

March 10, 1942.

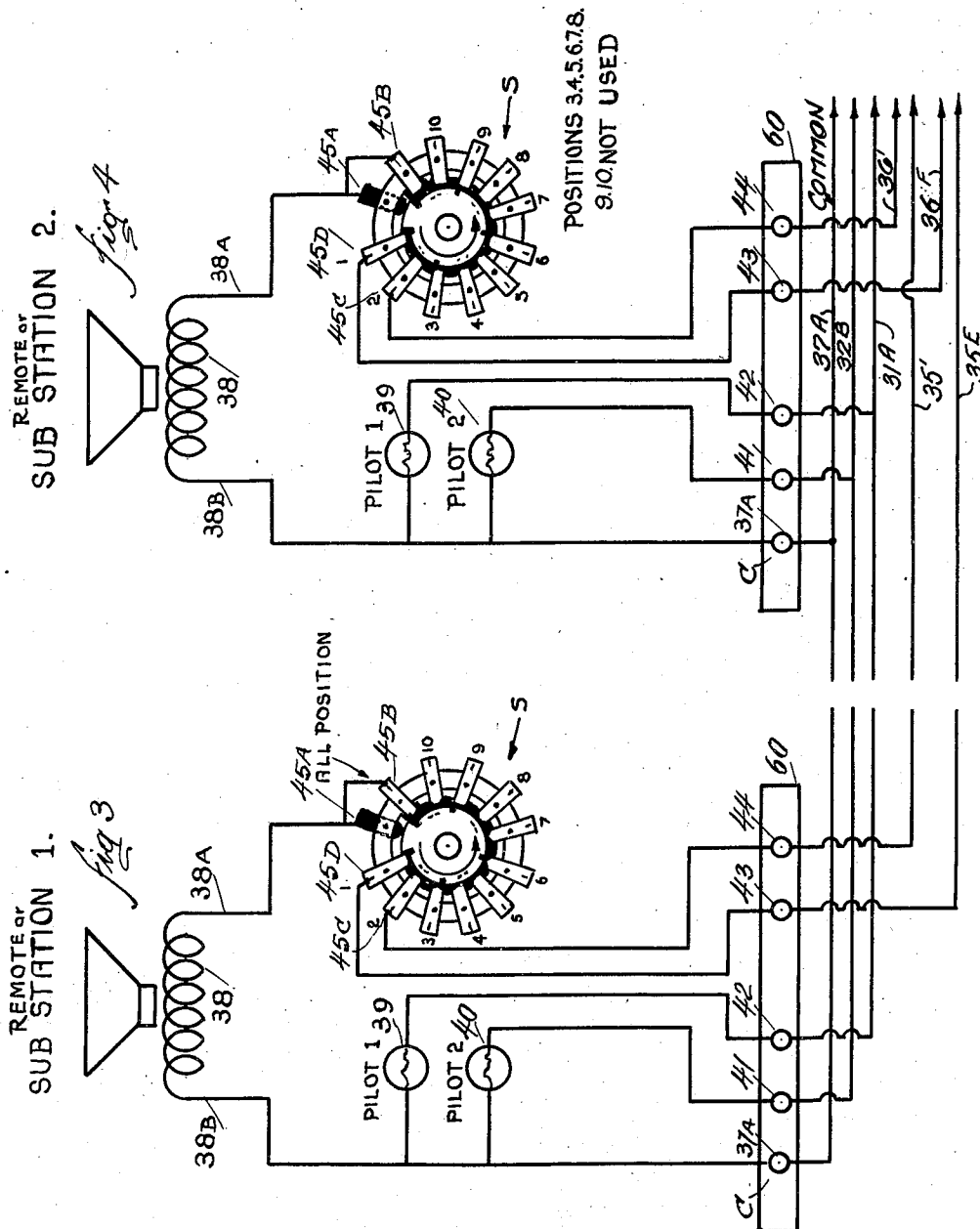
F. BERTLEY

2,275,406

INTERCOMMUNICATION SYSTEM

Filed Dec. 14, 1939

3 Sheets-Sheet 2



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3 Sheets-Sheet 3

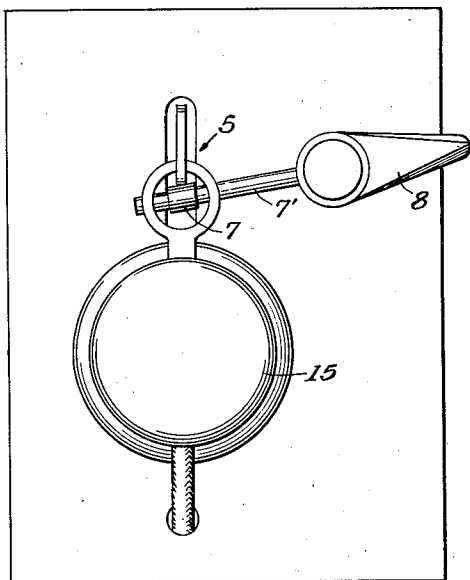


Fig. 7.

