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J. F. TOOMEY ET AL

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PROGRAM TRANSMISSION OVER WIRES

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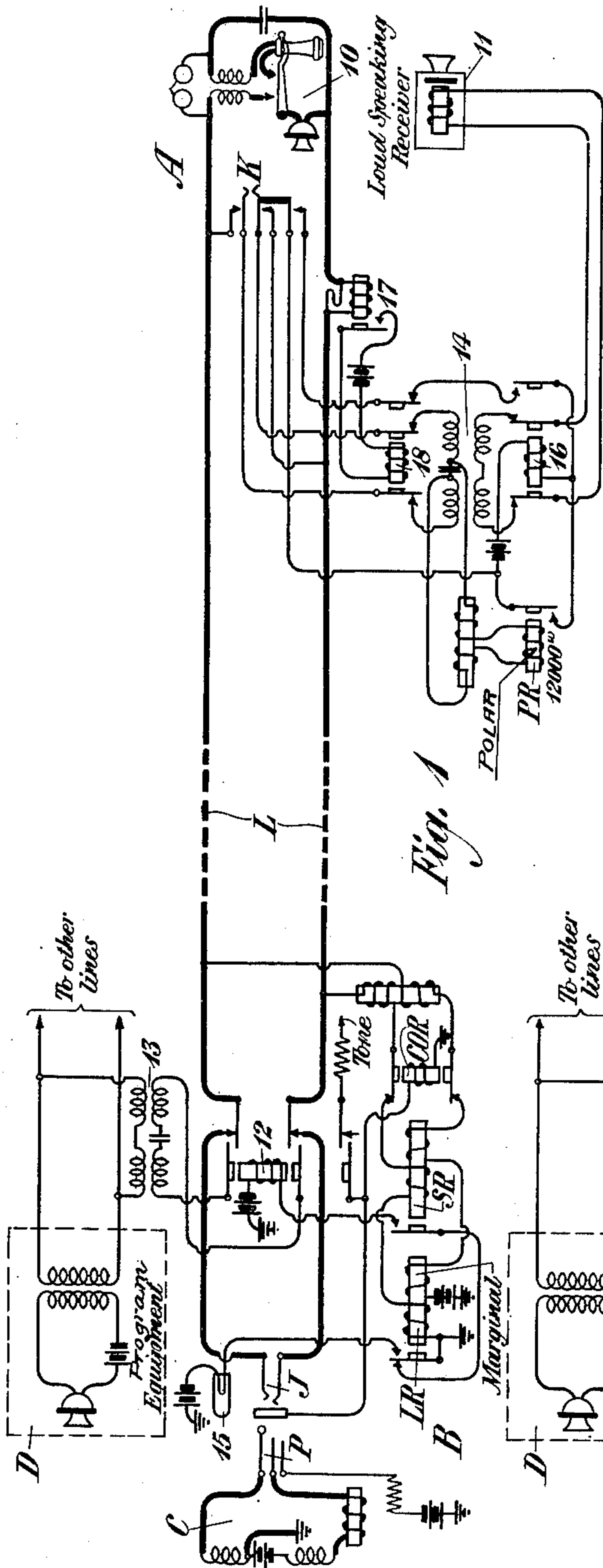


