United States Patent [19]

Goodwater

[11] **3,794,765**

[45] **Feb. 26, 1974**

[54] **ZONE SPEAKER RELAY SYSTEM**

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[73] Assignee: **Audio Alert Corporation,** San Francisco, Calif.

[22] Filed: **Feb. 24, 1972**

[21] Appl. No.: **229,075**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 93,768, Nov. 30, 1970, Pat. No. 3,656,158.

[52] **U.S. Cl.**..... **179/1 SW,** 179/1 B, 179/100.1 PS

[51] **Int. Cl.** **H04q 3/00**

[58] **Field of Search** .....179/1 SW, 1 B, 1 AT, 179/100.1 PS, 5 P

[56] **References Cited**

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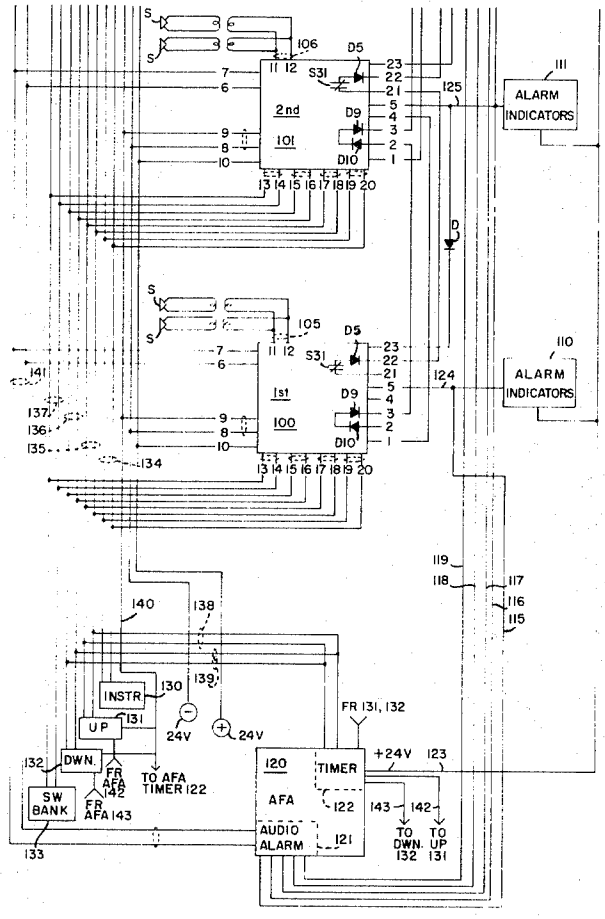
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[57] **ABSTRACT**

A zone speaker relay system is provided for selectively transmitting over loud speakers audio warning signals and audio evacuation instructions to personnel on selcted floors or in selected zones of a floor in a building in the event of an emergency. A separate zone speaker relay assembly is provided for each such floor and zone. When, for example, there is one speaker zone per floor, the zone speaker relay assemblies effect automatic switching of the loud speakers associated with the floor on which the emergency occurs, called the involved floor, and the floors immediately above and below the involved floor. The switching assemblies ensure that the speakers associated therewith receive a proper alarm signal and taped message when an alarm station is activated on the involved floor for directing personnel on those floors away from the location of the emergency. Personnel on the involved floor and the floor immediately below the involved floor are warned and directed to evacuate via lower floors. Personnel on the floor immediately above the involved floor are warned and directed to evacuate via upper floors. Provision is also made for permitting activation of alarm stations on other floors and in that event for the giving of proper evacuation instruction to personnel on those floors to prevent directing these personnel into previously involed areas.

