

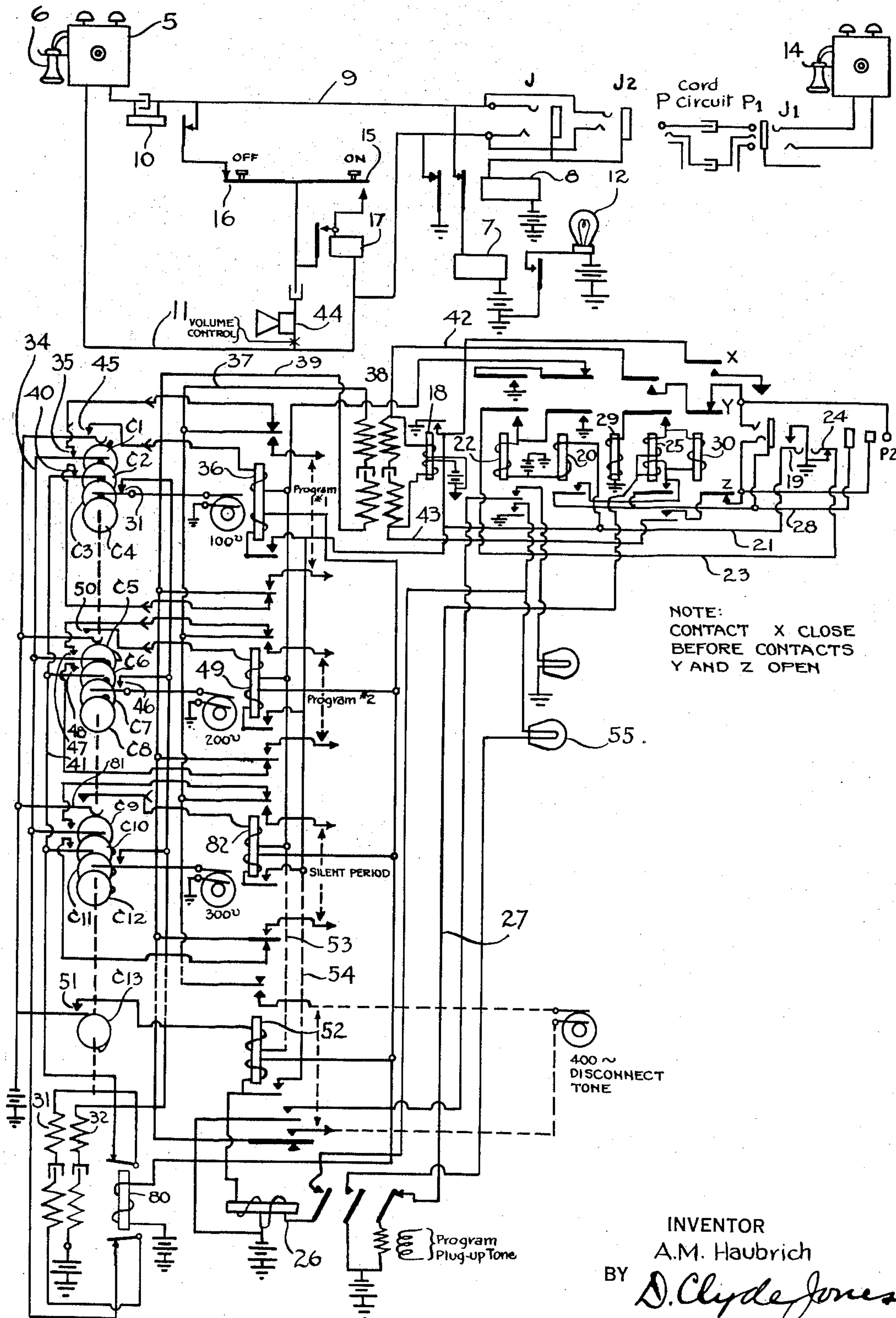
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SIGNALING SYSTEM

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SIGNALING SYSTEM

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This invention relates to a signaling system and more particularly to an arrangement for supplying programs over telephone lines.

