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[54] **AUDIBLE SIGNAL OR ALARM DEVICE INCLUDING TWO VARIABLE FREQUENCY UNIJUNCTION TRANSISTOR OSCILLATORS**

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[52] **U.S. Cl.**.....**331/47**, 331/111, 331/177 R, 331/179, 340/328, 340/384 E

[51] **Int. Cl.**.....**G08b 3/10**, G08b 19/00, H03b 3/04

[58] **Field of Search**.....331/47, 111, 177 R, 179; 340/328, 384 E

[56] **References Cited**

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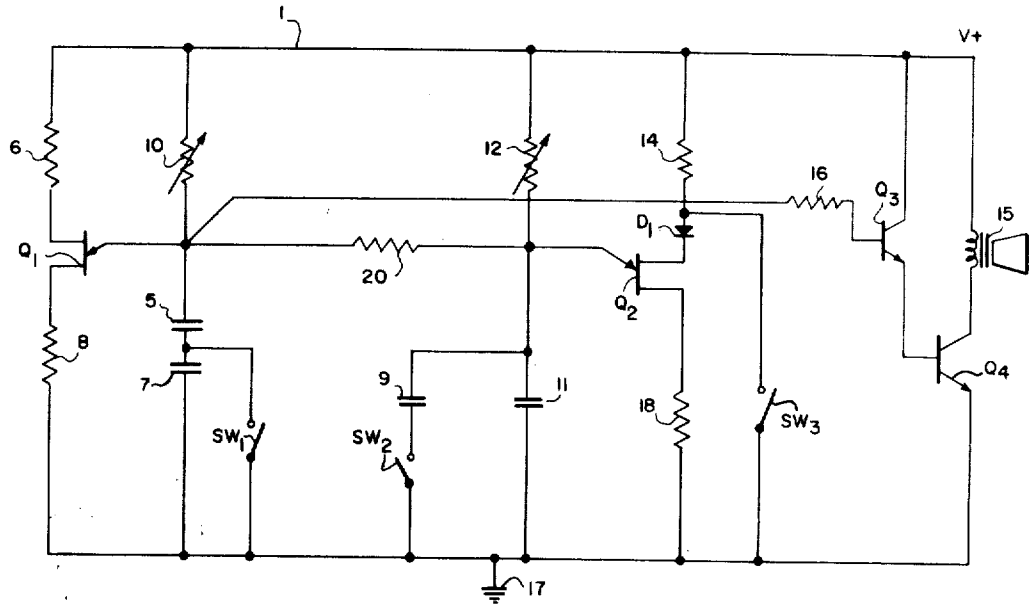
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[57] **ABSTRACT**

An audible signal or alarm circuit capable of selectively providing different output signals is disclosed. The circuit is capable of providing a steady output signal, a varying frequency output signal, different rates at which the frequency of the output signal is varied and different basic varying frequency signals. The alarm circuit may be used alone or in connection with any sensing or measuring circuitry, such as fire detectors, intrusion detection systems or the like. In addition, the different output signals can be selectively programmed using simple devices such as timing circuits, condition responsive circuits or the like. The alarm circuit comprises a pair of unijunction transistors, an amplifier circuit, a speaker and switching means used to obtain the various different output signals.

