Nov. 10, 1953 A. LIBERMAN 2,658,947

INTERCOMMUNICATION APPARATUS

Filed Nov. 25, 1949 2 Sheets-Sheet 1

Fig. 2.

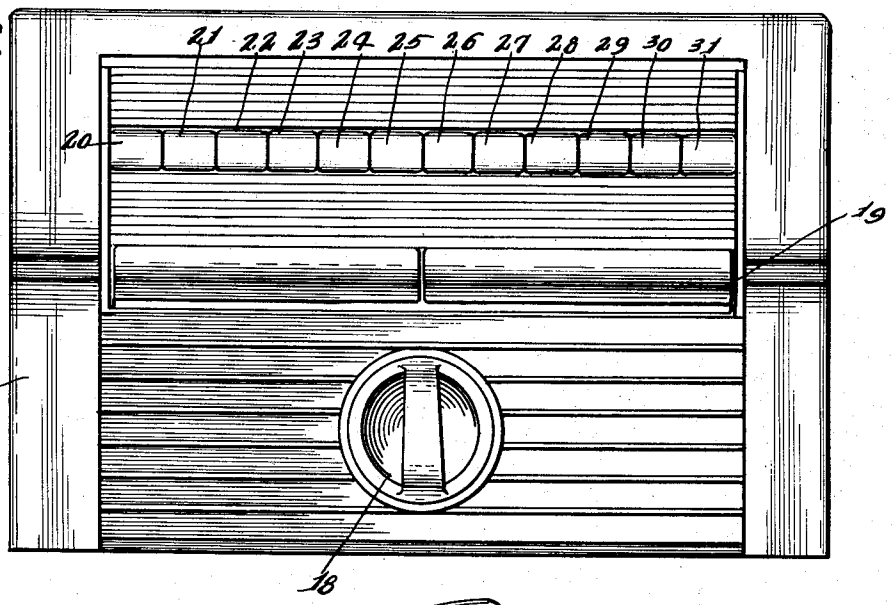


Fig. 3.

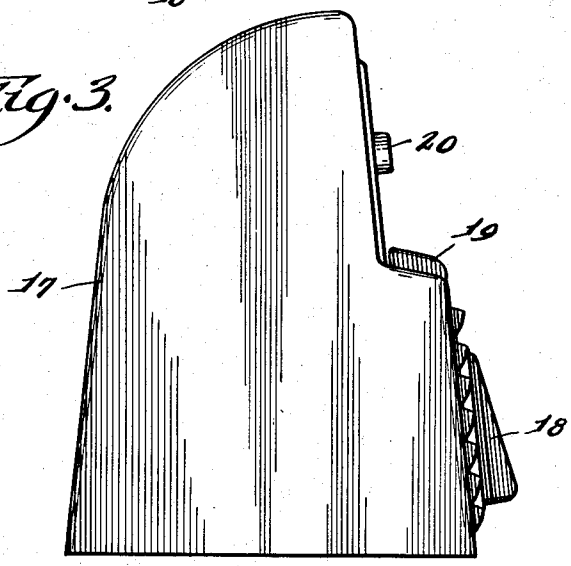
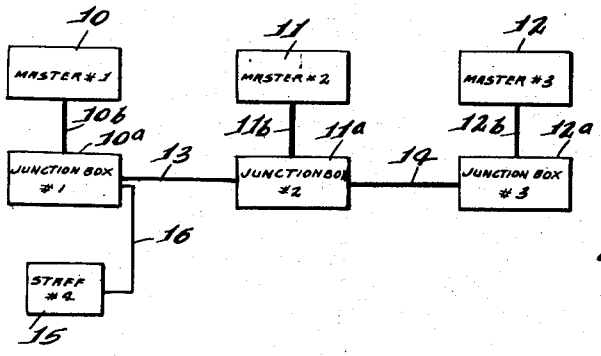


Fig. 1.