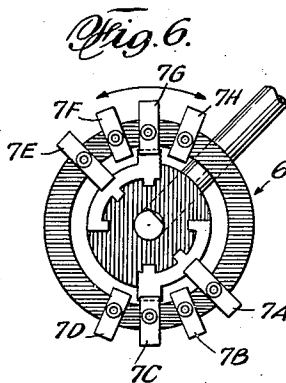
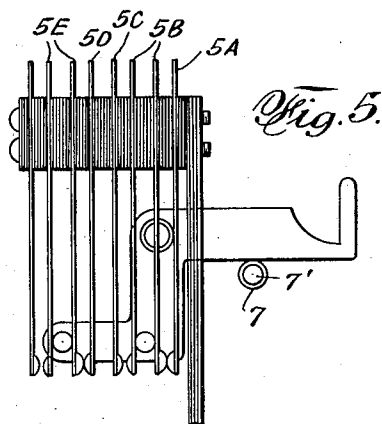
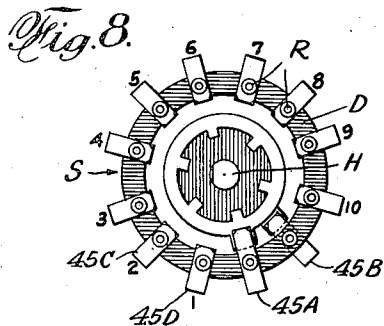
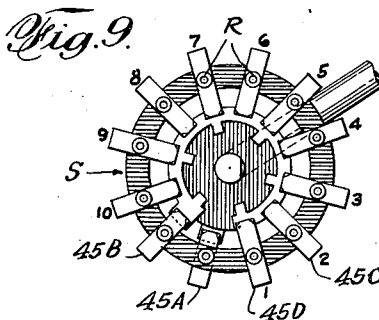


Fig. 5.



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2,275,406

INTERCOMMUNICATION SYSTEM

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14 Claims. (Cl. 179—1)

The present invention relates to intercommuni-
cation systems having a plurality of stations re-
motely located. According to this invention
some of the stations hereinafter referred to as
master stations are each provided with amplifying
means having input and output circuits, ear-
phone, loud speaker, change over switching
means, earphone hook switch, selector switches
(push button or otherwise), and a light indicator
system. Other stations, hereinafter referred to
as remote or sub-stations are each provided with
loud speaker, selector switch and light indicator
means. The loud speakers in both stations are
preferably of the permanent magnet type having
a voice coil suspended in a permanent magnetic
field.

It is an object of this invention to completely
eliminate side tones in intercommunication sys-
tems; that is, when one master is communicating
with another, neither master can hear its own
signal in its own receiving means.

A further object of this invention is to provide
a selective controllable intercommunication sys-
tem to enable interconnected stations to commu-
nicate with each other without interference from
each other. A twisted cable is preferably pro-
vided to interconnect all stations.

A still further object of this invention is to
provide a light indicating system throughout an
entire intercommunication system to indicate to
operators of stations which station desires to
communicate, or which stations are communicat-
ing with each other.

Another object of this invention is to provide
a novel buzzer to produce an audible signal at
any station.

Yet a further object of this invention is to pro-
vide a minimum of interstation conductors and
use a common wire as return conductor for the
signals from the buzzers, the light indicators,
and the speech signals without causing interfer-
ence with each other.

A further object of this invention is to provide
simple switching means for obtaining absolute
"private" intercommunication between master
stations; likewise between master and remote
stations, should it be so desired.

A further object of this invention is to provide
an intercommunication system having a plurality
of operating advantages by using the same type
of master and remote stations for multiple oper-
ations.

The following give some of the operating ad-
vantages of this invention.

No. 1 master to master.—Using the loud

speaker of the master as transmitter, amplifying
the signal by the master's own amplifier and re-
producing the signal in a second master's ear-
phone. Using the second master's loudspeaker
as a transmitter, amplifying the signal by the
second master's own amplifier and using the first
master's earphone as receiving means. Two way
communication is thus established after selecting
by means of the selector switch, the second
master. No further manipulation of any switches
for this method of intercommunication is nec-
essary.

No. 2 master to master.—A second method of
operation, in a master to master hookup can be
had by using the first master's loudspeaker as
transmitting means by operating its change-over
switch, and its earphone as receiving means; and
the second master's loudspeaker as a receiving
means for receiving the signal from the first
master and as a transmitter for transmitting to
the first master the second master's signal with-
out the second master manipulating any switches
or controls. For this operation power is supplied
to the first master only.

No. 3 master to master.—Each master using its
own amplifier and its own loud speaker as either
a transmitter or receiver by simply operating the
change-over switch on each master.

No. 4 master to master.—With the second
master not touching any controls or switches but
with the first master controlling the second
master's loud speaker circuit by its change-over
switch, and thus providing the second master
with either receiving or transmitting means, the
first master is able to receive the second master's
signal either by earphone or loud speaker. This
operation becomes important if one of the unit's
power should fail during any other mode of op-
eration.

No. 5 master to remote.—Each master being
able to communicate with either its own or with
any remote station common to its own or any
other master. The remote station having been
provided with a selector switch to include or ex-
clude any master's signal. Also each remote sta-
tion has light indicator means enabling it to be
able to tell instantly which master is calling. The
master communicating with a remote is able to
receive the remote's signal either by earphone or
loud speaker. The whole operation of receiving
and transmitting from any remote is controllable
from any master connected to the particular re-
mote station.

No. 6 master to master as remote.—The op-
eration between a first master and a second

master can be had by operating the second master exactly like a remote with the first master, by means of a change-over switch, controlling the loud speaker circuits of both the first master and the remote master station. It is not necessary to supply power to the amplifier of the second master for this type of intercommunication.