8 Claims, 3 Drawing Figures



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SHEET 1 OF 2

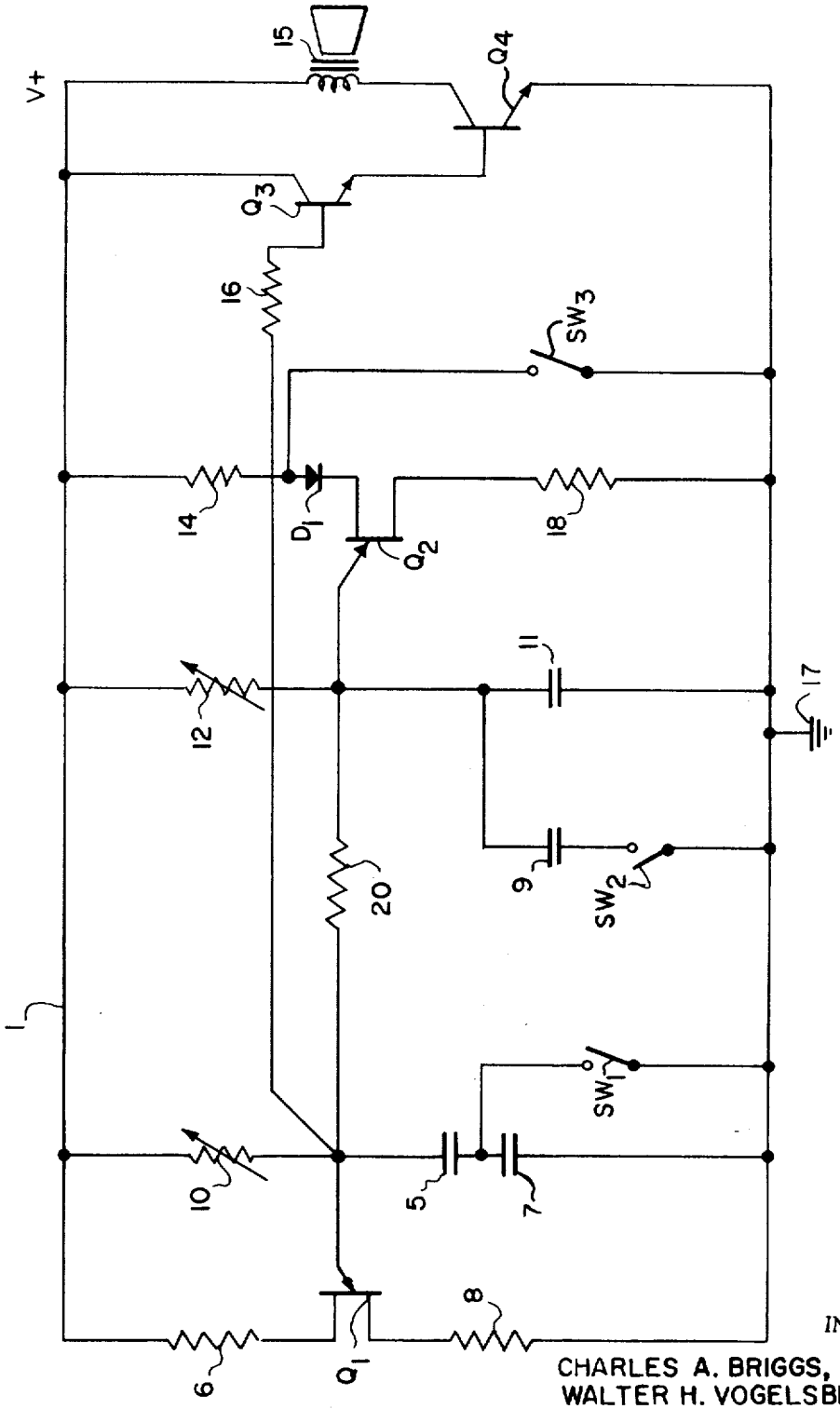


FIG. 1.

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FIG. 2.

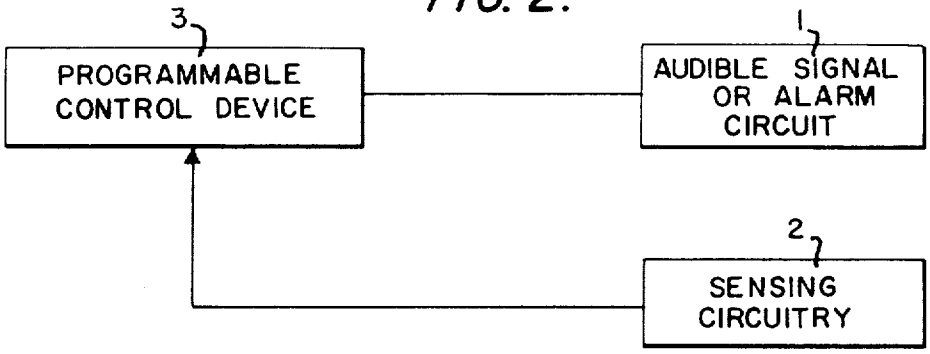
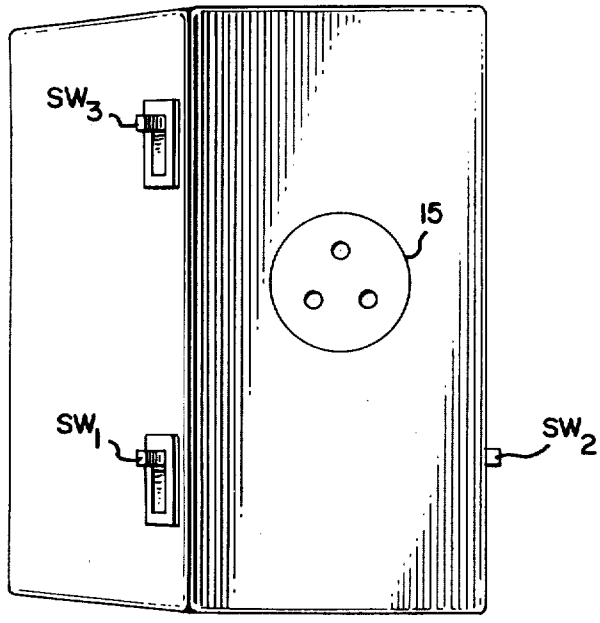


