United States Patent

Heneghan

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[54] **ALARM CIRCUIT**

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[52] **U.S. Cl.** .....**340/248 P,** 328/157

[51] **Int. Cl.**.....**G08b 21/00**

[58] **Field of Search** .....340/248 P; 331/113, 111, 47, 331/57; 328/143, 157; 178/4.1, 69 G; 307/231

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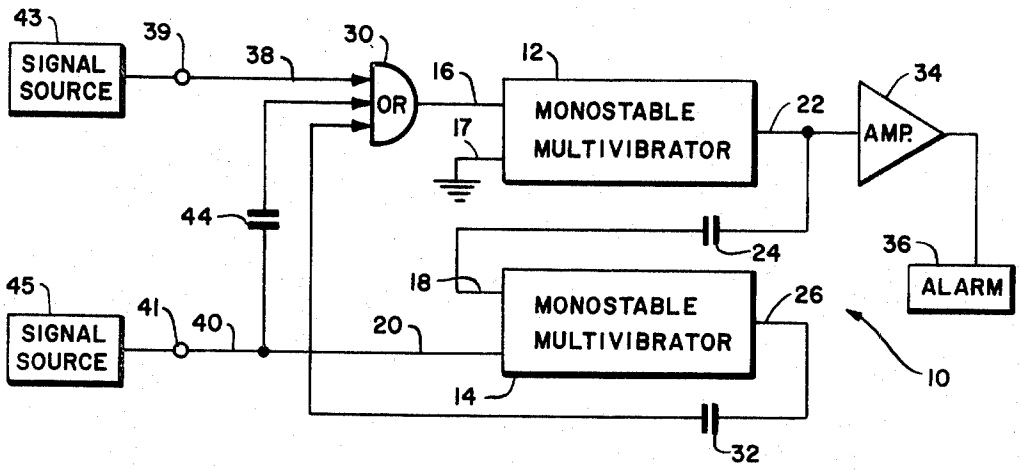
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[57] **ABSTRACT**

Two monostable multivibrators are interconnected to provide a single alarm output whenever a signal is applied to the circuit over a first input lead, and to provide a repetitive alarm output whenever a signal is applied to the circuit over a second input lead. The alarm is driven by the output from the first multivibrator, which output occurs once with each individual signal applied over the first input lead. Whenever a signal is applied over the second input lead the two multivibrators operate alternately for the duration of the signal, the output from the first multivibrator both driving the alarm and providing an input to the second multivibrator, and the output from the second multivibrator providing an input to the first multivibrator.

