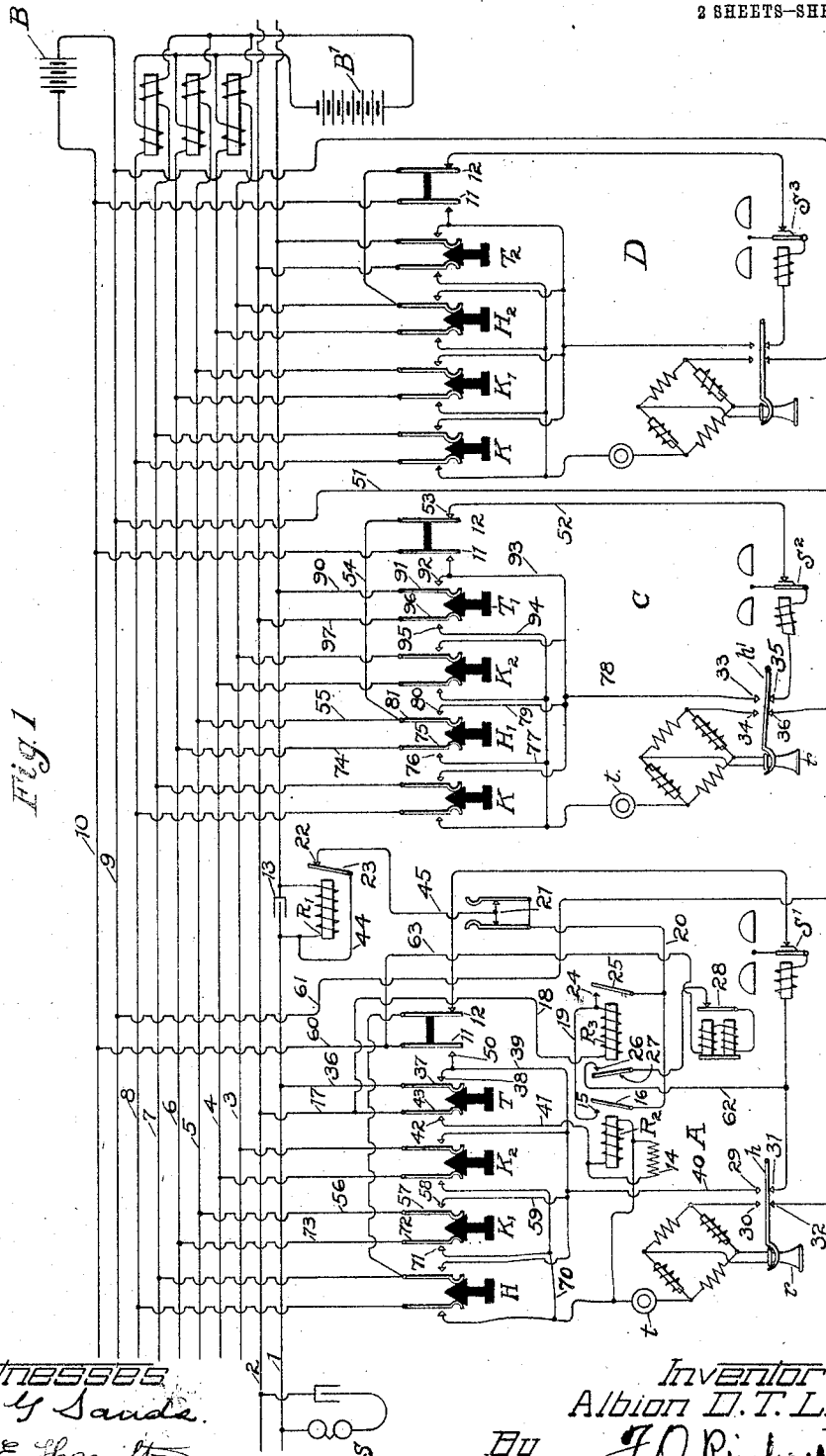


1,003,476.

Patented Sept. 19, 1911.

2 SHEETS—SHEET 1.



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TELEPHONE SYSTEM.  
APPLICATION FILED JULY 15, 1909.

1,003,476.

Patented Sept. 19, 1911.