24 Claims, 3 Drawing Figures



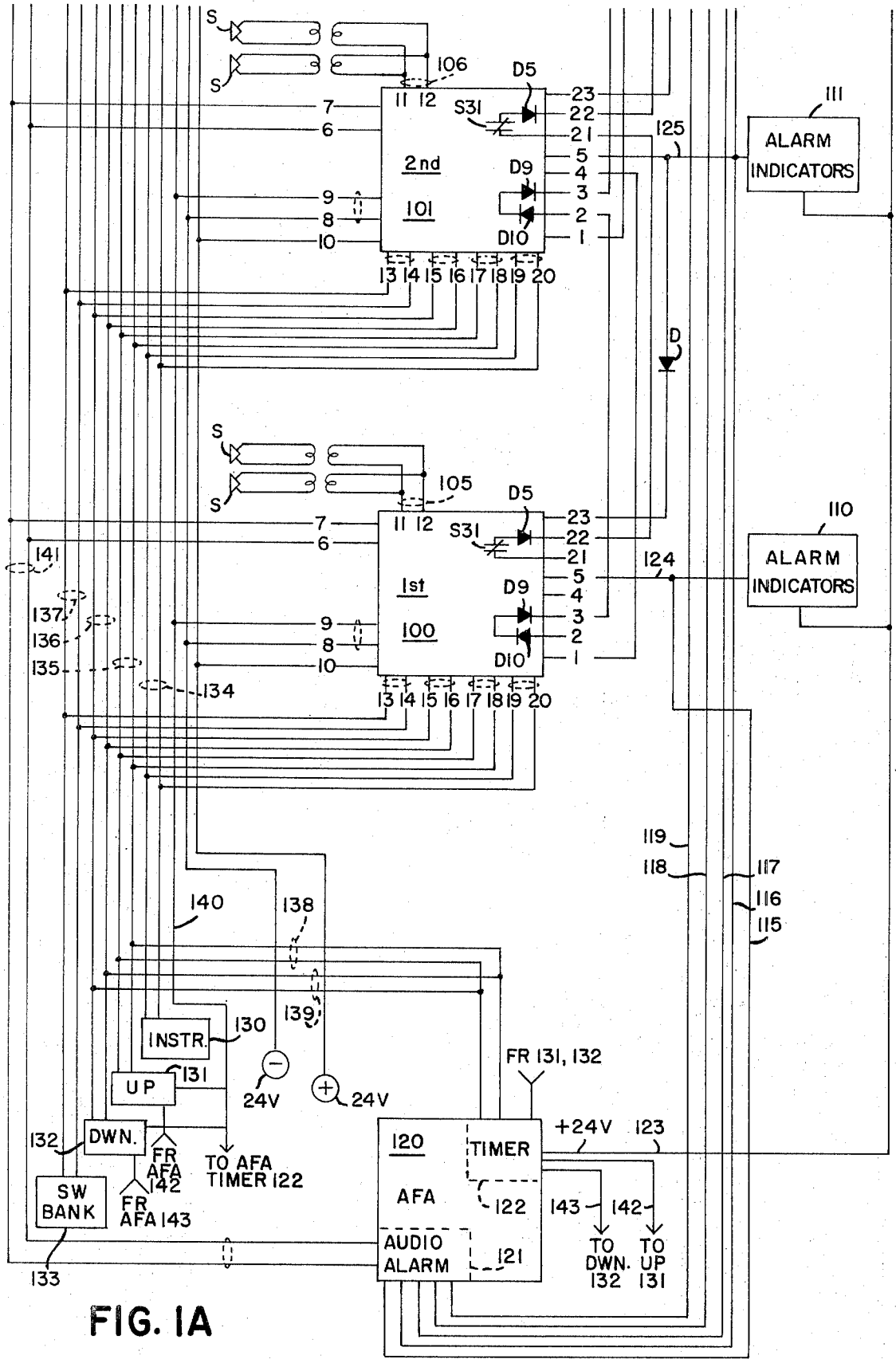
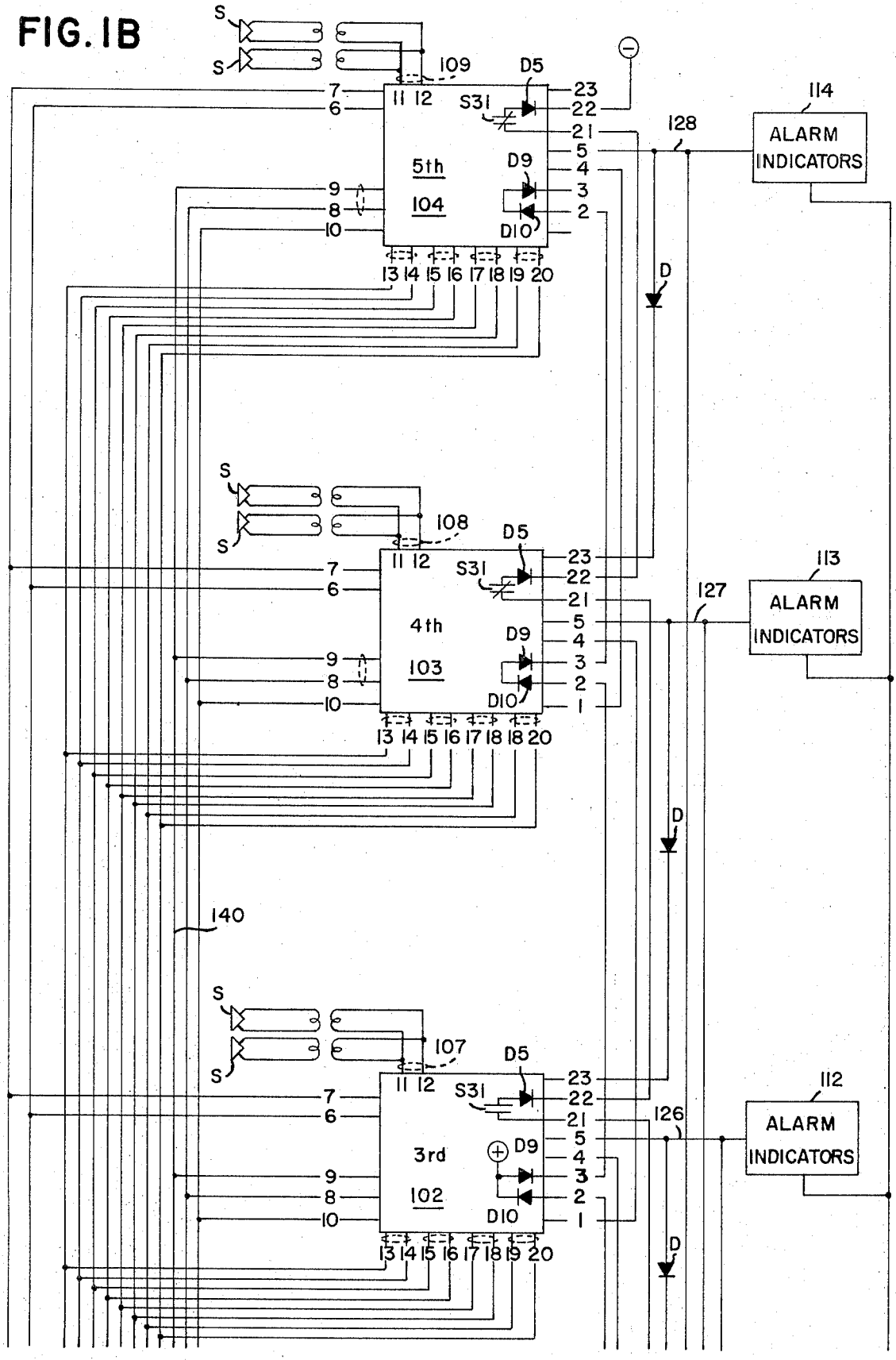

S
S
106
D5
11 12
S31
7
6
2nd
101
9
8
10
D9
D10
23
22
21
5
4
3
2
1
13 14 15 16 17 18 19 20
111
ALARM INDICATORS
125
D
105
1st
100
110
124
141
137
136
135
134
119
118
117
116
115
140
138
139
INSTR.
130
UP
131
DWN.
132
24V
FR 131, 132
+24V
123
120
TIMER
AFA
122
AUDIO ALARM
121
FR AFA 142
FR AFA 143
TO AFA TIMER 122
SW BANK
133
143
142
TO DWN. 132
TO UP 131

FIG. 1A

FIG. 1B


S
S
109
D5
11 12
S31
23
22
21
5
4
3
2
7
6
9
8
10
5th
104
D9
D10
13 14 15 16 17 18 19 20
114
ALARM
INDICATORS
128
D
108
4th
103
127
113
140
107
3rd
102
126
112