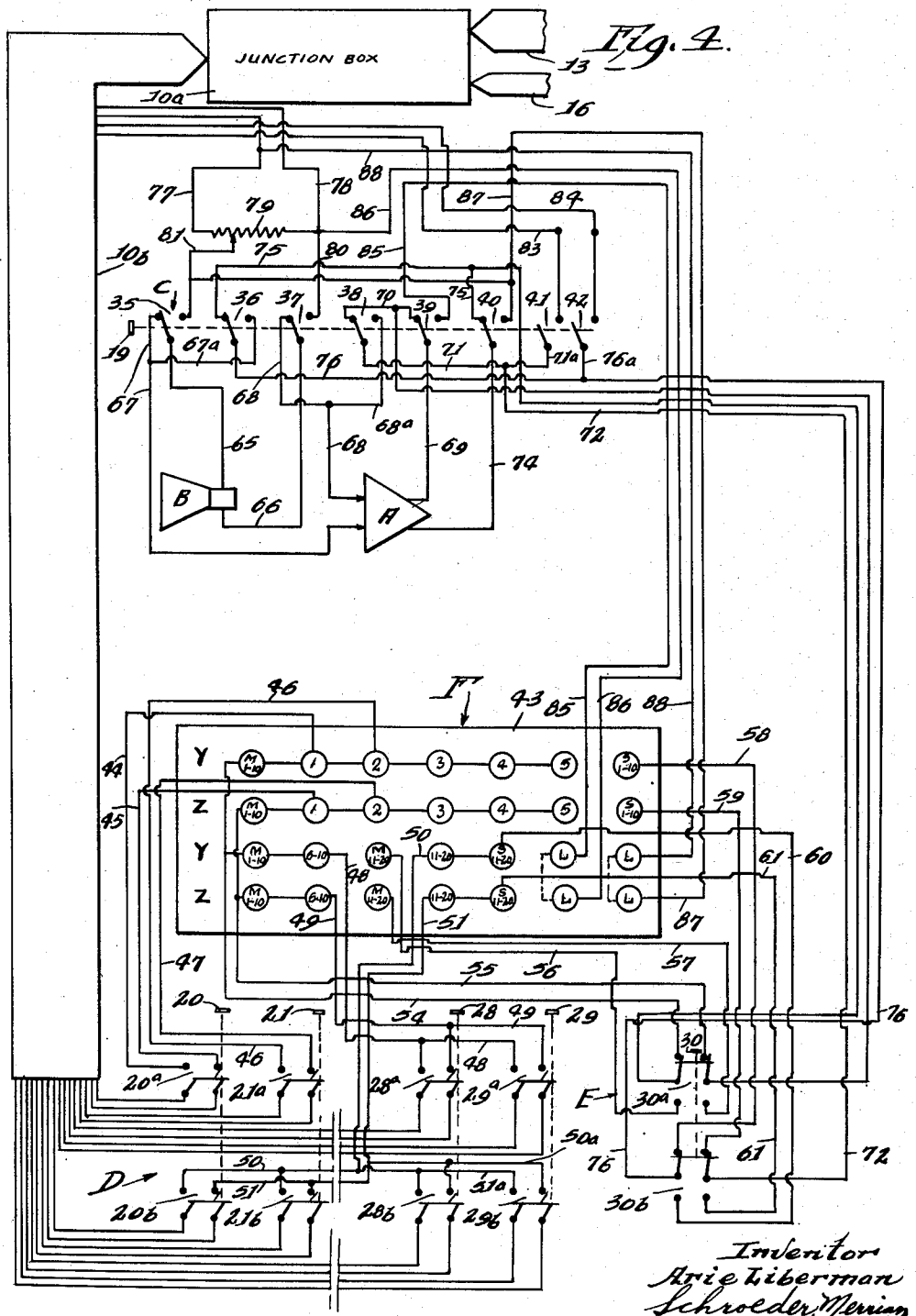
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Filed Nov. 25, 1949 2 Sheets-Sheet 2

Fig. 4.



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UNITED STATES PATENT OFFICE

2,658,947

INTERCOMMUNICATION APPARATUS

Arie Liberman, Chicago, Ill.