Fig. 1

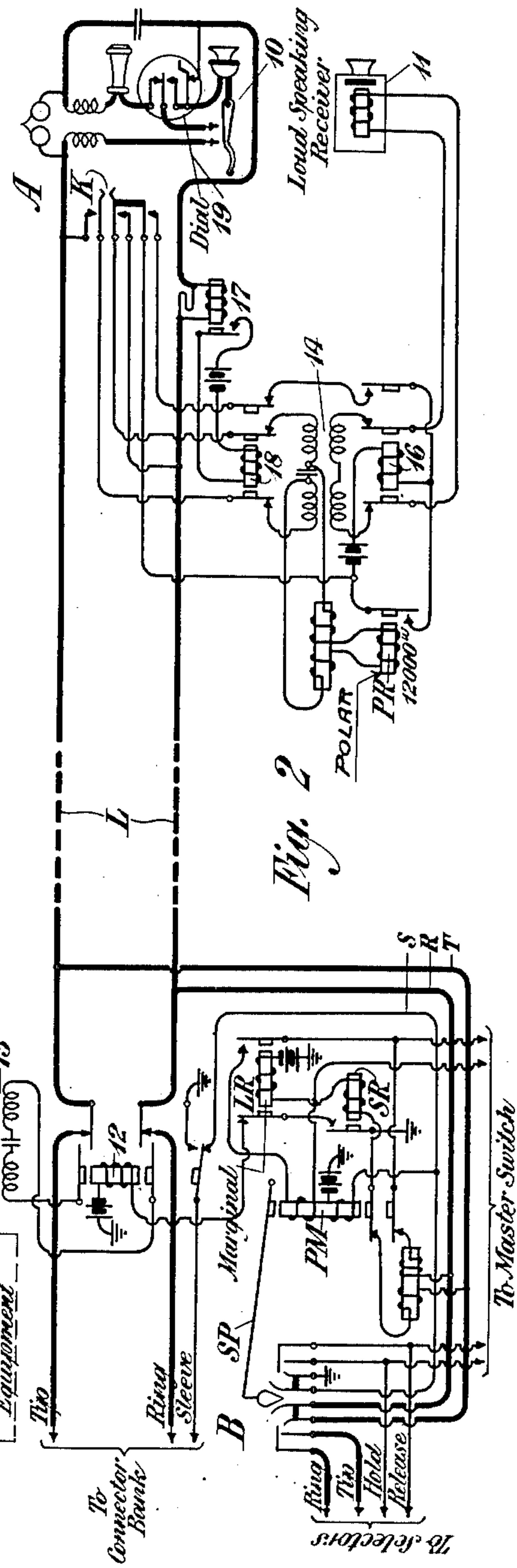


Fig. 2

INVENTORS
J. F. Toomey and H. E. Phelps
BY
g r 70 r
ATTORNEY

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UNITED STATES PATENT OFFICE.

JOHN F. TOOMEY AND HENRY E. PHELPS, OF NEW YORK, N. Y., ASSIGNORS TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

PROGRAM TRANSMISSION OVER WIRES.

Application filed November 11, 1922. Serial No. 600,355.

To all whom it may concern:

Be it known that we, JOHN F. TOOMEY and HENRY E. PHELPS, residing at New York and New York, in the counties of New York and Bronx and States of New York and New York, respectively, have invented certain Improvements in Program Transmission Over Wires, of which the following is a specification.

This invention relates to systems of communication and more particularly to systems for disseminating news, information, music or the like.

Various schemes have been proposed heretofore for program transmission. The only one of these schemes which has been exploited to any extent is radio broadcasting, that is, the broadcasting of news, information or entertainment by means of radio telephone equipment so that persons provided with suitable radio receiving sets tuned to the proper wave length may receive the transmitted entertainment or the like.

This method, however, has very serious objections. In the first place, numerous broadcasting stations in the same area operate on wave lengths sufficiently close together to interfere with each other. Furthermore, radio telephonic transmission necessarily involves the use of a much wider band of the frequency spectrum than is used for wireless telegraph purposes, and in view of the fact that the number of wave lengths available for radio communication are necessarily limited it is undesirable that wave lengths necessary for commercial communication should be utilized for purposes of mere entertainment. Finally, in order to avail himself of the desired information or entertainment, each individual subscriber must provide himself with a radio receiving equipment which involves storing upon his premises expensive storage batteries which are constantly in need of re-charging, together with a considerable amount of delicate and elaborate electrical apparatus, such as coils, detectors, amplifiers, etc., all of which involve careful maintenance. Moreover, the radio receiving set as now known is, at its best, an inherently ugly thing, absolutely out of place in the home and requiring for its operation a net work of unsightly wiring.