11 Claims, 3 Drawing Figures



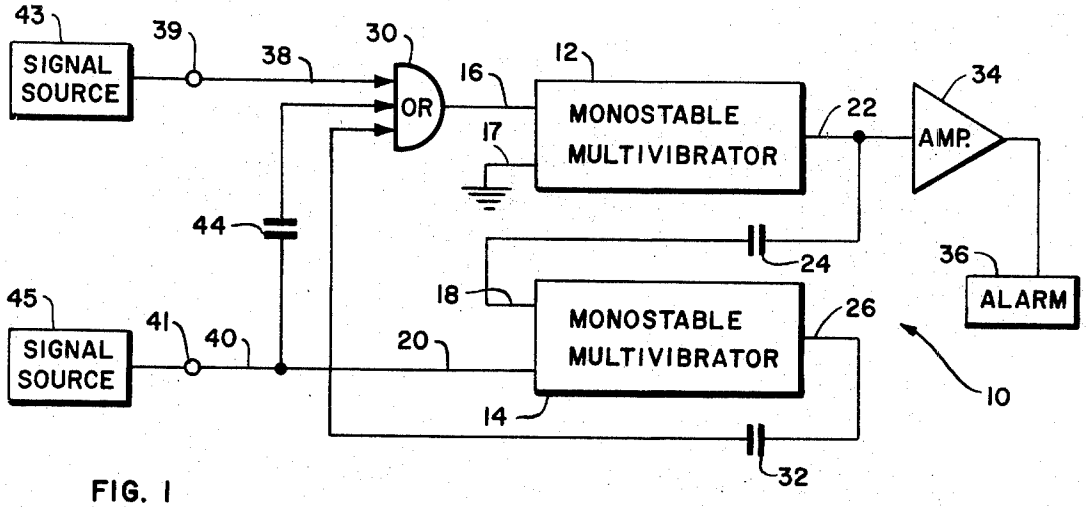


FIG. 1

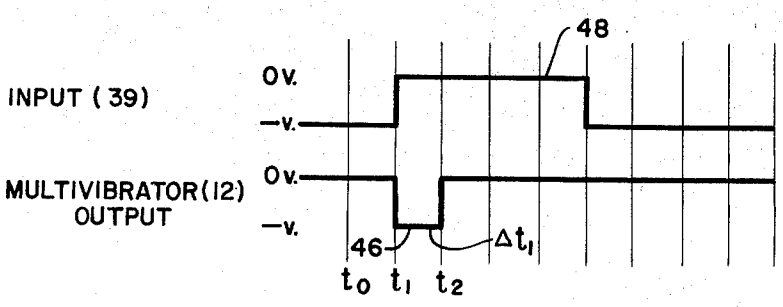


FIG. 2

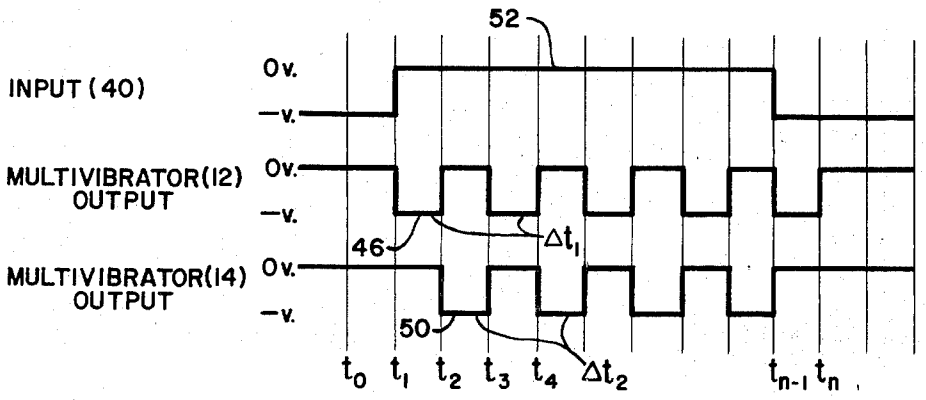


FIG. 3

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ALARM CIRCUIT

BACKGROUND OF THE INVENTION

The present invention relates to an alarm circuit, and in particular to an alarm circuit for providing either a single or a repetitive alarm output.

In maintaining attended and unattended sending and receiving teletypewriter terminals there is a need for alarm devices to occasionally call an operator's attention to a terminal. It is desirable, for example, to signal an operator that the paper record medium in an attended sender terminal is almost at the end of a line of type so that the operator may advance the paper one or more lines, or to signal the operator, by a signal generated at an associated transmitting teletypewriter apparatus, that the incoming message is important, so that the operator will direct his immediate attention to it. It is further desirable that the alarm device be capable of generating two types of signals, such as a single signal output or a repetitive signal output, the first to direct the operator's attention to a subcritical condition existing at the machine, that is, a condition which must be corrected but that doesn't require the operator's immediate attention, and the second to call the operator's attention to a critical condition existing at the machine which requires the operator's immediate attention.

An object of the invention is to provide an alarm circuit for selectively providing either a single or a repetitive alarm output.

SUMMARY OF THE INVENTION

The foregoing and other objects of the invention are accomplished by providing first and second monostable multivibrators, the first multivibrator being constantly enabled to provide an output in response to an input signal at a trigger input, and the second multivibrator having both a trigger and an enabling input. The output of the second multivibrator is capacitor coupled to a first input of a gate, the output of which gate is connected to the trigger input of the first multivibrator; and the output of the first multivibrator is capacitor coupled to the trigger input of the second multivibrator. A first input line is connected to provide a second input to the gate and a second input line is connected to provide an enabling input to the second multivibrator, the second input line also being capacitor coupled to a third input of the gate. An indicator device, such as an audible alarm, is connected to receive output pulses from the first multivibrator, so that an input signal on the first input line operates to trigger the first multivibrator to provide a single output from the alarm. An input signal on the second input line operates to both trigger the first multivibrator and to enable the second multivibrator, the subsequent termination of the output from the first multivibrator operating to trigger the second multivibrator and the termination of the output from the second multivibrator operating to again trigger the first multivibrator, the first and the second multivibrators being alternately triggered, so that a repetitive output is provided by the alarm in response to the triggering of the first multivibrator.

Other objects, advantages and features of the invention will be apparent from the following detailed description of a specific embodiment thereof, when taken in conjunction with the appended drawings.

BRIEF DESCRIPTION OF THE INVENTION

FIG. 1 is a block diagram of a preferred embodiment of the invention;

FIG. 2 is a timing diagram illustrating waveforms during the operation of the system shown in FIG. 1 in the mode producing a single alarm; and

FIG. 3 is a timing diagram illustrating waveforms during the operation of the system shown in FIG. 1 in the mode producing a repetitive alarm.

