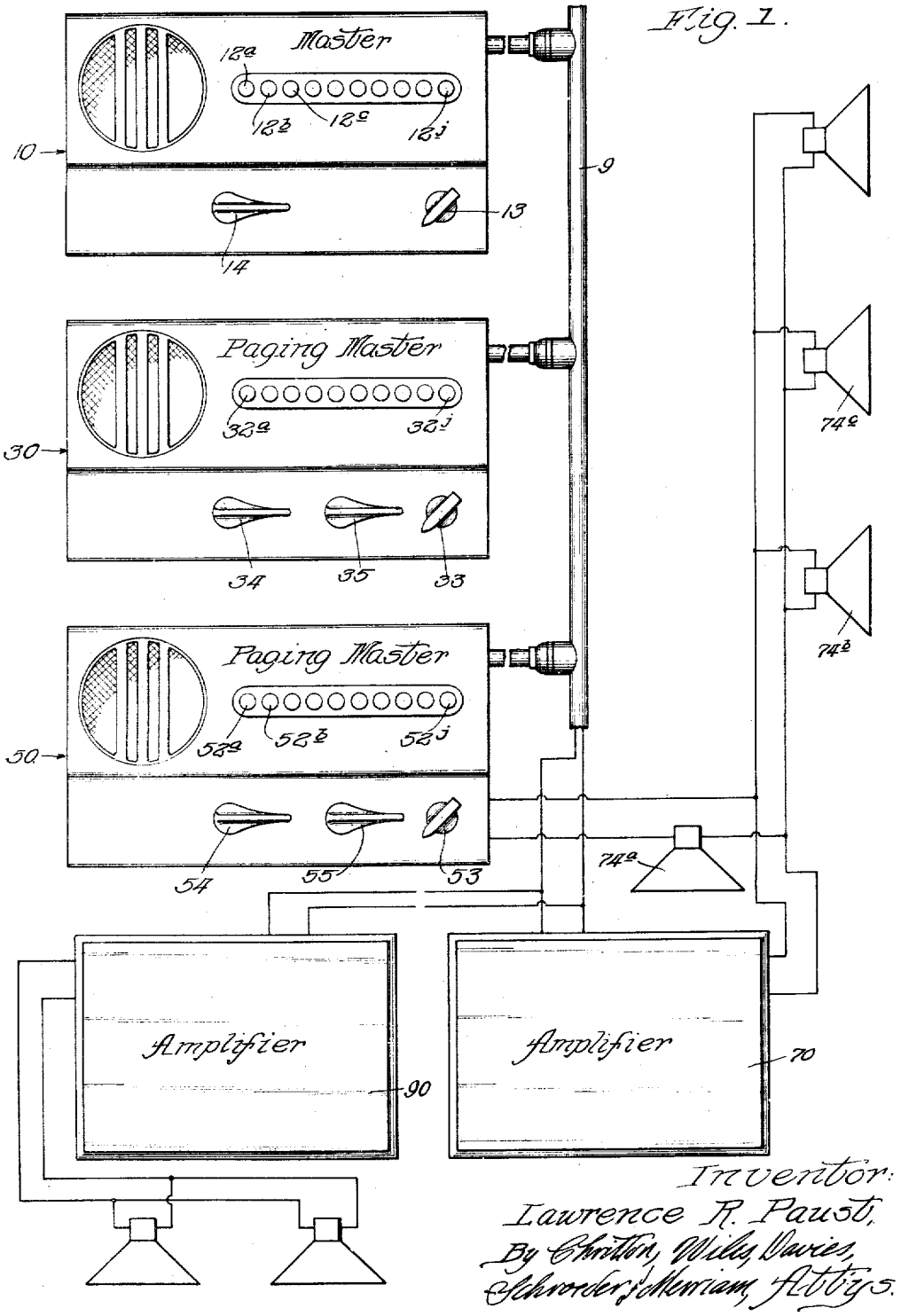
Jan. 2, 1945. L. R. PAUST 2,366,552

COMMUNICATING APPARATUS

Filed July 3, 1943 3 Sheets-Sheet 1

Fig. 1.