Realizing the inherent limitations of radio broadcasting, proposals have been made

to use existing wire systems, such as telephone, telegraph or power networks for program distribution purposes by transmitting carrier frequencies over such existing power or communication lines. Such a method however, would be extremely expensive as well as complicated, as it involves a very considerable reorganization of the telephone plant or power plant, and requires the use of quite complicated and expensive apparatus.

The ordinary telephone plant, however, offers unusual facilities for program distribution purposes by the use of ordinary telephonic methods and without the employment of any high frequency or carrier methods of signaling. When it is realized that the average subscriber's telephone set is in use for telephonic purposes only during an extremely small part of the time it becomes apparent at once that if the telephone line, during its idle periods, could be used for disseminating news, information or entertainment, the plant could be used much more economically and the information or the like to be distributed could be transmitted to the subscriber in the simplest manner possible. It may further be observed that the average subscriber to a distribution service, particularly a service for distributing entertainment, would only desire to avail himself of the service during the late afternoon or during the evening, at which times the average subscriber's telephone is only used for social purposes and is rarely or never used for business calls.

Having these circumstances in mind, it is proposed by this invention to provide simple, practical and economical arrangements by which news, information, music or other forms of entertainment may be transmitted at ordinary telephonic frequencies from a central program station over subscribers' telephone lines. It is also proposed by this invention to provide a system whereby the telephone subscriber may receive the program service without interfering in any way with the use of his line for ordinary telephone purposes. This invention also renders available a program distribution system in which the apparatus not only at the central station but more particularly at the subscriber's station will be extremely simple and economical and yet efficient.

The invention may now be more fully un-

derstood by reference to the following detailed description thereof when read in connection with the accompanying drawing in which Figure 1 is a circuit arrangement illustrating a program distribution system as applied to an ordinary subscriber's line involving manual switching, between subscribers, and Fig. 2 illustrates such a system applied to a subscriber's line involving machine switching at the central office.

Referring to Fig. 1, L designates an ordinary telephone subscriber's line terminating at one end at a subscriber's station A and at the other end in a central office B. At the station A, the usual form of telephone set 10 is provided for ordinary telephonic purposes and a supplemental key K is provided for associating with the line a broadcasting receiving equipment comprising a loud speaking receiver 11 and other apparatus to be described later.

At the central station B, the line terminates in the usual type of switching jack J whereby telephonic communication may be established through the cord circuit C between the line L and other lines terminating at the exchange. Normally, the line L is connected over the contacts of a relay 12 to the jack J, but the circuit of the relay 12 is so arranged that the line may be disconnected from the jack J when the key K is operated and connected through a transformer 13 with a program distributing equipment common to a large number of lines. The central program equipment itself is illustrated at D and is of a very simple type, consisting, in its most fundamental form, of an ordinary telephone transmitter and energizing battery such as is in common use in telephone substations today.

At the central office, in addition to the usual line relay LR, a special relay SR is bridged across the line, the latter relay operating when the key K is actuated by the subscriber to energize the relay 12, which functions to disconnect the line from the jack J and connect it to the program equipment at D, at the same time applying a busy tone to the sleeve conductor of the jack to notify the central operator when testing the terminal that the subscriber is using the line for receiving the program service. The line relay LR is marginal and does not operate through the high resistance connection established by the key K and will only operate when the line is closed through the low impedance telephone set 10 by taking the receiver from the switchhook.

If the subscriber should desire to use the line for ordinary telephonic purposes, the line relay LR will operate as soon as the receiver is taken from the hook, thereby causing the line lamp 15 to glow. At the same time it opens the circuit of the relay 12 to

prevent the relay SR from actuating the relay 12 to disconnect the line from the jack J. The operator, upon observing the glowing of the line lamp may establish a connection in the usual manner by means of a cord circuit C. If, upon an incoming call, the operator desires to establish a connection with the line L, the busy tone on the jack J may be disregarded if the subscriber is receiving program service and a connection established by inserting the plug of the cord C in the jack J. This operates the cut-off relay COR, which in turn disconnects the special relay SR and the line relay LR from the line.

