

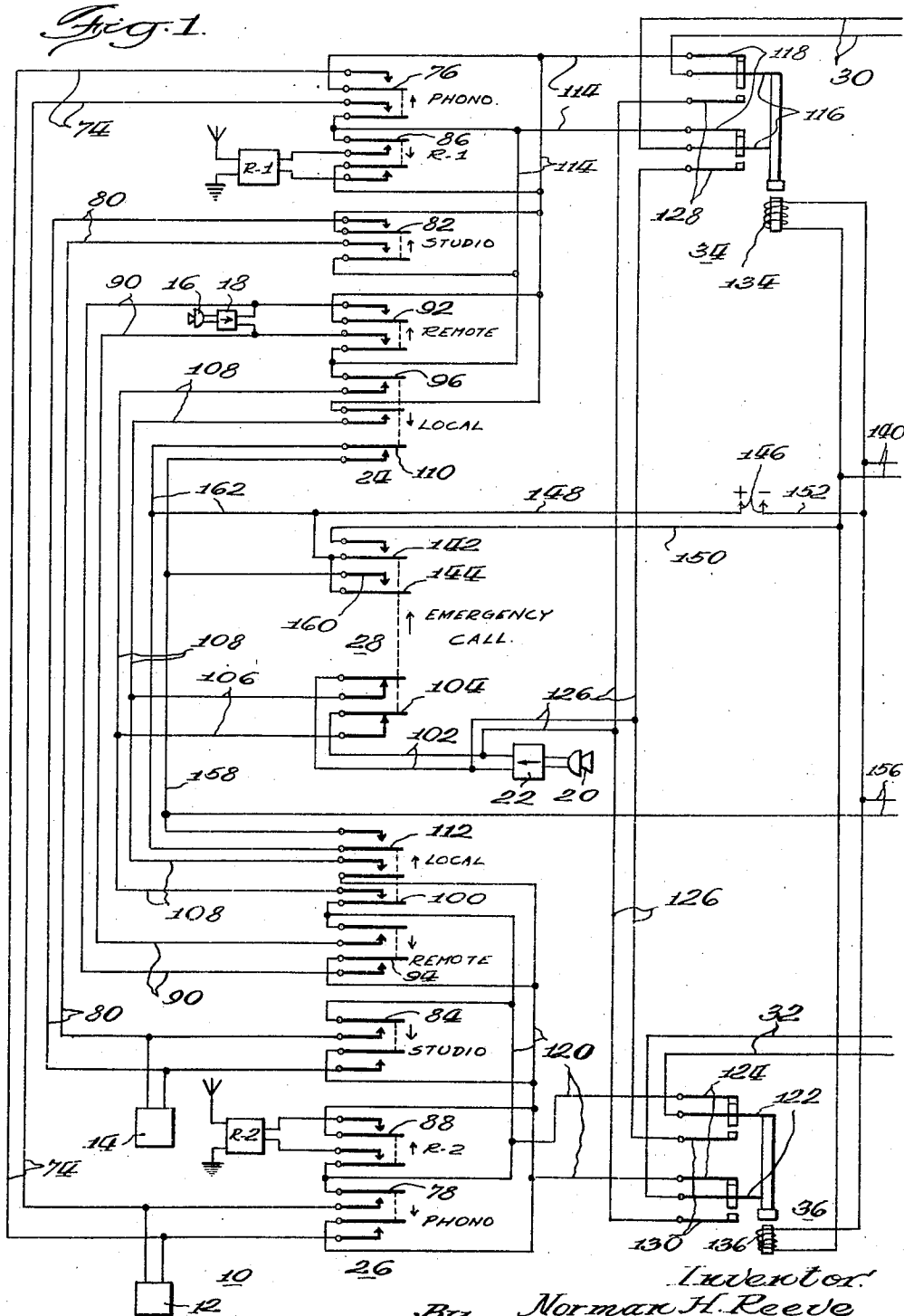
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N. H. REEVE
COMMUNICATION SYSTEM

2,324,877

Filed June 7, 1941

2 Sheets-Sheet 1



Inventor
By Norman H. Reeve
William, Bradley & Hinkle Attys.

