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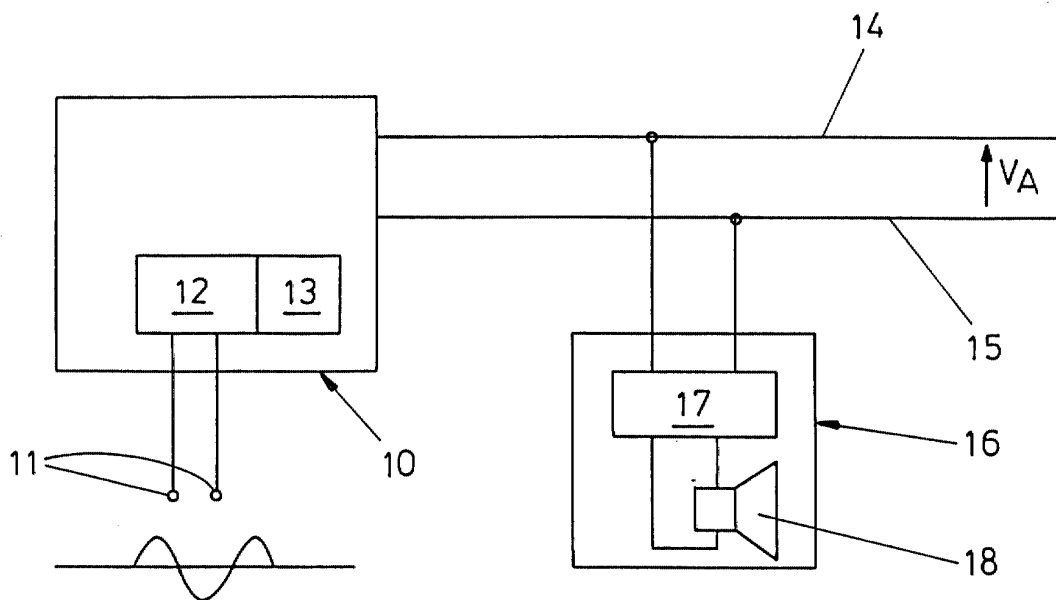
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(54) **Audible warning devices**

(57) An alarm system comprising a plurality of synchronised two-tone audible warning devices 18 connected to a power supply 12, each device 18 having an input connected to the output of a driver circuit 17 which is arranged to successively apply voltage pulses to the

device 18 at the two frequencies. The width of the voltage pulses is varied inversely to the frequency, in order that the average current drawn by the devices 18 from the power supply 12 is substantially uniform at both frequencies.



Description

[0001] This invention relates to audible warning devices and more particularly but not solely to audible warning devices for alarm systems.

[0002] It is well known that audible warning devices are extremely effective at providing an indication of an alarm condition. It is also known that audible warning devices which emit a sound that is continuously pulsed or sweeping are far more likely to be heard and responded to than warning devices which emit a single frequency.

[0003] Alarm systems are known which comprise a plurality of audible warning devices or so-called sounders, which each emit an audible alarm signal when the alarm is triggered. One such alarm system comprises a fire alarm system, comprising a plurality of sounders connected across one or more pairs of wires extending from a control panel. In use, when the alarm is triggered, the sounders draw current from the control panel.

[0004] It is preferable to arrange the sounders, so that they each produce a synchronised audible signal, which continuously pulses or sweeps between say 800 and 1000 Hz.

[0005] Most sounders comprise an audible transducer, such as a rocking armature loudspeaker of the type disclosed in GB 2 323 999, to which a pulsed audio signal is applied.

[0006] It is well known that the relationship between the width of the audio pulses and the sound output level is nonlinear or even curvilinear, especially if the audible transducer is inductive. Thus, no appreciable increase or even a reduction in sound output is achieved by widening the audio pulses above a certain width. Accordingly, a considerable amount of power can be saved and a high output level can be achieved by optimising the width of the pulses.

[0007] Accordingly, it is well known to apply pulses of uniform width to the sounders and to vary the spacing between the pulses, according to the desired frequency of the output signal. Thus at 800Hz, 50µS pulses would be spaced by 1.2mS and at 1000Hz, 50µS pulses would be spaced by 0.95mS.

[0008] The sounders draw current each time a pulse is applied and it will be appreciated that the average current drawn at the higher frequency is greater than the current drawn at the lower frequency.

[0009] A disadvantage of this arrangement is that the current drawn by alarm systems having synchronised sounders will pulse between a high and a low value as high and low frequency tones are respectively emitted. The difference between the high and low current values will depend on the number of sounders that are synchronised: This problem may be exacerbated if the sounder is inductive, since the instantaneous current drawn falls as the sounder approaches resonance.

[0010] This pulsed current can place considerable strains on the power supply in the control panel and this

can cause corresponding voltage fluctuations in the supply to other circuits, with the result that some circuits may malfunction.

[0011] Another disadvantage is that the current pulses or any associated voltage fluctuation may mask current and/or voltage signalling that is sent between the control panel and remote devices, such as smoke detectors, call points and sounders, particularly if the signalling is sent along the same pair of wires as those which carry current to the sounders.