For any type of intercommunication, other than No. 6 the light indicator system of this invention will tell at a glance which master is originating a call and which master is responding. Also the light indicator will also tell, in a master system having a plurality of master stations, which two or more masters are in communication.

The above and further objects of the invention and the means for their attainment will be more apparent from the following detailed description, taken in connection with the accompanying drawings, illustrating an embodiment of which the invention may be realized, and in which:

Figs. 1 and 2 show the complete circuit diagram of 2 master stations with provisions made for connecting two remote stations;

Figs. 3 and 4 show the circuit diagrams of said remote stations;

Fig. 5 shows the complete detail of an earphone hook switch;

Fig. 6 shows a change-over switch employable in the invention;

Fig. 7 shows in detail a method of mounting the earphone hook switch and the change-over switch;

Fig. 8 is a rear view of a remote station selector switch; and

Fig. 9 is a front view of Fig. 8.

The rotary selector switch shown in Figs. 8 and 9 is preferably a special type shorting switch. The common arm 45A of this switch when in one position 45B allows all masters connected to this switch to call the remote station and in other positions 45C, 45D, etc. (Figs. 3, 4) to exclude any unwanted master station.

The rotary selector switch shown in Figs. 8 and 9 consists of a single deck of insulating material D with a number of contacts points 1-10 mounted in front and in rear of the deck, a front and an opposite rear contact being held together by means of a single rivet R and electrically shorted together, with their common terminals 45A and 45B joined together by a conductor.

In the position shown in Figs. 8 and 9 the switches are in the all position, meaning that any master connected to this switch at the points 1-10, respectively, by means of an interstation conductor can call the remote station.

If, then, a master calls a remote station the operator of the remote can tell by means of the indicator light which master is calling and may then turn by means of shaft H of his switch S to the calling master's conductor connected to one of the points 1-10 thus excluding all other masters from communicating with this remote until remote has finished the first master's communication. The second master, however, can identify his call by flashing on his light indicator leaving on his light until the remote answers his call or if an urgent message must be transmitted to the remote can identify his call by a series of pre-arranged flashes.

It is evident from the above and by an examination of Figs. 3 and 4 of the drawings that any remote, common to a number of masters is selective in respect to the masters, meaning that the

remote can select any master's incoming and any remote's outgoing signal; also any master's outgoing and any remotes incoming signal as far as master to remote station operation is concerned.

Detail of the various operating methods

Figs. 1 and 2 show a complete circuit diagram of two masters and station conductors to two remote stations. Figs. 1 and 2 are the two masters in normal or receiving position, with power supplied to the masters, lever 8 in N or normal position, all push buttons released or in out position and being designated by the numerals 20, 21, 22, 23, 24 and 25. The earphone 15 is suspended from earphone hook switch 5. The weight of the earphone will close leaves 5B and 5C.

The common terminal 7A of change-over switch 6 engages contact 7C through feeder F and common terminal 7E engages contact 7G through feeder F'. A lever knob 8 is attached to shaft 8' of the change-over switch 6.

The lever 8 carries a small extension rod or bar 7'. A short piece of elastic or felt material 7 is slipped over and fastened in place on rod or bar 7'. This is done in order to prevent any clicks or mechanical noise being produced, when lever 8 is operated and in certain positions strikes the earphone hook 5'. The amplifier 9 is a standard device with its own power supply indicated at 10, but not shown. The amplifier has been provided with an input transformer 17-18 and an output transformer 12-13. The secondary of input transformer 17 connects with one side to the amplifier's ground lead the other side of the secondary to the signal grid of the first vacuum tube (not shown) of the amplifier. The primary side of the output transformer 12 connects with one side to the plate of the last or power tube (not shown) of the amplifier and the other side of the output transformer 12 connects to the amplifier's power supply B+.

Numeral 14 is the outspeaker's voice coil of a permanent magnet type suspended in a permanent magnetic field and is used as either receiving or transmitting means in this invention. The numeral 14' indicates the loudspeaker diaphragm. The earphone 15 is of a suitable impedance and the volume limiting resistor 16 is directly shunted across the earphone and is of a predetermined value. The condenser 11 is of a suitable value and is connected between the ground lead of the amplifier and the common conductor 37, this being done in order to eliminate stray coupling or capacity effects in the intercommunication system.

The selectors are shown as push buttons 20, 21, 22 and 23 of the conventional lock type holding their position when depressed and may be released by button 25. Button 24 is a simple spring return push button and is used for connecting feedback condenser 19 between the plate side of the output transformer primary 12 to the signal grid input side of input transformer 17A. Depressing button 24 will cause a certain amount of energy to be fed back from the output of the amplifier 9 to the input of the amplifier 9 and in audible note will be heard in any remote station that may be connected to this master and selected by the station selector push button. This constitutes the audible buzzer system. Push button 24 is independent of all other buttons.

Contacts 20A and 20C are mechanically coupled to button 20 though electrically insulated from each other. Likewise 21A and 21C; 22A

and 22C; 23A and 23C; are mechanically coupled to buttons 21, 22, 23, respectively.

Push buttons 20, 21, 22, 23, respectively, when pressed cause contacts between 20A—20B and 20C—20D, simultaneously; 21A—21B and 21C—21D, simultaneously; 22A—22B and 22C—22D, simultaneously; 22A—23B and 23C—23D, simultaneously.

Pressing push button 24 causes contact between 24A and 24B. This push button arrangement provides station selection and light indication in the present intercommunication system.