At the subscriber's station, the transformer 14, which serves to associate the loud speaking receiver 11 with the line, is provided with a condenser shunted by the high resistance winding of a polar relay PR. Owing to the high resistance of the latter, when the key K is thrown, only sufficient current flows through the bridge, including the windings of the relays SR and LR at the central station to operate the relay SR, the line relay LR not being operated when the set is used for program purposes. The polar relay PR controls a relay 16, whereby the loud speaking receiver 11 may be disconnected from the line, even though the key K is actuated. The polar relay PR is so poled as to energize the relay 16 for this purpose only when battery is supplied to the line from the cord circuit, the battery connections through the windings of the relays LR and SR being reversed with respect to the cord circuit. Consequently, the relay PR disconnects the loud speaking receiver only when the operator inserts the plug of the cord circuit C into the jack J to establish an ordinary telephone connection. This obviates any possibility of ringing current actuating the loud speaking receiver and annoying the subscriber. A low resistance relay 17 is included in series with the subscriber's set 10, said relay operating to disconnect the polar relay PR and loud speaking receiver 11 from the line L through an auxiliary relay 18 whenever the subscriber takes down the receiver to use his set for ordinary telephonic purposes. This arrangement is provided so that the special receiving equipment will be disconnected under these circumstances even though the subscriber should fail to restore the key K.

The detailed operation is as follows: Assuming that the subscriber at station A desires to receive the program service, the key K is actuated, thereby closing a circuit through the winding of the high resistance polar relay PR, over the normal contacts of the relay 18, over the make contacts of the key K, over the line L, normal contact of the cut-off relay COR and through the windings of the special relay SR and the line relay

LR. The special relay SR is operated over this circuit but the current flow is not in a direction to operate the relay PR. The marginal line relay LR is not operated and hence the energization of the relay SR completes a circuit from ground, over the back contact of the line relay LR and front contact of the special relay SR, through the winding of the relay 12. The latter is energized to disconnect the line L from the jack J and connect the line to the program equipment at D, at the same time applying a busy tone to the sleeve conductor of the jack J to apprise the central office operator when testing the terminal that the subscriber is receiving the distributed information. The actuation of the key K serves to connect the loud speaking receiver 11 with the line over the normal contacts of the relay 16, through the transformer 14 and the normal contacts of the relay 18. The subscriber is now enabled to hear by means of the loud speaker 11 the news, information, music or other entertainment distributed from the broadcasting station D.

If, while the line is thus in use, a sufficiently urgent call should come into the central switching office for the line L, the operator may disregard the busy tone on the sleeve of the jack J and insert the plug of the cord C into the jack J, which thus completes a circuit over the sleeve of the jack J through the cut-off relay COR. The cut-off relay COR is thereupon energized and operates to disconnect the special relay SR and the line relay LR from the line. Relay SR, upon being deenergized, opens a circuit of the relay 12, which at once disconnects the line L from the station D and connects it to the tip and ring of the jack J. The direct current supplied to the line L through the windings of the relays LR and SR was not in such a direction as to actuate the high resistance polar relay PR, but as soon as the cord circuit is connected to the line and the relays SR and LR disconnected, the direct current supplied through the cord will be in such a direction as to actuate the polar relay PR and close the circuit of the relay 16, which at once disconnects the loud speaking receiver 11 from the transformer 14. The relay 16 is locked over its right-hand front contact, right-hand back contact of relay 18 and lower make contact of key K, so that said relay 16 will be held up independently of the polar relay.