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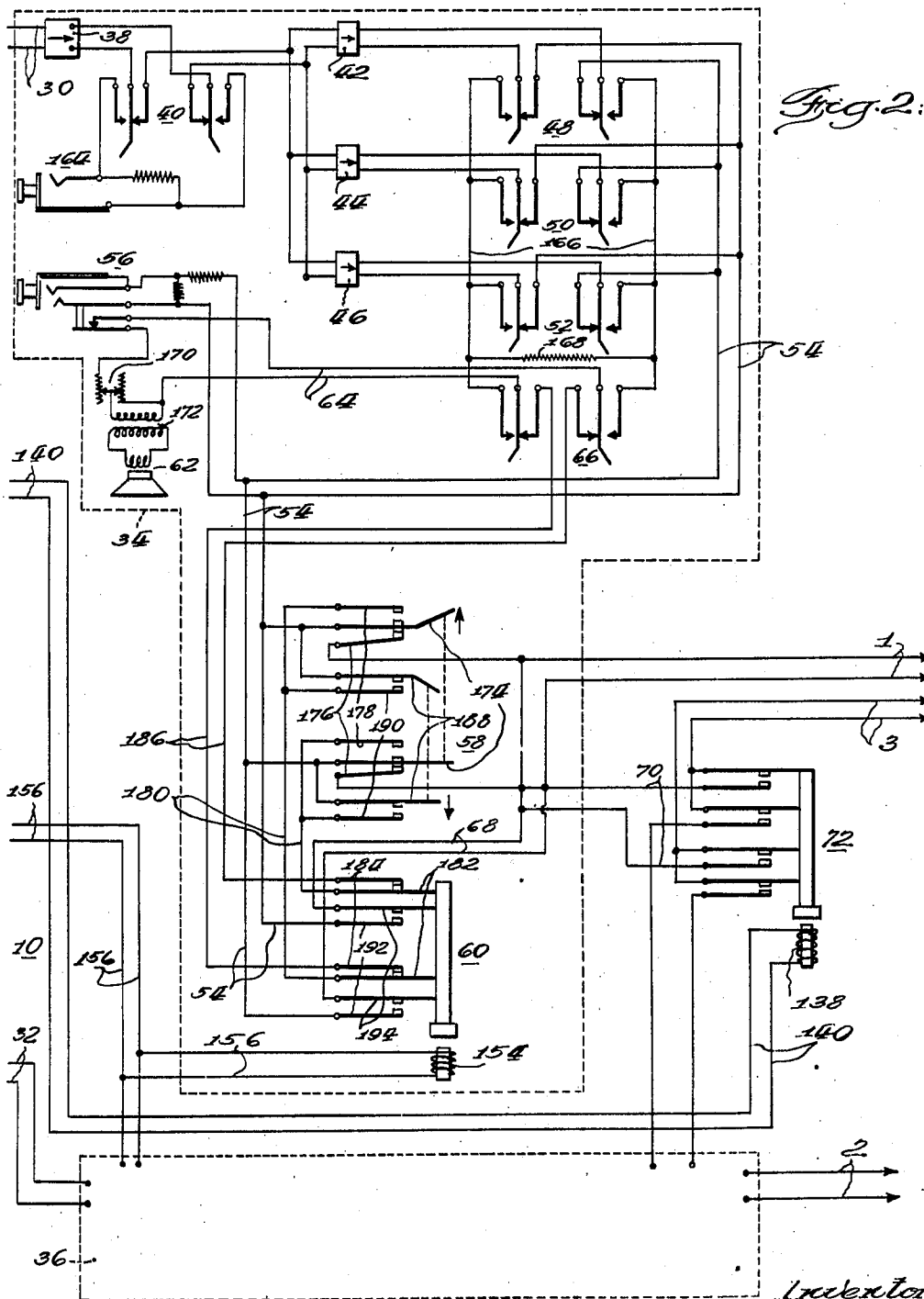
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By *Norman H. Reeve*
Williams, Bradbury & Hinkle, Attys.

UNITED STATES PATENT OFFICE

2,324,877

COMMUNICATION SYSTEM

Norman H. Reeve, Racine, Wis., assignor to Webster Electric Company, Racine, Wis., a corporation of Delaware

Application June 7, 1941, Serial No. 397,117.

22 Claims. (Cl. 179—2)

The present invention relates to communication systems and more particularly to a new and improved system of program distribution from a central station to a plurality of outlying stations, combined with means for paging the outlying points from the central station.

One of the objects of the present invention resides in the provision of a new and improved system of program distribution.

