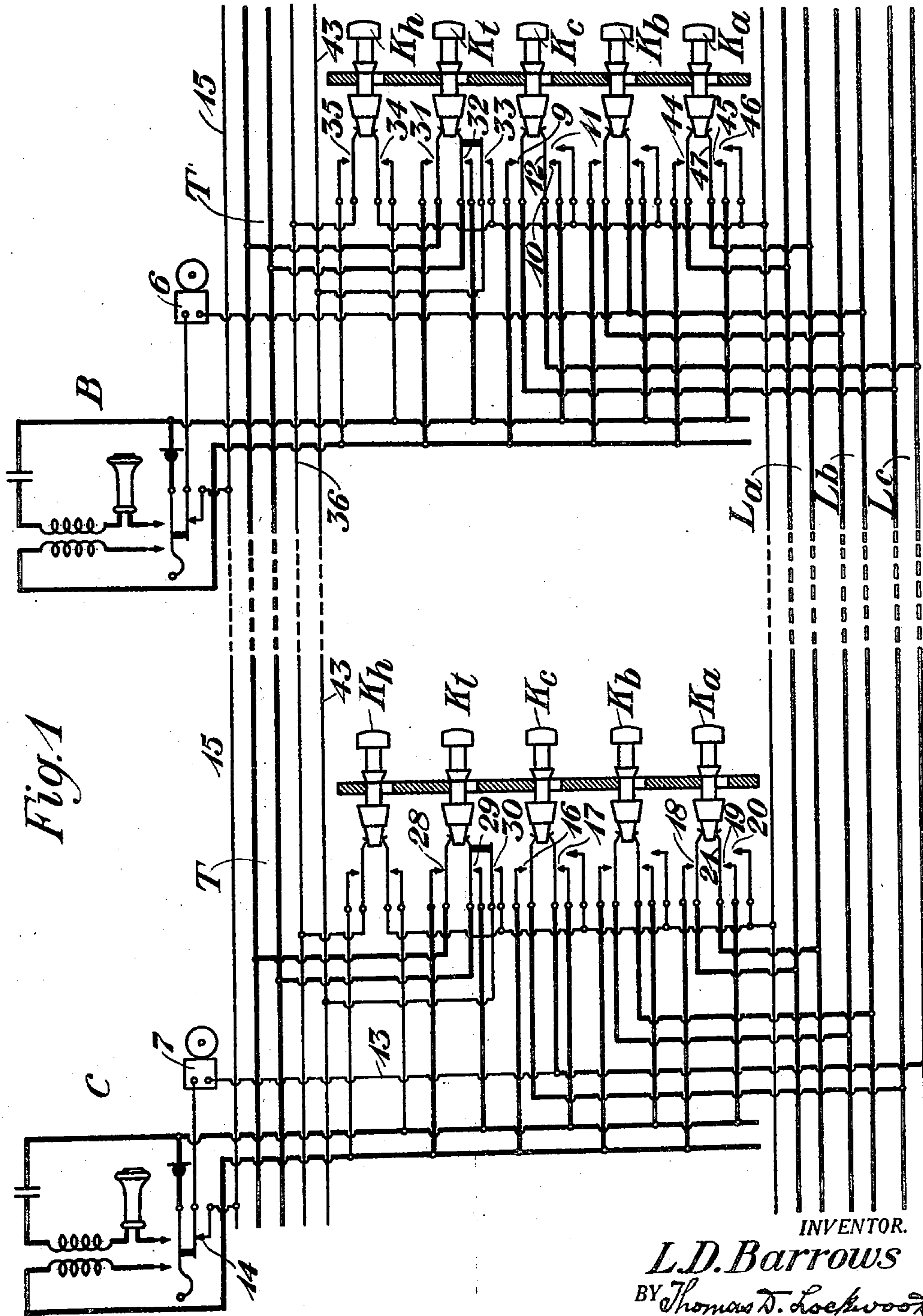


L. D. BARROWS.
INTERCOMMUNICATING SYSTEM.
APPLICATION FILED JULY 26, 1917.

1,410,545.

Patented Mar. 28, 1922.