The subscriber may now be rung in the usual manner by the operator and upon removing the receiver from the hook, the talking circuit will be established to the central office. Direct current from the central office battery flows through the cord circuit over the subscriber's line and through the relay 17, this relay being energized as long as the receiver is removed from the

hook. The relay 17 completes the circuit of the relay 18, which disconnects the program receiving apparatus from the line independently of the key K and at its right-hand contact opens a locking circuit of the relay 16, which is restored to normal. At the end of the conversation the subscriber may hang up his receiver, thereby giving the usual disconnect signal and deenergizing the relay 17 which (if the key K has not been restored) again connects the polar relay PR to the line. Current flows through the polar relay in such a direction as to energize and lock up the relay 16. As soon as the operator withdraws the plug of the cord C from the jack J, the cut-off relay COR is deenergized, thereby again connecting the special relay SR and line relay LR to the line. The line relay LR is not energized but the special relay SR is energized in series with the polar relay PR. The current flow is not in such a direction as to operate the polar relay PR but the energization of the special relay SR again completes a circuit of the relay 12, which disconnects the line L from the jack J and connects it to the broadcasting station D. Transmission from the program station may again be received by the loud speaking receiver 11 as soon as the subscriber restores the key K to unlock the relay 16, and then again actuates the key.

If, while the line is being used for receiving distributed information, the subscriber should desire to use the line for establishing a telephone call, the receiver may be removed from the hook, thereby energizing, in addition to the already energized relay SR, the line relay LR and the relay 17. The relay 17 actuates the relay 18 to disconnect the special receiving equipment independently of the key K. The line relay LR opens a circuit of the relay 12, which upon being deenergized, disconnects the line L from the program station and connects it to the jack J. The line relay LR at the same time completes a circuit of the line lamp 15 over its front contact. The operator will answer the call by inserting the plug of the cord circuit C in the jack J, thereby causing the cut-off relay COR to disconnect the relays LR and SR from the line as before so that the relay 12 remains deenergized with the line connected to the jack J. At the end of the conversation the subscriber may hang up his receiver and the apparatus may be restored to the condition for program reception in the manner already described.

When the subscriber no longer desires to receive the program service he will simply restore the key K, thereby disconnecting the loud speaker and associated apparatus from the line and opening the circuit of the special relay SR. The latter, upon being deener-

gized, will open the circuit of the relay 12, which will disconnect the line from the program equipment at D and connect it to the jack J.

6 Fig. 2 illustrates an arrangement for applying program service to telephone lines terminating at a central office equipped for machine switching. At machine switching
10 offices no operators will be provided to exercise discretion with regard to the urgency of incoming calls and in practice the circuits might be arranged either to exclude all incoming calls while the special program
15 equipment is in use or to permit all incoming calls to interrupt the program service. The circuit illustrated in Fig. 2 is arranged so that when the line is in use for program receiving no incoming calls may be made. The subscriber himself, however, can inter-
20 rupt the program service to make outgoing calls at any time by simply removing his receiver from the switch-hook as in the case of the circuit shown in Fig. 1.

In this form of the invention the equip-
25 ment at the subscriber's station A, both for program receiving and for ordinary telephonic purposes, is identical with that shown in Fig. 1, except that the subscriber's telephone set is provided with the usual form
30 of dial 19 for operating the switching machinery at the central office. The program equipment at the station D and its association with the line L at the central office is also identical with that illustrated in Fig.
35 1. The line L terminates at the central office for the purpose of establishing incoming connections in the usual form of connector bank (not shown) while, for the purpose of establishing outgoing connections the line
40 terminates in the well known Keith line switch and its associated master switch. As these elements are well known in the art only a portion of the circuits thereof are illustrated and the detailed construction thereof
45 need not be described. A marginal line relay LR is provided, as in the manual system, this relay being only operated when the receiver is removed from the switchhook. The line relay controls a double wound
50 plunger magnet PM of well known construction, which performs the double function of acting as a cut-off relay and of operating the plunger SP to connect the line to the dial-operated switching machinery (not shown).
55 The windings of the plunger magnet, as is well known, are so arranged that the upper winding, when energized, will cause the plunger P to operate. The lower winding, however, will not operate the plunger SP
60 but will only hold the plunger SP in operated position if it has already been operated. In addition to the marginal line relay LR, a special relay SR is provided, as in the manual system, said relay SR functioning, if
65 the line relay LR is not energized, to com-

plete the circuit of the relay 12, which disconnects the line from the jack J and connects it to the program equipment at D.