[0012] I has been proposed to overcome the above-mentioned problems by connecting a smoothing capacitor across the supply wires to the sounders. However, a disadvantage of this is that the smoothing capacitor filters out the current and/or voltage signalling that is sent between the control panel and remote devices.

[0013] I have now devised a driver for an audible which alleviates the above mentioned problems.

[0014] In accordance with the invention there is provided a driver circuit for an audible transducer, the circuit comprising an output for connecting to the input of the audible transducer and signal generating means for applying voltage pulses to said output at a variable rate, wherein the width of the voltage pulses is varied inversely to the rate, in order that the average current drawn by said transducer is substantially uniform, said pulses being short in duration compared with the period of the signal.

[0015] It will be appreciated that purely resistive transducers draw an average current, which is equal to the product of the instantaneous current value, the frequency and the pulse width. Thus, assuming that the instantaneous current value is always the same, a uniform average current can be obtained by increasing the pulse width when the frequency decreases and vice versa.

[0016] In one embodiment, the width of the voltage pulses is varied proportionately to said pulse rate, say where the transducer is substantially resistive.

[0017] In inductive loads, the instantaneous current will vary according to the frequency, owing to the Q of the coil. Thus, the width of the pulses may be varied non-proportionally, so that a uniform average current is drawn.

[0018] Preferably, the output of the driver circuit is connected to a plurality of audible transducers, which emit a synchronised audible output in the audio frequency range.

[0019] The rate of the pulses may be continuously increased and decreased between two values, either gradually or in a stepwise manner.

[0020] Preferably the pulse rate is successively varied, preferably at intervals of between 0.5 and 2 seconds.

[0021] Preferably the means for applying said pulsed voltage to the output comprises a microprocessor.

[0022] Also in accordance with this invention, there is provided an alarm system comprising a plurality of audible warning devices, connected to a power supply,

each having an input connected to the output of a driver circuit, said driver circuit comprising signal generating means for applying voltage pulses to said output at a variable rate, wherein the width of the voltage pulses is varied inversely to the rate, in order that the average current drawn by said transducers from said power supply is substantially uniform, said pulses being short in duration compared with the period of the signal.

[0023] In one embodiment, the alarm system comprises a plurality of warning devices each having an audible warning transducer and an associated driver circuit.

[0024] Preferably the alarm system further comprises a remote control unit incorporating said power supply, the control unit being arranged to send control signals to the warning device, in order to synchronise the outputs of their respective driver circuits.

[0025] In an alternative embodiment, the alarm system comprises a control unit incorporating said power supply and said signal generating means, the output of the signal generating means being connected to each audible transducer.

[0026] An embodiment of this invention will now be described by way of example only and with reference to the accompanying drawing, the single figure of which is a schematic diagram of an embodiment of fire alarm system in accordance with this invention.

[0027] Referring to the drawing, there is shown a fire alarm system comprising a control panel 10 having a power supply 12 provided with terminals 11 for connecting to the mains supply. A control circuit 13 is connected to the power supply 12.

[0028] A plurality of sounders e.g. 16 are connected in parallel across a pair of wires 14, 15 that extend from the control panel 10. The sounders 16 each comprise a speaker 18 and a speaker driver circuit 17.

[0029] The alarm system also comprises a plurality of heat and/or smoke sensors and manual call points (not shown), which are also connected across the wires 14, 15.

[0030] In use, when one of the sensors or call points is activated, the activated device draws a pulsed current along the wires 14, 15, to indicate to the control circuit 13 in the control panel 10 that an alarm condition has been detected, whereupon the control circuit 13 sends voltage pulses along the wires 14, 15 to trigger the sounders 16, which may in fact be located inside the same housing as the detectors.

[0031] The driver circuit 17 inside each sounder 16 then applies an audio signal to its associated speaker 18, so that a pulsed audible warning signal is emitted.

[0032] The audio signal comprises a series of voltage pulses of say 50µs duration which are successively transmitted at rates of 800 and 1000 Hz, with the frequency changing from one frequency to the other say every 1 second. The control circuit 13 in the control panel 10 outputs a synchronising pulse at regular intervals, which ensures that the pulsed output of each sounder

is synchronised: an accurate crystal oscillator in each sounder 16 ensures that the frequencies remain constant, as well as ensuring that the sounders remain synchronised between successive synchronising pulses.

[0033] A disadvantage of the system as hereinbefore described is that the current drawn by the synchronised sounders is greater at the higher frequency than it is at the lower frequency. For example at 800 Hz each sounder may draw an average 50mA, whereas at 1000Hz the sounders each draw an average 62.5mA. Obviously, if 25 sounders are connected across the wires 14, 15, there will be a difference of 312.5mA between the average currents at these two frequencies.

[0034] It will be appreciated that the average current on the wires 14, 15 thus pulses between the two values as the frequency toggles between 800 and 1000Hz. This varying current can mask the aforementioned current signalling pulses that are sent from the detectors and call points back to the control unit 10.