2 SHEETS—SHEET 1.



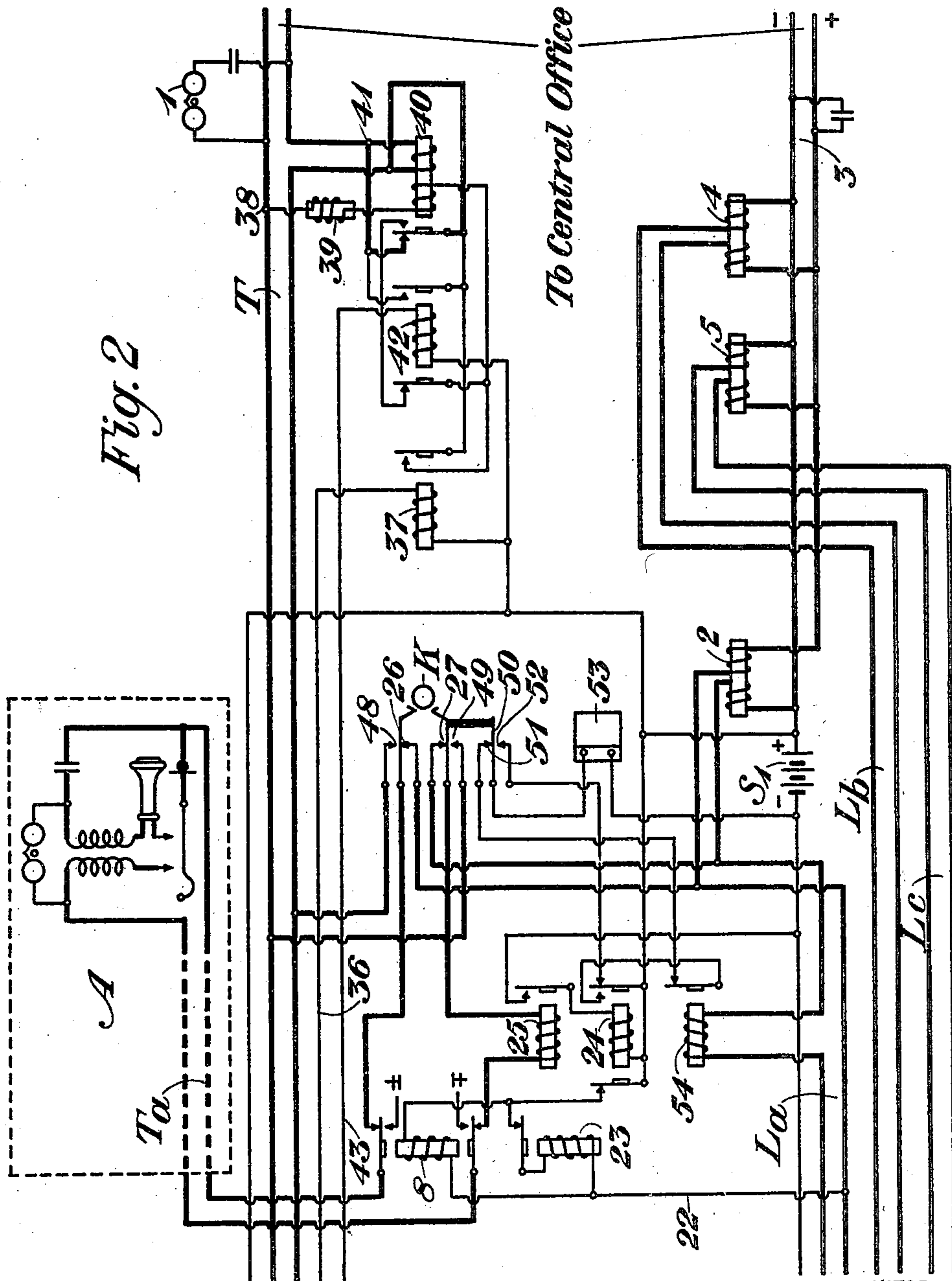
INVENTOR.

L.D. Barrows
BY *Thomas D. Lockwood*
ATTORNEYS.

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UNITED STATES PATENT OFFICE.

LEON DWIGHT MARROWS, OF NEW YORK, N. Y., ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

INTERCOMMUNICATING SYSTEM.

1,410,545.

Specification of Letters Patent. Patented Mar. 28, 1922.

Application filed July 26, 1917. Serial No. 182,953.

To all whom it may concern:

Be it known that I, LEON DWIGHT MARROWS, residing at New York city, in the county of New York and State of New York, have invented certain Improvements in Intercommunicating Systems, of which the following is a specification.