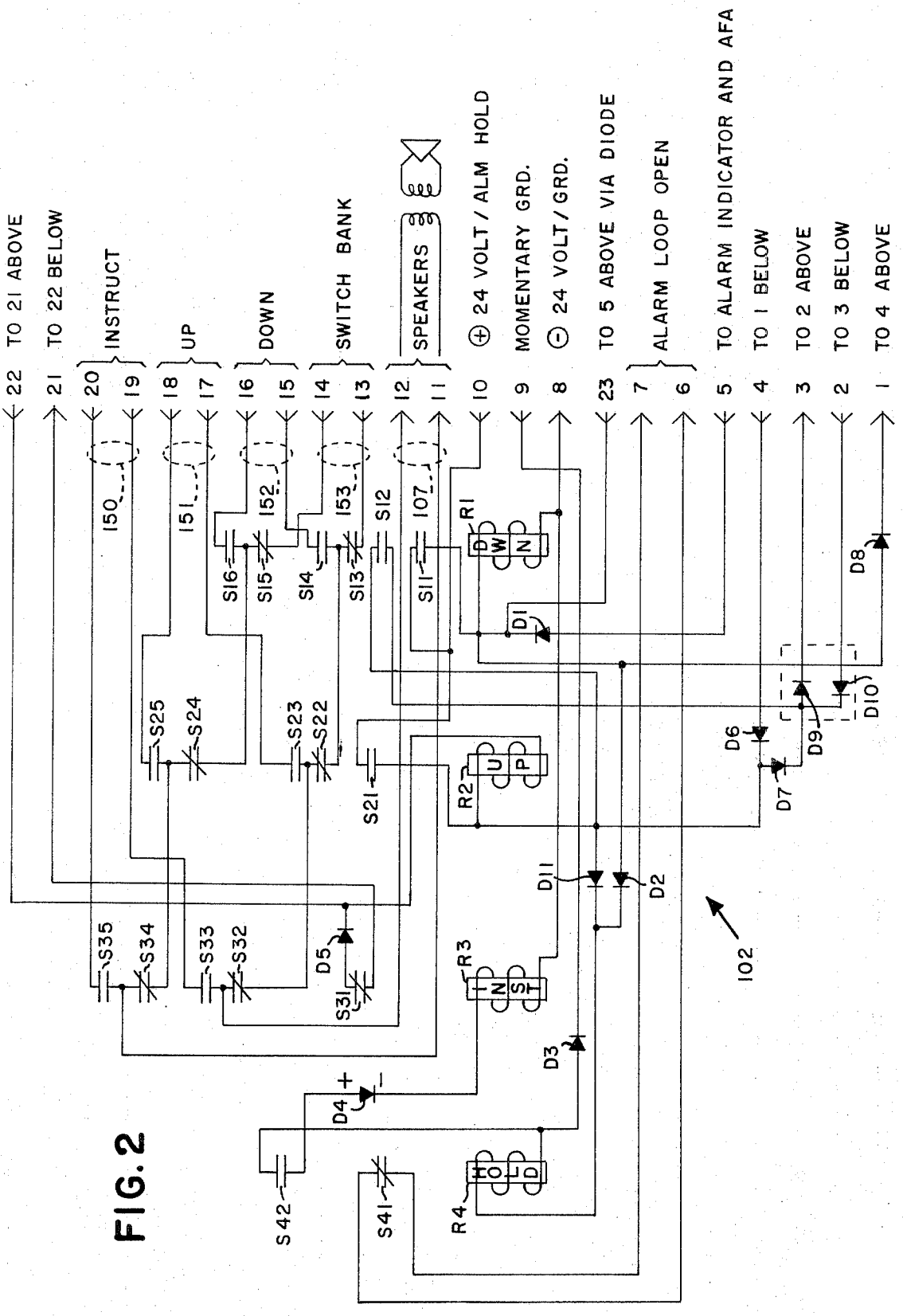

22 TO 21 ABOVE
21 TO 22 BELOW
20 INSTRUCT
19
18 UP
17
16 DOWN
15
14 SWITCH BANK
13
12 SPEAKERS
11
10 ⊕ 24 VOLT / ALM HOLD
9 MOMENTARY GRD.
8 ⊖ 24 VOLT / GRD.
23 TO 5 ABOVE VIA DIODE
7 ALARM LOOP OPEN
6
5 TO ALARM INDICATOR AND AFA
4 TO 1 BELOW
3 TO 2 ABOVE
2 TO 3 BELOW
1 TO 4 ABOVE
150
151
152
153
107
S16
S15
S14
S13
S12
S11
S25
S24
S23
S22
S21
S35
S34
S33
S32
S31
S42
S41
R1
R2
R3
R4
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
102

FIG. 2

ZONE SPEAKER RELAY SYSTEM

RELATED PATENT APPLICATION

This is a continuation-in-part of copending application Ser. No. 93,768, filed Nov. 30, 1970, now U.S. Pat. No. 3,656,158, entitled Integrated Fully Supervised Fire Alarm System, assigned to the same assignee as the present application.

BACKGROUND OF THE INVENTION

In the event of an emergency, such as a fire, in a high-rise building or a large single- or two-store building, there is an immediate need to communicate to the personnel located therein the manner in or the direction by which they may safely evacuate the involved areas.

Heretofore, it has been necessary for security personnel to determine the nature and extent of the emergency and to pass along to the personnel affected instructions as to how to evacuate the involved areas. If due to the emergency or other reasons the responsible security personnel are unsuccessful, panic often ensues and personnel become trapped and perish.

Not infrequently, a localized condition or a false alarm has needlessly resulted in the evacuation of an entire building due to the inability of security personnel to rapidly and accurately access the situation.

It is therefore highly desirable to have means by which an emergency can be rapidly and accurately localized to effect immediate and automatic evacuation of personnel from an involved area without the need for human intervention.

It is also desirable, in the event of an actual or false emergency, to minimize the confusion which ordinarily results by restricting the evacuation of personnel to the areas immediately involved and the areas immediately adjacent the involved areas, be they floors or zones on a given floor.

The zone speaker relay system of the present invention is suitable for use with any audio alarm generating system and has been adapted for compatable operation with the system disclosed in the aforementioned application. Accordingly, the switching assemblies of the present invention receive certain of their inputs from and provide certain outputs to that system. Certain features of that system, conveniently called an audio fire alarm system (AFA), are therefore modified to provide those inputs and receive those outputs. For example, the audio alarm signals generated by the AFA upon activation of an alarm indicating station, such as a pull box, are routed through the switching assemblies to loud speaker busses under the control of a timer in the AFA. Power to the pull boxes or other alarm condition signaling devices coupled to the AFA system which activate the switching assemblies and AFA is removed from the pull boxes under the control of the timer to prevent subsequent alarm signals from the same pull box circuit. After a predetermined period, the audio alarm generated by the AFA is terminated by the timer, and taped messages from recorders with taped evacuation instructions are transmitted over the speaker busses through the switching assemblies. Upon termination of the recorded messages, a reset signal is generated and by means of the switching assemblies, the AFA and timer are reset as by momentarily opening an alarm relay circuit readying the AFA for subsequent alarms.