Application November 25, 1949, Serial No. 129,411

6 Claims. (Cl. 179—1)

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This invention relates to intercommunication apparatus, and more particularly to intercommunication apparatus having one or more stations provided with novel selector means for selecting between various types of operation of each of a plurality of stations in the system.

One feature of this invention is that it provides novel selector means for selecting between types of operation of stations; another feature of the invention is that said selector means have at least one first terminal for one type of operation, at least one second terminal for another type of operation, and a plurality of intermediate terminals for connection to either said first or second terminals; a further feature of the invention is that it provides a plurality of station selector arrangements including first switches each having at least one contact connected to a cable leading to other stations and at least one contact removably connected to one of said intermediate terminals, and secondary switch means having different contacts connected to each of said first and second terminals; an additional feature of the invention is that the first and second terminals of said station selector means each comprises a group of terminals, each group including a plurality of terminals for connecting individual stations for either type of operation and including at least two terminals each for connecting a plurality of stations as a unit for one type of operation and at least two terminals each for connecting a plurality of stations as a unit for another type of operation; and still another feature of the invention is that the selector means has at least one pair of terminals having a readily removable jumper connection therebetween for determining the type of operation of the station with which the selector is associated.

Other features and advantages of the invention will be apparent from the following specification and from the drawings, in which:

Fig. 1 is a block diagram of an intercommunication system showing four stations;

Fig. 2 is a front elevational view of one of the stations in Fig. 1;

Fig. 3 is an end elevational view of the station of Fig. 2; and

Fig. 4 is a schematic wiring diagram of one of the stations of Fig. 1.

An intercommunication system of the character illustrating an embodiment of this invention comprises a plurality of stations connected to each other to provide intercommunication therebetween. The term "local station" is herein employed merely to designate the particular station the operation of which is being disclosed, and the term "distant station" is herein employed merely to designate other stations in the system, without regard to the actual location of these other stations. The stations may be so-called "master stations" including an amplifier, or may be so-called "staff stations" which have no amplifier, but merely comprise a translating device (as a speaker-microphone) and switching means. A master station may communicate with a staff station or another master station, the voice of the operator of the master station being amplified at his local station and then being connected to a desired distant station through a switching system as will be herein disclosed. However, a staff station has no amplifier and generally may communicate (or at least originate a conversation) only with master stations (normally few in number) to which the staff station is connected, the amplifier in the master station being utilized to render the signal which originates at the staff station strong enough to operate a speaker properly.

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In certain intercommunicating systems, means are provided wherein certain stations may be "private"—i. e., a station may be connected or arranged in such manner that sounds at that location can be heard only after that person moves his "talk-listen" switch to "talk" position. Other stations in the same system may be so arranged, if desired, that they are "non-private"—i. e., any master station making connection to that station through operating the appropriate connector switch may hear anything at the non-private location without any act by the person there. In the system disclosed herein, a staff station which is connected for non-private operation may originate a call only with the master station or stations with which it is connected, but any other master station in the system can call the staff station and the staff station can reply without operating the "talk-listen" switch; while a staff station connected for private operation can converse with only the master station or stations to which it is connected, and the "talk-

listen" switch at the staff station must be operated to talk to said master station or stations, an arrangement may also be made wherein any master station in the system can call any private staff station only for paging purposes, but the staff station cannot reply to the master station unless it is connected thereto.

Each intercommunication system may, by my improved arrangement, have a different hook-up from other systems; and this hook-up may be varied from time to time after the system is installed. For example, a system may include only a few stations as illustrated in Fig. 1 or it may include as many as forty or more stations; and in any given installation the number of master stations and staff stations may vary, and the number of stations connected for private operation or for non-private operation may vary. Despite all these variations which are possible in each different system, it is desirable to be able to manufacture systems on a mass production basis wherein each item or unit is standardized. In the past it has been impossible to manufacture such systems by mass production methods and at the same time take into account all the variations required for each individual system.