2 SHEETS—SHEET 2.

FIG. 2

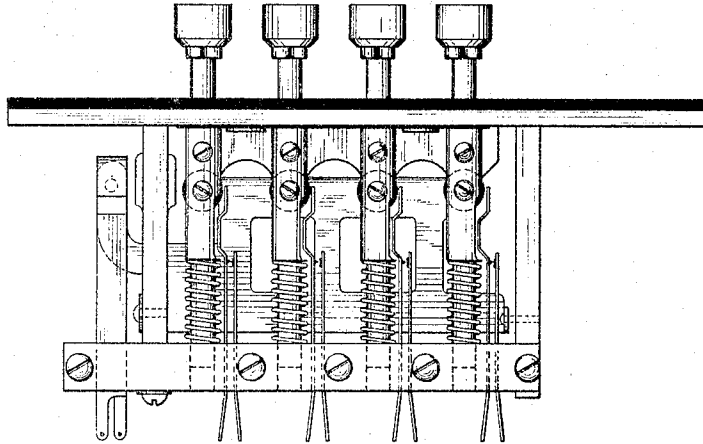
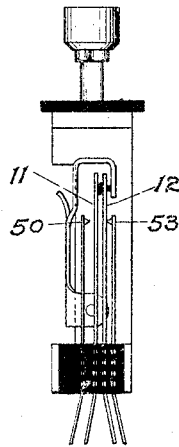


FIG. 3



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# UNITED STATES PATENT OFFICE.

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TELEPHONE SYSTEM.

1,003,476.

Specification of Letters Patent. Patented Sept. 19, 1911.

Application filed July 15, 1909. Serial No. 507,820.

*To all whom it may concern:*

Be it known that I, ALBION D. T. LIBBY, a citizen of the United States, residing at Elyria, in the county of Lorain and State of Ohio, 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.

This invention relates to telephone systems, and I have in mind more particularly the class of telephone systems commonly known as house or intercommunicating system. The use of such systems which are installed inside of buildings and which permit the intercommunication between the substations on the system, is well known in the telephone art. My purpose is to produce a convenient and satisfactory arrangement to connect any of the substations of such an intercommunicating system to subscribers on outside lines. I show a trunk circuit connected at its other end with an exchange adapted to connect the intercommunicating system with outside lines. To effect this, I utilize one of the interconnecting stations as an attendant station which is adapted more particularly to answer calls coming in over the trunk and to transfer them to the desired station. The central station is provided with a signal which is operated when the subscriber's circuit is interrupted, to indicate the termination of the use of a line. On observing this signal, the operator takes down the connection. Unless special means are provided, this signal will be operated and the connection interrupted when the attendant in the intercommunicating system is transferring the call. I provide means to prevent this and I place such means under the control of the called station. I also provide means whereby the attendant may release this circuit independently of the called station, and which may be utilized when the called station fails to respond. In systems of this kind, when the called subscriber does not respond, the attendant, not having been informed of this fact, leaves the trunk circuit tied up, as the holding means which prevents the display of the disconnect signal, will remain operative. To avoid this, I provide means which will indicate to the at-

tendant station that the called subscriber has not answered the call.

More minutely describing my invention, but not limiting myself thereto, I provide a holding circuit across the trunk line which is closed when the attendant answers, and a locking circuit therefor, closed when the call is transferred. An electromagnet which is included in circuit with the attendant's instrument when she plugs in on the trunk line, pulls up its armature, closing the holding circuit. A locking relay in the holding circuit fails to operate, owing to the fact that it is shunted by the attendant's set. When the attendant disconnects her set from the trunk by the release of the trunk key, the relay in circuit therewith being slow acting, holds up its armature long enough for the locking relay to be operated to hold the trunk. This locking relay also closes a circuit through a special signaling arrangement which immediately actuates. This signal continues until the called station comes in on the trunk. A condenser is placed in one side of the trunk and is shunted by a relay which controls the holding circuit. When the called station comes in on the trunk, this relay is energized to interrupt the holding circuit and deenergize the locking relay so that the special signaling means is rendered inoperative.

In this preliminary description I have endeavored to elucidate some of the features and objects of my invention, and I do not intend to be limited thereby.

My invention will be best understood by reference to the following description when taken in connection with the accompanying illustrations showing one specific embodiment thereof, while its scope will be more particularly pointed out in the appended claims.

Figure 1 is a diagram of the circuit arrangement of my improved system. Fig. 2 is a side elevation of a set of keys such as I may use at each station. Fig. 3 is an end elevation of Fig. 2 showing the ringing contact.

Referring to the drawings and to the embodiment of my invention there shown, I have illustrated in the diagram of Fig. 1 an attendant's station at A and other stations on the intercommunicating system at C and D.

1 and 2 indicate the trunk line.

3, 4, 5, 6, 7, and 8 are the lines on the intercommunicating system.

