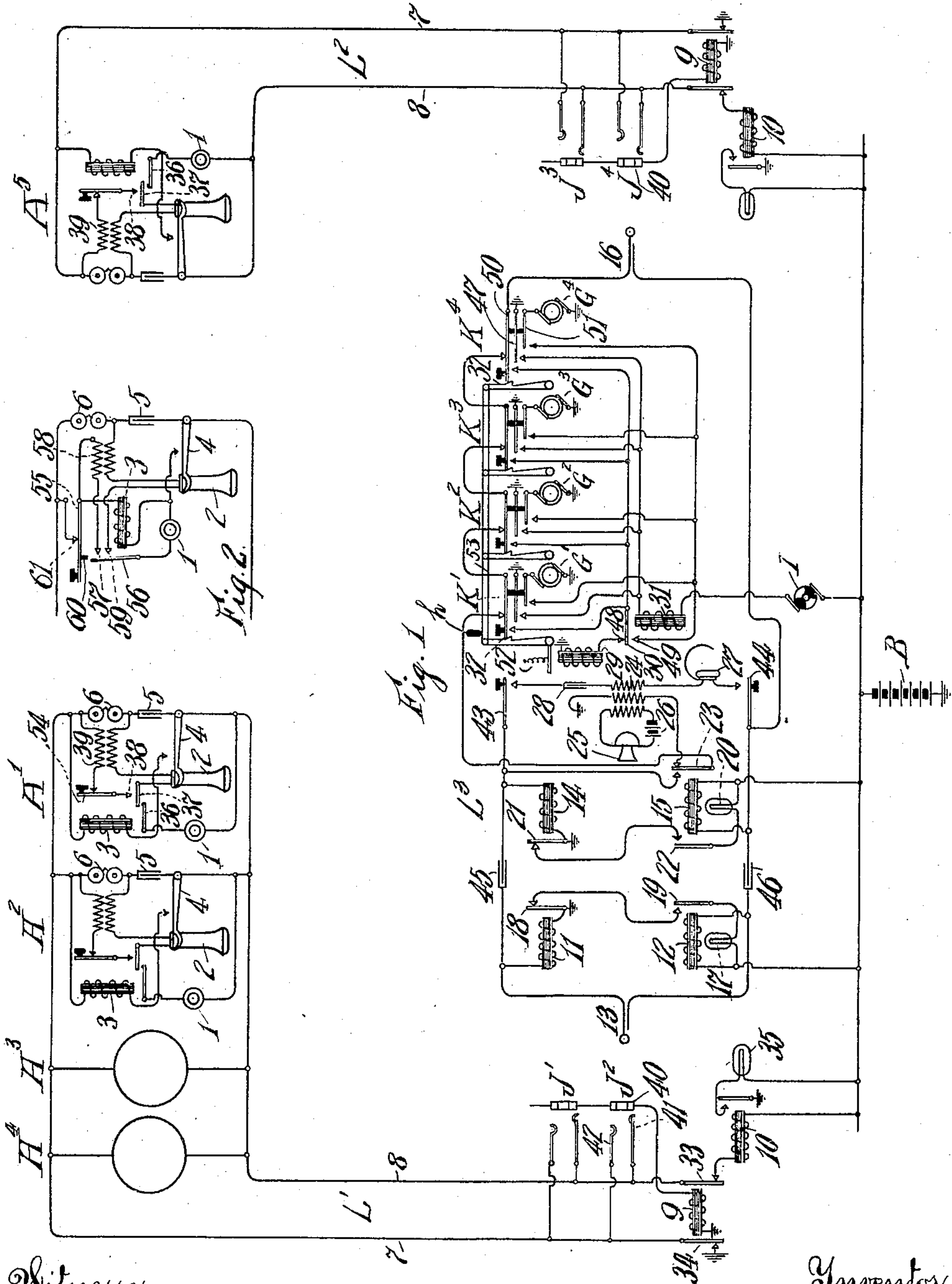


H. G. WEBSTER.
TELEPHONE SYSTEM.
APPLICATION FILED JAN. 22, 1907.

967,692.

Patented Aug. 16, 1910.



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TELEPHONE SYSTEM.

967,692.

Specification of Letters Patent.

Patented Aug. 16, 1910.

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To all whom it may concern:

Be it known that I, HARRY G. WEBSTER, a citizen of the United States, and resident of Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Telephone Systems, of which the following is a specification.

The present invention relates to telephone systems generally, and more particularly to party line systems of the so-called "lock-out" type.