This invention relates to telephone systems and more particularly to telephone systems of the intercommunicating type in which each telephone station is usually provided with lines leading to each of the other stations, suitable switching arrangements being also provided whereby any station may be connected to the line leading to another station or to one or more trunks common to all of the stations and leading to a distant central station.

In systems of this general character it sometimes occurs that one station of the intercommunicating system is located at a point somewhat distant from the other stations so that it is impracticable or unduly expensive to carry the large number of wires necessary for full intercommunication to the distant station. One of the principal objects of this invention is to provide a circuit arrangement in which the number of wires leading to the distant station of the intercommunicating system is reduced.

In accordance with the present invention this object, together with other objects which will more fully appear from the description hereinafter given, may be secured by providing the distant station with a single line circuit leading to each of the other stations of the system, and arranging suitable apparatus at some one of the other stations whereby an attendant at such other station may control the connection of the line circuit of the distant station with any one of the stations of the system or with the trunk or trunks leading to a distant central station. The system is so arranged that each of the stations may connect with the distant station direct without the intervention of the attendant at the controlling station. Suitable supervisory apparatus is also provided whereby the attendant at the controlling station may supervise a connection established between the distant station and any other station under the control of the attendant. By means of such an arrangement a single pair of wires leading to the

distant station is sufficient to provide telephone service between said distant station and all other stations of the system.

The invention may now be understood from the following description taken in connection with the accompanying drawings, Figures 1 and 2 of which, when placed side by side, constitute a circuit diagram of the invention. Referring to the drawings, stations A, B and C are shown, stations B and C being connected by an intercommunicating arrangement well known in the art. A number of lines, one corresponding to each of the stations of the system, are led through each of the stations such as B and C. Thus lines L_b and L_c correspond to stations B and C and are led through all of the stations of the system except the distant station A. One or more trunks such as T leading to a central office may also be provided, each of the trunks leading through all of the stations of the system except the distant station A. Distant station A is provided with a trunk T_a leading to one of the other stations of the system such as B, at which point it is connected by means of a key K to a line L_a , corresponding to station A and leading through all of the other stations of the system. It will be understood, of course, that while but two stations of the type of stations B and C are shown, as many other stations may be provided as conditions may require. For each additional station there would be another line of the type of lines L_b and L_c .

Each of the stations of the type of stations B and C is provided with a set of keys by means of which the stations may be interconnected, or may be connected to the trunk T leading to a distant central office. Thus by depressing key K_a , the telephone set of the station at which such key is located may be connected to the line L_a , leading over contacts of key K and trunk T_a to the distant station A. By depressing keys K_b and K_c , the telephone sets will be connected to lines L_b and L_c respectively. If therefore the key K_b is operated at both station B and station C, the telephone sets at the two stations will be bridged across line L_b and the two stations will be in communication. By depressing the key K, the corresponding telephone set will be connected to the trunk T leading to the central office. A holding key K_h is also provided at each station of the

type of stations B and C for a purpose which will be described later. If there is more than one trunk T, an additional set of keys K_1 and K_n will be provided at each station for each additional trunk, in order to connect the telephone set to any one of the trunks.

At station B, in addition to the apparatus already described, arrangements are provided whereby an attendant at station B may connect station A to the trunk T or to any one of the stations in the system. Thus if it is desired to connect station A to trunk T the attendant at station B, by throwing the key K , may connect the trunk T_a to the trunk T. If it is desired to connect station A to any other station in the system, the operator at station B may call the other station by means of the key corresponding to such other station. When the subscriber at such other station responds, the attendant at B will request him to operate his key K_a , thereby connecting his set to the line L_a , which is connected to the trunk T_a leading to the station A, over the normal contacts of the key K .

A ringer 1 is bridged across the trunk T at station B, so that if an operator at the central office desires to connect a subscriber at that office to a station of the intercommunicating system, the operator may actuate the ringer 1 by means of ringing current to call the attention of the attendant at station B, who, by operating the key K_1 at said station, may bridge the telephone set across the trunk T and ascertain the station desired. Having acquired this information, the operator at station B may then call the desired station by depressing the key corresponding to such station. When the subscriber at that station answers, upon being informed that a call awaits him upon the trunk T, the desired subscriber may connect his set to the trunk T by depressing the trunk key K_1 .