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Jan. 2, 1945. L. R. PAUST 2,366,552

COMMUNICATING APPARATUS

Filed July 3, 1943 3 Sheets-Sheet 2

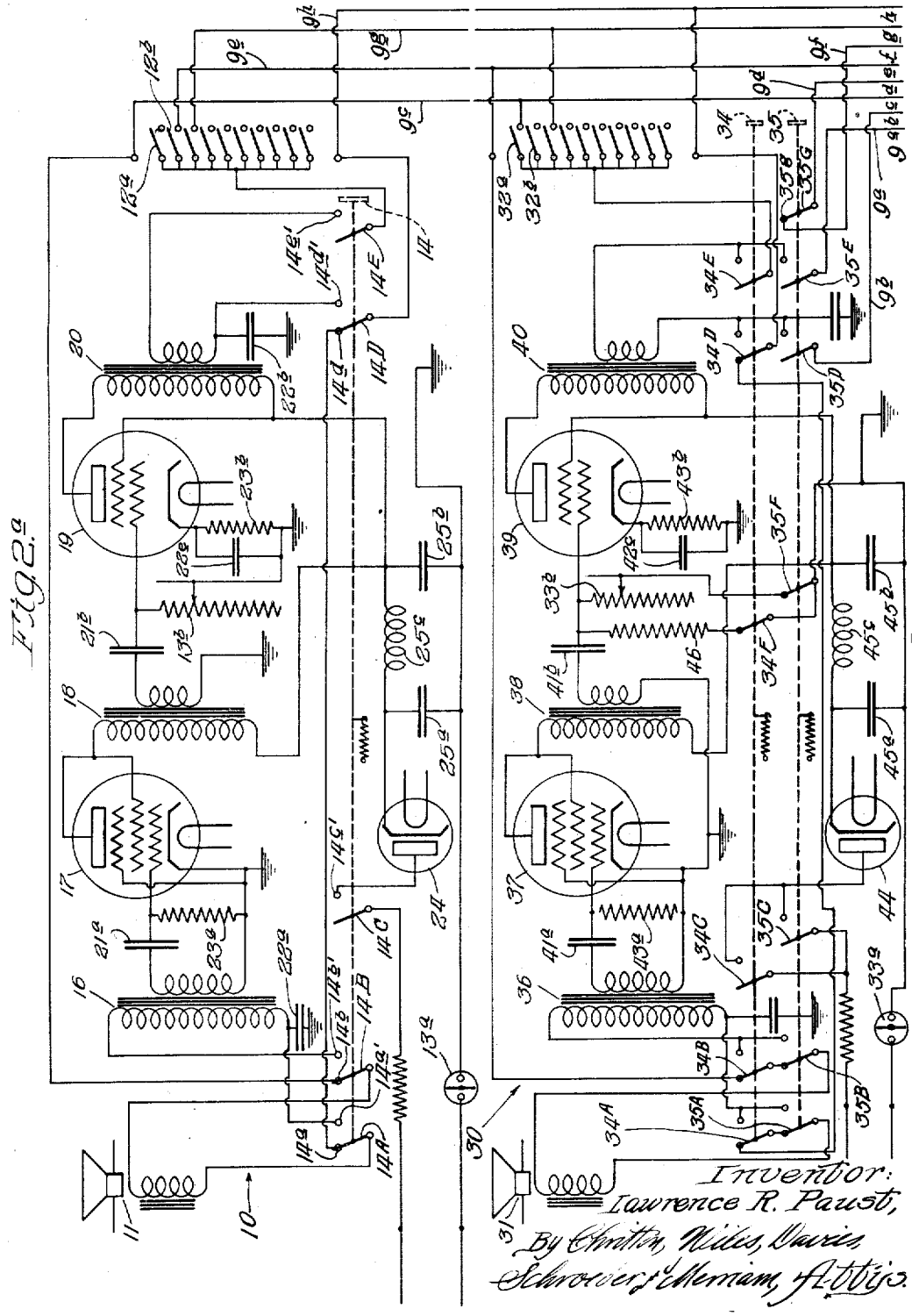


Fig. 2a.

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Jan. 2, 1945. L. R. PAUST 2,366,552