In the past it has been proposed to supply entertainment programs to telephone subscribers either over the conductors of the subscriber's telephone line or over a separate pair of conductors leading to the subscriber's substation. In certain of these systems, the subscriber has no choice of programs but must rely on the single program supplied at the central program source. In another form of program system, the subscriber is provided with an impulse sender such as is normally employed in automatic telephone systems and by suitably manipulating the impulse sender, he may select any one of a number of programs. In still a different arrangement a third conductor in addition to the pair of normal telephone conductors is provided and by a predetermined interconnection of these conductors through the use of keys, a choice of several programs may be made.

All of these different program systems, however, have been open to certain disadvantages. The single program system is unsatisfactory because subscribers demand a change of programs. The use of an impulse sender, in addition to the initial expense, has a certain maintenance cost, and to many people the manipulation of an impulse sender is an undesirable operation. The use of the three conductor system is undesirable because commercial telephone lines are provided with a pair of conductors and the addition of a third conductor introduces an undesirable condition. Furthermore, in such an arrangement, the number of programs is greatly restricted.

In accordance with the present invention, a novel program service system is provided in which the standard pair of conductors to the telephone station is sufficient for delivering a wide choice of programs to the substation and for the control of the selection of desired programs. Furthermore, the present system does not require an impulse sender at the substation and provides a simple procedure for the selection or rejection of programs. The main feature of the present invention resides in the provision of means at a central program source whereby portions of different programs are reproduced at the subscriber's substation through the telephone line and the subscriber when he hears a desired program may stop the operation of the program selecting operation so that the desired program may be reproduced at the subscriber's station as long as he cares to listen to it. A further feature of the invention resides in the provision of means whereby anyone of a large number of programs may be selected and reproduced at the subscriber's substation over his telephone line and whereby his telephone line may be called

without in any way disturbing the program selecting mechanism so that when the operator disestablishes the telephone connection from the subscriber's line, the program source may be immediately reproduced over the subscriber's line.

It is believed that the invention will best be understood by describing the operation of completing telephone connections and by describing the method of selecting and disconnecting a desired program source from a calling subscriber's line.

First let it be assumed that the subscriber at substation 5 initiates a call by removing the receiver 6 from its switch-hook. This completes a circuit from grounded battery, winding of the line relay 7, back contact and armature of cut-off relay 8, conductor 9 of the calling line, winding of the low wound relay 10 at the substation, through the contacts of the substation circuit now closed, conductor 11, back contact and armature of the cut-off relay 8 to ground. The low wound relay 10 is energized in this circuit and at its armature and contact disconnects the program selection controlling equipment at the substation from the subscriber's line, thereby rendering it ineffective at this time. The line relay 7 is also energized at this time and at its front contact and armature closes a lighting circuit from the line lamp 12.

The operator at the telephone exchange on noting the lighting of this lamp inserts the answering plug P of one of the cord circuits at her position into the jack J. This operation energizes the cut-off relay 8 from ground, its winding, sleeve contacts of jack J, and plug P, and thence to the grounded battery (not shown). The cut-off relay, when energized, opens the circuit of the line relay 7 which in turn extinguishes the line lamp 12. The operator's telephone set (not shown) is then manually or automatically connected to the cord circuit now extended to the calling line so that the operator can ascertain from the calling subscriber the designation of the wanted line. It is assumed that the wanted subscriber may be reached through the line terminating at substation 14. The operator thereupon inserts the calling plug P' of the cord circuit taken for use into the jack J' and thereafter applies ringing current through means not shown to signal the subscriber at substation 14. At the conclusion of the conversation, supervisory lamps (not shown) are lighted to indicate to the operator that the connection is to be terminated, and she thereupon removes the plugs P and P' from the jacks J and J', respectively. It will be understood that the showing of the cord circuit has been very much abbreviated for it will be appreciated that anyone of several standard cord circuits may be employed to ex-

tend telephone connections between the lines of the several subscribers of a telephone system.

If the subscriber at substation 5 desires to receive some one of the programs from the central plant, he removes his receiver from its switch-hook.