Terminal strip 50 carries the conductor terminals 37', 31, 32, 33, 34, 35 and 36.

Contact points 20C, 21C, 22C, 23C are connected in parallel and to one side of the power line. Contact points 20D, 21D, 22D and 23D also connect in parallel but to one side of primary 26 of the light indicator supply transformer. The other side of primary 26 connects to the other side of the power line. The secondary side 27 of the supply transformer connects directly to a small rectifier 28 of the oxide type, having sufficient capacity for the purpose intended. The negative side of the rectifier connects directly to the common lead conductor 37. The positive side of the rectifier connects to one side of pilot light indicator 29 and to terminal 32 on terminal strip 50 in Fig. 1 (master station No. 1); the other side of indicator 29 connecting directly to common conductor 37. Pilot light indicator 30 also connects to the common 37 with one side and with the other side to terminal 31 on terminal strip 50. This provides the light indicator system for power line operation. If this system is to be battery operated then a suitable battery supply must be substituted for transformer 26 and 27 and rectifier 28 with the following changes in wiring. The negative of the battery supply will have to be connected to the common lead 37, buttons 20C, 21C, 22C, 23C being still connected in parallel but going to the positive terminal of the battery supply, and buttons 20D, 21D, 22D, and 23D still connected together but connecting to the side of the pilot light indicator 29 that formerly connected to the positive terminal of rectifier 28. In Fig. 2 (master station No. 2) the positive supply from either rectifier or battery connects to one side of pilot light 30.

All stations are interconnected by the following conductors. Conductor 37A from terminal 37' of master station No. 1 (Fig. 1) to terminal 37' on master station No. 2 (Fig. 2) and to terminal C on remote stations Nos. 1 and 2 (Figs. 3 and 4). Conductor 31A from terminal 31 of master station No. 1 to terminal 31 of master station No. 2 and to terminal 42 of remote stations Nos. 1 and 2. Conductor 32B from terminal 32 of master station No. 1 to terminal 32 of master station No. 2 and to remote station No. 1 terminal 41; also remote station No. 2 terminal 41 of conductor 32B from terminal 33 of master station No. 1 to terminal 33 of master station No. 2. Conductor 34D from terminal 34 of master station No. 1 to terminal 34 of master station No. 2. Conductor 35E of master station No. 1 to 43 of remote station No. 1 and conductor 36F from terminal 36 of master station No. 1 to terminal 43 of remote station No. 2. Conductor 35' from terminal 35 of master station No. 2 to terminal 44 of remote station No. 1 and conductor 36' from terminal 36 on master station No. 2 to terminal 44 of remote station No. 2.

Let it be assured that master station No. 1

wishes to call master station No. 2, it being, however, understood that power is supplied to both master stations.

Now, if the earphone 15 is lifted off the earphone hook 5', leaf 5A contacts leaf 5B. A conductor 65 connects 5A—5B to common terminal 7E on change-over switch 6 through a common feeder F' to contact points 7F and 7G of switch 6 and from 7F—7G through conductor 66 to pushbutton contact 20B and from there through conductor 67 to terminal 33 on strip 50 of master station No. 1. Conductor 33C connects master station No. 1 to terminal 33 on master station No. 2. Conductor 68 connects terminal 33 on master station No. 2 with pushbutton contact 21B. Conductor 69 connects contact 21B with contact points 7G and 7F of switch 6 on master station No. 2 and through a common feeder F' to common terminal 7E of switch 6 on master station No. 2. The conductor 65 from 7E of master station No. 2 continues to leaves 5B—5C of earphone hook 5 of master station No. 2, leaf 5C being connected to leaf 5D, also through conductor 70 to one side of the loudspeaker 14. The other side of loudspeaker 14 connects to the common conductor 37 of master station No. 2 then to terminal 37' on terminal strip 50 of master station No. 2, the common conductor 31 then returns to master station No. 1 through conductor 37A. Referring back to earphone hook 5 of master station No. 1, it is to be noted that leaf 5A is connected to one side of the earphone 15, the other side of earphone 15 connecting directly with the common lead 37. The resistor 16 is shunted directly across the earphone 15 at all times. Upon lifting of earphone 15 from hook 5' leaf 5B disengages from leaf 5C and engages or contacts with leaf 5A, leaf 5D making contact with leaf 5E. Leaves 5C and 5D are connected together and by conductor 70 to one side of loudspeaker 14, the other side of the loudspeaker connecting with common lead 37. Leaf 5D having made contact with leaf 5E now carries one side of the loudspeaker 14 through a conductor 71 to one side of the input transformer primary 18 and to contact 1D on change-over switch 6. The other side of the input transformer's primary 18 connects with the common lead 37. One side of the output transformer's secondary 13 connects with the common lead 37, and the other side thereof with contact points 7B, 7C, and 7H on switch 6 through conductor 72, the latter also connecting with a common feeder to common terminal 7A on switch 6 and with a conductor 73F to pushbutton contact points 20A, 21A, 22A and 23A.

