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INTERCOM-SIGNAL DEVICE

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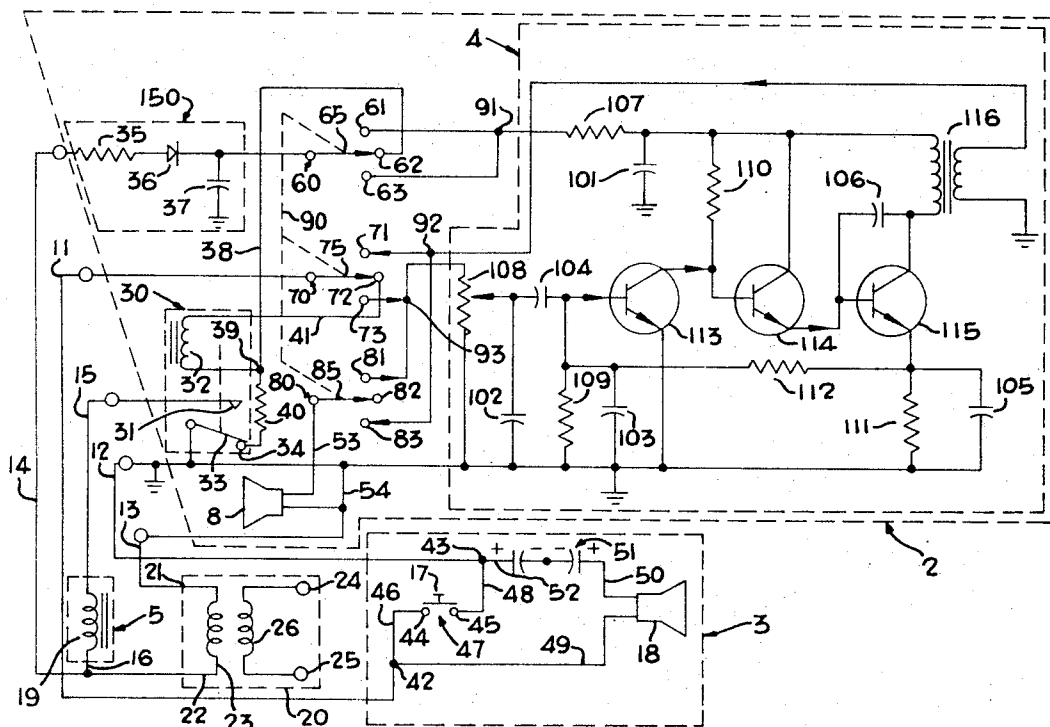


Fig 2

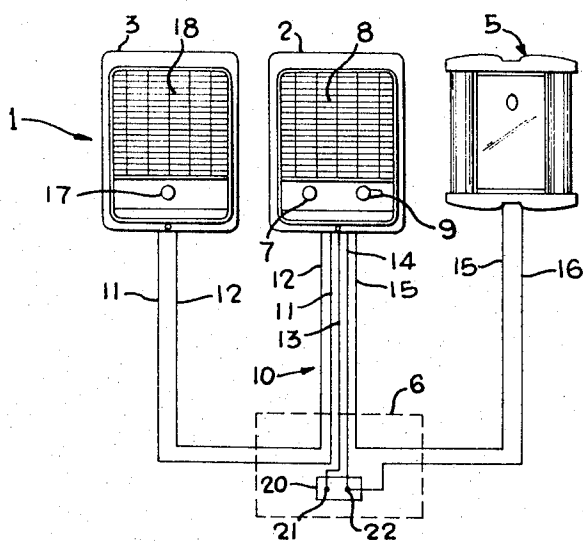


Fig 1

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INTERCOM-SIGNAL DEVICE

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ABSTRACT OF THE DISCLOSURE

A combined intercom and door chime especially adapted for attachment to an existing door chime installation. A remote station containing a speaker/microphone and a chime button connected in parallel with the speaker/microphone replaces the original door chime button. A central station having a second speaker/microphone and a function switch is positioned at a central location. The function switch is biased to a position in which the chime button is connected in series to a chime circuit relay and a direct current source. Depression of the chime button closes this circuit and thereby causes the relay to close an AC chime circuit and activate the chime solenoid. Two other positions of the function switch connect the speaker/microphones to an amplifier and simultaneously connect the direct current source to the amplifier.

This invention relates to communication systems. It has particular application to "intercom" systems with one speaker/microphone located inside a dwelling and another speaker/microphone, associated with a door chime, at an outside door of the dwelling, but is not limited thereto.