I have devised and am herein disclosing and claiming an intercommunication system having means associated with at least one station for selecting other stations including selector means for selecting between two types of operation of said other stations, said selector means having a group of terminals for connection for the type of operation, a group of terminals for connection for another type of operation, and a plurality of intermediate terminals for connection to either first or second groups. With my improved apparatus, readily removable means may be provided for interconnecting the intermediate terminals with either of the groups to determine the type of operation of each station, and intercommunication systems may be manufactured on a mass production basis and yet readily be converted to cover all various types of operation either at the time of installation or after the system has been installed in the event the conditions under which the system is used change.

In using the words "intermediate terminals" I do not intend to limit the physical location of said terminals, and these words should be construed to mean that the terminals are "intermediate" in the sense that they may be connected to either one of the groups of terminals which determine the type of operation.

The selector means includes at least one pair of terminals having a readily removable jumper connection therebetween for determining the type of operation of the station with which the selector means is connected.

Referring to the drawings, Fig. 1 shows a simple intercommunication system having four stations therein, each station having a different number for convenience in designation. It will be understood that the invention is applicable to much more compex systems having any desired number of stations therein. In Fig. 1 three master stations **10**, **11** and **12** are shown. Each master station has associated therewith a junction box **10***a*, **11***a*, and **12***a* respectively, and each master station is connected to its junction box by a cable **10***b*, **11***b*, and **12***b* respectively. The junction boxes are connected together by cables **13** and **14**, and a staff station **15** is connected to station **10** by a cable **16**. In this system each master station may converse with each other master station, while the staff station may originate a conversation only with master station **10**. If the staff station is connected for private operation, it may converse only with the master station **10**, although master stations **11** and **12** may talk to staff station **15** if the staff station selector switch is pushed at the master station. If staff station **15** is connected for non-private operation any master station in the system can talk to the staff station and persons at the staff station can answer from a distance without operating any controls. In other words, the microphone at the staff station may be connected to any master station at the will of the operator of the master station.

One of the master stations, as for example, master station **10**, is shown in Figs. 2 and 3. This station will be designated herein as a local station merely because it is the station the operation of which will be described, and the other stations in the system will be designated herein as distant stations. The station comprises a cabinet **17** housing an amplifier, speaker and microphone, switching arrangement, and means for selecting the type of operation of other stations. On the face of the cabinet is a control knob **18** which may be a combination on-off switch and volume control knob as is common in the art. A switch bar **19** operates a "talk-listen" switch more fully disclosed in Fig. 3, and across the face of the cabinet is a row of twelve pushbuttons **20**—**31**. These pushbuttons operate the station selector switches and while illustrated as pushbuttons, obviously other types of switches, such as rotary selector switches, can be utilized.

While only four stations are illustrated in the simple diagram of Fig. 1, it will be understood that generally more stations are incorporated in such a system. The circuit of Fig. 3 illustrates a 20-station system, and the same cabinet and pushbutton arrangement may be utilized for forty or more stations, as more fully disclosed in my application for "Switching System," Serial No. 126,327, filed November 9, 1949. In the event no more than twelve stations are in the system, each pushbutton **20**—**31** may select one of those stations. In the event more than twelve stations are in the system pushbuttons **30** and **31** may select groups of stations, and each pushbutton **20**—**29** may be connected to select one station from each group. For example, in my above mentioned application wherein a forty-station system is disclosed, pushbutton **20** might select any one of stations No. **1**, **11**, **21** and **31** and, if pushbutton **20** alone is pushed, station **1** is selected. Pushbutton **30** may "add 10" so that in the event pushbutton **20** and **30** are both operated station **11** would be selected; pushbutton **31** may "add 20" so that in the event pushbuttons **20** and **31** are both operated station **21** would be selected; and pushbuttons **30** and **31** together may "add 30" so that in the event pushbuttons **20**, **30** and **31** are all operated together station **31** would be selected.

In Fig. 4 the circuit of master station **10** is shown. Cable **10***b* connects junction box **10***a* with the master station; cable **13** connects junction box **10***a* with other junction boxes in the system, and cable **16** connects junction box **10***a* with staff station **15** as shown in Fig. 1.