Depressing pushbutton 21 of master station No. 1 will close and lock in position respective contact points 21A—21B and 21C—21D. A conductor 74 connects contact point 21B with terminal 34 on terminal strip 50 of master station No. 1. Conductor 34D connects master station No. 1 with terminal 34 of master station No. 2, and continuing to pushbutton contact 21B of master station No. 2, then through a conductor 69 to contact points 7F and 7G on switch 6 of master station No. 2 and through common feeder F' from contact point 7G to common terminal 7E, common terminal 7E through conductor 65 connects with earphone hook leaf 5B, leaves 5C—5D. Leaves 5C—5D are connected together and through conductor 70 to one side of loudspeaker 14 of master station No. 2. The other side of loudspeaker 14 connects with common lead 37. Having depressed button 21 on master station No.

1 thus closing contacts 21A—21B and 21C—21D and applied the power line voltage across the light indicator transformer's primary 26, a secondary voltage is induced in secondary 27 and is fed into the input of the oxide type rectifier 28. The negative terminal of the rectifier connects with the common lead 27. The positive terminal of the rectifier connects with one side of the pilot light 29 and to terminal 32 on terminal strip 50. In master station No. 2 the positive side of the rectifier 28 connects with pilot light 30, and with terminal 31 on the terminal strip 50. Terminal 32 of master station No. 1 connects through conductor 32B with terminal 32 on master station No. 2 and with one side of pilot 29. Applying a line voltage across transformer's primary 26 in master station No. 1 by depression button 21, will cause pilot light 29 thus closing contacts 21C and 21D in master station No. 1 and likewise pilot 29 in master station No. 2 to light up. If master station No. 1 now has its buzzer push button depressed an audible note will be heard in the loudspeaker of master station No. 2, due to the feed back capacity 19 being connected to push button contacts 24A—24B and to input transformer side 17A. The pilot light constitutes this system's visual, and the buzzer its audible, indication of a station's call. Now if the earphone 15 of master station No. 2 is lifted off the hook 5' and the operator of master station No. 2, knowing by prearrangement that his pilot 29 belongs to master station No. 1, depresses his pushbutton 20, thus closing pushbutton contacts 20A—20B and 20C—20D, he will cause his pilot light 30 and pilot light 30 in master station No. 1 to light up, indicating to master station No. 1 that master station No. 2 is ready for communication, because the exact electrical action has taken place in master station No. 2 as has been described with relation to master station No. 1, when the earphone on master station No. 2 was lifted off the hook.

To sum up, the action which takes place in both masters are as follows: The loudspeaker of each master station is now used as a transmitting means and is placed across the input transformer of each master station's amplifier, but the output transformer 13 of master station No. 1 is connected across the earphone of master station No. 2 and the output transformer 13 of master station No. 2 has been connected across the earphone of master station No. 1. Two-way communication has thus been established without further manipulation of any switches. When communication has been completed both masters press their respective release buttons 25, and replace the earphones thus restoring the master stations to their original or normal position and ready for another call.

It is evident from the above description that an intercommunication system has been provided with absolute privacy during communication between two master stations and no other master station that may be connected to the same system can possibly listen in. It is also evident that the system is not limited to two master stations but by simply adding interstation conductors, terminal posts, pilot lights, station selector pushbuttons, any number of master stations may be incorporated in an intercommunication system.

A second operation with the same master stations is possible, using loud speaker to loud speaker between 2 master stations as described heretofore in paragraph numbered 3. Again sta-

tion selection must be made by depressing and locking pushbutton 21, after supplying power to both master stations and again pilot light 29 will flash on in master station No. 1 and master station No. 2. Now the operator of master station No. 1 does not have to lift the earphone 15 of the earphone hook 5 but presses lever 8 on switch 6 into its lowermost position designated as T, or "talk position" and thereby lifts the earphone hook, just high enough to again close leaves 5A and 5B and leaves 5D and 5E of earphone hook 5 by means of extension rod 71 attached to lever 8. It is also evident that the conductor from pushbutton contacts 20A, 21A, 22A and 23A and connecting to the common terminal contact 7A on change-over switch 6 and has been transferred by means of a common feeder F from contact 7C to contact 7D and to input transformer 18; also to leaf 5E and leaf 5D, leaf 5D having made contact with leaf 5E, by pressing lever 8. Therefore loud speaker 14 being connected to leaf 5D has been placed against across the input transformer's primary 18. When lever 8 was pressed into its lowermost position T, common feeder F from common terminal 7A moved away from 7C to contact 7D and common feeder F' from terminal 7E moved away from contact 7G to contact 7F, thus freeing contacts 7B and 7C and contacts 7F and 7G. Contacts 7H—7B and 7C being connected together and to output transformer 12 are now connected through common feeder F to terminal 7A and by a conductor 73, to pushbutton contacts 20A, 21A, 22A, and 23A; and having depressed and locked button 21 and thereby closing contacts 21A and 21B, and continued from button contact 21B through conductor 74 to terminal 34 and by conductor 34D to terminal post 34 of master station No. 2 and on to button contact 21B through conductor 69 of master station No. 2 and to contact point 7G through common feeder F' to terminal point 7E and by conductor 65 to leaf 5B through contact 5C and by conductor 70 to loud speaker 14 of master station No. 2. Both master stations being connected also by the common conductor 37A, it is evident that loud speaker 14 of master station No. 2 is still placed across the output transformer 13 of master station No. 1. Master station No. 1 now uses his loud speaker as transmitting means and amplifying its signal by means of amplifier 9 reproduces its signal in loud speaker 14 of master station No. 2. When master station No. 1 has finished a call, master station No. 2 operates lever 8 in the same manner as has just been described for master station No. 1. It is, of course, understood that master station No. 1 has lever 8 returned to N or normal position leaving button 21 depressed and locked until all messages have passed between the two master stations. If master station No. 2 depresses and locks button 20 pilot light 30 will light up in both master stations No. 2 and No. 1. Depressing lever 8 on master station No. 2 to the lowermost position results in the exact electrical action as has been described for master station No. 1, except that master station No. 2 uses loud speaker 14 for transmitting means and loud speaker 14 of master station No. 1 as reproducing means for the amplified signal from master station No. 2 again through common conductor 37A and conductor 33C from terminal 33 on master station No. 2 to terminal 33 on master station No. 1. Two-way loud speaker communication between two master stations has thus been provided. It is also evident that either master sta-

tion may receive the incoming signal either by earphone or loud speaker, if so desired and by operating the change-over switch as mentioned hereinbefore in paragraph No. 2.