COMMUNICATING APPARATUS

Filed July 3, 1943 3 Sheets-Sheet 3

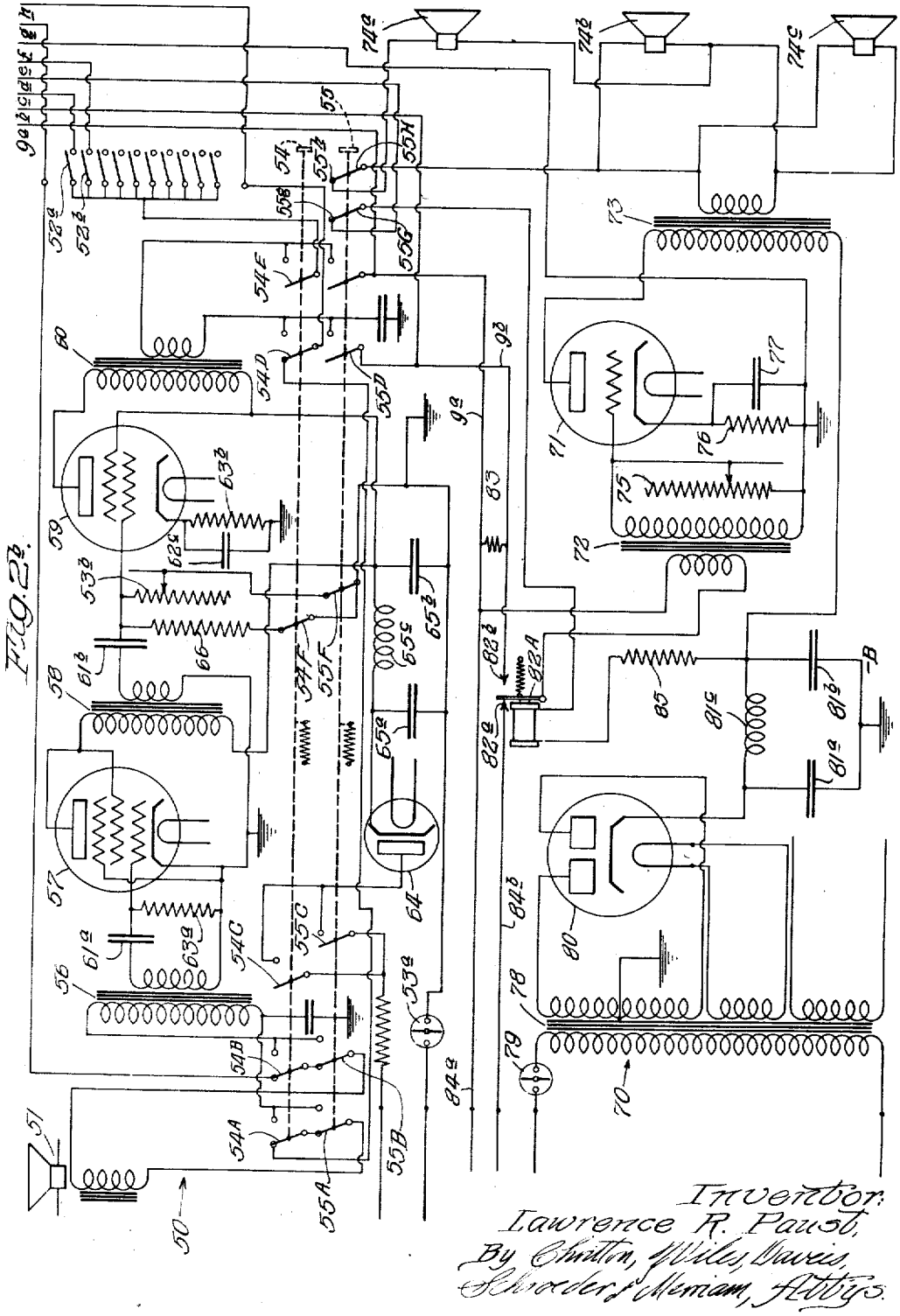


Fig. 2B.

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Patented Jan. 2, 1945

2,366,552

UNITED STATES PATENT OFFICE

2,366,552

COMMUNICATING APPARATUS

Lawrence R. Paust, Chicago, Ill.

Application July 3, 1943, Serial No. 493,461

19 Claims. (Cl. 179—1)

This invention relates to communicating apparatus, and more particularly to a system providing for both private intercommunication between certain units, and general communication or paging.

One feature of this invention is that it provides a combination intercommunicating and paging system; another feature of this invention is that paging or general communication can be effected from any one of a plurality of intercommunicating units; still another feature of this invention is that the general communication means may be normally supplied with music or other audio signals, means being provided for automatically cutting out this normal input when it is desired to page; still another feature of this invention is that the circuit impedance and switching arrangements are such that there is no undesired transfer of energy between the private intercommunicating circuits and the general communication circuit; still a further feature of this invention is that the paging or general communicating system is operated at a predetermined desired volume regardless of the setting of the variable volume controls in the intercommunicating units; and still a further feature of this invention is that certain speakers of the general communicating system can be cut out by certain of the intercommunicating units, when these particular units are paging, to prevent feed-back difficulties. Other features and advantages of this invention will be apparent from the following specification and the drawings, in which:

Figure 1 is a partial schematic diagram of a system embodying my invention; Figure 2*a* is a circuit diagram of the two upper units shown in Figure 1; and Figure 2*b* is a circuit diagram of the lower intercommunicating unit and right-hand amplifier of Figure 1.