A further object of the invention is the provision of a new and improved system of program distribution and monitoring, and likewise in the provision of an arrangement whereby the monitor speaker is utilizable to test the operation of various amplifiers included in the system.

A further object of the present invention resides in the provision of a new and improved arrangement for automatically cutting out the monitor speaker when announcements are being made locally, thereby to prevent feed-back.

A further object of the present invention resides in the provision of a new and improved arrangement for calling all the outlying stations, which stations may be connected to either of two program channels or "off" channel, and in which a monitor speaker is cut out to prevent feed-back when the stations are so called.

Another object of the invention is to provide a new and improved arrangement for calling a plurality of outlying stations wherein an emergency call switch is provided to take precedence over program selector switches and wherein the call is sent to all stations even though the output of the amplifiers included in the system is disconnected from the channels and connected to a monitor speaker.

Other objects and advantages of the present invention will become apparent from the ensuing description, in the course of which reference is had to the accompanying drawings in which Figures 1 and 2 are partial diagrammatic representations of one embodiment of the invention. The two figures, when laid side by side, illustrate the apparatus at the central station as a whole.

Referring now to the figures, it may be noted that the central station equipment is indicated as a whole by reference character 10. The outlying stations have not been illustrated, but each of these has three channels leading to it from the central station. Two of these channels, indicated by reference characters 1 and 2, are program channels and the third channel 3 is the previously referred to "off" channel. The outlying stations each have a loud speaker and a

selector switch for connecting the loud speaker to any of the three channels. The speaker and selector switches may be arranged as illustrated in the co-pending application of Richard H. Campbell, Serial No. 397,098, filed June 7, 1941, assigned to the assignee of this application.

Before proceeding with a detailed description of the circuit arrangement, it may be well briefly to consider the salient elements of the system. There are a plurality of program sources which may be directed to either or both of the program channels and other program sources which may be directed to but one or the other of the channels. The program sources are illustrated in Figure 1 and upon reference to this figure, it may be noted that these include a phonograph 12, radios R—1 and R—2, a radio station studio 14, and a remotely located microphone 16 connected to a pre-amplifier 18. In addition, there is provided a local microphone 20 (that is, one located at the central station) connected to a pre-amplifier 22 through which announcements may be made to stations over each or both of the channels and which is also used for calling all the stations.

The apparatus at the central station includes two banks 24 and 26 of program selector switches and an "emergency call" switch 28, preferably of the key type. The former are operable to connect the program sources to an input circuit 30 leading to channel 1, and an input circuit 32 leading to channel 2, except when the emergency call switch 28 is operated. When the latter is operated, relays 34 and 36 are effective to connect the local microphone 20 directly to both input circuits.

The input circuits 30 and 32 lead to apparatus included within the dotted lines 34 and 36, although that within the latter has not been illustrated as it is identical with that in the former which is associated with input circuit 30. The input circuit 30 leads to a driver amplifier 38, the output of which is connected directly through a driver amplifier test key 40 to the inputs of power amplifiers 42, 44, and 46, connected in parallel. The outputs of the latter are connected through test keys 48, 50, and 52 to an output bus line 54.

The output bus line leads to a monitor test jack 56, to a monitor control switch 58, and to a monitor control relay 60. The monitor speaker is indicated by the reference character 62 and it is connected through a circuit 64 to a monitor switch 66, the purpose and functioning of which will be described hereinafter.

Channel 1 is connected to the monitor control switch 58, through a branch circuit 60 to the monitor control relay, and through another branch circuit 70 to a relay 72 operable simultaneously with relays 34 and 36 to connect in parallel channels 1, 2, and 3.

Returning now to a detailed description of the circuits, and particularly to Figure 1 and the program sources, it may be noted that the phonograph 12 is connected through a circuit 74 to key switches 76 and 78 in the banks of switches 24 and 26, respectively. The studio 14 is similarly connected through circuit 80 to key switches 82 and 84. Radio R-1 is connected directly to key switch 86 in bank 24, and radio R-2 is connected to key switch 88 in bank 25. It may be seen, therefore, that the radio programs may be supplied only to the circuits to which the two banks of switches 24 and 26 are connected, namely, channels 1 and 2, respectively. The remotely located microphone 16 is connected through circuit 90 to key switches 92 and 94 in the banks of switches 24 and 26, respectively. The local microphone 20 is connected to key switches 96 and 100 in the respective banks, through a circuit including conductors 102, the normally closed key switch 104 of the emergency call switch 28, and conductors 106 and 108.

