parallel with the relay, whereby
55 when the source of signaling current is operated the relay is placed in circuit with the first mentioned source of current and is energized and breaks the closed circuit about the receiver, and when operation of the sig-
60 naling apparatus ceases the relay is deenergized, to be again energized when the telephonic apparatus is lifted from its hook switch, enabling conversation between a calling station and an unengaged called station
65 to take place.

3. In an intercommunicating telephone system comprising a plurality of interconnected stations and a battery common to the several stations, the combination at each sta-
tion of a telephonic apparatus including a
70 transmitter and a receiver, a relay normally inert and when inert having its actuated contacts included in a local closed circuit with the receiver, a jack provided with means for breaking said local closed circuit, and a plug
75 adapted to be inserted in the jack to operate said means to break the closed circuit and enable conversation to be carried on between a calling station and an unengaged called
80 station.

4. In an intercommunicating telephone system comprising a plurality of interconnected stations and a common battery for supplying current thereto, the combination
85 at each station of a telephonic apparatus including a transmitter and a receiver, a relay normally inert and when inert having its actuated contacts included in a local closed circuit with the receiver, a source of signaling
90 current adapted when operated to place the relay in circuit with the battery, energizing the relay at a calling station to break the said local closed circuit, a jack provided with means for breaking the local closed cir-
95 cuit including the receiver and relay, and a plug, which when inserted into the jack at an unengaged called station operates said means to break the local closed circuit thereat and enables conversation to be carried on
100 between a calling station and such unengaged called station.

5. In an intercommunicating telephone system comprising a plurality of interconnected stations and a suitable source for supplying current thereto, the combination with
105 means for connecting two stations, a relay at the calling station, a telephonic instrument thereat comprising a transmitter, and a receiver in a local closed circuit with the actuated contacts of the relay, a source of signaling
110 current adapted when operated at the calling station to break the local closed circuit and to energize the relay placing the same in circuit with the source of current supply and maintaining a talking circuit between
115 the called and calling stations, a signaling device at the called station, and an indicator at the calling station in circuit with the signaling device, said indicator being operative when the source of signaling current at the
120 calling station impresses impulses upon the line which actuate the signaling device at the unengaged called station.

In testimony whereof I have signed my name to this specification in the presence of
125 two subscribing witnesses.

ALFRED EKSTRÖM.

Witnesses:

JOHN DELMAR,
AUGUSTUS E. INGRAM.