A third way to operate this system is, as mentioned hereinbefore in paragraph 4, in a master station to master station operation without the second master station operating its controls or even turning on its power. This operation becomes important if the power should fail in any master station. With power supplied to master station No. 1 pushbutton 21 is again depressed and locked in position. This again closes contacts 21A and 21B, connects through conductor 34D to pushbutton contact 21B on master station No. 2 and to contacts 7G and 7F on switch 6 of master station No. 2, through common feeder F' to contact 7E and to switch leaf 5B closing through contact 5C loud speaker 14 to common conductor 37 on master station No. 2. Returning to master station No. 1 it is evident that the conductor 74 from pushbutton contact 21B is carried, by previously having locked 21A and 21B, to terminal point 7A on switch 6, through common feeder F to contact 7C, with contact 7C connecting to output transformer 13 and to common conductor 37. It is evident that loud speaker 14 of master station No. 2 now has been placed across the output transformer of master station No. 1 and is used as the reproducer for any signal coming from master station No. 1. If lever 8 of master station No. 1 is now again pressed into its lowermost position, earphone hook 51 will be lifted by extension rod 7', to close contacts on leaves 5A and 5B and leaves 5D and 5E. The conductor 70 coming from 5D connects loud speaker 14 through contact to leaf 5E and to input transformer primary 18. Loudspeaker 14 of master station No. 1 has now been connected across input transformer 18 and is used as transmitting means for master station No. 1, with loudspeaker 14 of master station No. 1 placed across input of master station No. 1 and with loud speaker 14 of master station No. 2, placed across the output of master station No. 1. Master station No. 1 can now transmit its signal to master station No. 2. In order to receive a reply from master station No. 2, lever 8 of master station No. 1 must be lifted to its uppermost or "listen position" L. The following takes place. The earphone hook 5' will be restored to normal position by weight of earphone, common feeder F' will move from 7G to 7F thus placing loud speaker 14 of master station No. 2 across the input transformer of master station No. 1 and loudspeaker 14 of master station No. 1 across the output transformer 12 of master station No. 1. It is now clear that by pressing lever 8 on master station No. 1 into the lowermost or "talk position," master station No. 1 loud speakers will be used as transmitting means and loud speaker 14 of master station No. 2 will be used as reproducing means, and with lever 8 of master station No. 1 in its uppermost or listen position, loud speaker 14 of master station No. 2 will be used as transmitting means and loud speaker 14 of master station No. 1 will be used as reproducing means. The above confirms with paragraph 4, the buzzer operates in the usual manner by depressing button 25 and letting button return to normal.

The next operation possible with this system, is in a master station to remote station hookup as mentioned hereinbefore in paragraph numbered 5. The operation between a master station and a

remote station is essentially the same as has been described for master station to master station operation with the second master station not operating any controls. Remote stations may be connected either to respond to one master station only or as shown in the drawings, common to all master stations. Remote station No. 1 connects to master station No. 1 by means of conductors 35E, common conductor 37A and conductor 32B, master station No. 2 connects also to remote station No. 1 by conductors 37A, 35' and 31A. Remote station No. 2 connects to master station No. 1 by conductors 37A, 32B and 36F. Master station No. 2 connects to remote station No. 2 by means of conductors 37A, 31A and 36'. If master station No. 1 wants to call remote station No. 1, the lever 8 of master station No. 1 must be pressed against into its lowermost or "talk" position, button 22 must be pressed and locked in position; then loud speaker 38 of remote station No. 1 will be placed across the output transformer 13 of master station No. 1 by means of conductors 37A and 35E, contact 45D on switch 46 in remote station No. 1 and through its common terminals 45A and 45B. Pilot light 40 will flash on by means of common conductor 37A and 32B. Figures 38A and 38B only signify start and finish of speaker winding and have no other meaning. It should be mentioned that power must be supplied to a master station wishing to communicate with a remote station. With switch S on the remote station in all positions as shown, it is entirely possible for all master stations to call the remote station No. 1 at the same time. While this feature is desirable it is not entirely practical, for the following reason: Should remote station No. 1 be in transmitting position to master station No. 1 and master station No. 2 in transmitting position to remote station No. 1, the total output of master station No. 2 along with the signal from remote station No. 1 would appear at the input of master station No. 1, resulting in such tremendous amplification, as to set up a howl or even render the whole system inoperative. Therefore, switch S has been provided to eliminate this possible interference. When master station No. 1 calls remote station No. 1, the pilot light 40, as stated before, will flash on and a buzzer signal will be heard in loud speaker 38 of remote station No. 1, informing the operator of remote station No. 1 by visual means of pilot light 49 that master station No. 1 wishes to communicate. Operator of remote No. 1 then sets his switch S to position 45D, thus connecting his loud speaker 38 to master station No. 1 through conductor 37A and 35E and thereby excludes all other master stations that may be connected to remote station No. 1. However, any other master station can identify itself by visual means of the indicator pilots lights 39, 40, informing the operator of remote station No. 1 that another master station has a call for him. Remote station No. 1 can communicate with one or more master stations should it be necessary, by manipulating selector switch S and without interference from or between master stations. The same action as described for master station No. 1, will take place if master station No. 2 should call remote station No. 1, but then pilot light 39 will flash on and operator of remote station No. 1 must set his selector switch S to contact 45C in order to exclude any other master station. After finishing communication with any master station, operator of remote station No. 1 returns his switch S to the all position 45B