SUMMARY OF THE INVENTION

A principal object of the present invention is an automatic loudspeaker switching system and in particular an alarm and evacuation switching system which automatically and selectively provides for the evacuation of personnel from floors of a high-rise and from zones or a large one- or two-story building in the event of an emergency.

In accordance with the present invention there is provided a zone speaker relay switching assembly for each zone or floor of a building for controlling one or more loud speakers coupled thereto in each of those areas. In a typical high-rise environment, when there is but one speaker zone per floor and when an alarm station is actuated on a given floor, conveniently called the "involved floor," an energizing voltage level, such as a positive 24 volts, is applied to a timer in a source of audio signals, such as an audio fire alarm system (AFA). The voltage level is also applied to a "down" relay coil in the switching assembly associated with that floor. The "down" relay connects an associated group of speakers on the involved floor to an output of an audio alarm portion of the AFA for a period of time determined by the timer and then to a "down" amplifier and taped message delivery system to instruct personnel to evacuate via the lower floors. The "down" relay, thus actuated, is then held by a positive potential supplied by its own contact, when closed. This positive potential is also applied to the "down" relay coil on an identical zone speaker relay switching assembly associated with the floor immediately below the involved floor to sequentially effect an audio alarm and an audio instruction of the personnel thereon to evacuate via lower floors. This positive potential is also applied to an "up" relay on an identical zone speaker relay switching assembly associated with the floor immediately above the involved floor to couple in an "up" amplifier and taped message delivery system to sequentially effect an audio alarm and an audio instruction of the personnel thereon to evacuate via higher floors. Thus three floors are selectively coupled to an audio alarm and a proper taped message amplifier in the event of an emergency of a given floor.

The relay coupling in the "up" amplifier associated with the above described group of three floors also places a potential, such as a positive 24 volts, on a diode buss in all zone speaker relay switching assemblies associated with the floors above this latter floor. This will, if an alarm is actuated on any of these floors, cause the "up" relay of the zone speaker relay switching assembly associated with these latter floors to activate coupling in an audio alarm and the "up" amplifier and taped message delivery system associated therewith instructing all personnel to evacuate via still higher floors and thus up and away from the latter and the three originally involved floors.

Of the original three floors involved, the "up" relay in the zone speaker relay assembly associated with the involved floor also provides a standing potential, as of a positive 24 volts, on an associated "hold" relay coil. After the taped messages have been transmitted to each of the three floors, the taped message delivery system applies a momentary negative potential or ground to the "hold" relay coil. The application of the momentary negative potential causes the "hold" relay to energize and close a first set of associated contacts and then

hold via current drawn through its contacts and the coil of an associated "instruct" relay.

Operation of the "instruct" relay opens a negative 24 volt or ground lead to all "up" relays associated with lower floors thus making it impossible to send alarm information and instructions which would move personnel up into an existing involved floor. The "instruct" relay also couples an audio system to the loud speakers on the involved floor for permitting the transmission of audio instructions via, for example, a microphone.

As soon as the "hold" relay is operated, a second set of normally closed contacts controlled thereby are opened removing a short in the alarm indicating station circuitry in the AFA to permit the AFA to reset and ready itself for another alarm call. The details of resetting the alarm indicating circuits depends, of course, on the specific nature of the audio alarm generating circuits used with the present invention.

These and other objects, features and advantages of the present invention will be apparent from the following detailed description and accompanying drawings.

DESCRIPTION OF DRAWINGS

FIGS. 1A and 1B are block diagrams of the present invention illustration a typical coupling of a plurality of zone speaker relay assemblies in a multiple floor high-rise environment;

FIG. 2 is a schematic of one of the plurality of zone speaker assemblies of FIG. 1.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIGS. 1A and 1B, the zone speaker relay system of the present invention comprises a plurality of zone speaker relay switching assemblies **100-104.** Each one of switching assemblies **100-104** is associated with a separate floor or zone in a building. For example, switching assembly **100** is associated with the first floor or zone, while switching assemblies **101-104** are each associated with the second through fifth floors or zones, respectively. When used in a building having but a single zone per floor, such as a high-rise, it will be appreciated that a single one of assemblies **100-104** is associated with each such floor. Thus, for convenience, the present invention will be described with regard to its used in a high-rise and hence the terms "up" and "down" refer to the relative location of floors and their associated switching assembly.

As with the switching assemblies, a plurality of alarm indicating station devices, such as pull boxes (not shown), are associated with each zone or floor of a building. These devices are located in convenient locations about the zone or floor for ready access by personnel in those areas. Typically, a number of such devices are coupled together to form an alarm indicating circuit for covering a specified zone or floor. Thus, in accordance with the present invention there is further provided a plurality of alarm indicating circuits **110-114** each associated with a given zone or floor and switching assembly. Alarm indicating circuit **110** is coupled to switching assembly **100,** while alarm indicating circuits **111-114** are coupled to assemblies **101-104,** respectively.

The present invention is designed for compatible use with any audio alarm system, that is, a system which generates signals for transmitting warning sounds over loud speakers in response to an alarm signal. Such a system is described and claimed in copending application Ser. No. 93,768, filed Nov. 30, 1970, now U.S. Pat. No. 3,656,158, entitled Integrated Fully-Supervised Fire Alarm System. As described in that application, the audio fire alarm system (AFA) is responsive to a signal from any one of a plurality of alarm indicating station devices such as comprise alarm indicating circuits **110-114** to generate an audio alarm which is transmitted over loud speaker busses for providing an audio indication of an emergency condition. As further stated in that application, the advantage of an audio alarm system is that the loud speaker busses may be used normally for paging and music transmissions and in the event of an emergency may be used for transmitting audio instructions for advising personnel in accordance with the nature of the emergency.

Since the alarm signal which activates the switching assemblies may also activate the AFA, an output of each of alarm indicating circuits **110-114** and an input of each of switching assemblies **100-104** are coupled in parallel to an audio fire alarm system (AFA) **120** via a plurality of alarm signal busses **115-119,** respectively.