9 and 10 are the leads for the ringing battery B.

I show a talking battery at B' which is connected to the intercommunicating lines through retardation coils.

Each of the stations is associated with the trunk and each of the intercommunicating lines, and is adapted to be connected thereto by push button switches shown at the attendant's station at H, K<sup>1</sup>, K<sup>2</sup>, and T.

T represents the trunk button, K<sup>1</sup> that appertaining to the first station C, and K<sup>2</sup> that appertaining to the second station D.

H is the home button.

11 and 12 are the springs for the ringing circuits, and are controlled by the push buttons as shown in Figs. 2 and 3. These buttons are so arranged that the contacts of the ringing circuit are closed only when the buttons are in the way-down or final position. The arrangement is such that on depression of one button, previously depressed buttons are released. This arrangement is old and well known in the art, and is collateral and auxiliary to my invention. A signal S is bridged across the trunk line. Signals S<sup>1</sup>, S<sup>2</sup> and S<sup>3</sup> are provided at the various stations for intercommunicating signaling. I provide a condenser 13 in one side of the trunk line. A relay R<sup>1</sup> is connected in multiple with the condenser. A relay R<sup>2</sup> having a non-inductive resistance 14 in multiple therewith, is connected in circuit with the attendant's substation set in such a way that it is energized when her set is connected with the trunk line. When the circuit through the relay R<sup>2</sup> is broken, the back electromotive force sends an impulse of current through the parallel branch, including the non-inductive resistance 14. This current causes the relay to hold up for a short interval of time after the interruption of the circuit. R<sup>2</sup> controls the switch 15-16 which is placed in the holding circuit. A relay R<sup>3</sup> in the holding circuit is adapted to control the two switches 24-25, 26-27. At 21 I provide a key to control the holding circuit. At 28 I provide a buzzer whose circuit is controlled by the relay R<sup>3</sup> at the switch 26-27. The substation sets at the intercommunicating stations include the usual transmitters, receivers, and gravity operated switch hooks. At the attendant's station this hook is shown at h, having the lower contacts 31 and 32 and the upper contacts 29 and 30. At station C the hook is shown at h' having lower contacts 35-36 and upper contacts 33-34.

In describing the operation of my system, I will assume that a call comes in over the trunk line, is answered by the attendant, and is transferred to station C. On observing

the operation of the signal S, the attendant presses down the key T and the following circuit is completed: trunk line 1-36-37-38-39-40-29-h-30,-- the attendant's substation set including the receiver r-- the transmitter t-- the relay R<sup>2</sup>-41-42-43-17, to the other side of the trunk 2. Relay R<sup>2</sup> is energized attracting the armature 16 and closing a bridge across the trunk line as follows: from the side 1, through 44-23-22-45-- the switch 21-20-16-15-19-- relay R<sup>3</sup>-18-17-- to the other side 2 of the trunk. The current over the trunk line may be strong enough to energize the relay R<sup>3</sup> in which case it will immediately pull up to lock itself. As a rule, however, the resistance of this relay is sufficient to prevent its operation as long as it is shunted by the substation bridge. The attendant is informed by the central operator that station C is desired. The attendant pushes in the button K<sup>1</sup> corresponding to station C. This releases the trunk button T so that the attendant's set is disconnected from the trunk line. The relay R<sup>2</sup> being slow acting, as described, holds up its armature for a short time after the circuit is broken, during which the relay R<sup>3</sup> now being energized by the full current of the trunk line, attracts its armature 25 and 27, locking itself and retaining the bridge through the following circuit: from the side 1 of the trunk line--44-23-22-45-21-20-25-24-R<sup>3</sup>-18-17-- to the other side 2. To ring station C the attendant pushes the button K<sup>1</sup> to its way-down position, closing the contacts 11-50. The following circuit is then completed: from the positive side of battery B-9-51-36-h'-35-S<sup>2</sup>-52-53-12-54-55-5-56-57-58-59-39-50-11-60-10-- to the negative side of battery B. This operates the signal S<sup>2</sup> at the station C. During this time the disconnect signal at the central station is prevented from operating by the bridge across the trunk line through the relay R<sup>3</sup>, previously described. Should the station C not answer immediately, attendant may hang up her receiver and ring the desired station from time to time until answered. During this interval a circuit will be closed through the buzzer 28 as follows: from the positive side of battery B-9-61-32-h-31-62-26-27-28-63-60-- and 10 to the negative side of the battery. When the station C does answer he is informed that he is wanted on the trunk line. He immediately depresses the trunk button T. Should he fail to do so, the attendant is apprised of that fact by the operation of the buzzer through the circuit previously described. The communication between stations A and C takes place as follows: In answering the signal S<sup>2</sup>, the party C depresses the home button H, placing the substation set in bridge of the lines 5 and 6.