Within the cabinet of master station **10** is an amplifier designated generally at A, which comprises a conventional audio amplifier; a transducer designated generally at B, which may comprise a conventional speaker-microphone; a

"talk-listen" switch and its associated circuits designated generally at C; a plurality of station selector switches designated generally at D; secondary switch means designated generally at E; and selector means for selecting between two different types of operation, this selector means being designated generally at F.

The "talk-listen" switch C comprises six single-pole, double-throw switches **35, 36, 37, 38, 39** and **40** and two single-pole, single-throw switches **41** and **42**, all of these being ganged for operation by the "talk-listen" pushbutton **19**. The "talk-listen" switch is shown in "talk" position. If the switch is operated by push-bar **19** to its other position it will be in "listen" position.

While a system incorporating forty or more stations may be controlled from the twelve pushbuttons **20—31** of Fig. 2, for simplicity I have shown a 20-station system in the wiring diagram of Fig. 4. Pushbutton **20** controls two ganged double-pole, single-throw switches **20***a* and **20***b*; pushbutton **21** controls two ganged double-pole, single-throw switches **21***a* and **21***b*. Pushbuttons **23—27** control similar ganged switches not shown for simplicity. Pushbutton **28** controls two ganged double-pole, single-throw switches **28***a* and **28***b*; and pushbutton **29** controls two ganged double-pole, single-throw switches **29***a* and **29***b*. Pushbutton **30** controls two ganged double-pole, double-throw switches **30***a* and **30***b*. Switches **30***a* and **30***b* comprise secondary switch means for selecting which horizontal row (as the parts appear in the drawing) of station selector switches **20–29** may be operative. Switches **30***a* and **30***b* comprise an "add 10" switch. In a 20-station system as illustrated, pushbutton **31** is not needed. When in the position shown, any one of stations numbered **1–10** may be selected by any one of the pushbuttons **20–29**, and if the pushbutton **30** is operated along with one of pushbuttons **20–29**, it moves switches **30***a* and **30***b* to the position other than that shown and under these conditions any one of stations numbered **11–20** may be selected by any one of pushbuttons **20–29**. In the event thirty stations were in the system, another horizontal row of station selector switches would be added, and pushbutton **31** would be employed to operate switches similar to those shown at **30***a* and **30***b*, being an "add 20" switch. In the event that forty stations were in the system, four horizontal rows of station selector switches would be provided and the switch **30** would comprise four double-pole, double-throw switches, while another switch would be provided for operation by pushbutton **31**.

The selector means F for selecting between the two types of operation comprises a mounting board **43** having a plurality of horizontally extending rows of terminals. It will be understood that each of the terminals is of the type adapted for ready connection and ready removal of a lead. The top row designated "Y" includes at one end a terminal labeled "M**1–10**" and at the other end a terminal labeled "S**1–10**," and five terminals extend in a row between these two end terminals, the five terminals being labeled **1, 2, 3, 4** and **5** respectively. The second row of terminals designated "Z" is similar, these two rows constituting a like terminal arrangement for use in a two-wire system.

In like manner the third and fourth rows of terminals are similar to each other, row "Y" including seven terminals designated respectively as "M**1–10**," "**6–10**," "M**11–20**," "**11–20**," "S**11–20**," "L" and "L." The terminals "M**1–10**" in the third and fourth rows are provided merely for convenience in making connections and are interconnected with terminals "M**1–10**" in the respective first and second rows. If desired, similar duplicate terminals "S**1–10**" may be provided in the third and fourth rows of terminals. The terminals labeled "M" comprise a group for private operation; the terminals labeled "S" comprise a group for non-private operation, and the terminals designated only by number comprise a plurality of intermediate terminals for connection to either of said groups. The two pairs of "L" terminals are utilized to determine the type of operation of the station with which the selector means is associated.

In the system illustrated, a station is selected by one of switches **20***a*–**29***a* which are connected for private operation or by switches **20***b*–**29***b* which are connected for non-private operation. Each station selector switch has contacts (the lower contacts as shown) connected to the cable **10***b* which extends between the respective switches and the junction box, and other contacts removably connected to certain of the intermediate terminals. The left upper contact of switch **20***a* is connected by a lead **44** to intermediate terminal **1** in row Y (hereafter designated as terminal Y**1**) and the upper right contact of this switch is connected by a lead **45** to intermediate terminal **1** in row Z (hereafter designated as terminal Z**1**). Similarly leads **46** and **47** connect the upper contacts of switch **21***a* to respective terminals Y**2** and Z**2**. The upper contacts of switches **28***a* and **29***a* are connected to respective terminals Y**6–10** and Z**6–10** by leads **48** and **49**.