This energizes the line relay 7 from grounded battery, winding of relay 7, inner armature and contact of the cut-off relay 8, line conductor 9, back contact and armature of relay 10, hook switch contacts at substation 5 (now closed) telephone line conductor 11, back contact and armature of the cut-off relay 8 to ground. With the line relay 7 energized, the line lamp 12 is lighted as previously described. The operator then inserts the answering plug P of the cord circuit C into the jack J of the calling line and by means of her telephone set ascertains from the calling subscriber that the subscriber desires connection to the central program course. The operator then inserts plug P2 of the program source into one of the multiple jacks such as J2 and the answering plug P of the cord circuit C is removed from the jack J. It has been assumed that a plurality of program sources are provided at the central source and in order to assist the subscriber in selecting a pleasing program, the designation, such as distinctive tone frequencies or call letters for the several programs, as well as excerpts of the programs, are reproduced in succession until the subscriber hears a program to which he desires to listen.

The circuit arrangement by which these results are obtained will now be described by setting forth the operation of the various elements of the system in their proper sequence. With the plug P2 in the jack J2, the operator depresses the trunk key 19. This results in the operation of the relay 20 from grounded battery, winding of this relay, conductor 21, key contacts 19 to ground. On the operation of the relay 20, the relay 22 is energized from grounded battery, upper armature and front contact of relay 20 to ground. Relay 22, when operated, locks itself in this condition in a circuit from grounded battery, its winding, front contact and armature, conductor 23, key contacts 24 to ground. Also with the relay 20 operated, the relay 25 is energized from grounded battery, secondary winding of the transformer, outermost armature and back contact of relay 26, conductor 27, lower winding of relay 25, lower front contact and armature of relay 20, conductor 28, sleeve contacts of the plug P2 and jack J2, winding of the cut-off relay 8 to ground. Relay 8 is thus operated and disconnects the line relay 7 from control over conductors 9 and 11 of the subscriber's line. The relay 25 is also locked energized from grounded battery, primary winding of the transformer, armature and back contact of relay 26, conductor 27, lower winding, front contact and armature of relay 25, conductor 28 and thence through the sleeve contacts of plug P2 and jack J2, winding of relay 8 to ground. It will be noted that the upper winding of the relay 25 is included in a locking circuit from ground, winding of the resistor 29, upper, inner armature, front contact and upper winding of relay 25 to grounded battery, over conductor 27 as previously described. The winding of relay 30 is connected in multiple with both windings of the relay 25, but it is not energized at this time since it is included in the neutral branch of a Wheatstone bridge, the purpose of which will be further

set forth in describing the completion of a telephone connection to the subscriber's substation 5 during a period when a program is connected thereto. It will be noted that the operation of the relay 25 closes break points in the upper and lower sides of the program conductor so that programs and their designation may be transmitted in succession to the calling subscriber's line until such time as the subscriber thereon selects a desired program.

At the central source of programs, there is provided a program timer in the form of a constantly rotating interrupter provided with cams by which circuits are completed in proper sequence to apply a program designation and excerpts of programs from the selected program source. For purposes of this description, it may be assumed that the program timer is in the position shown in the drawings at the time when the program plug is connected to the subscriber's line, that is, the cams C1, C2, C3, C4, etc. are in the position to close their contacts. C4 closes the contacts 31 at this time to connect a signaling device, such as the 100-cycle tone frequency generator, to apply the designation of program No. 1 to the primary winding 32 of the repeating coil. This designation is then introduced into the secondary winding 33 of the transformer and the designation is then transmitted over conductor 34, contacts 35, now closed by cam C2, back contact and armature of relay 36, conductor 37, primary windings of the repeating coil 38, conductor 39, lowermost armature and back contact of relay 36, contacts 40 now closed at cam C3, conductor 41, back contact and armature of relay 80, to the secondary winding 33 of the repeating coil. From the primary winding of the repeating coil 38, a program designation is introduced into the secondary winding of this repeating coil and thence over the program trunk conductors 42 and 43, armatures and front contacts of relay 25, armatures and back contacts of relay 30, tip and ring contacts of the plug P2 and jack J2, line conductors 9 and 11, back contact and armature of relay 10 to the winding of the loud speaker 44. Following the program designation the cams C2 and C3 advance until the contacts 35 and 40 are opened to disconnect this program designation and thereafter the cam C1 is advanced to the point where its contacts 45 are closed, thereby completing circuit from grounded battery, contacts 45, upper winding of the relay 36, back contact and armature of relay 20, front contact and armature of relay 22 to ground. The cam cutting on the cam C1 is such that the contacts 45 remain closed for a period of several seconds duration so that the relay 36 is maintained operated and through its front contacts and armatures applies an excerpt of the program #1 over conductors 37 and 39 to the primary winding of the repeating coil 38 from which point it is transmitted over conductors 42 and 43 to the loud speaker 44, as previously described.