Many offices, plants and other business establishments now employ intercommunicating systems to facilitate the work of their executives. These systems usually comprise a certain number of master units (sometimes as high as 30 in number); and, generally in addition to the master units, a certain number of subordinate units which can communicate with only a certain master unit. For example, a small business might have master units for its president, vice-president, secretary, factory superintendent, purchasing agent and stock room foreman. Then each of these master units (any one of which can communicate with any of the others) might have certain subordinate units connected to it only. For example, the secretary of the company might have subordinate units to his personal secretary, his chief accountant, etc.; and the factory superintendent might have subordinate units for several of his key foremen.

In addition, it is desirable to have some method of locating a man when he is not in his office or at his usual place of work, and does not answer when a call is brought in on his particular intercommunicating unit. The conventional method of locating a person who may be anywhere in the office or plant is by the old-fashioned auto-call, or by having a general communicating system with loud speakers scattered throughout the office and plant, with someone (generally the telephone operator) using a microphone to page the desired person through this general communicating system. Calling the telephone operator involves tying up the telephone facilities and a considerable loss of everyone's time, since if the president is looking for the plant superintendent there must be communication first between the president and the telephone operator, then by the telephone operator over the paging system, then between the superintendent and telephone operator to find out who wants him, and then finally a connection between the superintendent and the president. My invention obviates these and other objections in the former systems by providing communicating apparatus which serves the desired intercommunication function and which also allows anyone with a paging master to page or give general communications directly, without the use of an intermediary such as the telephone operator. I accomplish this by equipping some or all of the intercommunication units with paging switches which enables any of the units thus equipped to actuate the general communicating system. Achievement of this desirable result involved solution of a number of problems, as will appear more fully in the following specification.

In the particular embodiment of my invention shown in the accompanying drawings, three master intercommunicating units 10, 30 and 50 are illustrated as representative of the intercommunicating system, it being understood that there would normally be a larger number of such units, and generally certain subordinate units. Each of the units is connected, by its local cable, to a master cable or set of interconnecting wires here indicated at 9. The general communicating system is shown in Figure 1 as comprising an amplifier 70 with four speakers actuated thereby, and another amplifier 90 with two associated speakers.

Each of the master units is provided with a

dynamic speaker which is used both for its normal function as a speaker and for translating sound waves into corresponding electrical impulses, these being here indicated as 11, 31, and 51. Each unit is provided with selectively operative switch means for effecting intercommunicating connections to one or more of the other units, these being here shown as push-button operated switches identified as 12a—j, 32a—j and 52a—j. Pushing button 12b of unit 10, for example, might effect intercommunicating connection with unit 30; and operation of other buttons would effect similar two-way private intercommunicating connections between other units. Each unit is also provided with a manually operable on-off switch and variable volume control arrangement, as 13, 33 and 53; and with a talk-listen switch control, these being here indicated as 14, 34 and 54. The right-hand control switches are shown in what may be assumed to be the off position. Turning these a few degrees clockwise would turn on the power in the unit, and further rotation would control the volume of the output of the unit. The left-hand switches are shown in the listen position, to which they are normally urged by spring means; and when one desires to talk, he not only completes the desired connection to one of the other units but also pushes down his talk-listen switch, thereafter releasing this switch when he desires to listen to the other party.

In addition, the units 30 and 50 are shown as providing yet another control, these being here identified as 35 and 55. These are the paging switches (or rather, their control knobs as seen in Figure 1) which form the particular subject matter of the present application, together with their associated circuits and the general communicating system.

Referring now more particularly to Figure 2a, it will be seen that the unit 10 includes an input transformer 16, a first amplifying tube 17, a coupling transformer 18, a second amplifying or power output tube 19 and an output transformer 20. The tubes 17 and 19 may be a 12SJ7 and a 70L7GT respectively, for example; the coupling condensers 21a and 21b may be .006 mfd.; the by-pass condensers 22a and 22b may be .05 mfd.; and the condenser 22c 5 mfd. The fixed grid-leak resistor 23a may be 3 meg., and the fixed cathode biasing resistor 23b may be 180 ohms; and the variable volume control resistor 13b may have a maximum value of .5 meg. The transformers would have ratios appropriate to the impedance which they were to couple. The transformer 16 may have a step-up ratio of 1:100; the transformer 18 a step-up ratio of 1:3; and the output transformer 20 a step-down ratio of 24:1. In order to minimize intercircuit coupling of an undesired character it is desirable to have the output quite low in impedance. This output should be less than 100 ohms and preferably in the neighborhood of 6 to 10 ohms. A power supply circuit for the unit is controlled by the on-off switch 13a, and includes a rectifier tube 24 and a filter 25 comprising the condensers 25a and 25b and the choke 25c.