The key switches associated with all the sources except the local microphone and the emergency call switch are all identical and comprise pairs of fixed and movable blades. The switches associated with the local microphone include, in addition to the pairs of fixed and movable blades, a third fixed and movable blade defining switches 110 and 112 controlling the monitor relay 60 associated with channel 1, and a similar relay associated with channel 2 in the manner hereinafter to be described. All the switches of bank 24 are connected to a common circuit 114 connected to input circuit 30 through the movable switch blades 116 and fixed blades 118 of relay 34. In like manner, the movable blades of the switches of bank 26 are connected to a common circuit 120, connected to input circuit 32 through the movable and fixed blades 122 and 124 of relay 36.

When the emergency call switch is operated, the local microphone 20 is disconnected from its associated switches in banks 24 and 26 by switch 104, and is connected to both input circuits 30 and 32 through circuit 126, the fixed and movable switch blades 128 and 116 of relay 34, and the fixed and movable switch blades 130 and 122 of relay 36. The emergency call switch when operated is effective to energize the windings 134 and 136 of the relays 34 and 36, as well as the winding 138 of the output paralleling relay 72 which is connected in parallel with the former through a circuit 140. This energization of the relay windings is effected by movable switch blade 142 of the call switch. The windings of the monitor control relays 60 are energized at the same time through a circuit including the movable switch blade 144 of the emergency call switch.

The three first mentioned relays are connected upon operation of the emergency call switch to power lines 146 through the switch blade 142. The positive terminal of the power source is connected by conductor 148 to movable switch blade 142 and thence to one terminal of each of the relay windings to conductor 150. The other terminal of each winding is connected to

the negative terminal of the power supply by conductor 152. The windings 154 of the monitor control relays 60 are connected to the source of power upon operation of the emergency call switch through circuit 156, one conductor of which is connected directly to the negative power supply line, and the other to a conductor 158 connected to the fixed switch blade 160 associated with movable switch blades 144. The latter is connected through conductor 148 to the positive power supply line. The conductor 158 is connected also to the fixed blades associated with the movable blades 110 and 112 of the switches controlling the connection of the local microphone to the input circuits. The movable blades 110 and 112 are connected by a conductor 162 to the conductor 148 leading to the positive power supply line. It may be seen, therefore, that the monitor control relays are energized when the local microphone is used either as a program source over one or the other of the channels, or for making an emergency call to all the stations.

The amplifier test keys 40, 48, 50, and 52, and the monitor key 66 are provided for the purpose of testing the driver and power amplifiers. To test the driver amplifier 38, the test key 40 is depressed, thereby disconnecting the output of the driver amplifier from the inputs of the power amplifiers and connecting it to a driver test jack 164 adapted to receive a suitable instrument for indicating the output of the driver amplifier.

To test the power amplifiers, it is necessary to operate the monitor key 66 at the same time as the test key of the particular amplifier is operated. The amplifier test keys normally connect their respective amplifier outputs to the common output bus line 54 and, when depressed, connect the output to a test line 166 bridged by a load resistor 168. When the monitor key 66 is depressed, the test line 166 is connected to circuit 64 and thence through a volume control 170 and a transformer 172 to the monitor speaker 62. The described arrangement provides a simple and easily operable arrangement for testing the outputs of the various amplifiers.

The monitor control switch 58 normally connects the common output bus line 54 to channel 1 through the simultaneously movable switch blades 174 and the associated fixed switch blades 176. At this time, the monitor speaker is disconnected both from the channel 1 and from the common output bus line. If it is desired to connect the monitor speaker to the output bus line, the movable switch blades 174 are moved upwardly into contact with the fixed switch blades 178. When so operated, the channel 1 is disconnected from the output bus line and the latter is connected to the monitor speaker through the movable and fixed switch blades just referred to, circuit 180 leading to the monitor control relay 60, the movable blades 182 and fixed blades 184 of the latter, and a circuit 186 leading to the monitor key 66 and the speaker circuit 64. When it is desired to connect the monitor speaker to both the output bus line and to channel 1, the simultaneously movable switch blades 188 of the monitor control switch 58 are brought into engagement with the fixed contacts 190. The former are connected to the bus line and the latter to circuit 180 and thence through the contacts of the monitor control relay 60 to the monitor speaker as just described.