Conventional door chime systems consist of a chime button, a 16-volt transformer, and a chime which, electrically, is essentially a chime solenoid. Two electrical wires lead from the chime button location to the transformer. Two other electrical wires lead from the chime solenoid to the transformer. One of the chime button wires is connected to the ground side of the transformer. The other chime button wire is connected to one side of the chime solenoid. The other side of the chime solenoid is connected to the "hot" side of the transformer.

Presently known door chime-intercom devices have an outdoor station with a speaker/microphone and a chime button, an indoor speaker/microphone, an amplifier, a transformer, and a chime. Two wires lead from the outdoor speaker/microphone to the indoor speaker/microphone. Two different wires lead from the chime button to the transformer and are wired in the conventional door chime manner just described. Thus, an outdoor station with both a speaker/microphone and a chime button presently requires four electrical wires leading to interior locations.

The installation of a doorbell-intercom system in a home which already has a door chime system is thus difficult. Not only must an outdoor and an indoor station be installed and a power cable led from the indoor station to the transformer, but new wires must be led from the outdoor station to either the transformer or the indoor station. Installing these wires requires either making new openings through the outer wall or fishing the wires through existing wireways.

One of the objects of this invention is to provide a chime-intercom system device which is easier to install than devices known heretofore.

Another object is to provide such a device which is inexpensive to manufacture and maintain.

Still another object is to provide such a device in which

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the intercom system is controlled entirely from a location remote from the chime button.

Other objects will become apparent to those skilled in the art in the light of the following description and accompanying drawings.

In accordance with this invention, generally stated, an intercom-signal device is provided including a remote station which has only two electrical leads, and uses these same two leads for both a signalling function and an intercom function.

The remote station houses a signal switch (chime button), which is part of a signal switch circuit, and a remote speaker, which is part of an intercom circuit. The switch and speaker are connected in parallel to the two leads. As used hereinafter, the term "speaker" means a speaker/microphone. The signal switch circuit is a control circuit for an AC signal circuit; the signal switch circuit itself carries direct current. This direct current is blocked from the remote speaker by means which in the preferred embodiment takes the form of a capacitor in the intercom circuit. The intercom circuit carries alternating audio frequency current when the remote speaker is in use. This current is passed by the capacitor. Because the signal switch is normally biased open, the signal switch circuit does not normally short across the intercom circuit, although it does so when the signal switch is closed manually against the bias, by-passing the remote speaker. Thus, the signal switch circuit and the intercom circuit, although connected in parallel to the same two leads, effectively operate independently.

One of the two wires from the remote station leads to a three-way switch which connects it selectively to a DC power supply through a signal circuit relay, to the input of an amplifier, or to the output of an amplifier. The other wire is grounded.

In the illustrative embodiment described, the function switch, signal circuit relay, amplifier, and a second speaker are all located at an "indoor station," and the signal (a door chime) and the transformer from which the system is powered are at different locations. For some applications, the grouping of these elements could be altered. However, the configuration of elements described in the illustrative embodiment is advantageous.

In the illustrative embodiment, a door chime-intercom device is provided which utilizes all of the wiring of a pre-existing standard 16-volt door chime system, which requires the removal of only the door chime button, and which requires the addition of only an outdoor station, an indoor station and a single 5-wire cable from the indoor station to a junction point, generally at the transformer location.

In the drawing, FIGURE 1 is a somewhat diagrammatic front plan view of the main elements of one illustrative embodiment of the device of this invention; and

FIGURE 2 is a diagrammatic representation of the illustrative circuit described.

Referring now to the drawing for one illustrative embodiment of this invention, reference numeral 1 indicates an intercom-signal device of this invention, which, in the illustrative embodiment shown in FIGURE 1 includes an inside speaker station 2, an outside speaker station 3, a chime housing 5, and a transformer station 6.

The inside speaker station includes a standard amplifier 4, a speaker 8, a function switch control 9, a volume control 7, and electrical connections for a five-wire cable 10 containing electrical conductors 11, 12, 13, 14 and 15. The conductor 12 constitutes a common ground. The outside speaker station 3 includes a chime button 17, a speaker 18, and electrical connections for wires 11 and 12. The chime housing 5 contains a chime of the standard type in which activation of a solenoid 19 causes the chime to sound. The transformer station 6 includes a trans-

former 20 with terminals 21 and 22 connected to two ends of a secondary coil 23, and terminals 24 and 25 connected to two ends of a primary coil 26 and to a source of AC current (house current) not here shown. The terminal 21 is connected to the common ground 12. The terminal 22 is connected to electrical conductor 14. The electrical conductor 14 is connected to rectifier 150, of conventional configuration, which includes a resistor 35, a diode 36 and a capacitor 37. The output side of the rectifier 150 is electrically connected to a movable arm 65 of a switch 60. The switch 60 is one of three switches 60, 70 and 80, mechanically linked, which make up a function switch 90. The function switch 90 is a three-position switch.