In addition to any supervisory capability and tone generating circuits such as described in copending application Ser. No. 93,768, now U.S. Pat. No. 3,656,158, AFA **120** is further provided with an audio alarm circuit **121** and a timer circuit **122.** The output of each of alarm indicating circuits **110-114** is coupled to AFA **120** via the audio alarm circuit **121.** Audio alarm circuit **121** typically comprises a relay (not shown) which is energized upon receipt of an alarm signal from one of circuits **110-114** to initiate generation of a warning tone which is transmitted over a plurality of audio signal busses **138, 139, 135** and **136** as hereinafter described.

Power is provided to each of alarm indicating circuits **110-114** via the timer circuit **122** on a power buss **123.** In a typical system, the power comprises a positive 24 volt potential level. When an alarm indicating signal is generated upon the activation of any one of alarm indicating circuits **110-114,** the 24 volt level is transmitted to the AFA **120** via the alarm indicating busses **115-119** and also to an associated one of the switching assemblies **110-104** via the second set of alarm signal busses **124-128,** respectively. Thus if, for example, one of the alarm indicating station devices in alarm indicating circuit **112** is activated, a signal will be transmitted to AFA **120** via buss **117** and to switching assembly **102** via buss **126.**

For the transmission of audible warning and evacuation instructions to each floor or zone of a building, there is further provided a plurality of speakers S coupled to switching assemblies **100-104** via a plurality of speaker busses **105-109,** respectively.

In addition to AFA **120** there is further coupled to switching assemblies **100-104** a plurality of audio signal sources **130-133** which are referred to as an "instruct" audio amplifying circuit, an "up" amplifying and taped message delivery system, a "down" amplifying and taped message delivery system, and a "switch-bank" circuit, respectively.

As will be described in more detail herein below, audio instructions from "instruct" audio amplifying circuit **130,** "up" amplifying and taped message delivery system **131,** "down" amplifying and taped message delivery system **132,** and "switchbank" circuit **133,** are selectively transmitted to the speakers and speaker busses associated with switching assemblies **100-104** via an

"instruct" buss **134**, an "up" buss **135**, a "down" buss **136**, and a "switch-bank" buss **137**, respectively. As previously described, audio warning signals generated by AFA **120** upon activation of one of alarm indicating circuit **110-114** are coupled to speaker busses **105-108** under the control of timer **122** via the pair of busses **138, 139**, coupled in parallel with "up" buss **135** and "down" buss **136**, respectively.

At the conclusion of a taped message provided by "up" and "down" amplifying and taped message delivery systems **131, 132**, there is generated an end of message or reset pulse for resetting alarm circuit **121** and timer **122** in AFA **120** to ready AFA **120** for subsequent alarms. As described in more detail below, the reset pulse is transmitted from systems **131** and **132** to the audio alarm circuit **121** via a first reset buss **140** coupled to an input of switching assemblies **100-104** and a second reset buss **141** coupling circuit **121** to an output of switching assemblies **100-104.** The timer **122**, on the other hand, is coupled directly to buss **140** for receiving the reset pulse.

Upon the generation of an alarm indicating signal by one of alarm indicating circuits **110-114**, there is generated in AFA **120** an audio warning signal or tone such as a siren or a warble sound which is transmitted over busses **138** and **139** for a predetermined period under the control of timer **122.** Once timer **122** is energized upon receipt of an alarm indicating signal from one of the alarm indicating circuits **110-114**, it immediately thereafter interrupts the power being delivered to alarm indicating circuits **110-114** via buss **123** to deactivate said circuit to prevent the generation of further alarms from that circuit. The audio alarm is transmitted as previously mentioned under the control of timer **122** for a predetermined length of time; say, for example, 30 seconds to 1 minute. Thereafter, the audio alarm is interrupted and signals are generated by timer **122** on a pair of busses **142** and **143** coupled to the "up" and "down" amplifying and taped message delivery systems **131** and **132** respectively to start those systems for the delivery of taped audio instructions to selected speakers S under the control of appropriate ones of switching assemblies **110-104.**

For convenience, switching assemblies **100-104** are preferably identically constructed and intercoupled via pin connectors (not shown). This permits ready expansion of the system of the present invention as well as rapid removal of each module if necessary for repair and/or replacement. As will be more clearly understood with reference to FIG. **2**, each of switching assemblies **100-104** is for this reason therefore provided with a plurality of pin connections **1-23.**

Referring to FIGS. **1A** and **1B**, pin **1** of assembly **100** associated with the first floor is coupled to pin **4** of assembly **101** associated with the second floor. Similarly, pin **1** of assembly **101** is coupled to pin **4** of assembly **102** associated with the third floor. Thus a signal appearing on pin **1** of any of assemblies **100-104** will be transmitted to the assembly associated with the floor immediately above. Similarly, pin **3** of assembly **100** associated with the first floor is connected to pin **2** of assembly **101** associated with the second floor while pin **3** of assembly **101** associated with the second floor is coupled to pin **2** of assembly **102** associated with the third floor. Pin **22** of assembly **100** is coupled to pin **21** of assembly **101.** Pin **23** of assembly **100** is coupled through a diode D to pin **5** of assembly **101.** For reasons which will become apparent from the description of FIG. **2**, diode D serves to prevent a positive potential appearing on pin **23** from appearing on pin **5** of the assembly associated with the floor above.

Referring to FIG. **2**, whenever an alarm indicating signal is generated upon the activation of one of alarm indicating circuits **110-114**, a positive 24 volt dc level is applied to input **5** of the associated switching assembly.

For purposes of illustration, it is assumed that such a signal is first generated by alarm indicating circuit **112** and that such a positive 24 volt signal is applied to pin **5** of assembly **102** associated with the third floor. The positive level is also coupled to pin **23** of assembly **101** associated with the floor below through diode D which is coupled between pins **5** and **23** with the appropriate polarity.

Keeping in mind that under the assumed conditions that an emergency exists on the third floor, the third floor will hereinafter be sometimes referred to as the "involved floor." consequently the fourth floor and associated assembly **103** will be referred to as the "above floor" or "floor above," and the second floor and associated assembly **101** will be sometimes referred to as the "below floor" or "floor below."