The upper contacts of switches **20***b* and **21***b* are connected to respective terminals Y**11–20** and Z**11–20** by leads **50** and **51**, and the upper contacts of switches **28***b* and **29***b* are connected into this circuit by branch leads **50***a* and **51***a*.

Terminals Y**1**, Y**2**, Y**3**, Y**4** and Y**5** and terminals Z**1**, Z**2**, Z**3**, Z**4** and Z**5** comprise a plurality of terminals each for connecting an individual station for either type of operation. In the circuit shown, terminals Y**1**, Y**2**, Y**3**, Y**4** and Y**5** are shown as interconnected with terminal YM**1–10** and terminals Z**1**, Z**2**, Z**3**, Z**4** and Z**5** are shown as interconnected with terminal ZM**1–10**. Thus stations **1–5** are connected individually for private operation. If it were desired to make station **2** non-private, for example, it would be only necessary to disconnect terminals Y**2** and Z**2** respectively from terminals YM**1–10** and ZM**1–10** and connect them to terminals YS**1–10** and ZS**1–10**.

On the other hand terminals Y**6–10** and Z**6–10** are for connecting a plurality of stations as a unit for either type of operation. As shown, these terminals are connected for private operation. If it were desired to connect stations **6–10** as a unit for non-private operation, terminals Y**6–10** and Z**6–10** would be disconnected respectively from YM**1–10** and ZM**1–10** and would be connected to terminals YS**1–10** and ZS**1–10**. In the same manner stations **11–20** are shown as connected as a unit for non-private operation because terminals Y**11–20** and Z**11–20** are connected respectively to terminals YS**11–20** and ZS**11–20**. If desired these connections may readily be changed to connect stations **11–20** as a unit for private operation. Consequently, in the manufacture of these intercommunication systems a standard arrangement may be provided and yet any arrangement

may be made either at the time of installation or at any time after installation for connecting any number of stations for private operation or for non-private operation as desired. Furthermore, an important feature is that any given station may be private to some of the other stations in the system and non-private to others. It is not necessary that any given station be connected for the same type of operation with all other stations in the system. In other words, while station No. 4 is illustrated as being connected for private operation with the local station being described, station No. 4 may be connected with other distant stations for non-private operation if desired.

The upper contacts of switch 30*a* control all stations 1–10 which are connected for private operation insofar as the local station being described is concerned, these upper contacts being connected to the respective terminals YM1–10 and ZM1–10 by leads 54 and 55. The lower contacts of switch 30*a* control all those stations 11–20 which are connected for private operation insofar as the local station being described is concerned, these lower contacts being connected to the respective terminals YM11–20 and ZM11–20 by leads 56 and 57.

The upper contacts of switch 30*b* control all those stations 1–10 which are connected for non-private operation insofar as the local station being described is concerned, these upper contacts being connected to the respective terminals YS1–10 and ZS1–10 by leads 58 and 59. The lower contacts of switch 30*b* control all those stations 11–20 which are connected for non-private operation insofar as the local station being described is concerned, these lower contacts being connected to the respective terminals YS11–20 and ZS11–20 by leads 60 and 61.