Thus, the three switches 60, 70 and 80 have a middle contact 62, 72 and 82 respectively, to which the switch is normally biased, an upper, talk contact 61, 71 and 81 respectively and a lower, listen contact 63, 73 and 83 respectively. The function switch can be turned manually selectively to the talk or listen position from the inside speaker station, returning to the middle or standby position when released.

In the illustrative specific embodiment of a suitable electrical circuit, shown in FIGURE 2, the transformer 20 is a standard 16-volt chime transformer which supplies power to a chime circuit and, through a rectifier, to a chime control circuit and an intercom circuit.

The chime circuit is connected to the electrical conductor 14 from the terminal 22 of the transformer 20 by means of electrical conductor 16. Conductor 16 is connected to one side of the chime solenoid 19. The other side of chime solenoid 19 is connected, by electrical conductor 15 to one stationary contact 31 of a relay 30. The relay 30 also includes a relay solenoid 32, a movable switch arm 33 and a fixed contact 34. The switch arm 33 is electrically connected to the ground wire 12. When relay solenoid 32 is activated (by completion of a chime control circuit) switch arm 33 is brought into contact with contact 31 and completes the chime circuit.

The chime control circuit is connected to a fixed normal position contact 62 of the switch 60.

When function switch 90 is in a middle position, switch arm 65 is in electrical contact with fixed terminal 62, hence the chime ringing circuit is electrically connected to the rectifier 150. Terminal 62 is connected by an electrical conductor 38 to a terminal 39. Terminal 39 is connected to a large resistor 40 which is connected to the stationary contact 34 of relay 30. Resistor 40 functions as a voltage divider. When relay solenoid 32 is not activated, contact 34 is grounded through switch arm 33 and ground wire 12. Terminal 39 is also connected to one side of relay solenoid 32. The other side of relay solenoid 32, is connected by an electrical conductor 41 to a contact 72 of switch 70. When the function switch 90 is in its middle position, contact 72 is connected by a switch arm 75 to electrical conductor 11. Conductor 11 is connected to a terminal 42, in the outside speaker station 3. Terminal 42 is connected by an electrical conductor 46 to a contact 44 of a chime switch 47. The other terminal 45 of chime switch 47 is connected by electrical conductor 48 to a terminal 43. Terminal 42 is also electrically connected to terminal 43 through a parallel circuit consisting of an electrical conductor 49, a speaker 18, an electrical conductor 50, a nonpolarized capacitor 51, and an electrical conductor 52 attached to terminal 43. As will be explained hereinafter, this parallel circuit is not a part of the chime control circuit. Terminal 43 is connected to the common ground wire 12.

The intercom circuit is completed when function switch 90 is in either the upper or lower position. When the function switch 90 is in the upper position, switch arm 65 is in contact with contact 61, switch arm 75 with contact 71, and switch arm 85 with contact 81. When the function switch 90 is in the lower position, switch arm 65 is in contact with contact 63, switch arm 75 with contact 73, and switch arm 85 with contact 83. As can be seen in

FIGURE 2, contacts 61 and 63 are both electrically connected to a power terminal 91 of the amplifier 4. Contacts 71 and 83 are both electrically connected to an output terminal 92 of the amplifier 4. Contacts 73 and 81 are both electrically connected to an input terminal 93 of the amplifier 4. When the function switch 90 is in the upper position, amplifier power terminal 91 is connected to rectifier 150. Amplifier output terminal 92 is electrically connected through switch arm 75 and electrical conductor 11 to terminal 42 in the outside station 3. Terminal 42 is connected through the outside speaker 18 and non-polarized capacitor 51 to terminal 43 and the ground as hereinbefore described. Amplifier input terminal 93 is electrically connected through switch arm 85 and electrical conductor 53 to the inside speaker 8. The speaker 8 is also connected by an electrical conductor 54 to the common ground 12. When the function switch 90 is in its lower position, switch arm 75 is connected to amplifier input terminal 93 and switch arm 85 is electrically connected to amplifier output terminal 92 through contact 85. The circuits are otherwise the same.