Returning to the description of FIG. **2**, each of assemblies **100-104** comprise a plurality of switchbanks which in turn comprise a plurality of relays conveniently called a "down" relay **R1**, an "up" relay **R2**, an "instruct" relay **R3**, and a "hold" relay **R4.** "Down" relay R1 controls a plurality of switch contacts **S21-S25.** "Instruct" relay R3 controls a plurality of switch contacts **S31-S35.** "Hold:" relay R4 controls a plurality of switch contacts **S41-S42.** Each of relays **R1, R2, R3,** and R4 are normally de-energized. Each of switch contacts such as S11 associated with R1 which do not have a diagonal line crossing the two parallel lines is a normally open switch contact. Whereas a switch with a diagonal line crossing the two horizontal lines such as S13 is a normally closed switch contact. The switchbanks are coupled to a plurality of audio signal busses **150-153** which are in turn coupled to audio signal busses **134-137** via pins **13-20** for controlling the transmission of audio signals on the busses to the speaker buss **107.**

Referring to FIGS. **1A** and **1B** it will be noted that the reset pulse appearing on buss **140** is coupled to the switching assemblies **100-104** via pin **9** and to AFA **120** via buss **141** coupled to pins **6** and **7.** Busses **134-137** are coupled respectively to pins **13-20** and speaker busses **105-109** are coupled to pins **11** and **12** of assemblies **100-104.**

Referring again to FIG. **2**, it is understood that in the absence of an alarm condition, none of relays R1-R4 are energized. Under such circumstances it will be noted that the switch-bank circuit **133** coupled to assembly **102** via buss **137** will have an uninterrupted audio path via pins **13** and **14**, switch contacts S13 and **S15, S22** and **S24, S32** and **S34** to speaker buss **107** via pins **11** and **12.** In the absence of an alarm condition, switchbank circuit **133** is thus coupled through to all speaker busses associated with each of switching assemblies **100-104.** Accordingly, switchbank circuit **133** is used to couple conventional paging and music systems to the speaker busses under normal conditions.

When as is assumed for purposes of this description a positive 24 volt level appears on pin **5** of assembly

102, the 24 volt level is coupled to the coil of "down" relay R1 through a diode D1 to ground through pin 8. The energization of "down" relay R1 effects a change of state of each of switches S11-S16. With S13 and S15 thus opened, and S14 and S16 closed, continuity is established between "down" buss 136 coupled to pins 15 and 16 through S14 and S16, S22 and S24, and S32 and S34, to speaker buss 107 and speakers S via pins 11 and 12. As previously described, the audio alarm signal generated by the AFA 120 will then be transmitted over busses 139 and 136 under the control of timer 122 for the preselected period of time, after which, "down" amplifying and taped message delivery system 132 will transmit its taped message over the same lines to instruct all personnel on the third floor to evacuate the building via lower floors. Since switch S11 is also closed, a 24 volt alarm hold level coupled to pin 10 will hold "down" relay R1 in an energized state after the removal of the 24 volt level supplied alarm indicator 112 by timer 122 as previously described.

As shown in FIGS. 1A, 1B and 2, pin 23 of each of assemblies 100-104 is coupled to its "down" relay R1. The positive level from alarm indicator circuit 112 appearing on pin 5 of switching assembly 102 is directed through diode D to pin 23 of assembly 101 associated with the floor below to energize the "down" relay R1 in assembly 101 to couple in the "down" buss for also instructing personnel on the second floor to evacuate via lower floors. However, it will be noted that the positive level appearing on pin 23 of assembly 101 will be blocked by diode D1 of that module so as to prevent energizing the "down" relay associated with any of the still lower floors, e.g., the first floor. This prevents needless evacuation of those floors. Similarly, diode D coupled between pin 5 of assembly 103 associated with the fourth floor and pin 23 of assembly 102 associated with the third floor will block the positive potential appearing on pin 23 of assembly 102 from appearing on pin 5 of assembly 103 to prevent the issuance of instructions to personnel on the fourth floor which would cause them to evacuate down into an involved area; namely, the third floor.

To ensure that personnel on the fourth floor are directed up and away from the involved floor, the 24 volt level appearing on the "down" relay R1 of assembly 102 is coupled to pin 1 of assembly 102 through a diode D8. As seen in FIGS. 1A, 1B and 2, pin 1 of assembly 102 is coupled to pin 4 of assembly 103 and pin 4 of assembly 103 is coupled to the coil of the "up" relay R2 of assembly 103 through a diode D6. Energization of relay R2 of assembly 103 changes the state of its associated switch contacts S21-S25. Since "down" relay R1 of assembly 103 is not energized, there is no continuity between "down" buss 136 and speaker buss 108. There is continuity, however, between "up" buss 130 and speaker buss 108 via pins 17 and 18, switch contacts S23 and S25, S32 and S34. With such continuity the taped message delivered by "up" amplifying and taped message delivery system 131 will be transmitted to personnel on the fourth floor directing them to evacuate via upper floors and hence up and away from the involved third floor. The positive 24 volt alarm hold potential level which holds "down" relay R1 of assembly 102 is also applied to the pin 10 of assembly 103 to hold the "up" relay R2 of assembly 103 through switch contacts S21 which are closed upon energization of "up" relay R2 in assembly 103. Referring again to assembly 102, it will be noted that the positive potential level appearing on the coil of "down"relay R1 is also coupled to its "hold"relay R1 to place a standing positive potential thereon through a diode D2. The negative or lower potential side of the coil of "hold" relay R4 of assembly 102 is coupled to pin 9 of assembly through a diode D3.

Referring to FIGS. 1A and 1B it will be noted that pin 9 of each of assemblies 100-104 is coupled to an output of "up" and "down" amplifying and taped message delivery systems 131 and 132. As previously described, an end of message or reset pulse is generated at the termination of the messages from systems 131 and 132. This pulse is caused to be a momentary negative pulse or ground potential so as to provide the potential across the coil of "hold" relay R4 of assembly 102 sufficient to energize relay R4. In addition to energizing relay R4 of assembly 102, the momentary negative pulse also rests timer 122 of audio fire alarm system 120 as previously described and results in a change of state of switch contacts S41 and S42 associated with "hold" relay R4. Normally closed switch contacts 41 associated with "hold" relay R4, are coupled to pins 6 and 7 of assembly 102. As previously described, pins 6 and 7 of each of assemblies 100-104 are coupled to the audio alarm circuit of audio fire alarm system 120.