When the emergency call switch is operated, the monitor speaker is cut out by the relay 60.

The latter disconnects the monitor circuit 186 from the monitor control switch by disengagement of blades 182 and 184, and connects the output bus line 54 to channel 1 through the fixed and movable blades 192 and 194, and the branch circuit 68. The same result is obtained whenever the local microphone is used since the monitor control relays are operated also upon actuation of the switches for connecting the local microphone to either one or both of the channels.

When the emergency call switch is operated, it will be remembered that the output paralleling relay 72 is also operated. This relay, when operated, serves to parallel channels 1, 2, and 3 so that the local microphone 20 is connected to all three channels through the sets of amplifiers associated with both channels 1 and 2.

From the foregoing detailed description of the circuits, it may be noted that the central station is normally conditioned to transmit either programs or announcements over either or both channels. Assuming, for instance, that it is desired to place a radio program obtainable from radio R—1 on channel 1, and a program obtainable from radio R—2 on channel 2, then it is simply necessary for the operator at the central station to close switches 86 and 88, respectively. The radio programs are thereby supplied to the channels through the input circuit, the driver and power amplifiers, the output bus line, and the monitor control switch associated with each of the channels. In a similar manner, the phonograph, studio program, or program announcements obtainable through the remotely located microphone 16 may be supplied on either or both channels since these program sources are connected to switches in both banks of switches 24 and 26. Announcements may be likewise sent over the local microphone 20 over channel 1 by operation of switch 96, or over channel 2 by operation of switch 112. When either of these switches is operated, the local microphone is connected to the output line through the same circuits as the programs and, at the same time, both the monitor control relays 60 are operated thereby to disconnect the monitor speakers in case the monitor control switches 58 are in positions connecting the monitor speakers either to the output bus lines 54 of the power amplifiers or to the bus lines and channels. It should be noted that when the local microphone is used, the channel is connected to the bus line even through the monitor control switch 58 be in a position to disconnect the bus line from the channel and connect it to the monitor speaker.

The emergency call switch takes precedence over the other program sources so that it is not necessary to operate any of the switches associated with the latter when it is desired to make an emergency call. When the emergency call switch is operated, the local microphone is connected to both input circuits 30 and 32 upon operation of relays 34 and 36. At the same time, the program sources are disconnected by operation of the relay. The emergency call switch also energizes the monitor relays 60 and the output paralleling relay 72 through circuits previously described. As a consequence, an emergency call may be made without regard to the position of the other program selector switches and through both channels so that the call is heard at the outlying stations irrespective of whether the

loudspeakers thereat are connected to channel 1, channel 2, or the "off" channel 3.

The emergency call is sent to the outlying stations also, even though the monitor speaker alone be connected to the output bus line 54. This takes place as a result of the operation of the monitor control relays 60, the same as when the local microphone is used through one of the normal channels.

While only a single embodiment of the present invention has been described, it should be understood that this embodiment is not to be construed as limitative of the invention but merely as illustrative of its principles, and that the scope of the invention is defined in the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. In a program distributing and calling system, the combination including, amplifying means, switch means for selectively connecting program sources to said amplifying means, a calling microphone, and means including a switch and a relay controlled thereby for disconnecting a selected program source from said amplifying means and connecting said microphone thereto.

2. In a program distributing and calling system, the combination including, amplifying means, a calling microphone, switch means for selectively connecting program sources or said microphone to said amplifying means through one circuit, and means including other switch means and a relay controlled thereby for disconnecting said first mentioned switch means from said amplifying means and connecting said microphone to said amplifying means through another circuit.

3. In a program distributing and calling system, the combination including, amplifying means in one channel, amplifying means in another channel, switch means associated with each channel for connecting program sources to the amplifying means in said channels, a calling microphone, and means including a switch and relays controlled thereby for disconnecting selected program sources from said amplifying means and connecting said microphone to the amplifying means in both said channels.

4. In a program distributing and calling system, the combination including, amplifying means in one channel, amplifying means in another channel, switch means associated with each channel for connecting program sources to the amplifying means in said channels, a calling microphone, means including a switch and relays controlled thereby for disconnecting selected program sources from said amplifying means and connecting said microphone to the amplifying means in both said channels, and means including another relay controlled by said switch for connecting in parallel the output ends of both said channels.