If the subscriber elects to select the #1 program, he depresses the "on" key 15 at the substation which energizes the relay 18 of the trunk from grounded battery, lower winding of this relay, conductor 43, lower armature and front contact of relay 25, lower armature and back contact of relay 30, ring contacts of the plug P2 and the jack J2, line conductor 11, winding of the relay 17, key contacts 15, normally-closed contacts 16 of the "off" key, armature and back contact of relay 10, line conductor 9, tip contacts of the jack J2 and the plug, P2, back contact and

armature of relay 30, uppermost front contact and armature of relay 25, conductor 42, upper winding of relay 18 to ground. The relays 18 and 17 are energized over this circuit and the relay 17 at its front contact and armature closes a locking circuit for itself independent of the key contacts 15. As soon as the relay 18 operates, the relay 36 which is initially energized through the cam contacts 45, is locked operated in a circuit traceable from grounded battery, winding of relay 80, lower winding of this relay, its lower inner armature and front contact, front contact and armature of relay 18 to ground. In this manner the #1 program is connected to the program trunk through the front contacts and armatures of relay 36 until such time as the subscriber at substation 5 elects to discontinue receiving a program.

In the event that the subscriber, after hearing the excerpt of program No. 1 for several seconds determined by the cam cutting of cam C1, decides that he does not care to listen to an extended program from this source, then he does not depress the "on" key 15 at this time. Consequently the program timer continues to rotate until such time as the cams C5, C6, C7 and C8 close their respective contacts. The closing of the contacts 46 of cam C8 renders effective the program designation device here represented as a 200-cycle generator to connect an audible designation corresponding to the #2 program to the primary winding 32 of the repeating coil. At this same time, the cams C6 and C7 close their contacts 47 and 48 so that the winding 33 of the repeating coil is connected to the conductors 34 and 41, which conductors are connected through the cam contacts 47 and 48 and through the armatures and back contacts of relay 49 to the conductors 37 and 39 leading to the winding of the repeating coil 38 in the program trunk. After the designation of this program is transmitted to the subscriber at substation 5, the cam C5 closes its contacts 50 to energize the relay 49 in a circuit completed from grounded battery, cam contacts 50, upper winding of relay 49, back contact and armature of relay 20, front contact and armature of relay 22 to ground. Thus an excerpt from the program of predetermined duration is transmitted to the subscriber at substation 5 and after hearing this excerpt of the program, if the subscriber desires to listen to it, the "on" key 15 is depressed to close its contacts which results in the energization of the relay 18 of the program trunk in the manner already described. The energization of the relay 18 results in closing a locking circuit for the relay 49 through the front contacts and armatures of which the #2 program is applied to the program trunk.

If, however, the #2 program is undesirable, the program timing device continues to rotate bringing other sets of program cams (not shown) into a position to close their respective contacts. This results in the transmission to the subscriber of other program designations and in the transmission over the program trunk of excerpts of other programs which may be selected by depressing the "on" key 15, all of which takes place in the manner similar to that already described in connection with the programs Nos. 1 and 2.

In this disclosure but two program sources have been indicated, however, it will be understood that a large number of program sources may be provided, the number of which theoretically is unlimited.