Two sources of current are provided, one source S_1 being for the purpose of providing signaling current for the bells at station B and C as well as other stations of the system of the same type. The source S_1 is also for the purpose of supplying energy to operate certain supervisory equipment whereby the attendant at station B may supervise connections from station A. Talking current is supplied from a second source of current at a distant central office over conductors 3 and through a retardation coil 2 for connections between station A and other stations of the system. Talking current for connections between stations of the type of stations B and C is supplied from the distant central office over conductors 3 and through retardation coils 4, 5, etc. Stations B and C are provided with bells 6 and 7 by which they may be signalled. In order to signal station A a ringing relay 8 is pro-

vided which connects ringing current to trunk T_a to operate the ringer at station A, which is of the standard type.

The key sets at stations of the type of stations B and C are of the well known locking type whereby, upon depressing any key, the depressed key is locked in depressed condition, any key had been previously operated being at the same time released. Keys K_a , K_b , K_c and K_t are provided with one set of contacts which are closed when the key is partially depressed, and with additional contacts which are only closed when the key is fully depressed, the latter contacts being for signaling purposes. When the key after being depressed, is released, it remains locked in a partially depressed condition. Distant station A, unlike the other stations, is not provided with a key set.

With this general description in mind the invention may now be fully understood from a description of the operation. Assuming that the party at station B desires to call station C, the key K_c will be completely depressed at station B, thereby bridging the telephone set of station B across line L_c , over contacts 9 and 10 of key K_c , and closing a circuit over contact 11 from the negative pole of source S_1 , contact 11 and spring 12 of key K_c , lower conductor of line L_c , conductor 13, through bell 7, contact 14 of the switch hook, conductor 15, to the positive pole of source S_1 . The party at station C, in response to the signal thus given, will depress key K_c at such station, thereby bridging the telephone set at such station across the line L_c over the contacts 16 and 17 of said key. The parties at stations B and C now have their telephone sets bridged across line L_c and may communicate with each other. The signaling circuit through bell 7 will be broken as soon as the party at station B ceases to depress the key K_c , so that the key returns to its intermediate position. The signaling circuit will also be broken when the party at station C lifts the receiver from the switch hook, thereby opening the contact 14.

If the party at station C should desire to communicate with the party at station A, the key K_a at station C will be fully depressed, thereby bridging the telephone set across the line L_a , over the contacts 18 and 19 of key K_a , and closing a signaling circuit over contact 20 and spring 21 of key K_a as follows: From negative pole of source S_1 , over contacts 20 and 21, to the lower conductor of line L_a , and thence over conductor 22 and the winding of relay 8, in parallel with the winding and back contact of buzzer relay 23, over the left hand back contact of relay 24, to the positive pole of source S_1 . Relay 8 is energized over this circuit, and at its front contacts connects ringing current to trunk T_a , whereby the station A is signalled.

When the party at station A removes his receiver from the switch hook during a non-ringing period, supervisory relay 25, which is in the line circuit of station A, will be energized, thereby closing the circuit from negative pole of source S_1 over the front contact of relay 25, through the winding of relay 24, to the positive pole of source S_1 . Relay 24 is thereby energized, and at its left hand contact opens the circuit of ringing relay 8, whereby said relay will be prevented from again signaling station A. Stations A and C are now in communication over the trunk T_a and line L_a , which are connected over contacts 26 and 27 of key K . The function of the buzzer relay 23, which was energized at the same time as ringing relay 8, is to apply a non-busy tone to the line L_a , to indicate to the calling subscriber that said line is not busy. If the line is busy the circuit of the buzzer relay will be opened at the left hand contact of relay 24 due to the energization of relay 25 and no tone will be heard. The non-busy tone provided by the relay 23 is similar to that applied to lines L_b and L_c by the operation of ringers 6 and 7 respectively.

Assuming that the party at station C desires to obtain access to the central office over the trunk T , the key K_t at said station will be depressed, thereby bridging the telephone set across the trunk T , over the contacts 28 and 29 of key K_t . The bridge thus closed across the trunk T , through the telephone set at station C, operates the line signal at the central office in a well known manner, to apprise the operator at said office that a connection is desired. The connection will be completed at the central office in the usual manner.