Further details of the invention will be understood from the description of the op- 70
eration which is as follows: Assuming that the subscriber desires to receive distributed information or the like, the key K is actuated to connect the high impedance polar relay PR and the loud speaking receiver 11 75
to the line as before. This established a direct current circuit from battery through the line relay LR, through the winding of the special relay SR, over the upper contact of the plunger magnet PM, through a wind- 80
ing of the retard coil, to the tip side of the line L, upper make contact of the key K, left-hand contact of the relay 18, winding of polar relay PR, inner right-hand con- 85
tact of relay 18, make contact of key K, ring side of the line L, through the right-hand winding of the retard coil at the central station and over the lower contact of the plunger magnet to ground, through the cir- 90
cuits of the master switch (not shown). The current flowing through this circuit is not sufficient to operate the line relay LR and is not in such a direction as to operate the polar relay PR. The special relay SR is 95
operated, however, and completes a circuit for the relay 12, which disconnects the line L from the connector bank terminals and connects it to the station at D, so that distributed information from said station D is 100
transmitted over the make contacts of the relay 12 and over the line L to the loud speaking receiver 11. It will be noted that while the line is in this condition a busy po- 105
tential is applied to the sleeve conductor leading to the connector bank at the central office, over the lower front contact of the relay 12. Therefore, if, while the line is being thus used, some other subscriber desired to converse with the subscriber on the line L, the switching machinery (not shown) op- 110
erated at the central station in a well known manner to establish connection with the line L, will find the busy potential upon the sleeve and will therefore fail to establish a connection with the line. The program 115
service cannot be interrupted by an incoming call, therefore, if the special receiving equipment is in use.

If, while the program receiving apparatus is associated with the line by means of the 120
key K so that the loud speaker 11 is being operated, the subscriber at station A should desire to use the line for ordinary telephone purposes the subscriber may remove the re- 125
ceiver from the switchhook, thereby establishing a low resistance connection over a circuit through the line relay LR, special relay SR and the relay 17. Relay 17 is energized and completes the circuit of relay 18, thereby disconnecting the loud speaking 130

receiver and associated equipment from the line independently of the key K. The marginal line relay LR is operated over the low resistance circuit through the substation set and its left-hand contact opens a circuit of the relay 12, which upon being deenergized disconnects the line from the central program station. Over its right-hand contact the line relay LR completes a circuit through the upper winding of the plunger magnet PM (the portion of this circuit extending through the master switch is not shown). The plunger SP is actuated by means of the upper winding of the plunger magnet to complete a circuit from the line L over the switches controlled by the plunger magnet to the selector switches (not shown). The plunger magnet, upon being energized, disconnects the line relay LR and special relay SR from the line. Both relays are now deenergized so that the circuit of the relay 12 is maintained open. The actuation of the plunger switch completes a circuit from battery, through the lower winding of the plunger magnet and over the inner right-hand contact of the plunger switch (the complete circuit not being shown). The lower winding of the plunger magnet remains energized during the entire connection to hold the plunger in actuated position. The upper operating winding of the plunger magnet is deenergized as soon as the armature of the line relay falls off.