If the subscriber desires to discontinue the re-

ception of the program temporarily, he depresses the "off" button 16 which results in the deenergization of the relay 17 at substation 5 and in the deenergization of the relay 18 associated with the trunk. It will be remembered that if the subscriber has been listening to program #1, the relay 36 is locked operated at the front contact and armature of relay 18 so that when the last-mentioned relay deenergizes, the relay 36 also releases. Thereafter, the cam contacts of the program timing device are effective in proper sequence and the subscriber hears excerpts of the program #2, etc., until the cams C9, C10, C11, and C12, individual to a quiet period close contact 81, which results in the energization of relay 82 over a circuit including conductor 53, back contact and armature of relay 20, front contact and armature of relay 22 to ground. When the subscriber notes the silent period immediately following the 300-cycle frequency or silent period tone designation, he depresses the "on" key 15 and this in turn effects the energization of the relays 17 and 18, and the relay 17 locks itself operated in a circuit independent of the key 15 so that both relays 17 and 18 are maintained operated as long as the subscriber cares to maintain the silent period. The operation of the relay 18 locks the relay 82, associated with the silent period, energized in the circuit traceable from ground, armature and front contact of relay 18, conductor 54, lower front contact, armature and winding of relay 82, winding of relay 80 to grounded battery. The subscriber may maintain this connection in the silent period originally characterized by the tone of 300-cycle frequency and at the conclusion of the desired quiet interval, the subscriber may select any program that he desires in the manner already described.

When the subscriber intends to disconnect the program sources for a relatively long period, he waits for the disconnect period designated by the 400-cycle tone and then depresses the "on" key 15, followed immediately by the depression of the "off" key 16. The relays 17 and 18 operate as before and relay 52 is operated over conductor 53, back contact and armature of relay 20, front contact and armature of relay 22 to ground. Relay 52 locks itself in operated condition from grounded battery, its lower winding, inner armature and front contact, conductor 54 to ground, at the front contact and armature of relay 18. Relay 26 is then operated from grounded battery, its left hand winding, lower armature and front contact of relay 52, conductor 54, front contact and armature of relay 18 to ground. Relay 26, when operated, closes a locking circuit for itself from grounded battery, its right hand winding, innermost armature and front contact, front contact and armature of relay 22 to ground. Relay 25 releases because its holding circuit is interrupted at the outermost armature and back contact of relay 26. Relay 25 on releasing, opens break points in the program trunk so that no program is transmitted to the subscriber's substation. Relay 22 remains operated over a circuit completed at contacts of key 24 and relay 26 remains operated under the control of relay 22, but the other relays of the program system are inactive. With the relay 26 energized, the disconnect lamp 55 is lighted from grounded battery, middle armature and front contact of relay 26, lamp 55, lowermost front contact and armature of relay 22. The trunk operator then opens the key contacts 24 which results in the release

of relays 22 and 26 and the extinguishing of the disconnect lamp 55 and then removes the plug P2 from the jack J2.

When the subscriber at substation 5 desires to initiate a telephone call at the time when the program trunk is connected to his line, he proceeds to effect the operation which has been described of disconnecting his line from the program source by depressing the "on" key, followed immediately by depressing the "off" key 16, resulting in the lighting of disconnect lamp 55, and the operator proceeds as already outlined to remove the plug P2 from the jack J2. However, it is unnecessary for the subscriber to wait until the program trunk plug P2 is removed from the subscriber's jack J2, since cut-off relay 8, of the subscriber's line, as well as the relay 25 of the program trunk are both deenergized as a result of the energization of the relay 26 as above described. When the cut-off relay 8 restores its armature, the line relay 7 is reconnected to the subscriber's line and when the relay 25 deenergizes, it opens a break-point in the program trunk so that programs are not supplied to the contacts of the plug P2. When the subscriber at substation 5 removes his receiver from the switch-hook, the low resistance relay 10 is energized to disconnect the program selecting equipment including the keys 15 and 16 from control as long as the subscriber's receiver is removed from the switch hook. The line relay 7 of the subscriber's line is energized in series with the relay 10 and effects the lighting of the line lamp 12, after which the operator may complete the telephone connection through one of the ordinary cord circuits.