Intercommunicating connections are effected in the first instance by the push button switches 12a, 12b, etc., only two of these being here shown as connected in as much as only two other units are illustrated. After the desired intercommunicating connection has been made, however, the talk-listen switch must be operated during two-way conversation as mentioned before. This switch comprises a number of movable switch elements, here identified as 14A, 14B, 14C, 14D and 14E. These movable switch elements are shown in the listening position, the position which they assume when the control knob is released. In this position one side of the translating device 11 is connected (through the switch element 14A and the contact 14a and the switch element 14D and contact 14d) to the common wire 9h of the connecting cable between the units; and the other side of the translating device is connected through the switch element 14B and the contact 14b to the input wire of this particular unit, here identified as 9c. Under these conditions the translating device 11 is adapted to be supplied with signals delivered by the output of another unit through the wires 9c and 9h and to operate as a speaker. If the talk-listen switch is moved to its other position, however, one side of the translating device is now connected through the switch element 14A and the contact 14a' to one side of the primary input transformer 16; and the other connection of the translating device is completed through the switch element 14B and the contact 14b' to the other side of the primary. Also, the secondary of the output transformer 20 has one side connected (through the switch element 14D and the contact 14d') to the common wire 9h; and the other side connected (through the switch element 14E and the contact 14e') to the bus bar of the selector switch arrangement, so that connection is then completed to whichever wire is chosen by one of the switches 12a—j. At the same time, it will be noted that switch element 14C makes connection to contact 14c', completing the connection to the plate power supply and delivering appropriate plate voltage (90 volts or more) to the tubes 17 and 19. The filaments of these tubes are energized by separate means of conventional type (not shown), and are on as long as the on-off switch 13a is in on position. By applying B-voltage to the plates of the tubes 17 and 19 only when they are being used when talking, however, and not when the tubes are merely standing by, the life of these tubes is usually increased from 100 to 300%. Moreover, removing the plate supply voltage when the amplifier is not being used prevents difficulty with oscillations because of the absence of load, with crackle or static in the translating device, and with undesired cross talk pick-up.

The unit 30, shown in the lower part of Figure 2a, is for the most part identical with the unit just described. Accordingly, this portion of the description will not be repeated, attention being called to the fact that similar elements bear similar reference numerals. For example, in the unit 10 the input transformer was identified as 16, whereas in unit 30 it is 36; the first and second amplifying tubes in unit 10 were identified as 17 and 19, respectively, while the corresponding tubes in unit 30 are numbered 37 and 39, respectively; the rectifier tube in the first unit is 24, and in the second unit 44, etc.

The unit 30, however, is one of a plurality of paging units; i. e., one who has this unit can make use of the general communicating system at any time. The difference between the units lies primarily in the switches which comprise the paging switch arrangement identified as 35, and in the presence of additional volume control means and switch elements that select the volume control means to be operative under various conditions. It is preferable, in order to avoid unde-

sired coupling between the intercommunication and general communication circuits, that the paging switch 35 be physically and electrically separate from the intercommunication switches 32.

The paging switch elements are spring biased to and normally lie in the position shown in the drawings. In this position the movable switch elements 35A and 35B connect the translating device to the elements 34A and 34B of the talk-listen switch, so that operation is as previously described during intercommunication; and switch elements 35D and 35E are in open position, these switches controlling the output. If the paging switch is rotated clockwise, however (moving the switch elements to the right as illustrated in Figure 2a), switch elements 35A and 35B take the translating device 31 out of the control of the talk-listen switch and connect it directly across the primary of the input transformer 36 of the amplifier of this unit. At the same time switch elements 35D and 35E connect the output of the amplifier to the wires 9a and 9b of the cable, these wires leading to the inputs of the amplifier or amplifiers of the general communicating system as will be more fully described in connection with Figure 2b. At the same time switch element 35C (in shunt with the talk-listen plate voltage control switch 34C) completes the connection to the plate of the rectifier tube 44 and supplies plate voltage to the amplifier tubes 37 and 39, rendering the amplifier operative.

It will be noted that in unit 30 there are two volume control resistors connected to the grid of the tube 39, one being the variable volume control 33b corresponding to 13b in unit 10, and the other being a fixed volume control resistor 46, which may have a value of 50,000 ohms, for example. In the first unit the movable arm of the variable volume control 13b was connected directly to ground; but in this unit 30 the variable volume control arm is connected to ground through a contact and the movable switch element 35F, so that movement of the paging switch to paging position opens the circuit and renders the variable volume control 33b inoperative. The fixed volume control resistor 46 is connected to ground through a movable switch element 34F forming part of the talk-listen switch. Whenever this switch is moved to talking position the circuit is broken and the fixed resistor is inoperative. It is apparent that when one unit is talking privately with another unit the paging switch is in the position shown in the drawing, so that the variable volume control is operative; and the talk-listen switch 34 would be operated whenever one wanted to talk from the unit 30, rendering the fixed resistor 46 inoperative. Under these conditions the volume or output of the amplifier, during intercommunication, would be determined by the setting of the variable volume control. On the other hand the output of the amplifier during paging would be out of the control of the operator of the unit, being determined by the fixed resistor 46. The level of the output of the general communicating system is thus a fixed and predetermined quantity regardless of which unit may be initiating the paging.