The line circuit L, having been extended over the contacts of the Keith line switch under the control of the plunger SP to the tip and ring conductors extending to the selector (not shown), the subscriber may manipulate the dial 19 in a well known manner, thereby transmitting impulses over the line to the switching machinery and establishing the desired connection. At the conclusion of the conversation, the subscriber at the station A hangs up his receiver. This causes a release of the switching machinery in a well known manner. As soon as the switching machinery is released the ground applied through such machinery to the conductor marked "Release" at the station B is removed therefrom, thereby opening the holding circuit extending over the inner right-hand contact of the plunger switch to the holding winding of the plunger magnet PM. The plunger magnet is now deenergized, releasing the plunger SP which disconnects the line from the switching apparatus. The plunger magnet, upon deenergizing, also connects the line relay LR and special relay SR to the line over the circuit previously traced. Relay 17 is deenergized when the receiver is hung up so that the loud speaking receiver and associated equipment is again connected to the line. The line relay LR remains deenergized because of the high impedance of the

polar relay PR. The special relay SR is energized, however, and again completes a circuit of the relay 12 so that the line may be again connected to the program receiving equipment and placed in condition for receiving the distributed information as before.

If the subscriber desires to terminate the reception of distributed information he merely restores the key K to normal, thereby opening the circuit through the line relay LR, special relay SR and polar relay PR. The loud speaking receiver and associated equipment is now disconnected from the line at the contacts of the key K. The deenergization of the special relay SR results in opening the circuit of the relay 12, which thereupon disconnects the line L from the program equipment at station D and connects the line to the switching terminals.

If, while the line is not being used either for ordinary telephone purposes or for program receiving a connection should be initiated through the switching machinery (not shown) for the line L, no busy ground would appear at the sleeve conductor of the connector bank and consequently the connector would make connection with the line terminals and complete a circuit over the sleeve conductor and the lower back contact of the relay 12 through the holding winding of the plunger magnet PM. The plunger SP would not be operated but the plunger magnet would be energized sufficiently to disconnect the line relay LR and special relay SR from the line L, thereby preventing any possibility of the relay 12 being operated to disconnect the line from the connector bank. The battery current supplied over the line through the connector will flow in the opposite direction from that supplied from the line relay LR and special relay SR and therefore, if the subscriber should inadvertently or otherwise operate the key K after such a connection has been established and before the receiver is removed from the switchhook, the polar relay PR would be energized in such a direction as to operate the relay 16, thereby disconnecting the loud speaking receiver 11 from the line. If the subscriber, upon receiving a ringing signal from the connector switch, removes his receiver from the switchhook, the relay 17 will be operated, thereby in turn completing the circuit of the relay 18 and disconnecting both the polar relay PR and the loud speaker 11 from the line.

It will be obvious that the general principles herein disclosed may be embodied in many other organizations widely different from those illustrated without departing from the spirit of the invention as defined in the appended claims.

What is claimed is:

1. In a telephone system, a subscriber's

line terminating at one end at a subscriber's station and at the other end in a central office, a telephone set at said subscriber's station, switching means at the central office whereby said telephone line may be interconnected with other telephone lines for ordinary telephonic intercommunication, a program transmitting station normally disconnected from said telephone line, a program receiving equipment at the subscriber's station, means for connecting said program station over said telephone line to said program receiving equipment at will when the line is not being used for ordinary telephonic intercommunication, and means operating automatically when said telephone set is used for ordinary telephone purposes at a time when the program connection is established for disconnecting said line from said program station and connecting it to said switching means.

2. In a telephone system, a subscriber's line terminating at one end at a subscriber's station and at the other end in a central office, a telephone set at said subscriber's station, switching means at the central office whereby said telephone line may be interconnected with other telephone lines for ordinary telephonic intercommunication, a program transmitting station normally disconnected from said telephone line, a program receiving equipment at the subscriber's station, means for connecting said program station over said telephone line to said program receiving equipment at will when the line is not being used for ordinary telephonic intercommunication, and means responsive to an incoming call from said substation at a time when the program is established for automatically disconnecting said line from said program station and connecting it to said switching means.