If the subscriber at substation 5 is called at a time when the program trunk is connected to his line, then, it will be remembered that relays 18, 22, 20 and 25 are operated. At this time, a distinctive tone herein referred to as a program plug tone, is applied to the sleeve of the jacks, such as jack J2, individual to the subscriber's line terminating at substation 5. This tone is applied from grounded battery, secondary winding of the tone induction coil, outer armature and back contact of relay 26, conductor 27, lower winding of relay 25, its contact and armature, conductor 28, sleeve contacts of the plug P2 and jack J2. The operator on testing the called line terminating at substation 5 will hear this distinctive tone and will be informed thereby that the subscriber at substation 5 is receiving programs from the program source, that is, the line is not engaged in a telephone conversation. Under this condition, the operator inserts the plug P' of a cord circuit already connected to the calling line into the jack, such as J, of the called line. This operation is effective automatically to disconnect the program sources from the called subscriber's line, although the plug P2 may be left in engagement with jack J2.

This is due to the fact that the relay 30 connected in multiple with the windings of the relay 25, is normally inactive since it is in the neutral branch of a balanced Wheatstone bridge, except when a conversational cord circuit is connected to the subscriber's line to which the program trunk is already connected. One pair of arms of this bridge include the resistor 29 and the resistance of the upper winding of the relay 25, which are included in a circuit from grounded battery, secondary winding of the transformer connected to the "plug-up" tone, armature and back contact of relay 26, conductor 27, upper winding of the relay 25, its front contact and upper armature, re-

sistor 29, to ground. The other pair of resistance arms of this bridge, which is completed at the time when only the program cord is connected to the subscriber's line, are the resistance of the lower winding of the relay 25 and the resistance of the cut-off relay 8 of the subscriber's line. The circuit for these arms of this bridge is traceable from grounded battery, secondary winding of the transformer, armature and back contact of relay 26, conductor 27, lower winding of relay 25, its front contact and armature, sleeve contacts of the plug P2 and the jack J, winding of the cut-off relay 8, to grounded battery. Thus when only the program trunk is connected to the subscriber's line, the Wheatstone bridge is balanced and the relay 30 which is connected across its neutral points is not operated so that the break points in the program trunk are not opened. When, however, a plug, such as P, of a conversational cord circuit is inserted in one of the multiple jacks, such as J2, of the subscriber's line at the same time that the program trunk is connected thereto, the resistance in the sleeve circuit of the answering end of this cord circuit unbalances the bridge and causes the relay 30 to operate thereby opening break points in the program trunk for the purpose of disconnecting the selected program from the subscriber's line and for preventing the common program equipment from interfering with the normal operation of the conversational cord circuit.

In accordance with one method of operating the system, the telephone operator may be instructed not to remove the plug P2 of the program trunk from connection with the subscriber's line either when the line is calling or when it is being called. Under such conditions, it is necessary to maintain the operated program locking relay, such as 36 or 49, in operated condition, so that as soon as the conversational cord circuit is removed from engagement with the subscriber's line, the break points in the program trunk will be closed and the program will then be transmitted to the subscriber's line. This is effected by holding the program locking relay such as 36 actuated in a circuit from grounded battery, lower winding, armature and front contact of this relay, uppermost armature and front contact of relay 30 to ground. Thus while the relay 30 is operated, the program locking relay 36 is held operated at the front contact of relay 30. When, however, the conversational cord circuit is disconnected from the subscriber's line and the balance of the Wheatstone bridge is restored, the relay 30 then deenergizes and the relay 36 is then held operated as usual at the upper front contact and armature of relay 18. To insure proper operation of the system, the uppermost armature and front contact of the relay 30 (designated X) should be so adjusted that it is closed before the other armatures and back contacts of this relay (designated Y and Z, respectively) are opened to interrupt the program trunk.

What I claim is:

1. In a program service system, subscribers' lines, a central station including a plurality of program sources, means for connecting said central station to a subscriber's line, means automatically responsive to the completion of said connection for transmitting excerpts of predetermined length of said programs in succession over said subscriber's line, and means under subscriber's control for connecting a desired program to said subscriber's line.

2. In a program service system, a central sta-

tion including a plurality of program sources, a loud speaker at a remote point, conductors connecting said loud speaker with said central station, a timing device, means controlled by said timing device for transmitting excerpts of each of said programs in succession and the designation of said programs over said conductors, and means controlled from said remote point for transmitting a selected program over said conductors during a period terminable from said remote point.