FIG. 3.



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AUDIBLE SIGNAL OR ALARM DEVICE INCLUDING TWO VARIABLE FREQUENCY UNIJUNCTION TRANSISTOR OSCILLATORS

BACKGROUND OF THE INVENTION

This invention relates to audible signal devices and more particularly to an audible signal circuit capable of selectively providing different output signals.

In recent years it has become apparent that the conventional audible signal or alarm devices, such as steady signals, horns, buzzers or the like are not easily heard in a noise environment or people tend to ignore these signals, probably because such signals or alarms have become too common place and no longer attract attention. Also some of the higher frequency steady signals cannot be heard at all by older people.

Recently, new audible signal or alarm devices such as the warblers and varying frequency devices have been invented to overcome the problems encountered with the prior art conventional alarms or signal devices. Generally, the presently available varying frequency devices operate on a fixed frequency and fixed rate of varying the frequency. While these devices are normally readily hard in a noise environment, they are limited in scope because the frequency and variation rate are fixed. Thus, if one wanted to indicate specific different conditions by means of these prior art varying frequency signal devices, he would have to use a separate varying frequency signal device each fixed at a different frequency and/or rate for each of the desired conditions.

SUMMARY OF THE INVENTION

This invention provides a varying frequency audible signal or alarm circuit capable of selectively providing a fixed signal output, and a varying frequency output signal, the frequency of which can be selectively varied at different rates. In addition the basic frequency of the device can be changed. Thus, not only can the rate of frequency variation be changed but in addition the basic frequency of the signal being varied can also be selectively changed. With this device one can obtain a plurality of different output signals with a single alarm or signal device. These different output signals can be selectively programmed to indicate specific conditions, the passage of a fixed amount of time or the like.

The alarm or signal circuit comprises a pair of unijunction oscillators so interconnected that one of the oscillators frequency modulates the other oscillator. A transistor amplifier is connected to the output of the oscillator circuit to obtain an amplified frequency varying signal. Switches or other means are provided to selectively obtain different variation rates and different oscillator frequencies. A steady output signal can also be obtained by means of a switch. These switches or selector means may be automatically operated by simple programming means.

It is therefore an object of this invention to provide an audible alarm or signal device.

Another object of this invention is to provide a steady tone audible signal or alarm device.

A further object of this invention is to provide an audible signal or alarm device having a varying frequency output signal.

A further object of this invention is to provide an audible signal or alarm device having a varying frequency output signal, the frequency variation rate of which can be selectively changed.

A further object of this invention is to provide an audible signal or alarm oscillator circuit having means for selectively changing the frequency of oscillation.

A still further object of this invention is to provide an audible signal or alarm capable of providing programmed selected output signals.

BRIEF DESCRIPTION OF THE DRAWING

The above mentioned and other objects of the invention will become readily apparent from the following detailed description of the invention when read in conjunction with the annexed drawing in which:

FIG. 1 is a circuit diagram showing a preferred embodiment of the audible signal or alarm circuit of this invention;

FIG. 2 shows in block diagram form the audible signal circuit used in conjunction with sensing circuitry and programmable control circuit for selectively changing the output of the signal or alarm circuit; and

FIG. 3 is a pictorial view showing how the audible signal or alarm circuit may be packaged.