The principal object of the present invention is to produce a novel system of the type indicated which will be so constructed and arranged that in operation the use of the party line by one of the parties thereon will prevent others on the line from listening in or calling the central office until the line is again idle, or at the will of the party using the line. In the latter event, a specific act on the part of the subscriber using the line enables a second party on the same line to establish a conversational circuit. By such means it is possible for two parties on the same line to carry on conversation with each other, but the arrangement of the system is such that this cannot take place without the knowledge of the operator since she is required to supply ringing current to actuate the calling device of the second party.

The system which I devise is especially designed to work with a centralized or common source of battery supply and with selective signaling, although obviously the latter is not essential.

Another feature of the invention resides in a novel circuit arrangement for the selective ringing keys and the associated link-circuit apparatus.

The above and other features of the invention will be more fully understood upon reference to the following detailed description taken in connection with the accompanying drawing, and the scope of the invention will be particularly pointed out in the appended claims.

Referring to the said drawing, Figure 1 illustrates diagrammatically a system embodying the features of the present invention, and Fig. 2 illustrates a modified arrangement of the substation circuits and apparatus. In these views, like characters refer to like parts.

The diagram of Fig. 1 illustrates two telephone lines L' — L^2 , extending from substa-

tions to a central office; line L' extending from substations A' , A^2 , A^3 and A^4 to jacks J' , J^2 ; and line L^2 extending from substation A^5 to jacks J^3 , J^4 . It will be obvious, however, that the line L^2 might also be provided with a plurality of substations. Interconnection between the various lines is accomplished through the agency of suitable link-circuits, such as L^3 , provided with terminal plugs and with the usual party line equipment.

At the substation, various circuit arrangements may be employed. In the present instance, I have illustrated a well-known substation circuit modified in accordance with the present invention. In this case, the transmitter 1 and receiver 2 are included in normally open circuits which are controlled by the actuation of an electromagnet 3 whose winding is included in a normally open bridge adapted to be closed by the switch-hook 4. A condenser 5 and call-bell 6 are included in a normally closed bridge. The line limbs 7 and 8 are normally connected at the central office to the opposite poles of a central source of battery supply B, the line limb 8 extending through one contact of the cut-off relay 9 and the winding of line relay 10 to the live pole of the battery, and the line limb 7 extending by way of a second contact of the cut-off relay 9 to the grounded pole of the battery.

The interconnecting link-circuits at the central office, including the associated sources of ringing current, may be of any preferred type such, for example, as disclosed in Patent #779,533, granted January 10, 1905. The illustrated link-circuit is of the well-known Kellogg four-relay type in which a pair of relays 11—12 is associated with the answering plug 13, and a corresponding pair of relays 14—15 is associated with the calling end of the link-circuit and calling plug 16. The relays 11—12 jointly control the supervisory lamp 17 through the agency of their contacts 18 and 19 respectively, while relays 14 and 15 similarly control supervisory lamp 20 through the agency of their contacts 21 and 22 respectively. Relay 15 is also provided with a movable contact 23 which is adapted to unite adjacent portions of the tip strand running to calling plug 16 or to connect the tip of said plug through the induction coil 24 of the operator's set. This set includes the transmitter

25, in a local circuit with one winding of induction coil 24 and a local battery 26, and the head receiver 27 adapted to be included in bridge of the link-circuit strands with another winding of induction coil 24 and condenser 28. Obviously the operator's set may be connected in any other preferred manner. For the purpose of supplying ringing current to the line, four ringing keys $K^1-K^2-K^3-K^4$ are shown in association with corresponding generators $G^1-G^2-G^3-G^4$. These generators are designed to supply currents of different frequencies, and the substation call devices are correspondingly tuned so as to correspond therewith, as clearly indicated in the aforesaid patent. Thus, when current from generator G^1 is supplied to the line, it will be instrumental in ringing the call signal at one of the substations of the line only, and the same will be true for each of the other generators. Upon the depression of any one key, its generator is adapted to be connected to the tip of the calling plug 16 alternately with electromagnet 29 through the agency of contact 30 of electromagnet 31 commonly called the "flip-flop" magnet, whose winding is included in circuit with battery B and an interrupter I. The actuated key in any particular instance is held in its actuated position by a suitable catch lever 32 which is adapted to be released upon the energization of electromagnet 29.