As used with the audio fire alarm system described in copending application Ser. No. 93,768, the opening of switch contacts 41 serves to open the alarm relay circuit in the audio fire alarm system as therein described to reset the audio fire alarm system. Referring again to FIG. 2, the closing of switch contacts S42 associated with "hold" relay R4 of assembly 102 causes the positive potential standing on the coil of "hold" relay R4 to be applied to the coil of "instruct" relay R3 through a diode D4 to the negative side of the 24 volt supply or ground coupled to pin 8 of assembly 102 thus latching up both "hold" relay R4 and "instruct" relay R3 of assembly 102. The energizing of "instruct" relay R3 causes switch contacts S31-S35 associated therewith to change state. The previously continuous audio path between "down" buss 136 coupled to pins 15 and 16 of assembly 102 is then interrupted and a continuous audio path provided between "instruct" buss 134 coupled to pins 19 and 20 and speaker bus 107 via pins 19 and 20 and switch contacts S33 and S35.

Referring to "up" relay R2 of FIG. 2, it will be noted that in order for any "up" relay R2 in any of assemblies 100-104 to be energized a negative level or ground must appear on the negative or low potential side of the coil of the relay R2. Referring to FIGS. 1 and 2, it will be noted that this negative or ground potential is applied to the negative or low potential side of the coil of the "up" relays R2 of each of assemblies 100-104 via a diode D5 and normally closed contact S31 associated with "instruct" relay R3 in each of the assemblies. So long as switch contact S31 remain closed, a continuous path will be provided for this negative or ground potential level from pin 22 of the assembly associated with the highest floor through diode D5 and switch contacts S31 to pin 21 of the highest floor and then to pin 22 of the next lower floor through a corresponding diode D5 and switch contacts 31 and so on.

Recalling that in the example given, the third floor is assumed to be the involved floor. The "instruct" relay R3 of assembly 102 will be energized and switch contacts S31 associated therewith will be opened thus

interrupting this negative or ground level path. As shown more clearly with reference to S31 of assembly **102** in FIGS. 1A and 1B, with the ground level or negative path to the corresponding "up" relays R2 of each of the assemblies associated with the floors below the third floor interrupted, it will be seen that under no circumstances can an "up" buss **135** be coupled into the speaker busses associated with these floors so as to direct personnel on these floors up into involved areas.

Referring again to FIG. **2**, the positive potential applied to the coil of the "down" relay R1 of assembly **102** is also applied to pin 1 of assembly **102** through a diode D4. As shown in FIGS. 1A and 1B, pin **1** of each of assemblies **100-104** is coupled to pin **4** of the assembly associated with the floor above. In addition to causing the energizing of the "up" relay R2 of the assembly of the floor above, the positive potential is also applied to pin **3** of the assembly associated with the floor above, in this case assembly **103**, through a diode D7 and a diode D9. As shown in FIGS. 1A and 1B, pin 3 of each of assemblies **100-104** is coupled to pin **2** of the assembly associated with the floor above. The positive potential appearing on the line intermediate diodes D7 and D9 of each of the assemblies thus appears as a standing potential on the switch contacts S12 associated with the "down" relay R1 associated with the assemblies of these higher floors. The purpose of this arrangement is to energize the "up" relay R2 associated with any floor above an originally involved floor so as to effect the audio instruction of personnel to evacuate via higher floors.

Thus, for example, if following an alarm indicating signal from alarm indicating circuit **112** which established as in our example that the third floor was an involved floor, there occurred thereafter an alarm indicating signal from alarm indicating circuit **113** coupled to assembly **103**, it would be inappropriate for the system of the present invention to operate as previously described with respect to assembly **102** directing personnel on the floor to evacuate via lower floors, the third floor being assumed to still be an involved floor. It will be noted that this safety feature will serve to effect the appropriate instructions to personnel on any floor above an initially involved floor, such that they will not be directed to evacuate via lower floors but rather up and away from the originally involved floor.

In addition to the diodes D1-D10 previously described, there is a diode D11 coupled between Diode D2 and the coil of "up" relay R2. Diode D11 serves merely to prevent any positive potential appearing across D2 from appearing on the coil of "up" relay R2.

Thus, in summary, the zone speaker relay system of the present invention rapidly, accurately, and automatically localizes an indicated emergency condition to three floors or zones in a building unless subsequent alarm indicating signals are generated on other floors or in other zones such as may occur in the spreading of an emergency throughout a building. In the event that subsequent alarm indicating signals are generated, the system provides safety measures whereby personnel located on the floors or zones associated with these subsequent emergencies are directed away from the subsequent as well as from the original emergency condition.

It is understood that various changes and modifications of the invention as described may be made by those skilled in the art and that the invention as described is to be limited only by the claims appended hereto.

What is claimed is:

1. A zone speaker switching system comprising: a plurality of zone speaker switching assemblies, each of said assemblies having a speaker buss, a plurality of audio signal busses and switching means for selectively coupling a predetermined one of said plurality of audio signal busses to said speaker buss; and a first means for interconnecting said switching means in a first one of said plurality of switching assemblies to said switching means in a second one of said plurality of switching assemblies, said switching means in said second assembly including means responsive to a signal from said first assembly for selectively coupling a predetermined one of said plurality of audio signal busses in said second assembly to said speaker buss in said second assembly.

2. A switching system according to claim **1** further comprising: a second means for interconnecting said switching means in said first one of said plurality of said switching assemblies to said switching means in a third one of said plurality of switching assemblies, said switching means in said third one of said plurality of switching assemblies including means responsive to a signal appearing on said second interconnecting means for selectively coupling a predetermined one of said plurality of audio signal busses in said third assembly to said speaker buss in said third assembly.

3. A switching system according to claim **1** wherein each of said switching means in said plurality of switching assemblies comprises: a first switchbank coupled to a first and a second one of said plurality of audio signal busses; a second switchbank coupled to said first switch-bank and to a third one of said plurality of audio signal busses; a third switchbank coupled to said second switchbank and to a fourth one of said plurality of audio signal busses; and a first, a second, and a third means for switching said switchbanks for selectively coupling said first, said second, and said third one of said plurality of audio signal busses to said speaker buss.

4. A switching system according to Claim **3** wherein each of said switchbanks comprise: a plurality of normally open and normally closed signal paths and further comprising means for coupling said first one of said plurality of audio signal busses to said speaker buss through said normally closed signal paths of each of said switchbanks.

5. A switching system according to claim **4** further comprising means for coupling said second one of said audio signal busses to said speaker buss through said normally open signal paths of said first switchbank and said normally closed signal paths of said second and said third switchbanks.