DESCRIPTION OF THE INVENTION

As shown in FIG. 1, the audible signal or alarm circuit 1 comprises a first oscillator having an unijunction transistor Q1 and a second oscillator having an unijunction transistor Q2. The first oscillator in addition to unijunction transistor Q1 comprises a resistor 6 connected between a source of positive voltage V+ and one of the bases of unijunction transistor Q1; a resistor 8 connected between the ground 17 and the second base of unijunction transistor Q1; a first capacitor 5 and a second capacitor 7 serially connected between the emitter of unijunction transistor Q1 and ground 17; and a variable resistor 10 connected between the emitter of unijunction transistor Q1 and voltage source V+.

Similarly, the second oscillator in addition to unijunction transistor Q2 comprises a variable resistor 12 connected between source V+ and the emitter of unijunction transistor Q2; a capacitor 11 connected between ground 17 and the emitter of unijunction transistor Q2; a resistor 18 connected between one base of unijunction transistor Q2 and ground 17 and a resistor 14 and a diode D1 serially connected between source V+ and the second base of unijunction transistor Q2. The two basic oscillator circuits are connected together by means of a resistor 20 connected between the emitter of unijunction transistor Q1 and the emitter of unijunction transistor Q2. An output signal is taken from the emitter of unijunction transistor Q1. This output signal is applied to an amplifier circuit comprising the transistors Q3 and Q4 by means of a resistor 16 connected between the base of transistor Q3 and the emitter of unijunction transistor Q1. A speaker is connected between the collectors of amplifier transistors Q3 and Q4 to provide an audible output.

The oscillator circuit just described which is made up of two basic unijunction oscillators provides a varying frequency output signal. Oscillator circuits of this type are known in the art. Furthermore, varying frequency devices using two basic unijunction transistor oscillator

circuits are also known in the art. However, in these prior art circuits, single capacitors are used in place of capacitors **5** and **7** and **9** and **11**, no diode such as **D1** is located in one of the base circuits of the second unijunction transistor and the resistors **10** and **12** are generally fixed resistors. With this type of device, the output signal varies at a fixed rate and the frequency of the oscillators is also fixed.

With the circuit shown in FIG. **1**, different outputs can be selectively obtained by means of the switches **SW1**, **SW2** and **SW3** and by means of variable resistors **10** and **12**. Closing of **SW1** shorts out capacitor **7** thereby leaving only capacitor **5** in the circuit. Removing one of the two series capacitors will increase the capacitance of the oscillator circuit and therefore change the frequency of oscillation. In a similar fashion closing of switch **SW2** adds the capacitor **9** in parallel with capacitor **11** thereby changing the frequency of this oscillator circuit. The two oscillators operate in such a fashion that the second oscillator that is the one having unijunction transistor **Q2** (herein after referred to as the **Q2** oscillator) frequency modulates the output of the first or **Q1** unijunction transistor oscillator (hereinafter referred to as the **Q1** oscillator). In other words the **Q2** oscillator establishes the rate at which the frequency of the output signal varies. It is, therefore, obvious that the closing of switch **SW2** will change the rate of variation of the output signal. Changing of the resistances of variable resistors **10** and **12** will also change the frequencies of the oscillators and therefore the basic output frequency and/or rate of variation of the output. The changing of the resistance of resistor **10** alone will only change the basic frequency of the output signal whereas the changing of resistor **12** alone will only change the rate of variation of the output signal. Of course changing the resistance of both resistors **10** and **12** will affect both the frequency and the rate.

From the foregoing description of the function of switches **SW1** and **SW2** and variable resistors **10** and **12**, it is apparent that with the circuit of FIG. **1** the basic frequency of the output signal, the rate at which the output signal varies or both can be selectively changed. Closing of switch **SW1** alone changes only the frequency; closing of **SW2** alone changes only the rate of variation; and closing of both these switches changes both the frequency and rate. Further selective changes in frequency, rate or both can be obtained by varying either or both of the variable resistors **10** and **12**.

While only two capacitors and a single switch are shown in each of the oscillator circuits, it should be obvious that additional capacitors can be connected in series or parallel or in a series-parallel arrangement in each of the oscillators with appropriate switches to selectively obtain any desired capacitance. Also the capacitors shown could be replaced with variable capacitors or a plurality of variable capacitors. With these more elaborate arrangements, a greater number of distinct and readily discernible output signals can be obtained.