If a call should come in over the trunk T from the central office for station C, the ringer 1 bridged across the trunk T at station B would be actuated, thereby apprising the attendant at such station that there is a call for some station of the system. The attendant at B thereupon depresses the key K_t , thereby bridging the telephone set at station B across the trunk T , over contacts 31 and 32. Upon ascertaining that the call is for station C, the attendant at station B now depresses key K_h , thereby restoring key K_t and disconnecting the telephone set from the trunk T , at the same time closing the following circuit: From the negative pole of source S_1 , over contact 34 of key K_h , through the telephone set at station B, over contact 35 of key K_h , and over conductor 36, through the winding of holding relay 37 to the positive pole of source S_1 . Relay 37 is thereby energized, and at its front contact closes a holding bridge across the trunk T from point 38, through inductance 39, left hand winding of relay 40, front contact of relay 37, back contact of relay 40, to point

41. The purpose of this holding bridge is to maintain the line signal at the central office in operative condition after the telephone set at station B has been disconnected. The relay 40 is energized by the circuit just traced through its left hand winding, and upon pulling up its armature opens the short circuit normally closed about its right hand winding, and at its front contact closes a locking circuit for the holding bridge and the relay 40, as follows: From point 38, through inductance 39, left hand winding of relay 40, back contact of relay 42, front contact of relay 40, right hand winding of relay 40, to point 41. Immediately after the key K_h has been depressed at station B, the attendant will fully depress the key K_c at station B, in order to call station C. The operation of key K_c releases key K_h , but the holding bridge is locked up over the contact of relay 40 as already described, so that the release of key K_h , with the consequent deenergization of relay 37, is without effect. Station C is signalled by the operation of key K_c in the manner already described, and upon being informed by the attendant at station B that a call is waiting upon the trunk T , the party at station C will fully depress the key K_t , thereby bridging the telephone set across the trunk T , over the contacts 28 and 29 of key K_t , and at contact 30 of said key closing a circuit as follows: From the negative pole of source S_1 , over contact 30 of key K_t , over conductor 43, and through the winding of release relay 42 to the positive pole of source S_1 . Relay 42 is energized over this circuit, and at its left hand contact opens the holding bridge through inductance 39 already described, while at its right hand front contact a short circuit is closed about the right hand winding of relay 40. Relay 40 is thereby deenergized, and its winding shunted out of the trunk circuit leading to station C, the bridge through inductance 39 being at the same time disconnected, so that a trunk circuit extends from the central office to the station C which is clear of all auxiliary apparatus. When the party at station C hangs up his receiver, the disconnect signal at the central office is operated in the usual manner, and the connection may be taken down by the operator at the central office.

Assuming that a call comes in over trunk T for station A, the ringer 1 at station B is operated, and the attendant at station B, upon hearing the signal, depresses key K_t to connect the telephone set at station B to the trunk T . Upon ascertaining that the call is for station A, the attendant at station B first depresses key K_h to close the holding bridge through inductance 39, and then depresses key K_a , thereby bridging the telephone set at station B across the line L_a , over contacts 44 and 45 of key K_a , at the

same time closing a circuit over contact 46 and spring 47 of said key as follows: From the negative pole of source S_1 , over contacts 46 and 47, lower conductor of line L_a , over conductor 22, through the winding of ringing relay 8 in parallel with the winding and contact of buzzer relay 23, over the back left hand contact of relay 24, to the positive pole of source S_1 . Ringing relay 8 applies signaling current to the trunk T_a leading to station A. The attendant at station B also actuates the key K , thereby connecting the trunk T to the trunk T_a , over contacts 48 and 49 of key K , at the same time shifting the spring 50 of said key from contact 51 to contact 52. A circuit is thereby closed from the negative pole of source S_1 , through buzzer 53, over spring 50 and contact 52, over the back right hand contact of relay 24, to the positive pole of source S_1 . When the party at station A, in response to the signal, takes his receiver off the switch hook, the supervisory relay 25 is energized, thereby closing the circuit already traced through relay 24, which at its right hand armature opens the circuit just traced through buzzer 53, to notify the attendant at station B that the party at station A has answered. Relay 24 at its left hand contact, opens the circuit of ringing relay 8 and buzzer relay 23, to prevent further signaling of station A. Station A is now connected to the central office over trunk T_a , back contacts of ringing relay 8, contacts 48 and 49 of key K and trunk T . The attendant at station B, upon noting that the buzzer 53 has ceased to operate, fully depresses key K , thereby closing contact 33 of said key, to actuate relay 42 over a circuit already traced. Relay 42 disconnects the bridge through inductance 39, and short circuits the winding of relay 40 in a manner already described, so that the party at station A is able to communicate with the central office over the trunk T , free of all auxiliary apparatus. When the party at station A hangs up the receiver, supervisory relay 25 is deenergized, opening the circuit of relay 24 which at its back right hand contact closes the circuit previously traced through the buzzer 53. The buzzer is thereby actuated to notify the attendant at station B that the call is completed, whereupon the attendant restores key K , disconnecting trunk T_a from the trunk T and opening the buzzer circuit.