Conversation takes place over the following circuit:  $t$  at station A—70—71—72—73—6—74—75—76—77— $t^2$ — the substation set at C including the receiver  $r^1$ —34,— and the receiver having been removed from the hook, the hook  $h^1$ —33—78—79—80—81—55—5—56—57—58—59—40—29— $h$ —30— back to  $t$ . The battery  $B'$  is bridged across the lines 5 and 6 and supplies energy for this circuit. Should the party C fail to come in upon the trunk, the attendant may release the holding bridge by operating the switch 21 which would interrupt it. Assuming that station C depresses the button  $T^1$ , the following circuit will be closed: 1—90—91—92—93—78—33— $h^1$ —34— the substation set—94—95—96—97—to the other side of the trunk 2. The relay  $R^2$  will be energized over this circuit to attract its armature 23 and interrupt the holding bridge at 22—23. The circuit of  $R^3$  will be broken and its armatures released interrupting the locking circuit and the circuit of the buzzer. The station C is now in communication with the party on the trunk line, the voice currents passing through the condenser 13 which is in multiple with  $R^1$ . When the conversation is terminated, the party at C restores the receiver to the hook, interrupting the continuity of the circuit, and operating the disconnect signal at the central station, whereupon the operator pulls down the connections, restoring the system to normal condition.

While I have shown this particular form of slow acting relay, it is obvious that I may employ any other form which performs the required function. It will also be obvious to those skilled in the art, that numerous and extensive departures from the form and the details of the apparatus here shown, may be made without departing from the spirit of this invention, the same being herein shown solely for the purpose of clearly illustrating one specific embodiment thereof.

I claim:

1. In an intercommunicating telephone system, a plurality of stations and conductors interconnecting them, one of said stations constituting an attendant's station, a main exchange trunk line extending to such stations, holding means at the attendant's station for holding a main exchange connection through such trunk line while calling the desired interconnected station, a normally closed switch in said holding means, and means controlled only from the called station for opening said switch and releasing the holding means.

2. In an intercommunicating telephone system, a plurality of stations and conductors interconnecting them, one of said stations constituting an attendant's station, a main exchange trunk line extending to such

stations, holding means at the attendant's station for holding a main exchange connection through such trunk line while calling the desired interconnected station, a normally closed switch in said holding means and means operated only by the removal of the receiver at the called station for opening said switch and releasing the holding means.

3. In an intercommunicating telephone system, a plurality of stations and conductors interconnecting them, one of said stations constituting an attendant's station, a main exchange trunk line extending to such stations, holding means at the attendant's station for holding a main exchange connection through such trunk line while calling the desired interconnected station, a normally closed switch in said holding means, and means operated only by the closure of a talking circuit through the trunk line at the called station for opening said switch and releasing the holding means.

4. In an intercommunicating telephone system, a plurality of stations and conductors interconnecting them, one of said stations constituting an attendant's station, a main exchange trunk line extending to such stations, holding means at the attendant's station for holding a main exchange connection through such trunk line while calling the desired interconnected station, a normally closed switch in said holding means, means controlled from the called station for opening said switch and releasing the holding means, and a manually operable switch in said holding means adapted to release the holding means independently of said first named releasing means.

5. In an intercommunicating telephone system, a plurality of stations and conductors interconnecting them, one of said stations constituting an attendant's station, a main exchange trunk line extending to such stations, holding means at the attendant's station for holding a main exchange connection through such trunk line while calling the desired interconnected station, and a slow acting relay in the attendant's trunking circuit controlling said holding means.

6. In an intercommunicating telephone system, a plurality of stations and conductors interconnecting them, one of said stations constituting an attendant's station, a main exchange trunk line extending to such stations, holding means at the attendant's station for holding a main exchange connection through such trunk line while calling the desired interconnected station, and a slow acting relay operated when the attendant comes in on the trunk to control said holding means.

7. In an intercommunicating telephone system, a plurality of stations and conductors interconnecting them, one of said sta-

tions constituting an attendant's station, a main exchange trunk line extending to such stations, holding means at the attendant's station for holding a main exchange connection through such trunk line while calling the desired interconnected station, a slow acting relay in circuit with the attendant's set, and locking means for said holding means in multiple with the attendant's set and the slow acting relay.