[0035] In accordance with this invention this problem is overcome, by arranging the driver circuit to reduce the width of the voltage pulses as the frequency increases and vice-versa, according to the following formula:

$$w = \frac{I}{F}$$

Where:

W = pulse width
I = average current
F = frequency

[0036] Thus, in order to achieve an average of 50mA per sounder at 800 and 1000Hz, the pulse widths are adjusted to 62.5µs and 50µs respectively.

[0037] Thus, it will be appreciated that a constant current is drawn, regardless of the frequency and the aforementioned problems are avoided.

Claims

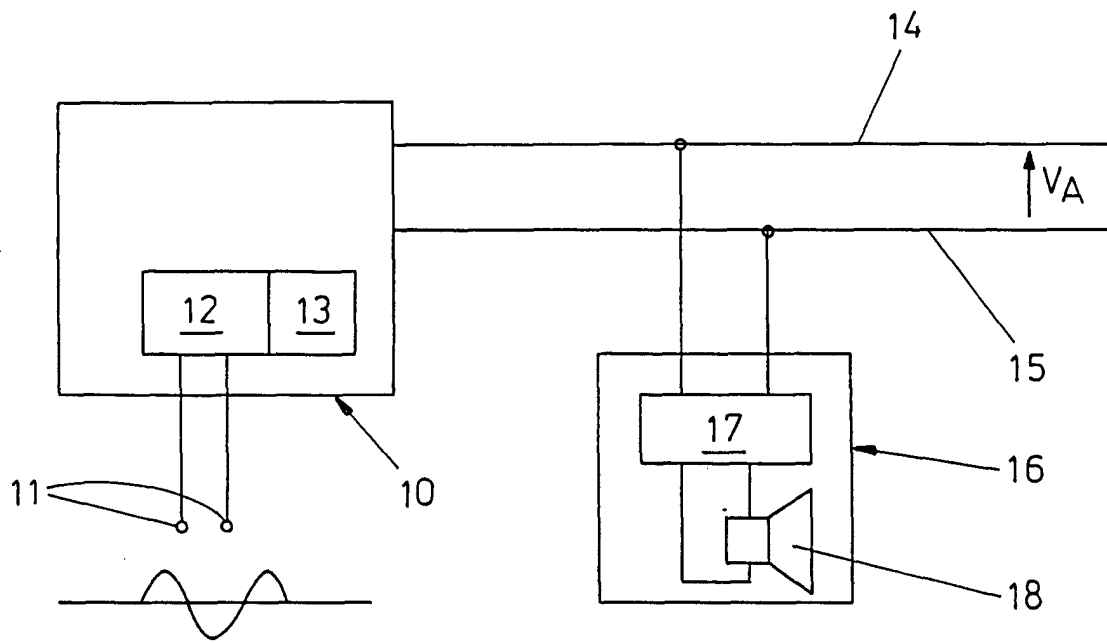
1. An alarm system comprising a plurality of audible warning devices, connected to a power supply, each having an input connected to the output of a driver circuit, said driver circuit comprising signal generating means for applying voltage pulses to said output at a variable rate, wherein the width of the voltage pulses is varied inversely to the rate, in order that the average current drawn by said transducers from said power supply is substantially uniform, said pulses being short in duration compared with the period of the signal.
2. An alarm system as claimed in claim 1, comprising a plurality of warning devices each having an audible warning transducer and an associated driver cir-

cuit.

3. An alarm system as claimed in claim 2, comprising a remote control unit incorporating said power supply, the control unit being arranged to send control signals to the warning device, in order to synchronise the outputs of their respective driver circuits. 5
4. An alarm system as claimed in claim 2, comprising a control unit incorporating said power supply and said signal generating means, the output of the signal generating means being connected to each audible transducer. 10
5. A driver circuit for an audible transducer, the circuit comprising an output for connecting to the input of the audible transducer and signal generating means for applying voltage pulses to said output at a variable rate, wherein the width of the voltage pulses is varied inversely to the rate in order that the average current drawn by said transducer is substantially uniform, said pulses being short in duration compared with the period of the signal. 15 20
6. A driver circuit as claimed in claim 4, in which the width of the voltage pulses is varied proportionally to said pulse rate. 25
7. A driver circuit as claimed in claim 5, in which the width of the voltage pulses is varied non-proportionally to said pulse rate. 30
8. A driver circuit as claimed in of claims 5 to 7, in which the frequency rate of the pulses is in the audio frequency range. 35
9. A driver circuit as claimed in claims 5 to 8, in which the rate of the pulses is continuously increased and decreased between two values, either gradually or in a stepwise manner. 40
10. A driver circuit as claimed in claims 5 to 9, in which the means for applying said pulsed voltage to the output comprises a microprocessor. 45

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EUROPEAN SEARCH REPORT

Application Number
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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	US 4 926 159 A (BARTLETT ALAN L) 15 May 1990 (1990-05-15) * the whole document *	1-10	G08B3/10
A	US 3 981 007 A (CIESLAK RICHARD F ET AL) 14 September 1976 (1976-09-14) * the whole document *	1-10	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			G08B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 3 November 2000	Examiner Sgura, S
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 00 30 4285

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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03-11-2000

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82