in order to allow any master station to call remote station No. 1. It is evident from the above description that the loud speaker 38 of any remote station is alternately used as transmitting and reproducing means, remotely controlled by switch 6 of any master station connected to the remote station, and also that any master station in communication with any remote station can receive the signal of the remote station at the master station using either the earphone 15 or the loud speaker 14 of the master station as reproducing means. After completing any call, release button 25 must be pressed to restore all circuits to normal.

A still further type of operation possible with this system and as mentioned hereinbefore in paragraph numbered 6 is as follows: Master station No. 1 may call master station No. 2 operating master station No. 2 as outlined before with no power applied to master station No. 2 and operating remote station exactly as outlined under master station to remote station operation with switch 6 and push-buttons 21, 22 or 23 of master station No. 1, the controlling factor in this type of operation. Again the loudspeaker of master station No. 2 and the loud speaker of any remote station are used alternately as reproducing and transmitting means.

Thus there has been provided an efficient intercommunication system with audible and visual signals at remote master stations and remote substations, thus minimizing manufacturing and electrical difficulties, and with an unlimited amount of master and remote stations operation in a system without interference from and between each other.

It is, of course, understood that this system is not limited to the number of master and remote stations shown in the drawings but may be extended to include any number of stations by adding additional selector and light-indicator means, terminals, interstation conductors, pilot lights, etc.

In the accompanying drawings there is illustrated the invention embodied in one of its practical forms but as this illustration is primarily for purposes of disclosure it will be understood that the invention is not limited to this particular form of structure and that it may be modified in many respects without departure from the true spirit and scope of the invention as herein defined and claimed. It is further understood that the terms which are employed herein are used in a descriptive rather than in a limiting sense, except, however, for such limitations that may be imposed by the state of the prior art.

Having thus described the invention what is claimed as new and desire to secure by Letters Patent, is:

1. In an intercommunication system the combination including a plurality of stations each station having loud speaker means, amplifying means and an earphone; means for using the loud speaker means of each station as a transmitter, said amplifying means of one station for amplifying the signal of said one station and simultaneously reproducing said signal in the earphones of the remaining stations, means for selecting for communication any one of the said remaining stations, and indicating means for each of said stations for indicating the origin of a signal from any of said plurality of stations.

2. In an intercommunicating system the combination including a plurality of stations each station having loud speaker means, amplifying

means, station selector switching means, and switching means for transferring the loud speaker means of one station from reproducing position to transmitting position and simultaneously reproducing the signal of said one station in the loud speaker means of the remaining stations, means for selecting for communication any one of the said remaining stations, and indicating means for each of said stations for indicating the origin of a signal from any of said plurality of stations.

3. In an intercommunicating system the combination including a plurality of stations each station having loud speaker means, amplifying means, switching means, means for alternately using the loud speaker means of one station as its transmitter and as reproducer for the signal from the remaining stations, station selector switching means for selecting for communication any one or all of said remaining stations, and indicating means for each of said stations for indicating the origin of a signal from any of said plurality of stations.

4. In an intercommunicating system the combination including a plurality of stations each station having loud speaker means, at least one station having amplifying means, switching means, and station selector means for selecting for communication any one or all of the remaining stations, said switching means in one position conditioning the loud speaker means of said one station as a transmitter and simultaneously the loud speaker means of the station selected by said selector means as reproducing means for the signal from said one station, said switching means in another position conditioning the loud speaker of said selected station as a transmitter for the amplifying means of said one station and the loud speaker means of said one station as reproducing means for the signal from the said selected station, and indicating means for each of said stations for indicating the origin of a signal from any of said plurality of stations.

5. In an intercommunicating system the combination including a plurality of stations a first number of said stations having loud speaker means, amplifying means, earphone, earphone switch means and station selector switch means, a second number of said stations having loud speaker means and station selector switch means, the station selector switch means of one of said second number of stations being operable in one position for selecting an incoming signal from one of said first number of said stations and an outgoing signal from said second number of said stations to one of said first number of said stations and being operable in another position for permitting communication between one of said second number of said stations with one or all of said first number of said stations.

6. In an intercommunicating system the combination including a plurality of stations a first number of said stations having loud speaker means, amplifying means, earphone, earphone switch means and station selector switch means, a second number of said stations having loud speaker means and station selector switch means, the station selector switch means of one of said second number of stations being operable in one position for selecting an incoming signal from one of said first number of said stations and an outgoing signal from said second number of said stations to one of said first number of said stations and being operable in another position for permitting communication between

one of said second number of said stations with one or all of said first number of said stations, and indicating means for indicating in said one of said second number of said stations which stations are communicating with each other or which of said first number of said stations desire to communicate with said one of said second number of said stations.