Should the party at station A desire to obtain access to the trunk T , the receiver would be removed from the switch hook at station A, thereby actuating the supervisory relay 25 which in turn closes the circuit of relay 24 already traced. Relay 24 at its front right hand contact closes a circuit from the negative pole of source S_1 , through buzzer 53, contact 51 of key K , back contact of su-

pervisory relay 54, front contact of relay 24, to the positive pole of source S_1 . The buzzer 53 is thereby actuated to inform the attendant at station B that the party at station A desires a connection. The attendant at station B thereupon depresses the key K_a , bridging the telephone set to the line L_a , whereby the supervisory relay 54 is actuated to open the circuit of the buzzer 53. The attendant at station B is now connected to station A over the line L_a , contacts 26 and 27 of key K and the trunk T_a . Upon ascertaining that the party at station A desires to be connected to the central office, the attendant at station B actuates the key K , thereby connecting the trunk T_a to the trunk T , over contacts 48 and 49 of the key K , so that the line signal at the central office is operated in the usual manner. The actuation of key K also shifts the spring 50 from contact 51 to contact 52. The attendant at station B now hangs up the receiver at said station, whereupon the supervisory relay 54 is deenergized, and the party at station A may proceed with the call to the central office without interruption by the attendant at station B. At the close of the call, upon the party at station A hanging up his receiver, the disconnect signal is given at the central office in the usual manner and the supervisory relay 25 at station B is deenergized, thereby opening the circuit of relay 24 which at its right hand back contact closes a circuit from the negative pole of source S_1 , through the buzzer 53, over spring 50 and contact 52 of key K , and right hand back contact of relay 24, to the positive pole of the source S_1 . The actuation of the buzzer 53 notifies the attendant at station B that the call from station A is completed, whereupon the attendant restores the key K to normal, disconnecting the trunk T_a from the trunk T and opening the circuit of the buzzer 53.

In case the party at station A desires a connection with station C, upon removing the receiver from the switch hook the supervisory relay 25 is energized as before, closing the circuit of relay 24 which in turn closes a circuit for buzzer 53 as follows: From the negative pole of source S_1 , through buzzer 53, over contact 51, back contact of supervisory relay 54, front contact of relay 24, to the positive pole of source S_1 . The attendant at station B, upon hearing the buzzer, depresses key K_a to connect the telephone set at said station to the line L_a , whereupon the supervisory relay 54 is actuated to open the buzzer circuit. Stations B and A are now in communication and the attendant at the former, upon ascertaining that a call to station C is desired, fully depresses key K_a , thereby disconnecting the telephone set at station B from line L_a , and connecting it to line L_c . This operation re-

sults in the deenergization of supervisory relay 54, so that the buzzer circuit is again closed. The actuation of key K_c also closes a signaling circuit for station C over the contact 11 and spring 12 of said key, in a manner already described. The party at station C in response to the signal, actuates the key K_c , thereby bridging the telephone set at such station across the line L_c , so that stations B and C are now in communication over the line L_c . The attendant at station B thereupon informs the party at station C that a call from station A is now waiting, whereupon the attendant at station B hangs up the receiver, and the party at station C depresses key K_a which restores key K_c and bridges the telephone set at station C across the line L_c . The supervisory relay 54 is now energized, due to the closing of the bridge through the telephone set at station C, and the buzzer circuit is again opened, indicating to the attendant at station B that the parties at stations C and A are in communication. At the close of the conversation between the parties at stations A and C the parties hang up their receivers thereby deenergizing supervisory relays 25 and 54. Relay 25 upon being deenergized opens the circuit of relay 24, thus restoring the apparatus to normal without any further attention upon the part of the attendant at station B.