In the operation of the intercommunication system, with the "talk-listen" switch in the position shown the operator of the local station may talk to any distant station by operating the station selector switches. For example, if the operator wishes to talk to station 12, he would push pushbutton 21 thus closing switches 21*a* and 21*b* and would also push pushbutton 30 thus "adding 10" and moving switches 30*a* and 30*b* to the position other than that shown so that the movable poles of the switches close with the lower contacts thereof. When the operator speaks into the transducer B the voice waves are translated into electrical energy and appear across leads 65 and 66 which are connected with the input of the amplifier A. Lead 65 connects with the movable pole of switch 35, the closed contact of this switch being connected to the amplifier input by lead 67, while lead 66 connects with the movable pole of switch 37, the closed contact of this switch being connected with the other amplifier input terminal by a lead 68. The audio amplifier A amplifies the voice waves and connects them through closed switch 21*b* to the cable 10*b*. In the junction box 10*a* connection is made to station 12. The connection between the amplifier output and the selector switches is as follows: from one terminal of the amplifier through a lead 69, switch 39, a lead 70, switch 38, lead 71, and lead 72 to the movable pole of switch 30*b* which is now closed with the lower contact of said switch. Lead 61 connects the lower contact of said switch with terminal ZS11–20, this terminal being interconnected with terminal Z11–20 which is connected to closed switch 21*b* for station 12 by lead 51.

The other output terminal of the amplifier is connected by a lead 74 to the movable pole of switch 40. A lead 75 connects the closed contact of switch 40 with one contact of switch 36, and a lead 76 connects the movable pole of switch 36 with the other movable pole of switch 30*b*. The other lower stationary contact of switch 30*b* is connected by the lead 60 to terminal YS11–20 which is interconnected with terminal Y11–20, this latter terminal being connected by lead 50 to the other contact of switch 21*b*.

When the operator of the local station wishes to listen to the distant station, interconnections in the junction box 10*a* bring the signal in to the local station through leads 77 and 78 which are connected across a volume control resistor 79. One end of the volume control resistor is connected to a contact of switch 37 by a lead 80, and this contact (when the switch is in "listen" position) is connected to the speaker through lead 66. The movable slider of the volume control is connected to one contact of switch 35 by a lead 81, and this contact is connected to the speaker through lead 65. Inasmuch as the incoming signal was already amplified at the distant master station, no further amplification is normally required at the local station. However, when the local station converses with the staff station, the incoming signal from the staff station has not earlier been amplified and must be amplified at the local station. Incoming signals from staff stations are connected in the junction box into leads 83 and 84 which connect with respective switches 41 and 42, these switches also being closed when in "listen" position. A branch lead 71*a* connects the movable pole of switch 41 with lead 71, and this lead is connected to the amplifier input through switch 38 and a branch lead 68*a* which connects with lead 68. Switch 42 is connected to lead 76 by a branch lead 76*a* and connection is made to the amplifier input through leads 76*a*, 76, switch 36, branch lead 67*a* and lead 67.

With the talk-listen switch in listen position, the amplifier output terminals are connected with the speaker so long as jumpers are connected between the terminals of each pair designated LL on the selector F. The upper amplifier output terminal is connected to the speaker through lead 69, switch 39 and a lead 85 which connects one contact of switch 39 with one of the L terminals of the selector means. The two L terminals are connected by a jumper and a lead 86 connects the other L terminal with one end of the volume control resistor 79, connection to the speaker being made through lead 80, switch 37 and lead 66. The lower amplifier output terminal is connected through lead 74, switch 40 and a lead 87, a jumper between the other L terminals and the lead 88 which connects with the other end of the volume control resistor 79 through the lead 77. Connection to the speaker is completed through lead 81, switch 35 and lead 65. In the event LL jumpers are removed, the amplifier output is no longer connected to the speaker and the station can be made non-private as to other stations so connected.

While I have shown and described certain embodiments of my invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from

the spirit and scope of the invention as disclosed in the appended claims.

I claim:

1. In an intercommunication system having a plurality of stations and cable means interconnecting said stations to provide for communication therebetween, means in at least one station for selecting other stations, comprising: means for selecting between private and non-private operation of said other stations, including a circuit in said one station having at least one first terminal for private operation, a circuit in said one station having at least one second terminal for non-private operation, a plurality of intermediate terminals each adapted to be connected to at least one of said other stations and readily removable leads interconnecting each of said intermediate terminals with either said first or said second terminals to determine whether each of said other stations shall be private or non-private with regard to said one station; and a plurality of station selector switches each having at least one contact connected to a portion of said cable means and at least one other contact connected to one of said intermediate terminals, to select the other station with which said one station will communicate.