3. In a combined telephone and program service system, a plurality of telephone lines, means for interconnecting said lines, a central station including a plurality of program sources, means for connecting said central station to a telephone line, a timing device, means controlled by said timing device for transmitting excerpts of each of said programs in succession over said telephone line, means under subscriber's control for connecting a desired program to said telephone line, and means responsive to the interconnection of a telephone line to said first-mentioned telephone for disconnecting said selected program source from said subscriber's telephone line.

4. In a combined telephone and program service system, a plurality of telephone lines, means for interconnecting said lines, a central station including a plurality of program sources, means for connecting said central station to any telephone line, a timing device, means controlled by said timing device over said connected telephone line for transmitting excerpts of said programs in succession over said telephone line, means under subscriber's control for connecting a desired program to said telephone line, means automatically responsive to the connection of a second calling telephone line to said first telephone line for disconnecting the selected program source therefrom, and means automatically responsive to the disestablishment of said connection for automatically reconnecting the selected program source to said first telephone line.

5. In a combined telephone and program service system, a plurality of telephone lines, means for interconnecting said telephone lines, a central station including a plurality of program sources, operator-controlled means for connecting said central station to a telephone line, means for transmitting a distinguishing portion of each of said programs in succession over said telephone line, means under subscriber's control for selecting and connecting a desired program to said telephone line, and means controlled over said telephone line for giving a disconnect indication to said operator whereby said central station may be disconnected from said telephone line.

6. In a combined telephone and program service system, a plurality of telephone lines, means for interconnecting said telephone lines, a central station including a plurality of program sources, means for connecting said central station to a telephone line, a timing device at said central station, means cooperating with said timing device for transmitting during a series of intervals of predetermined length a distinguishing portion of each of said programs in succession over said telephone line, and means controlled over said telephone line for connecting a desired program thereto.

7. In a combined telephone and program service system, a plurality of telephone lines, means for interconnecting said telephone lines, a central station including a plurality of program sources, means for connecting said central station to a

subscriber's line, means including a telephone line for informing an operator to connect said central station to said telephone line, means controlled over said telephone line for transmitting a distinguishing portion of each of said programs in succession over said telephone line, a single program selecting key associated with said telephone line, and means responsive to a single operation of said key for selecting any one of said programs.

8. In a combined telephone and program service system, a plurality of telephone lines, means for interconnecting said telephone lines, a central station including a plurality of program sources, operator-controlled means for connecting said central station to a telephone line, means responsive to an operator-control connection for transmitting distinguishing portions of said programs in succession over said telephone line, and means controlled over said telephone line for disabling said connecting means without disestablishing said connection between said telephone line and said central station.

9. In a combined telephone and program service system, a plurality of telephone lines, means for interconnecting said telephone lines, a central station including a plurality of program sources, means for connecting said central station to a telephone line, means at said central station including a timing device comprising a set of cam-actuated contacts for each program, said sets of cams being arranged to close their related contacts in succession, means cooperating with said timing device for transmitting a distinguishing portion of said programs in succession over said telephone line, and means controlled over said telephone line for connecting a desired program to said telephone line.

10. In a combined telephone and program service system, a plurality of telephone lines, means for interconnecting said telephone lines, a central station including a plurality of program sources, a timing device at said central station including sets of cam-actuated contacts for each program, said sets of cams being actuated to close their related contacts in succession, each set of cams including at least three cams to actuate their related contacts in succession, means cooperating with said timing device for transmitting, during predetermined intervals, distinguishing portions of said programs in succession over said telephone line, and means controlled over said telephone line for connecting a desired program thereto.

11. In a combined telephone and program service system, a plurality of telephone lines, means for interconnecting said telephone lines, a central station including a plurality of program sources, a timing device at said central station including sets of cam-actuated contacts for each program, said sets of cams being actuated in accordance with a predetermined time cycle to close their related contacts in succession, each set or cams including at least three cams to actuate their related contacts in succession, means cooperating with said timing device and controlled over said telephone line for transmitting distinguishing portions of said programs in succession over said telephone line, a switch associated with said subscriber's line, and means controlled by said switch over said telephone line for connecting a desired program thereto.