In order to avoid confusion or misunderstanding of what is means by the terms change in the basic frequency of the output signal and change in rate of variation of the output signal as they are used throughout this specification, the term change in basic frequency is here defined as being the frequency of the **Q1** oscillator which is changed by closing switch **SW1**. The output of the **Q1** oscillator is frequency modulated by the **Q2** oscillator. Thus changing the frequency of the **Q1** oscillator changes the carrier or fundamental frequency which is varied or modulated by the **Q2** oscillator. From this definition is is obvious that output signal will be distinctly different since the frequency of the **Q1** oscillator is noticeably changed by the opening and closing of switch **SW1**. The term rate of variation of the output signal is here defined as being the rate at which the frequency of the output signal of the **Q1** oscillator is changed by the **Q2** oscillator which frequency modulates the signal from the **Q1** oscillator. Since the frequency of the **Q2** oscillator is noticeably changed by the opening and closing of switch **SW2** it is obvious that the rate at which the frequency of the output signal applied to the transistor amplifier changes will also be noticeably changed.

As has been mentioned above, the signal or alarm circuit of this invention can also provide a non-varying or steady output signal. This steady output signal is obtained by closing switch **SW3** When switch **SW3** is closed the **Q2** oscillator is rendered inoperative and therefore the output of the **Q1** oscillator is not frequency modulated. The frequency of this steady output signal can, of course, be changed by opening and closing switch **SW1** or by varying resistor **10**.

From the foregoing description of the overall operation of the circuit of FIG. **1**, it is obvious that this circuit provides a versatile audible signal or alarm device. With switches **SW1**, **SW2** and **SW3** all open, a first audible output signal varying at a first rate will be obtained from speaker **15**. When switch **SW1** is closed and switches **SW2** and **SW3** are opened a second audible output signal varying at the first rate will be obtained. If switches **SW1** and **SW3** are opened and switch **SW2** is closed, the above mentioned first audible output signal varying at a second rate will be obtained. If switches **SW1** and **SW2** are closed and switch **SW3** is open, the above mentioned second audible output signal varying at the above mentioned second rate is obtained. If switch **SW3** is closed and switch **SW1** is opened (the position of switch **SW2** when switch **SW3** is closed is of no significance since oscillator **Q2** is rendered inoperative), a steady single frequency audible output signal will be obtained. If both switches **SW1** and **SW3** are closed, a steady single frequency output signal different in frequency from the output signal obtained when switch **SW1** is open, will be obtained. Thus by the mere opening and closing of switches **SW1**, **SW2** and **SW3** six different output signals are provided. As has been mentioned above, additional different outputs can be obtained by varying resistors **10** and **12** or by adding additional capacitors and switches or by using variable capacitors. Thus, it is quite apparent that the circuit of FIG. **1** provides a very versatile signal or alarm device. The circuit of FIG. **1** can be powered by conventional transistor dry cells and the amplifier provides a considerably amount of output power. No additional amplification is required to provide an audible signal that can be heard for a considerably distance from the site of the device. Of course, additional amplification can be added but is not needed for most applications.

FIG. 2 shows in block diagram form a system in which the alarm or signal circuit 1 of FIG. 1 can be readily incorporated. As shown in FIG. 2, this system comprises the sensing circuitry 2, a programmable control device 3, and the audible signal or alarm circuit 1. Sensing circuit 2 can be any circuit capable of sensing a condition and does not form a part of this invention. For example, if the system shown in FIG. 2 is a security system, sensing circuitry 2 could include fire detectors, burglar detection apparatus, temperature sensors, water or moisture detectors or the like. Any or all of these systems could be included in such a security system. The output of sensing circuitry 2 is applied to programmable control device 3. Programmable control device 3 is used to select the proper one of the multitude of output signals available from signal device 1 and as will be apparent later can be used to program these outputs in any particular desired manner or sequence.