8. In an intercommunicating telephone system, a plurality of stations and conductors interconnecting them, one of said stations constituting an attendant's station, a main exchange trunk line extending to such stations, holding means at the attendant's station for holding a main exchange connection through such trunk line while calling the desired interconnected station, a normally closed switch in said holding means adapted to control said holding means after the interruption of its circuit, slow acting means in circuit with the attendant's set controlling said holding means while the attendant's station is connected to the trunk and locking means for the holding means adapted to operate while the control of the slow acting means prevail.

9. In an intercommunicating telephone system, a plurality of stations and conductors interconnecting them, one of such stations constituting an attendant's station, a main exchange trunk line extending to such stations, means for calling a desired station from the attendant's station, a signal at the attendant's station brought into operative condition by such act of calling, and means controlled by the called station for retiring such signal to its inoperative condition.

10. In an intercommunicating telephone system, a plurality of stations and conductors interconnecting them, one of such stations constituting an attendant's station, a main exchange trunk line extending to such stations, holding means at the attendant's station for holding a main exchange connection through such trunk line while calling the desired interconnected station, means for calling a desired station from the attendant's station, an indicator circuit at the attendant's station closed by such act of calling, means controlled from the called station for interrupting such indicator circuit and for releasing such holding means.

11. In an intercommunicating telephone system, a plurality of stations and conductors interconnecting them, one of such stations constituting an attendant's station, a main exchange trunk line extending to such stations, holding means at the attendant's station for holding a main exchange connection through such trunk line while calling the desired interconnected station, means for calling a desired station from the attendant's station, an indicator circuit at the attendant's

station closed by such act of calling and means operated by the removal of the receiver at the called station for interrupting such indicator circuit and for releasing such holding means.

12. In an intercommunicating telephone system, a plurality of stations and conductors interconnecting them, one of such stations constituting an attendant's station, a main exchange trunk line extending to such stations, holding means at the attendant's station for holding a main exchange connection through such trunk line while calling the desired interconnected station, means for calling a desired station from the attendant's station, an indicator circuit at the attendant's station closed by such act of calling, and means operated by the removal of the receiver at the called station for interrupting such indicator circuit and for releasing such holding means.

13. In an intercommunicating telephone system, a plurality of stations and conductors interconnecting them, one of such stations constituting an attendant's station, a main exchange trunk line extending to such stations, a relay connected to such trunk line, an electrical path of low resistance closed through contacts on such relay by the act of calling a desired station, and means for controlling the operation of such relay from the called station.

14. In an intercommunicating telephone system, a plurality of stations and conductors interconnecting them, one of such stations constituting an attendant's station, a main exchange trunk line extending to such stations, a relay connected to such trunk line, an electrical path of low resistance closed through break contacts on such relay by the act of calling a desired station, and means for energizing such relay from the called station by establishing thereat a talking connection with the trunk line.

15. In an intercommunicating telephone system, a plurality of stations and conductors interconnecting them, one of such stations constituting an attendant's station, a main exchange trunk line extending to such stations, keys at the attendant's station for calling a desired one of the interconnected stations, a buzzer at the attendant's station, means for closing the buzzer circuit when one of such keys is operated, and means operated by the establishing at the called station of a talking circuit with the trunk line for interrupting such buzzer circuit.

16. In an intercommunicating telephone system, a plurality of stations and conductors interconnecting them, one of such stations constituting an attendant's station, a main exchange trunk line extending to such stations, keys at the attendant's station for calling a desired one of the interconnected stations, a first relay controlled in its opera-



tion by the act of calling, such relay by its  
operation serving to close a signaling cir-  
cuit, a relay circuit, contacts in said circuit,  
and a second relay under the control of the  
5 called station serving by its operation to  
open such contacts and disconnect said sig-  
naling circuit.

10 17. In an intercommunicating telephone  
system, a plurality of stations and conduc-  
tors interconnecting them, one of such sta-  
tions constituting an attendant's station, a  
main exchange trunk line extending to such  
stations, keys at the attendant's station for  
calling a desired one of the interconnected  
15 stations, a first relay adapted to be energized

by the operation of one of such keys, a lock-  
ing circuit for such relay, a second relay  
adapted to be energized by the establishment  
at the called station of a talking circuit with  
the trunk line, and a signaling circuit closed 20  
by the energization of the first relay, such  
second relay serving by its energization to  
open such locking circuit.

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

A. D. T. LIBBY.

Witnesses:

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C. A. SEVERCOOL.