The non-polarized capacitor 51 consists of two capacitors "back-to-back." Its function is to block non-pulsed direct current. Thus, the DC of the chime control circuit is blocked by the capacitor 51, but the alternating audio frequency current of the amplifier output or input of the intercom system is passed. The non-polarized capacitor 51 also makes unimportant whether electrical conductors 11 and 12 are connected to terminals 42 and 43 or terminals 43 and 42 respectively.

Merely by way of illustration, and not by way of limitation, components of the following values or character may be used in the illustrative circuit described and illustrated:

Reference numeral:	Value or description
8	Speaker, 4".
18	Speaker, 4" weatherproof.
35	39 ohms, 1/2 w., 10% carbon.
37	250 microfarads.
40	470 ohms, 1.0 w., 10% carbon.
51	Two capacitors, each 10 microfarads, 64 v.

Although the construction of the amplifier forms no part of this invention, it may be noted that components of the following character and values are well suited for use in the amplifier of the illustrative embodiment:

Reference numeral:	Value or description
101	Capacitor, 125 microfarads.
102	Capacitor, 0.47 microfarad.
103	Capacitor, 0.10 microfarad.
104	Capacitor, 0.22 microfarad.
105	Capacitor, 250 microfarads.
106	Capacitor, 0.0015 microfarad.
107	Resistor, 390 ohms.
108	Resistor, variable, 500 ohms.
109	Resistor, 10K ohms.
110	Resistor, 100K ohms.
111	Resistor, 47 ohms.
112	Resistor, 10K ohms.
113	Amplifier, typically GE 2N 2923.
114	Amplifier, typically GE 2N 2924.
115	Amplifier, typically GE 2N 2923.
116	Output transformer.

The illustrative device operates as follows: Chime switch 47 is normally biased open. Function switch 90 is normally biased to the middle position. Relay switch 33 is normally biased into contact with terminal 34. Therefore, the only normal current flow is a very small direct current from the rectifier 150 through contact 62 of switch 60, electrical conductor 38, resistor 40, terminal 34, and switch arm 33 to the ground. Resistor 40 has a high resistance, so that the current flow is small.

When chime button 17 is depressed, chime switch 47

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is closed, and the chime control circuit is completed. Direct current flows from the rectifier 150 through the relay solenoid 32, through conductor 11, through the chime switch 47, and through conductor 12 to the ground. Energization of the relay solenoid 32 throws relay switch arm 33, completes the (AC) chime circuit through the chime solenoid 19, and sounds a chime. When chime button 17 is released, all circuits return to their normal states.

The intercom functions of the illustrative device are entirely controlled from the inside speaker station. Turning the function switch control 9 to a "talk" position moves the function switch 90 to its upper position. The inside speaker 8 is then connected to the amplifier input terminal 93 and acts as a microphone. Sounds picked up by the inside speaker 8 are emitted at amplifier output terminal 92 as amplified alternating audio frequency current. The outside speaker 18 is connected to the amplifier output terminal 92 by electrical conductor 11 and acts as a speaker. The non-polarized capacitor 51 will pass the alternating audio frequency amplifier output; therefore, the outside speaker circuit is completed through line 12 to the ground.

When the function switch control is turned to a "listen" position, the function switch 90 is moved to its lower position. The outside speaker 18 is then connected through conductor 11 to the amplifier input terminal 93 and acts as a microphone. The outside speaker circuit is again grounded through conductor 12 because the non-polarized capacitor 51 passes the alternating audio frequency current. The inside speaker 8 is connected to the amplifier output terminal 92.

It will be apparent that when the function switch control is in its normal position neither speaker is activated and the chime can be sounded. When the function switch control 9 is turned to either the talk or listen position, the chime control circuit is broken and depression of the chime button 17 will not sound the chime.

The installation of the device described, to replace a standard door chime system, is extremely simple. The existing door chime button is removed and its wires are attached to terminals 42 and 43 of the outside station 3. The outside station 3 is then attached to the outdoor wall. The five-wire cable is led from the transformer station to the inside speaker station location, and each of the five wires 11-15 is attached to a corresponding wire of the inside speaker station. The inside speaker station is attached to an indoor wall. At the transformer station, the two wires from the outside speaker station are disconnected from transformer terminal 21 and from a chime wire, and attached to wires 11 and 12 of the five-wire cable. The loose chime wire is attached to wire 15. The other chime wire is already attached to transformer terminal 22 and is not disturbed. Wire 14 is attached to transformer terminal 21. The device is then in operating condition. If there is another door chime circuit for another door attached to the transformer and chime, it need not be touched at all. The two circuits will continue to operate independently.