For purposes of clarity in describing the operation of the system shown in FIG. 2, assume that sensing circuitry 2 includes fire detection devices, burglar detection devices and water detection devices. In this case three separate output lines could be connected between sensing circuitry 2 and programmable control device 3, or if coded signals are used, a single output would suffice. The type of circuitry used will, of course, depend upon the type of output signals emanating from sensing circuitry 2 and the nature of the control of signal device 1 that is to be obtained. In any event as will be apparent, the circuitry used for programmable control device 3 is in all cases conventional well known circuitry. If now sensing circuitry 2 detects a fire in the protected area, a signal will be transmitted to control device 3 from sensing circuitry 2 and control device 3 will actuate signal device 1 and open or close the appropriate switches, or the equivalent as the case may be. Thus, control device 2 will control signal device 1 to obtain a particular output signal that is selected as the fire alarm signal. For example, if the circuitry of FIG. 1 is used, the fire signal could be the output obtained when switches SW1, SW2 and SW3 are all open. If on the other hand a burglar is detected, control device 2 could operate to close SW1 and leave switches SW2 and SW3 open, thereby obtaining a second signal different from the fire alarm signal. A distinct water alarm signal could be obtained by closing switch SW2 and opening switches SW1 and SW2. Similarly, a combination burglar and fire alarm signal could be obtained by having programmable control device 3 close both switches SW1 and SW2 and open switch SW3, etc. Thus, programmable control device 3 programs audible signal device 1 in such a manner that a predetermined distinct output is obtained for each condition sensed. In this case programmable control device can be any known electromechanical device capable of opening and closing switches or if electronic switches are used control device 3 can be an electronic control circuit.

The above specific example of a system using the signal or alarm circuit 1 is given by way of example only. This audible signal or alarm circuit can be used in any environment in which it is desired to provide an audible output signal or preferably a plurality of different audible output signal or preferably a plurality of different audible signals. Similarly, the specific programmable control device described above is given by way of example only to show that audible signal or alarm device 1 can be programmed to provide different output signals to impart specific information. Programmable control device 3 could be a simple timing circuit used to program audible signal device 1 to produce specific output signals at certain times. For example, if signal or alarm device 1 were used in a fire detection system or in a machine monitor to indicate a breakdown or the like, programmable control device 3 could be a simple timing circuit that programs audible signal or alarm device 1 to produce a first output signal when the fire or breakdown first occurs and at a later time a second signal if no response is made to the first signal, and still at a later time a third signal if no response is made to the first and second signals and so forth. In this case, it is obvious that simple well known timing and control circuits could be used for programmable control circuit 3. One having ordinary skill in the art could think of many other different examples of circuits that can be used for programmable control circuit 3. The circuit used, of course, depends upon the result desired. Thus, the important fact is not the specific circuitry used in programmable control circuit 3, but is the fact that audible signal or alarm device 1 can be programmed to obtain particular output signals or sequence of different output signals. The particular programmed control of audible signal or alarm device 1 that is used in any given situation will, of course, depend upon the environment in which the signal device is used and the signals desired. Thus, not only does audible signal or alarm device 1 provide a signal device having a multitude of selectable output signals, but by the addition of a programmable control device the selection of these outputs can be programmed.

FIG. 3 is a pictorial view showing one way in which the circuit of FIG. 1 can be fabricated and packaged. As shown in FIG. 3, the switches SW1, SW2 and SW3 are brought out at each side and the speaker 15 is mounted under the face plate. This figure is given to show that while audible signal or alarm device 1 is capable of providing a strong output signal it can be fabricated into a compact unit. Printed circuit techniques are used and the resultant overall unit is very small when compared with conventional sirens, horns or the like. In fact, a model of the circuit of FIG. 1 has been manufactured and the overall size of the device, including batteries, is approximately $5 \times 2 \times 2$ inches; yet the output signal is strong enough to be heard at a considerable distance. The model constructed looks exactly like the device shown in FIG. 3, except that SW3 was omitted from this model. In this respect all the switches could be omitted and electronic switches could be used. Further, the capacitors, variable resistors 10 and 12 could all be housed in the programmable control device rather than in the signal or alarm device, if such a control device is used. The specific fabrication used will, of course, be governed by each particular use of signal or alarm device 1. However, if signal or alarm device 1 is to be fabricated as a portable device that can be readily incorporated into any system or used by itself, for example as an alarm carried by a women in her purse, the construction shown in FIG. 3 is ideally suitable.