5. In a program distributing system, the combination including, a distributing channel including amplifying means, an "off" channel, switch means associated with said distributing channel for connecting program sources to said amplifying means, a calling microphone, means including a switch and a relay controlled thereby for disconnecting selected program sources from said amplifying means and connecting said microphone thereto, and means including another relay controlled by said switch for connecting said

"off" channel to the output end of said distributing channel.

6. In a program distributing and calling system, the combination including, first and second distributing channels each including amplifying means, switch means associated with each channel for connecting program sources to the amplifying means in said channels, an "off" channel, a calling microphone, means including a switch and relays controlled thereby for disconnecting selected program sources from said amplifying means and connecting said microphone to the amplifying means in both said channels, and means including another relay controlled by said switch for connecting in parallel said "off" channel and the output ends of said distributing channels.

7. In a program distributing and calling system, the combination including, first and second distributing channels each including amplifying means, a calling microphone, means including switches associated with each channel for connecting program sources or said calling microphone to the amplifying means through channel input circuits, and means including a switch and relays controlled thereby for disconnecting said switches from said amplifying means and connecting said calling microphone to both amplifying means through another circuit.

8. A system according to claim 7, including another relay controlled by said last mentioned switch operable to connect in parallel the output ends of both said channels.

9. A system according to claim 7, including an "off" channel and another relay controlled by said last mentioned switch for connecting in parallel the "off" channel and the output ends of both of said distributing channels.

10. In a program distributing system, the combination including, a distributing channel including amplifying means, a monitor loudspeaker connected to the output of said amplifying means, a microphone located in proximity to said loudspeaker, switch means for connecting said microphone to said amplifying means, and means including a relay controlled by said switch means for simultaneously disconnecting said loudspeaker from said output.

11. In a program distributing system, the combination including, a distributing channel including amplifying means, a monitor loudspeaker connected to the output of said amplifying means and to the output end of said channel, a microphone located in proximity to said loudspeaker, switch means for connecting said microphone to said amplifying means, and means including a relay controlled by said switch means for simultaneously disconnecting said loudspeaker from said output and output end of said channel.

12. In a program distributing system, the combination including, a distributing channel including amplifying means, a monitor loudspeaker, switch means operable to connect said loudspeaker to the output of said amplifying means or to both said output and to the output end of said channel, a microphone located in proximity to said loudspeaker, switch means for connecting said microphone to said amplifying means, and means including a relay controlled by said switch means for simultaneously disconnecting said loudspeaker from both said output and the output end of said channel and connecting said output to the output end of said channel.

13. In a program distributing system, the combination including, a distributing channel includ-

ing amplifying means, a monitor loudspeaker connected to the output of said amplifying means, a microphone located in proximity to said loudspeaker, switch means for connecting said microphone to said amplifying means, and means including a relay controlled by said switch means for simultaneously disconnecting said loudspeaker from said output and for connecting said output to the output end of said channel.

14. In a program distributing and calling system, the combination including, first and second distributing channels each including amplifying means, monitor loudspeakers connected to the outputs of each of said amplifying means, a microphone located in proximity to said loudspeakers, separate switch means for selectively connecting said microphone to the amplifying means in both channels, and means including relays controlled by each of said switch means for simultaneously disconnecting both said loudspeakers from said outputs.

15. In a program distributing and calling system, the combination including, first and second distributing channels each including amplifying means, monitor loudspeakers connected to the outputs of each of said amplifying means, a microphone located in proximity to said loudspeakers, separate switch means for selectively connecting said microphone to the amplifying means in both channels, and means including relays controlled by each of said switch means for simultaneously disconnecting both said loudspeakers from said outputs and connecting each of said outputs to the outgoing end of its distribution channel.

16. In a program distributing and calling system, the combination including, first and second distributing channels each including amplifying means, monitor loudspeakers for each channel, separate switch means operable to connect said loudspeakers either to the output of the amplifying means or to said output and the outgoing end of its associated channel, a microphone located in proximity to said loudspeakers, other switch means for connecting said microphone to the amplifying means in either channel, and means including relays controlled by said other switch means for connecting the outputs of both of said amplifying means to the outgoing ends of their respective channels.

17. In a program distributing and calling system, the combination including, first and second distributing channels each including amplifying means, monitor loudspeakers connected to the outputs of each of said amplifying means, a microphone located in proximity to said loudspeakers, switch means for selectively connecting said microphone to the amplifying means of either of said channels, other switch means for connecting said microphone to the amplifying means of both said channels, irrespective of the positions of said first switch means, and means including relays associated with each loudspeaker controlled by both said switches for disconnecting both said loudspeakers from said outputs.