7. In an intercommunicating system the combination including a plurality of stations a first number of said stations having loud speaker means, amplifying means, earphone, earphone switch means and station selector switch means, a second number of said stations having loud speaker means and station selector switch means, the station selector switch means of one of said second number of stations being operable in one position for selecting an incoming signal from one of said first number of said stations and an outgoing signal from said second number of said stations to one of said first number of said stations and being operable in another position for permitting communication between one of said second number of said stations with one or all of said first number of said stations, indicating means for indicating in said one of said second number of said stations which stations are communicating with each other or which of said first number of said stations desires to communicate with said one of said second number of said stations, and audible signal means for indicating to said station of said second number of said stations which of said first number of said stations desires to communicate with said station of said second number of said stations.

8. In an intercommunicating system the combination including a plurality of stations a first number of said stations having loud speaker means, amplifying means, earphone, earphone switch means and station selector switch means, a second number of said stations having loud speaker means and station selector switch means, the station selector switch means of one of said second number of stations being operable in one position for selecting an incoming signal from one of said first number of said stations and an outgoing signal from said second number of said stations to one of said first number of said stations and being operable in another position for permitting communication between one of said second number of said stations with one or all of said first number of said stations, indicating means for indicating in said one of said second number of said stations which stations are communicating with each other or which of said first number of said stations desires to communicate with said one of said second number of said stations, audible signal means for indicating to said station of said second number of said stations which of said first number of said stations desires to communicate with said station of said second number of said stations, and conductors connecting said stations, said conductors including a common conductor for receiving and transmitting.

9. In an intercommunicating system the combination including two stations, each having amplifying means, loud speaker means adapted to be used both as a receiver and a transmitter, an earphone and earphone hook switch; a communication circuit between said amplifying means, loud speaker means, earphones and earphone hook switches, said circuit including interstation conductors connecting said stations with one of said conductors acting as a common

conductor for receiving and transmitting, a second of said conductors completing the communication circuit between the amplifying means of one station and the receiving means of the other station, and a third conductor completing the communication circuit between said other station's amplifying means and the receiving means of said one station.

10. In an intercommunicating system the combination including a plurality of stations, each having amplifying means, loud speaker means adapted to be used both as a receiver and a transmitter, a station selector switch, an earphone and earphone hook switch; a communication circuit between said amplifying means, loudspeaker means, station selector switches, earphones and earphone hook switches, said circuit including interstation conductors connecting said stations with one of said conductors acting as a common conductor for receiving and transmitting, a second of said conductors completing the communication circuit between the amplifying means of one station and the receiving means of another station, and a third conductor completing the communication circuit between said another station's amplifying means and the receiving means of said one station; and a change-over switch for each station, said change-over switch being connected with earphone, earphone hook switch, loud speaker means, amplifying means and to selector switch for selectively using the loud speaker means of said stations as receiving or transmitting means.

11. In an intercommunicating system the combination including stations, each having amplifying means, loudspeaker means, earphone, an earphone hook switch, a change-over switch a selector switch, and light indicating means; a communication circuit between said amplifying means, loud speaker means, station selector switches, earphones, earphone hook switches, said circuit including interstation conductors connecting said stations with one of said conductors acting as a common conductor for receiving, transmitting and indicating, a second of said conductors completing the communication circuit between the amplifying means of one station and the receiving means of another station, a third conductor completing the communication circuit between said another station's amplifying means and the receiving means of said one station, a fourth conductor completing the indicating circuit from one station to said another, and a fifth conductor completing the light indicating circuit from the said another station to the said one station, said indicating means being operable simultaneously with the station selector switch to indicate which of the stations are in communication in the system.

12. In an intercommunication system, the combination including two stations, first and second respectively, a transmission circuit between the first station and the second station, a transmission circuit between the second station and the first station, each circuit including a loud speaker used as a transmitter, an earphone used as a receiver, an earphone hook switch, an amplifier, input means to said amplifier, output means from said amplifier, and selector switch means; said transmission circuits including a common conductor connecting with one side of the loudspeaker, earphone, output means and input means, the selector switch means of one of said stations for closing the

transmission circuit of the other of said stations through its receiving means.

13. In an intercommunicating system the combination including two stations, each having amplifying means, loudspeaker means adapted to be used both as a receiver and a transmitter; a communication circuit between said amplifying means and loudspeaker means, said circuit including interstation conductors connecting said stations with one of said conductors acting as a common conductor for receiving and transmitting, a second of said conductors completing the communication circuit between the amplifying means of one station and the receiving means of the other station, and a third conductor completing the communication circuit between said other station's amplifying means and the receiving means of said one station.

14. In an intercommunicating system the combination including a plurality of stations, each having amplifying means, loudspeaker means

adapted to be used both as a receiver and a transmitter, a station selector switch; a communication circuit between said amplifying means, loudspeaker means and station selector switches, said circuit including interstation conductors connecting said stations with one of said conductors acting as a common conductor for receiving and transmitting, a second of said conductors completing the communication circuit between the amplifying means of one station and the receiving means of another station, and a third conductor completing the communication circuit between said another station's amplifying means and the receiving means of said one station; and a change-over switch for each station, said change-over switch being connected with loudspeaker means, amplifying means and to selector switch for selectively using the loudspeaker means of said stations as receiving or transmitting means.

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