With this preliminary description of the apparatus employed, it will be apparent that in operation, assuming that a party at substation A' desires to converse with a party at substation A⁵, upon the removal of the receiver 2 from its switch-hook 4, a path for current will be completed through electromagnet 3 at substation A', which may be traced from the live pole of the battery B through the winding of the line relay 10, closed contact 33 of cut-off relay 9, line limb 8, switch-hook 4, winding of electromagnet 3, line limb 7, closed contact 34 of cut-off relay 9 to ground, whereupon the line relay 10 and electromagnet 3 will be sufficiently energized to attract their contacts. By the attraction of the former, a circuit will be completed through line lamp 35 causing its display as a signal to the operator that connection is desired. The actuation of relay 3 on the other hand will close its contacts 36-37-38, thereby including the transmitter 1 at substation A' in bridge of the line limbs L', and at the same time closing the local circuit of the receiver 2, this circuit including transmitter 1, contacts 36-37, receiver 2, a winding of induction coil 39, and condenser 5. The relays 10 and electromagnets 3 should be so proportioned and constructed that electromagnet 3 will always attract its contacts at the same time or before relay 10 whenever the initial energiz-

ing circuit is established in the act of calling. Then, as soon as electromagnet 3 attracts its contacts, the resistance of the circuit will be greatly reduced by the closing of the associated low resistance path through the substation transmitter 1, contacts 36-37-38 and key 54. Upon observing the display of call signal 35, the operator will thereupon insert answering plug 13 into an answering jack, as J², of line L', thereby completing a circuit from the live pole of battery B through the winding of supervisory relay 12, sleeve contact of plug 13, sleeve contact 40 of jack J² and winding of cut-off relay 9 to ground, thereby energizing the cut-off relay to interrupt the normal connection of the line limbs to the battery B, thereby also destroying the normal substation control of the line relay 10. The normal connection of the line limbs to the battery is, upon the insertion of the plug, replaced by connection from the live pole of the battery through the winding of supervisory relay 12, sleeve contact of plug 13 and sleeve contact 41 of jack J² to line limb 8, and from line limb 7 through the tip contact 42 of the jack J² and tip contact of plug 13 through the winding of supervisory relay 11 to ground. Since at this time the line limbs 7 and 8 are united at the substation, current will flow not only from the sleeve side of the circuit and through the cut-off relay 9 to ground, but also over the line limbs and through supervisory relay 11 to ground, thereby energizing the latter and preventing the display of the associated supervisory lamp 17. The operator will now depress her listening-key levers 43-44 and thereby connect her telephone set in bridge of the link-circuit strands and thus place her equipment in condition to enable her to converse with the calling party through the condensers 45 and 46. Upon learning that connection is desired with substation A⁵, she will then test the line L² to determine its busy or idle condition. This she does by touching the tip of the calling plug 16 to the contact 40 of one of the multiple jacks associated with said line; and in case said line is in use, a potential above that of ground will exist at the contact thus touched, and current will flow therefrom over the tip strand of the link-circuit through normal contact 23 of relay 15 and a winding of induction coil 24 to ground, thereby producing a "click" in the operator's receiver 27 as an indication to her that the line is busy.

The potential at the contact 40 of the tested jack will be obtained through the connection of a multiple of the jack tested with the sleeve strand of another link-circuit connected to said line. This connection may be either through the sleeve contact of answering plug corresponding to plug 13 and

the associated supervisory relay corresponding to relay 12, or through the sleeve contact of calling plug corresponding to plug 16 and the winding of the associated supervisory relay corresponding to relay 15. If the line L^2 is found to be busy, the operator will so inform the calling party. If, on the other hand, said line is found to be idle, the operator will insert calling plug 16 into the tested jack and thereby complete a circuit through the supervisory relay 15 and cut-off relay 9 over the sleeve side of the circuit, in a manner similar to that previously described in connection with L' , thereby closing contact 22 and moving contact 23 of relay 15 to its alternating position and destroying the normal connection of the line L^2 with battery B by way of the cut-off relay contacts. The movement of contact 23 will connect the adjacent portions of the tip strand running between condenser 45 and the tip of plug 16. The closing of contact 22 will cause the display of supervisory lamp 20. The next operation on the part of the operator in completing a connection will be to depress that ringing key which is designed to actuate the call-bell 6 at substation A^5 . Assuming that this key is that designated K^4 , it will be observed that as soon as the same is depressed, a circuit is completed from the live pole of the battery B through interrupter I, electromagnet 31, closed contact 47 to ground. By reason of the inclusion of the interrupter I in this circuit, electromagnet 31 will be successively energized and deenergized, thereby moving its contact 30 back and forth between contacts 48 and 49. While contacts 30 and 48 are in engagement, the tip of the plug 16 is connected to ground via closed contact 50 of key K^4 , contacts 30—48 and winding of electromagnet 29. While contacts 30 and 49 are in engagement, the tip of plug 16 is connected to ground via closed contact 50 of key K^4 , contacts 30 and 49, closed contact 51 of key K^4 and generator G^4 . Thus, ringing current is applied at regular intervals to the tip side of the circuit, the ringing circuit extending from the tip of the plug 16 to tip contact of the connected jack, line limb 7, through condenser 5, call-bell 6, line limb 8, plug and jack sleeve contacts, winding of relay 15 to the live pole of the battery B. The completion of this circuit will cause the actuation of call-bell 5 as a signal to the called-for party. In this ringing operation, as soon as key K^4 is depressed, the associated catch 32, by reason of the action of the spring 52, engages the contact 50 of said key and holds all of the contacts of said key in their actuated position. These contacts are maintained in these positions until the electromagnet 29 is energized to actuate the bar 53, which unites the catches 32, and