2. In an intercommunication system having a plurality of stations and cable means interconnecting said stations to provide for communication therebetween, means in at least one station for selecting other stations, comprising: means for selecting between private and non-private operation of said other stations, including at least two first terminals for private operation, at least two second terminals for non-private operation, a plurality of intermediate terminals adapted to be connected to said other stations and readily removable leads interconnecting each of said intermediate terminals with one of said first or second terminals to determine whether each of said other stations shall be private or non-private with regard to said one station; two groups of station selector switches, each switch in one group being ganged with a switch in the other group and each switch having at least one contact connected to a portion of said cable means and at least one other contact connected to one of said intermediate terminals, the intermediate terminals connected to the switches of one group being connected only to one of said first or second terminals and the intermediate terminals connected to the switches of the other group being connected only to the other of said first or second terminals; secondary switch means comprising a double throw switch having at least two sections, each section having two fixed contacts and an element movable therebetween, the fixed contacts of one section being connected with said first terminals and the fixed contacts of the other section being connected with said second terminals; means connecting the movable element of said one section with said one station; and means connecting said movable element of said other section with said one station.

3. Apparatus of the character described in claim 2 wherein said plurality of intermediate terminals includes a terminal for connecting a plurality of stations as a unit for a given type of operation.

4. In a two wire intercommunication system having more than two stations and cable means interconnecting said stations to provide for communication therebetween, means in at least one

of said stations for selecting other of said stations, comprising: means for selecting between private and non-private operation of said other stations with regard to said one station, including at least one pair of first terminals for private operation, at least one pair of second terminals for non-private operation, a plurality of pair of intermediate terminals each pair adapted to be connected to the two wires from at least one of said other stations and pairs of readily removable leads interconnecting each pair of intermediate terminals with one or the other of the pairs of said first or second terminals; a plurality of double-pole, single-throw station selector switches, each switch having one pair of contacts connected to said cable means and the other pair of contacts connected to a pair of said intermediate terminals, to select the other station with which said one station will communicate; means connecting said private operation terminals to said one station; and means connecting said non-private operation terminals to said one station.

5. In a two wire intercommunication system having more than two stations and cable means interconnecting said stations to provide for communication therebetween, means in at least one of said stations for selecting other of said stations, comprising: means for selecting between private and non-private operation of said other stations, including at least two pairs of first terminals for private operation, at least two pairs of second terminals for non-private operation, a plurality of pairs of intermediate terminals adapted to be connected to said other stations and pairs of readily removable leads interconnecting each pair of intermediate terminals with one or the other of said pairs of first or second terminals to determine whether each of said other stations shall be private or non-private with regard to said one station; two groups of double-pole, single-throw station selector switches, each switch in one group being ganged with a switch in the other group, and each switch having a pair of contacts connected to said cable means and the other pair of contacts connected to a pair of said intermediate terminals, to select the other station with which said one station will communicate, the pairs of intermediate terminals connected to the switches of one group being connected only to one of the pairs of the first or second terminals and the pairs of intermediate terminals connected to the switches of the other group being connected only to the other of the pairs of the first or second terminals; secondary switch means comprising a four section, double-throw switch, each section having two fixed contacts and an element movable therebetween, the fixed contacts of two sections being connected with the pairs of said first terminals and the fixed contacts of the other two sections being connected with the pairs of said second terminals; means connecting the movable elements of the first two sections with said one station; and means connecting the movable element of said other two sections with said one station.

6. In an intercommunication system having a plurality of stations and cable means interconnecting said stations to provide for communication therebetween, means in at least one station for selecting other stations, comprising: means for selecting between private and non-private operation of said other stations, including a circuit in said one station having a connection point for private operation, a circuit in said one station

having a connection point for non-private operation, a plurality of intermediate connection points and means readily removably interconnecting said intermediate connection points with either said private or non-private connection points to determine whether each of said other stations shall be private or non-private with regard to said one station; and means for selectively connecting a desired portion of said cable means to said plurality of intermediate connection points to select the other station with which said one station will communicate.

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