Referring now more particularly to Figure 2b, it will be seen that the unit identified as 50 is another paging master unit having all of the elements heretofore described in the previous two units, these corresponding elements being again correspondingly numbered. That is, the translating device 51 of the unit 50 corresponds to the translating devices 11 and 31 of the units 10 and 30; the talk-listen switch 54 and the paging switch 55 correspond to the switches 34 and 35 in the unit 30; the amplifying tubes 57 and 59 in the unit 50 correspond to the amplifying tubes 17 and 19 in the unit 10 and the tubes 37 and 39 in the unit 30, etc. It will be apparent that private intercommunication with either of the other units can be effected by operation of one of the switches 52 and the intermittent operation of the talk-listen switch 54; and that initiation of paging is effected by operation of the paging switch 55.

Referring now to the lower portion of Figure 2b, the amplifier 70 will be described in more detail. For purposes of illustration this is shown as having only a single amplifying tube 71, although it will be understood that in actual practice there may be a plurality of such tubes in cascade. The amplifier also includes an input transformer 72 and an output transformer 73, the secondary of this transformer supplying power to the various speakers connected in parallel, the speakers being here identified as 74a, 74b and 74c. Associated with the grid of the tube 71 is a variable volume control 75; and associated with the cathode of the tube is a cathode resistor 76 and a by-pass condenser 77. Power for the amplifier is delivered by a power supply unit comprising a transformer 78 controlled by an on-off switch 79, a rectifier tube 80, and a filter comprising the condensers 81a and 81b and the choke 81c.

It will be seen that there is a connection directly from the wire 9a to the upper end of the primary of the input transformer 72 of the amplifier; and that the lower end of the primary is connected to the movable element 82A of a relay, this movable switch element being adapted to cooperate with either the contact 82a or the contact 82b, this latter contact being connected permanently to the wire 9b. It will be noted that the switch element 82A is held in engagement with the contact 82a by the coil when it is energized; but is moved into engagement with the contact 82b (by a spring) when the relay coil is deenergized. A resistor 83 of very low value (for example, 6 ohms) is shunted across the wires 9a and 9b to insure a low impedance characteristic of the input of the amplifier when this is being operated by any of the paging units.

During other times, when no paging is being done, the amplifier is supplied with continuous audio signals, as music, from the wires 84a and 84b, these latter being connected to a radio, automatic phonograph or the like. When it is desired to page, however, this normal input must be disconnected and this is done by interrupting the current through the coil of the relay 82. It will be noted that the voltage output of the filter 81 (which may be 250 volts) is delivered to one side of the relay coil through the resistor 85 (which may, for example, be of 1500 ohms). The other side of the coil is connected to the movable switch element 55G of the paging switch of the unit 50. When this switch is in its normal position as shown in the drawings the circuit is completed to the contact 55g and thence through the wire 9d to the movable switch element 35G in the unit 30. When this is closed, as is normally the case, the circuit is completed through the contact 35g and the wire 9g back to ground in the amplifier or negative B. It is thus apparent that as long as none of the paging switches are operated, the relay coil is energized and the switch element 82A remains in engagement with the contact 82a, keeping music or other signals supplied to the general communi-

cating system. Whenever any of the paging master units are operated, however, this breaks the holding circuit and switches the amplifier input transformer primarily over to the wires 9a and 9b, so that any output delivered to these wires from the master unit being operated for paging is passed through the amplifier 70 and delivered to the speakers 74.

Again referring to the previously described assembly of a small system embodying this invention it will be assumed that the paging master unit 50 is that of the plant superintendent, located on his desk in one corner of the plant. In order that someone talking to him may be located by the general communicating system, it is desirable that one of the general communicating speakers as 74a, be in the same corner of the plant; and this is perfectly satisfactory when paging is being initiated from any other unit. If the superintendent trys to page on his unit 50, however, sounds from the speaker 74a will be received by the translating device 51 and put back into the input of the amplifier of this unit, so that there is an undesirable feed back which causes howling.