thereby release the key. The electromagnet 29 is energized as a result of the called-for party removing his receiver from its hook. As soon as this is done, he completes a path for battery current through his transmitter 1, contacts 36—37—38 and winding of induction coil 39, as previously traced in connection with substation A' ; and thereafter, as soon as electromagnet 31 is deenergized by interrupter I and electromagnet 29 is connected to the tip strand of the link-circuit, current will flow from the live pole of the battery B through the winding of relay 15, sleeve strand of the link-circuit, plug and jack sleeve contacts, line limb 8 through the substation, line limb 7, plug and jack tip contacts, closed contact 50 of key K^4 , contacts 30—48 and winding of electromagnet 29 to ground. The closing of this circuit energizes electromagnet 29 and thereby releases key K^4 . As soon as the contact 50 of key K^4 returns to its normal position, the tip strand of the link-circuit is completed from the tip contact of plug 16 to the condenser 45, and battery current may flow through supervisory relay 14 to ground. When this takes place, relay 14 will be energized with the consequent opening of its contact 21 to extinguish the supervisory lamp 20. During connection, the lamps 17 and 20 remain dark, but are lighted as soon as the corresponding receiver is restored to its hook. The lighting of both lamps constitutes a signal to the operator to take down the connection. If the called-for party fails to respond to the call, the operator may readily restore the ringing keys to their normal positions, and thereby discontinue the application of ringing current, by manipulating the handle h on the bar 53 so as to release the catch or catches 32. If, at any time during this connection, another party on the line L' desires to make a call or to listen to the conversation carried on between substations A' and A^5 , he will be unable to do so. This is true for the reason that upon removing his receiver from its hook, a path through his electromagnet 3 in parallel to electromagnet 3 of substation A' will be completed. Because of the shunting action of the low resistance path through transmitter 1, contacts 36—37—38 and winding of induction coil 39 at substation A' , insufficient current will flow through the electromagnet 3 of the interfering party to cause the attraction of its contacts. Therefore, no talking circuit will be closed through the interfering party's substation; and by reason of the fact that the normal connection of the line L' with the line limb 10 has been interrupted, he will be unable to display the call signal 35 at the central office.

If, in the first instance, the party at substation A' desires connection with another

party on the same line, as, for example, a party at substation A², he will call in a manner heretofore described; and the operator will, after learning that the party with which connection is desired is on the same line as the calling party, remove the plug 13 and insert the plug 16 into the jack of the line L' and will hold down for a proper interval the ringing-key corresponding to the station desired. This will send ringing current over the line which will actuate the call-bell of the called-for party. But before it will be possible for him to complete a conversational circuit through his substation, it will be necessary for the calling party to depress his key 54 to open the low resistance shunt at his station about the winding of electromagnet 3 of the called-for party. By breaking this shunt, enough current will flow through the electromagnet 3 of the called-for party to cause it to close its contacts and thereby complete its conversational circuit with the circuits through the transmitters and receivers at the calling and called stations on the line L'. It will be observed that the depressing of the key 54 does not open the circuit of the magnet 3 at substation A', but only opens the shunt at said station, said magnet 3 continuing energized as before so that on the release of key 54 the talking circuit is again reestablished at substation A'. At the end of conversation, it will be necessary for both parties to hang up their receivers in order to display the associated supervisory lamp 17. As soon as this takes place, the operator may take down the connection.