6. A switching system according to claim **5** further comprising means for coupling said third one of said audio signal busses to said speaker buss through said normally open signal paths of said second switchbank and said normally closed signal paths of said third switchbank.

7. A switching system according to claim **6** further comprising means for coupling said fourth one of said audio signal busses to said speaker buss through said normally open signal paths of said third switchbank.

8. A switching system according to claim **7** wherein each of said switchbanks has a first and a second state of operation, and further comprising: a means for cou-

pling said first switchbank of said first one of said switching assemblies to said first and said second switchbank of said second one of said switching assemblies for changing said second switchbank in said second one of said switching assemblies from its first state of operation to its second state of operation when said first switchbank in said second one of said switching assemblies is changed from its first state of operation to its second state of operation after said first switchbank in said first one of said switching assemblies is in its second state of operation for coupling said third one of said audio signal busses to said speaker buss in said second one of said switching assemblies.

9. A switching system according to claim **8** further comprising means for coupling said first switchbank of said first one of said switching assemblies to said first switchbank in said third one of said switching assemblies for changing said first switch-bank in said third one of said switching assemblies from its first state of operation to its second state of operation when said first switchbank in said first one of said switching assemblies is changed from its first state of operation to its second state of operation.

10. A switching system according to claim **9** wherein said third switchbank in said first one of said switching assemblies further comprises: means for coupling said second switchbank in said first one of said switching assemblies to said second switch-bank in said second and said third one of switching assemblies and means for changing the state of operation of said third switchbank in said first one of said switching assemblies for decoupling said second switchbank in said first one of said switching assemblies from said second switchbank in said third one of said switching assemblies for preventing a change of state of operation of said second switchbank in said third one of said switching assemblies when said first switchbank in said first one of said switching assemblies is in its second state of operation.

11. A switching system according to claim **10** wherein each of said switchbanks are relay controlled switchbanks.

12. A zone speaker switching system comprising:

a first means for selectively coupling a first and a second audio signal buss to a first speaker buss;

a second means for selectively coupling said first and said second audio signal busses to a second speaker buss; and

a third means for selectively coupling said first and said second audio signal busses to a third speaker buss; said first, said second, and said third coupling means including means responsive to a control signal for automatically coupling said first audio signal buss to said first speaker buss and said second audio signal buss to said third speaker buss when said second audio signal buss is coupled to said second speaker buss.

13. A switching system according to claim **12** wherein said first, said second and said third coupling means comprise relay controlled switching means.

14. A switching system according to claim **12** wherein said first, said second and said third coupling means further comprise:

a means reponsive to a control signal for automatically coupling said first audio signal buss to said first and said second speaker busses when said first audio signal buss is coupled to said third speaker buss.

15. A switching system according to claim **14** wherein said first, said second and said third coupling means comprise relay controlled switching means.

16. A switching system according to claim **12** wherein said first, said second and said third coupling means further comprise:

a means responsive to a control signal for automatically coupling said second audio signal buss to said second and said third speaker busses when said second audio signal buss is coupled to said first speaker buss.

17. A switching system according to claim **16** wherein said first, said second and said third coupling means comprise relay controlled switching means.

18. A switching system according to claim **12** further comprising:

a third audio signal buss; and

means coupled to said responsive means for automatically simultaneously coupling said third audio signal buss to said first, said second and said third speaker busses.

19. A switching system according to claim **18** wherein said first, said second and said third coupling means comprise relay controlled switching means.

20. A zone speaker switching system comprising:

a first speaker buss for coupling to a speaker in a first speaker zone;

a second speaker buss for coupling to a speaker in a second speaker zone adjacent said first speaker zone;

a third speaker buss for coupling to a speaker in a third speaker zone adjacent said second speaker zone;

a first and a second audio signal buss;

a first source of audio signals including timing means responsive to a first indicator signal originating from said second speaker zone coupled to said first and said second audio signal busses for generating a first audio signal for a first predetermined length of time;

means reponsive to said first indicator signal for selectively coupling said first audio signal buss to said first and said second speaker busses and said second audio signal buss to said third speaker buss for transmitting said first audio signal over said first, said second and said third speaker busses for said first predetermined length of time;

means for generating a first control signal upon the termination of said first audio signal;

a second source of audio signals including means responsive to said first control signal coupled to said first and said second audio signal busses for transmitting a second audio signal over said first, said second and said third speaker busses for a second predetermined length of time;

means for generating a second control signal upon the termination of said second audio signal;

a third audio signal buss; and

means responsive to said second control signal for coupling said third audio signal buss to said first, said second and said third speaker busses for sequentially transmitting said first, said second and a third audio signal over said first, said second and said third speaker busses.

21. A zone speaker switching system according to claim **20** further comprising:

means responsive to said first indicator signal for inhibiting the generation of a second alarm signal in response to a second indicator signal while said first and said second audio signal busses are coupled to said first, said second and said third speaker busses.

22. A zone speaker switching system according to claim **21** further comprising:

means responsive to said second control signal for inhibiting the transmission of a second alarm signal generated in response to a second indicator signal to said first, said second and said third speaker busses while said third audio signal buss is coupled to said first, said second and said third speaker busses.

23. A zone speaker switching system according to claim **22** wherein said first source of audio signals includes means for generating a first audio alarm signal and said second source of audio signals includes a source of a first pre-recorded audio message coupled to said first audio signal buss and a source of a second pre-recorded audio message coupled to said second audio signal buss for sequentially transmitting said first audio alarm signal and said first audio message over said first and said second speaker busses and said first audio alarm signal and said second audio message over said third speaker buss.

24. A zone speaker switching system according to claim **23** further comprising:

a fourth speaker buss for coupling to a speaker in a fourth speaker zone adjacent said first speaker zone;

a fifth speaker buss for coupling to a speaker in a fifth speaker zone adjacent said third speaker zone;

means responsive to a second indicator signal coupled to said first and said second audio signal busses for generating a second alarm signal for a third predetermined length of time; and

means reponsive to said second indicator signal for selectively coupling said first audio signal buss to said fourth speaker buss for sequentially transmitting said second alarm signal and said first pre-recorded audio message over said fourth speaker buss if said second indicator signal originates from said fourth speaker zone and said second audio signal buss to said fifth speaker buss for sequentially transmitting said second alarm signal and said second pre-recorded audio message over said fifth speaker buss if said second indicator signal originates from said fifth speaker zone.

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