From the foregoing description, it is obvious that this invention provides a versatile signal or alarm device that is compact, provides a multiplicity of different signals, and is self-contained. In addition, the device can be used with a control device to program the audible signal outputs in accordance with a predetermined pattern or desired sequence.

While the invention has been described in detail with reference to a specific embodiment, it will be obvious to one skilled in the art that various changes and modification, in addition to those mentioned, can be made without departing from the spirit and scope of the invention as defined in the claims. For example, any appropriate oscillator other than unijunction oscillators can be used for the two oscillator circuits.

What is claimed is:

1. An audible signal circuit comprising: A first unijunction transistor having an emitter, a first base and a second base; a source of voltage, a first resistor connected between said source of voltage and said first base of said first unijunction transistor; a point of common potential; a second resistor connected between said point of common potential and said second base of said first unijunction transistor; a first variable resistor connected between said voltage source and said emitter of said first unijunction transistor; a first capacitive circuit connected between said emitter of said first unijunction oscillator and said point of common potential; means coupled to said first capacitive circuit for selectively changing the capacitance of said first capacitive circuit; a second unijunction transistor having an emitter, a first base and a second base; a third resistor connected between said second base of said second unijunction transistor and said point of common potential; a fourth resistor coupled between said first base of said second unijunction transistor and said source of voltage; a second variable resistor connected between said emitter of said second unijunction transistor and said voltage source; a second capacitive circuit connected between said emitter of said second unijunction transistor and said point of common potential; means coupled to said second capacitive circuit for selectively changing the capacitance of said second capacitive circuit; a fifth resistor connected between said emitter of said first unijunction transistor and said emitter of said second unijunction transistor; a diode connected in series with said fourth resistor in such a manner that its cathode is connected to said first base of said second unijunction transistor; a switch connected between said point of common potential and the common point of the anode of said diode and said fourth resistor; a transistor amplifier having an input and an output; means to couple said amplifier input to said emitter of said first unijunction transistor; and a loudspeaker coupled to said amplifier output.

2. An audible signal circuit as defined in claim 1 wherein said first capacitive circuit includes at least two capacitors serially connected between the emitter of said first unijunction transistor and said point of common potential; said means for changing the capacitance of said first capacitive circuit is a switch connected to short out at least one of said serially connected capacitors when said switch is closed; said second capacitor circuit comprises at least two parallel capacitors connected between said point of common potential and said emitter of said second unijunction transistor and said means for changing the capacitance of said second capacitive circuit comprises a switch so connected as to remove at least one of said two parallel capacitors from said point of common potential.

3. An audible signal circuit as defined in claim 1 wherein said first capacitive circuit and said means for changing the capacitance of said first capacitive circuit comprises a first variable capacitor connected between said point of common potential and said emitter of said first unijunction transistor and wherein said second capacitive circuit and said means for changing the capacitance of said second capacitive circuit comprises a second variable capacitor between said point of common potential and said emitter of said second unijunction transistor.

4. An audible signal circuit as defined in claim 1 wherein a programmable control circuit is coupled to said switch, to said means for changing the capacitance of said first capacitive circuit and to said means for changing the capacitance of said second capacitive circuit.

5. An audible signal circuit as defined in claim 1 wherein said first capacitive circuit includes a first plurality of capacitors, said means for selectively changing the capacitance of said first capacitive circuit comprises a first switching means for selectively switching any number of said first plurality of capacitors between said emitter of said first unijunction transistor and said point of common potential; and wherein said second capacitive circuit includes a second plurality of capacitors and said means for selectively changing the capacitance of said second capacitive circuit comprises a second switching means for selectively switching any number of said second plurality of capacitors between said emitter of said second unijunction transistor and said point of common potential.

6. An audible signal circuit as defined in claim 2 wherein a programmable control circuit is coupled to said switch connected to short out at least one of said serially connected capacitors, to said switch so connected as to remove at least one of said two parallel capacitors from said point of common potential and to said switch connected between said point of common potential and the common point of the anode of said diode and said fourth resistor.

7. An audible signal circuit as defined in claim 3 wherein a programmable control circuit is coupled to said first variable capacitor, to said second variable capacitor and to said switch.

8. An audible signal circuit as defined in claim 5 wherein a programmable control circuit is coupled to said first switching means, to said second switching means and to said switch.

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