In Fig. 2, I have illustrated a modification of the substation circuit arrangement heretofore described. In this instance, a bridge normally open at switch-hook 4 extends through electromagnet 3 and closed contact 55. Upon the energization of the electromagnet, the transmitter 1 is included in bridge between the line limbs extending through switch-hook 4, transmitter 1, contact 56—57, winding of induction coil 58 and closed contact 55. The local circuit of the receiver extends from switch-hook 4 through transmitter 1, contact 56—59, receiver 2 and through a winding of induction coil 58 and condenser 5. In the operation of this substation equipment, the removal of the receiver, when the line is idle, displays the signal at the central office as before, and also energizes electromagnet 3 sufficiently to close contacts 56—57—59. By reason of the low resistance of the path through the transmitter 1, contact 56—57 and winding of induction coil 58, a second party attempting to obtain connection or to listen in is prevented from doing so because he is unable to obtain a sufficient flow of current through his electromagnet 3, as before explained. In case connection is de-

sired with a second party on the same line, the calling party, after instructing the operator, depresses his key 55 and thereby, by reason of the insulating projection 60, mechanically holds the contacts 56—57—59 in engagement, thus interrupting the energizing circuit through electromagnet 3 at his station, but maintaining a listening circuit through the high resistance bell 6. In other respects, the operation is substantially the same as that heretofore described and need not be further explained. It should be noted that in this operation, the calling party retains his key 55 in its depressed position until he hears the reply of the called-for party. He may then allow the key 55 to return to its normal position. In order that in this operation the circuit of relay 3 may be again established before the mechanical control of the contact 56 is lost, the contact 61 associated with said key 55 is made flexible so as to follow the key 55 during its downward movement until the projection 60 engages contact 56 and will again engage key 55 upon its return movement before projection 60 disengages contact 56.

In carrying out my invention, in a forty volt system, supervisory relays having a resistance of two hundred ohms each, cut-off relays having a resistance of twelve hundred ohms each, and substation relays 3 having a resistance of one thousand ohms each, will be found satisfactory. These values and their ratios are merely typical and, obviously, may be varied to suit the exigencies of any given case.

Obviously in the practice of the invention, many alterations and modifications may be made in the character of equipment and circuit arrangements without departing from the spirit and scope of my invention. I, therefore, do not wish to be limited to the specific matter herein disclosed, but aim to cover by the appended claims all such alterations and modifications.

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

1. A party line telephone system comprising a telephone line having two limbs; a plurality of substations on said line each having two normally open branches in bridge of said limbs; a suitable source of current associated with said line; a transmitter, relay contacts, a manual switch and a winding of an induction coil in one of said branches at each substation; a relay in the companion branch at each substation for controlling said relay contacts; and a receiver, another winding of said induction coil and a contact of said relay included in a local circuit at each substation.

2. A party line telephone system comprising a telephone line having two limbs; a plurality of substations on said line each having two normally open branches in

bridge of said limbs; a suitable source of current associated with said line; a transmitter, relay contacts, a manual switch and a winding of an induction coil in one of said branches at each substation; a relay in the companion branch at each substation for controlling said relay contacts; a bell and condenser in permanent bridge of said limbs at each substation; and a receiver and another winding of said induction coil included in a branch connected at one end to one of said relay contacts and at the other to said bell and condenser bridge at a point between said bell and condenser.

3. A party line telephone system comprising a telephone line having two limbs; a plurality of substations on said line, each having two normally open branches in bridge of said limbs; a suitable source of current associated with said line; a transmitter, normally open relay contacts, a normally closed manual switch, and a winding of an induction coil in one of said branches at each substation; a normally open switch-hook, and a relay in the companion branch at each substation, said relay for controlling said relay contacts; and a receiver, another winding of said induction coil, and a con-

tact of said relay included in a local circuit at each substation.

4. A party line telephone system comprising a telephone line having two limbs; a plurality of substations on said line, each having two normally open branches in bridge of said limbs; a suitable source of current associated with said line; a transmitter, normally open relay contacts, a normally closed manual switch, and a winding of an induction coil in one of said branches at each substation; a normally open switch-hook and a relay in the companion branch at each substation, said relay for controlling said relay contacts; a bell and condenser in permanent bridge of said limbs at each substation; and a receiver and another winding of said induction coil included in a branch connected at one end to one of said relay contacts and at the other end to said bell and condenser bridge at a point between said bell and condenser.

In witness whereof, I hereunto subscribe my name this 19th day of January, 1907.

HARRY G. WEBSTER.

Witnesses:

G. E. MUELLER,
H. C. OLMSTEAD.