3. In a telephone system, a telephone line terminating at a subscriber's station at one end and in a central office at the other end, a telephone set at said subscriber's station, switching means at said central office for interconnecting said line with other lines for ordinary telephonic intercommunication, a program transmitting station normally disconnected from said line, special receiving equipment at the subscriber's station for receiving program transmission, and means to associate said equipment with the line and to connect said program station to the line at the will of the subscriber.

4. In a telephone system, a telephone line terminating at a subscriber's station at one end and in a central office at the other end, a telephone set at said subscriber's station, switching means at said central office for interconnecting said line with other lines for ordinary telephonic intercommunication, a program transmitting station normally disconnected from said line, special receiving

equipment at the subscriber's station for receiving program transmission, means to associate said equipment with the line and to connect said program transmitting station to the line at the will of the subscriber, and means operating when said telephone set is used for ordinary telephonic purposes to disconnect said special receiving equipment and said program station from the line.

5. In a telephone system, a telephone line terminating at a subscriber's station at one end and in a central office at the other end, a telephone set at said subscriber's station, switching means at said central office for interconnecting said line with other lines for ordinary telephonic intercommunication, a program transmitting station normally disconnected from said line, special receiving equipment at the subscriber's station for receiving program transmission, means to associate said equipment with the line and to connect said program station to the line at the will of the subscriber, and means responsive to an incoming call from said substation for disconnecting said special receiving equipment and said program station from the line.

6. In a telephone system, a telephone line terminating at a subscriber's station at one end and in a central office at the other end, a telephone set at said subscriber's station, switching means at said central office for interconnecting said line with other lines for ordinary telephonic intercommunication, a program transmitting station normally disconnected from said line, special receiving equipment at the subscriber's station for receiving program transmission, means to associate said equipment with the line and to connect said program station to the line at the will of the subscriber, and means responsive to the connection of another line to said switching means to disconnect said special receiving equipment and said program station from the line and to connect the line to said switching means.

7. In a telephone system, a telephone line terminating at a subscriber's station at one end and in a central office at the other end, a telephone set at said subscriber's station, switching means at said central office for interconnecting said line with other lines for ordinary telephonic intercommunication, a program transmitting station normally disconnected from said line, special receiving equipment at the subscriber's station for receiving program transmission, means to associate said equipment with the line and to connect said program station to the line at the will of the subscriber, and means associated with said switching means for indicating when the line is being used for program reception.

8. In a telephone system, a plurality of telephone lines terminating at one end in a

central office, switching means at said central office whereby any one of said lines may be connected with another line for ordinary telephonic interconnection, a program transmitting station common to a plurality of said lines but normally disconnected therefrom, means whereby said program station may be connected with a plurality of said lines when they are not being used for ordinary telephonic intercommunication, special program receiving equipment for each line in addition to the subscriber's set, and means to connect said equipment to the line at will.

9. In a telephone system, a plurality of telephone lines adapted to be interconnected for telephone purposes, a program transmitting station common to a plurality of said lines and normally disconnected therefrom, means for connecting said program station with a plurality of said lines when they are not interconnected for telephone purposes, special program receiving equipment for each line in addition to the subscriber's set, and means to connect said equipment to the line at will.

10. In a telephone system, a subscriber's line terminating at one end at a subscriber's

station and at the other end in a central office, a telephone set at said subscriber's station, switching means at the central office whereby said telephone line may be interconnected with other telephone lines for ordinary telephonic intercommunication, a program transmitting station normally disconnected from said telephone line, means for connecting said program station with said telephone line at will when the line is not being used for ordinary telephonic intercommunication and means to give an indication at the central office when program transmission is being received.

11. In a program transmitting system, a subscriber's telephone line having a subscriber's telephone set at the subscriber's station and a program receiving circuit adapted to be bridged across said line at the subscriber's station, said receiving circuit including a receiver for program currents, and means in said circuit to prevent ringing current from actuating said receiver.

In testimony whereof, we have signed our names to this specification this 10th day of November, 1922.

JOHN F. TOOMEY.
HENRY E. PHELPS.