It will be seen that by the arrangement above described the various stations of an intercommunicating system may communicate with a distant station in the usual manner, although but a single pair of conductors associates the distant station with the other stations of the intercommunicating system. At the same time the distant station may obtain access to any of the other stations of the system through an attendant at an intermediary station. By this arrangement it is possible in an intercommunicating system to provide for full telephone service between all stations of the system even though one station is located at a point so remote from the other stations as to prohibit the running of the large number of wires usually required in an intercommunicating system.

While the invention has been disclosed as embodied in what is considered its most desirable form, it will be understood that it may be embodied in many widely different organizations without departing from the spirit of the invention.

What is claimed is:

1. An intercommunicating system comprising a plurality of stations of different types, lines corresponding to all of the stations of one type running to all stations of that type, a line corresponding to a station of a second type and running to all stations of the first type, means at each station of the first type whereby said station may be con-

nected to any of said lines, and means at a special station of the first type whereby said station of the second type may be connected to any station of the first type over a connection controllable from said special station.

2. An intercommunicating system comprising a plurality of stations of different types, lines corresponding to all of the stations of one type running to all stations of that type, a line corresponding to a station of a second type and running to all stations of the first type, means at each station of the first type whereby said station may be connected to any of said lines, means at one station of the first type whereby said station of the second type may be connected to any station of the first type, and means at said station of the first type controllable from other stations of that type to signal said station of the second type.

3. An intercommunicating system, comprising a plurality of stations of different types, lines corresponding to all of the stations of one type running to all stations of that type, a line corresponding to a station of a second type and running to all stations of the first type, a central office, a trunk leading to said office and running to all stations of the first type, means at each station of the first type whereby said station may be connected to any of said lines or to said trunk, means at each station of the first type to transmit calling signals to said station of the second type, and means at one station of the first type whereby said station of the second type may be connected to any station of the first type or to said trunk.

4. An intercommunicating system, comprising a plurality of stations of different types, lines corresponding to all of the stations of one type running to all stations of that type, a line corresponding to a station of a second type and running to all stations of the first type, a central office, a trunk leading to said office and running to all stations of the first type, means at each station of the first type whereby said station may be connected to any of said lines or to said trunk, means at one station of the first type whereby said station of the second type may be connected to any station of the first type or to said trunk, and means at said station of the first type to signal said station of the second type, said means being controlled from any of said stations of the first type.

5. An intercommunicating system, comprising a plurality of stations of different types, lines corresponding to all of the stations of one type running to all stations of that type, a line corresponding to a station of a second type and running to all stations of the first type, a central office, a trunk leading to said office and running to all stations of the first type, means at each station of the

first type whereby said station may be connected to any of said lines or to said trunk, means at one station of the first type whereby said station of the second type may be connected to any station of the first type or to said trunk, means at said station of the first type whereby a connection between the station of the second type and said trunk may be supervised, and means at each station of the first type to transmit calling signals to said station of the second type.

6. An intercommunicating system comprising a plurality of stations of different types, lines corresponding to all of the stations of one type running to all stations of that type, a line corresponding to a station of a second type and running to all stations of the first type, means at each station of the first type whereby said station may be connected to any of said lines, means at a special station of the first type whereby said station of the second type may be connected to any station of the first type over a connection controllable from said special station, and means whereby said station of the second type may signal said station of the first type.

7. An intercommunicating system comprising a plurality of stations of different types, lines corresponding to all of the stations of one type running to all stations of that type, a line corresponding to a station of a second type and running to all stations of the first type, means at each station of the first type whereby said station may be connected to any of said lines, means at one

station of the first type whereby said station of the second type may be connected to any station of the first type, means at said station of the first type controllable from other stations of that type to signal said station of the second type, and means to indicate that the line leading to said station of the second type is busy while said station is being signalled.

8. An intercommunicating system comprising a plurality of stations, a line leading from one of said stations to a second station, an extension of said line leading to other stations of the system, a trunk leading to a central office, means whereby said line may be connected either to said extension or to said trunk, and means whereby any of said stations may transmit calling signals over said line leading from said first mentioned station.

9. An intercommunicating system comprising a plurality of stations, a line leading from one of said stations to a second station, an extension of said line leading to other stations of the system, a trunk leading to a central office, means whereby the connection of said line to said extension or said trunk may be controlled at said second station, and means whereby any of said stations may transmit calling signals over said line leading from said first mentioned station.

In testimony whereof, I have signed my name to this specification this 17th day of July, 1917.

LEON DWIGHT BARROWS.