I have devised an arrangement to overcome this difficulty by providing still another circuit associated with the paging switch 55 of this unit, this circuit being completed through the movable switch element 55H and the cooperating contact 55h. The circuit of the speaker 74a is completed through this switch means, so that it is normally closed. Whenever paging is initiated in the unit 50, however, operation of the paging switch 55 breaks the circuit through the speaker 74a by opening the connection between the switch element 55H and the contact 55h. This completely obviates any difficulty with feed back without in any way detracting from the usefulness of the general communicating system, since there would never be any need for the superintendent to page any one standing within a few yards of his desk.

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. Communicating apparatus of the character described, including: a number of units adapted to provide private inter-communication; speaker means adapted to provide general communication; and selectively operable means enabling at least one of said units to actuate the speaker means.

2. Communicating apparatus of the character described, including: a number of units adapted to provide private inter-communication; speaker means adapted to provide general communication; and selectively operable means in each of a plurality of said units enabling any one of said plurality of units to actuate the speaker means.

3. Communicating apparatus of the character described, including: a number of units adapted to provide private inter-communication; selectively operable switch means in at least some of said units for providing the desired interconnections therebetween; speaker means adapted to provide general communication; and selectively operable switches in each of a plurality of said units enabling any one of said plurality of units to actuate the speaker means, these last mentioned switches being separate from said switch means.

4. Apparatus of the character claimed in claim 1, wherein each unit adapted to actuate the speaker means includes a first volume control means and a second normally operative volume control means, and wherein operation of the selectively operable means to actuate the speaker means renders the second volume control means inoperative and the first volume control means inoperative.

5. Apparatus of the character claimed in claim 3, wherein each unit adapted to actuate the speaker means includes fixed volume control means and normally operative variable volume control means, and wherein operation of the selectively operable switches to actuate the speaker means renders the variable volume control means inoperative and the fixed volume control means operative.

6. Communicating apparatus of the character described, including: a number of units adapted to provide private intercommunication; selectively operable switch means in at least some of said units for providing the desired inter-connections therebetween; paging means adapted to provide general communication, this means including an amplifier and a plurality of speakers; and paging switches in each of a plurality of said units to actuate the paging means, these last mentioned switches being separate from said switch means.

7. Apparatus of the character claimed in claim 6, including input means for normally supplying said paging means with audio signals and means for rendering said input means inoperative when any one of the paging switches is operated.

8. Communicating apparatus of the character described, including: a number of units adapted to provide private intercommunication; paging means adapted to provide general communication, this means including an amplifier and a plurality of speakers; paging switches in each of a plurality of said units enabling any one of said plurality of units to actuate the paging means; input means for normally supplying the paging means with audio signals; and means for rendering said input means inoperative when any one of the paging switches is operated.

9. Apparatus of the character claimed in claim 8, wherein said units all have low impedance outputs and said paging means amplifier has a low impedance input.

10. Communicating apparatus of the character described, including: an amplifier; a plurality of speakers connected to the amplifier to be actuated thereby; and a paging unit including means for translating sound impulses into corresponding electrical impulses, this unit being adapted to be connected to the amplifier to actuate it, the output of the unit and the input of the ampifier both being of low impedance.

11. Communicating apparatus of the character described, including: a number of units adapted to provide private inter-communication; paging means adapted to provide general communication, this means including an amplifier and a plurality of speakers; paging switches in each of a plurality of said units enabling any one of said plurality of units to actuate the paging means, one of said plurality of units being adjacent one of said speakers; and means in the adjacent unit for rendering said one speaker inoperative when the adjacent unit is actuating the paging means.

12. Communicating apparatus of the character described, including: a number of units adapted to provide private inter-communication; selectively operable switch means in at least some of said units for providing the desired interconnections therebetween; paging means adapted to provide general communication, this means including an amplifier and a plurality of speakers; paging switches in each of a plurality of said units enabling any one of said plurality of units to actuate the paging means, these switches being separate from said switch means; and low impedance connections between said units and to the paging means.

13. Apparatus of the character claimed in claim 12, wherein one of said plurality of units is adjacent one of said speakers and there is means in the adjacent unit for rendering said one speaker inoperative when the adjacent unit is actuating the paging means.

14. Communicating apparatus of the character described, including: a number of units adapted ot provide private inter-communication, each such unit including translating means and an amplifier having at least one tube with plate, filament, and grid elements; selectively operable switch means in at least some of said units for providing the desired interconnections therebetween; paging means dapted to provide general communication, this means including an amplifier and a plurality of speakers; paging switches in each of a plurality of said units enabling any one of said plurality of units to actuate the paging means, these switches being separate from said switch means; power supply means for each of said units, this means being normally inoperative to supply power to the plate element of the unit; and means for automatically connecting the power supply to the plate element of a unit when the paging switch of such unit is operated.