Numerous variations in the construction of the various components of the device of this invention, within the scope of the appended claims, will occur to those skilled in the art. For example, any number of speakers, either in the broad sense or in the limited sense of speakers without microphones, can be connected to the system. Radio receivers can be connected to play over the various speakers. Various of the elements of the system may be located in other positions or housed differently from the arrangement shown. The system may be used entirely inside, as a factory communication system, for example. These are merely illustrative variations.

Having thus described the invention, what is claimed and desired to be secured by Letters Patent is:

1. An intercom-signal device comprising a remote station including a speaker and a signal switch; two electri-

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cal conductors electrically connected to said speaker in at least one position of said signal switch, said signal switch selectively electrically connecting one of said conductors with the other of said conductors, and switch means electrically connected to one of said conductors for selectively connecting said conductor to a direct current source at one position of said switch means and to an amplifier at another position of said switch means.

2. The intercom-signal device of claim 1, in which said signal switch is connected electrically in parallel with said speaker and including blocking means connected electrically in series with a conductor electrically connected to said speaker for blocking direct current.

3. The intercom-signal device of claim 2 in which the blocking means comprise a non-polarized capacitor.

4. An intercom-signal device comprising an AC signal circuit, a DC signal control circuit, including a signal switch, for selectively energizing and de-energizing said AC signal circuit, and an intercom circuit comprising a first and a second speaker, said first speaker being connected electrically in parallel with said signal switch.

5. The intercom-signal device of claim 4 including function switch means for selectively connecting said signal switch to said signal control circuit and said first speaker to said intercom circuit, said first speaker and said signal switch being located in a remote location and said second speaker and said function switch means being located in a central location.

6. The intercom-signal device of claim 4 in which blocking means are connected electrically in series with said first speaker to block non-pulsed direct current through said speaker.

7. The device of claim 6 in which the blocking means comprise a non-polarized capacitor.

8. An intercom-signal device comprising first and second speakers positioned remotely from one another; an amplifier selectively connectable to both said speakers; a source of direct current selectively connectable to said amplifier; a first electrical conductor at least normally electrically connected with the first speaker and selectively connectable with said direct current source and said amplifier; a second electrical conductor at least normally connected to said first speaker and to ground; direct current blocking means in series with one of said first and second electrical conductors; a signal control circuit, and switch means, in said signal control circuit, selectively connecting said first and second electrical conductors.

9. In an intercom-signal device having at least two speakers, an amplifier electrically connectable to said speakers, an electrically operated chime and a chime switch, the improvement comprising two electrical conductors at least normally connected to a first of said speakers, one of said conductors being electrically connected to ground, the second of said conductors being electrically connected to a control switch; a blocking capacitor connected electrically in series with one of said electrical conductors; a direct current source; a chime circuit including said chime; a chime transformer electrically connected to the input side of said direct current source and to said chime circuit; a chime circuit switch in said chime circuit; a solenoid connected to operate said chime circuit switch, said control switch electrically connecting, in a first of its operative positions, said second of said electrical conductors to said solenoid and the output side of said direct current source electrically in series,

said control switch electrically connecting, in a second of its operative positions, said second of said electrical conductors to the input side of said amplifier, said control switch electrically connecting, in a third of its operative positions, said second of said electrical conductors to the output side of said amplifier, said control switch normally being biased to said first operative position,

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said chime switch in one of its operative positions electrically connecting said first and second conductors between said first speaker and said solenoid, said chime switch normally being biased out of said one operative position,

whereby moving said chime switch to said one operative position when said control switch is in its normally biased position completes a circuit from said direct current source through said solenoid and said chime switch to ground.

10. An intercom-signal device comprising a first station including a first speaker and a signal switch; a second station including a second speaker and a function switch; exactly two electrical conductors leading out of said first station, said signal switch electrically connecting said

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electrical conductors to each other in one of its operative positions; and an amplifier having an input side and an output side; said function switch selectively electrically connecting one of said conductors to said input side of said amplifier in one of its operative positions and to said output side of said amplifier in a second of its operative positions.

References Cited

UNITED STATES PATENTS

3,205,307	9/1965	Schmitthenner	-----	179—1.4
3,284,571	11/1966	Wittig	-----	179—2

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