18. In a program distributing and calling system, the combination including, first and second distributing channels each including amplifying means, monitor loudspeakers connected to the outputs of each of said amplifying means, a microphone located in proximity to said loudspeakers, switch means for selectively connecting said microphone to the amplifying means of either of said channels, other switch means for connect-

ing said microphone to the amplifying means of both said channels, irrespective of the positions of said first switch means, and means including relays associated with each loudspeaker controlled by both said switches for disconnecting both said loudspeakers from said outputs and simultaneously connecting said outputs to the outgoing ends of their respective channels.

19. In a program distributing and calling system, the combination including, first and second distributing channels each including amplifying means, monitor loudspeakers for each channel, switch means associated with each connecting in one position the outputs of the amplifying means to the outgoing end of its associated channel, said switch means being operable to a second position to connect said loudspeakers to the outputs or to a third position to connect said loudspeakers to both the outputs and outgoing ends of said channels, a microphone located in proximity to said loudspeakers, switch means for selectively connecting said microphone to the amplifying means of each of said channels, other switch means for connecting said microphone to the amplifying means of both said channels irrespective of the positions of said second switch means, and means including relays in said channels controlled by said second and third switch means for disconnecting said loudspeakers and connecting the outputs of the amplifying means to the outgoing ends of said channels irrespective of the position of said first switch means.

20. In a program distributing and calling system, the combination including, first and second distributing channels each including an input circuit, amplifying means, an output bus line and an outgoing circuit, an "off" channel, a local microphone, other program sources, selector switches in each channel for connecting said program sources or local microphone to the input circuits of either or both amplifying means, the connections to each of said amplifying means including a relay having normally closed switches, said relays also having normally open switches for providing alternate connections to the input circuits, said switches being connected to the local microphone, other switch means normally connecting said local microphone to its said selector switches and operable in an "emergency call" position to disconnect said local microphone from its selector switches, said other switch means including means for operating said relays in its "emergency call" position, whereby said microphone is connected to the input circuits of both said amplifying means, monitor loudspeakers for each channel, monitor control switch means located between the bus line and outgoing circuit of each of the distributing channels, said switch means connecting the bus lines to the outgoing circuits in one position, connecting the monitor

speaker to the bus lines only in a second position and connecting the monitor speaker to the interconnected bus lines and outgoing circuits in a third position, a monitor speaker control relay in each channel having normally closed switches for connecting the monitor speaker to monitor control switch means, which switches are opened upon operation of the relays, and having normally open switches closable on operation of the relays to connect the bus lines to their associated channel outgoing circuits, said monitor control relays being operable upon operation of the selector switches connecting the local microphone to either of said amplifying means or upon operation of said other switch to connect said microphone to both said amplifying means, whereby the monitor speakers are cut out by opening of the normally closed switches of the relays to prevent feed back, and the bus lines are connected directly to the outgoing ends of their respective channels irrespective of the position of the monitor control switch means, and a relay having normally open switch means for connecting in parallel said distributing and "off" channels, said relay being operable to close said switch means by said "emergency call" switch, whereby, when the latter is operated, all three channels are connected in parallel to the outputs of the amplifying means in the two distributing channels.

21. In a sound amplifying system, the combination including, a plurality of amplifiers having their outputs connected to a common line, switch means in each of said connections normally completing said connections and operable to connect said outputs to a second common line, a monitor loudspeaker, switch means normally disconnecting said loudspeaker from said second common line and operable to connect it thereto, whereby the outputs of said amplifiers may be selectively directed to said loudspeaker by operating said last mentioned switch means and the switch means individual to the amplifiers.

22. In a sound amplifying system, the combination including, a plurality of amplifiers having their outputs connected to a common line, switch means in each of said connections normally completing said connections and operable to break said connections and to connect said outputs to a second common line, a monitor loudspeaker, switch means normally connecting said loudspeaker to said first common line and operable to connect it to said second common line, whereby the monitor loudspeaker is normally connected to the common output of all said amplifiers and may be connected to the outputs of the individual amplifiers by operating said last mentioned switch means and the switch means individual to the amplifiers.

NORMAN H. REEVE.