15. Apparatus of the character claimed in claim 14, wherein each unit includes a talk-listen switch and means for automatically connecting the power supplied to the plate element upon movement of the talk-listen switch to the talk position.

16. An intercommunicating unit of the character described, including: a translating device; amplifying means including at least one tube with plate, filament, and grid elements; power supply means, this means being normally inoperative to supply power to the plate element of the tube; and a talk-listen switch, this switch including means for applying power to the plate element only when the switch is in the talk position.

17. Communicating apparatus of the character described, including: a number of units adapted to provide private inter-communication; selectively operable switch means in at least one of said units for providing the desired inter-connections therebetween; speaker means adapted to provide general communication; and a selectively operable switch in at least said one unit for enabling it to actuate the speaker means, this last mentioned switch being separated from said switch means.

18. Communicating apparatus of the character described, including: a number of units adapted to provide private inter-communication; selectively operable switch means in at least one of said units for providing the desired inter-connections therebetween; paging means adapted to provide general communication, this means including an amplifier and a plurality of speakers; and a paging switch in at least said one unit to actuate the paging means, this last mentioned switch being separate from said switch means.

19. Communicating apparatus of the character described, including: a number of units adapted to provide private inter-communication, each unit including amplifying means and means for translating sound waves into electrical waves; selectively operable switch means in at least some of said units for providing the desired inter-connections therebetween; speaker means adapted to provide general communication; and paging switches in each of a plurality of said units, operation of a paging switch in any unit opening an inter-communication circuit therein and completing a connection to the speaker means, whereby sound waves supplied to the translating means are delivered by the speaker means at greatly amplified volume.

LAWRENCE R. PAUST.

CERTIFICATE OF CORRECTION.

Patent No. 2,366,552. January 2, 1945.

LAWRENCE R. PAUST.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, second column, line 12, claim 4, for the word "inoperative" read --operative--; page 5, first column, line 23, claim 14, for "ot" read --to--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 10th day of April, A. D. 1945.

Leslie Frazer

(Seal) Acting Commissioner of Patents.

12. Communicating apparatus of the character described, including: a number of units adapted to provide private inter-communication; selectively operable switch means in at least some of said units for providing the desired interconnections therebetween; paging means adapted to provide general communication, this means including an amplifier and a plurality of speakers; paging switches in each of a plurality of said units enabling any one of said plurality of units to actuate the paging means, these switches being separate from said switch means; and low impedance connections between said units and to the paging means.

13. Apparatus of the character claimed in claim 12, wherein one of said plurality of units is adjacent one of said speakers and there is means in the adjacent unit for rendering said one speaker inoperative when the adjacent unit is actuating the paging means.

14. Communicating apparatus of the character described, including: a number of units adapted ot provide private inter-communication, each such unit including translating means and an amplifier having at least one tube with plate, filament, and grid elements; selectively operable switch means in at least some of said units for providing the desired interconnections therebetween; paging means dapted to provide general communication, this means including an amplifier and a plurality of speakers; paging switches in each of a plurality of said units enabling any one of said plurality of units to actuate the paging means, these switches being separate from said switch means; power supply means for each of said units, this means being normally inoperative to supply power to the plate element of the unit; and means for automatically connecting the power supply to the plate element of a unit when the paging switch of such unit is operated.

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17. Communicating apparatus of the character described, including: a number of units adapted to provide private inter-communication; selectively operable switch means in at least one of said units for providing the desired inter-connections therebetween; speaker means adapted to provide general communication; and a selectively operable switch in at least said one unit for enabling it to actuate the speaker means, this last mentioned switch being separated from said switch means.

18. Communicating apparatus of the character described, including: a number of units adapted to provide private inter-communication; selectively operable switch means in at least one of said units for providing the desired inter-connections therebetween; paging means adapted to provide general communication, this means including an amplifier and a plurality of speakers; and a paging switch in at least said one unit to actuate the paging means, this last mentioned switch being separate from said switch means.

19. Communicating apparatus of the character described, including: a number of units adapted to provide private inter-communication, each unit including amplifying means and means for translating sound waves into electrical waves; selectively operable switch means in at least some of said units for providing the desired inter-connections therebetween; speaker means adapted to provide general communication; and paging switches in each of a plurality of said units, operation of a paging switch in any unit opening an inter-communication circuit therein and completing a connection to the speaker means, whereby sound waves supplied to the translating means are delivered by the speaker means at greatly amplified volume.

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Leslie Frazer

(Seal) Acting Commissioner of Patents.