DETAILED DESCRIPTION

Referring to FIG. 1 of the drawings, there is shown a selectively regenerative alarm circuit particularly adaptable for operation as a signaling device for a teletypewriter sending or receiving terminal. In the description of the operation of the circuit shown in the drawing, reference will be made to negative and to ground potentials. These terms for defining the potentials used in the circuit are relative terms used to illustrate the operation of the circuit and are not to be considered limiting, since any other two potentials could be used, the potential being substituted for the ground potential referred to in the specification being merely more positive than the potential being substituted for the negative potential.

The specific embodiment of the selectively regenerative alarm circuit **10** includes two conventional monostable multivibrators **12** and **14** having, for the purpose of this embodiment of the invention, a quasi-stable period of **500** milliseconds, the multivibrator **12** having a trigger input **16** and a continuous "enable" input **17** and the multivibrator **14** having both a trigger input **18** and an "enable" input **20**. The multivibrator **12** is continuously enabled to provide an output in response to an appropriate input signal at the input **16**, both multivibrators **12** and **14** being characterized in that a positive going transition applied to their trigger input in the presence of a positive potential enabling input signal switches the multivibrators to their quasi-stable state and provides a negative going transition at the output of the multivibrator for a time interval of 500 milliseconds. It is to be appreciated that any predetermined quasi-stable period other than 500 milliseconds could be obtained from the multivibrators, the difference merely being in the selection of the particular resistors and capacitors within the multivibrators which control the time duration of the quasi-stable period of the multivibrator.

The output **22** of the multivibrator **12** is coupled to the trigger input **18** of the multivibrator **14** through a coupling capacitor **24**, and the output **26** of the multivibrator **14** is coupled to a first input of an OR-gate **30** through a coupling capacitor **32**, the output of which OR-gate **30** is connected to the trigger input **16** of the multivibrator **12**. The output **22** of the multivibrator **12** also provides an input to an amplifier **34**, the output of which drives an audible alarm device **36**, such as a horn or a buzzer, upon the receipt of a negative potential input. An input signal line **38** having a terminal **39**, and an input signal line **40** having a terminal **41**, are provided for the alarm circuit **10**, the input line **38** being connected to a second input of the OR-gate **30** and the input line **40** being connected to the enable input **20** of the multivibrator **14**. The input line **40** is also coupled

to a third input of the OR-gate **30** through a coupling capacitor **44**. Two signal sources **43** and **45** selectively provide negative or ground potential signals to the terminals **39** **41**, respectively.

OPERATION

Referring to FIG. **2**, the continuously enabled multivibrator **12** is designed to provide a single output pulse **46** (−V in the example) lasting a predetermined time Δt_1 (500 milliseconds for the particular embodiment of the invention) after a positive (ground in the example) transition input signal **48** is applied by the signal source **43**, to the input terminal **39**, through the gate **30** and to the trigger input **16** of the multivibrator **12**. Referring to FIG. **3**, the multivibrator **12** is designed to produce a plurality of output pulses **46**, each lasting the predetermined time Δt_1, and the multivibrator **14** is designed to produce a plurality of output pulses **50** (−V in the example), each lasting a predetermined time Δt_2 (500 milliseconds for the particular embodiment of the invention), in response to a positive transition input signal **52** applied to the input terminal **41** by the signal source **45**, the pulses **46** and **50** occurring in an alternate sequence with the beginning (negative transition) of each pulse occurring upon the termination (positive transition) of the opposite pulse.

To follow the operation of the circuit when the positive transition input signal **48** is applied to the input terminal **39** at a time t_1 in FIG. **2**, the signal **48** is passed by the gate **30** to the trigger input **16** of the continuously enabled multivibrator **12**, switching the multivibrator **12** to its quasi-stable state and providing a negative output pulse **46** therefrom, which pulse is applied as an input to the amplifier **34** which in turn drives the audible alarm **36** for as long as the output of the multivibrator **12** remains at a −V potential. After a time interval of Δt_1 the multivibrator **12** returns to its stable state, allowing the potential at the output **22** to return from a −V to a ground potential to deenergize the alarm device **36**. Upon the return of the multivibrator **12** to its stable state, the positive transition provided at the output **22** is passed by the coupling capacitor **24** to the trigger input **18** of the multivibrator **14** providing an input thereto. However, unless a ground potential enabling signal is present at the enabling input **20** of the multivibrator **14** at the time that the positive transition signal is applied to the trigger input **18** through the capacitor **24**, the multivibrator **14** will not be switched to its quasi-stable state and the alarm circuit **10** will remain dormant until the input signal **48** first returns to a −V potential and thereafter again rises to a ground potential.

Therefore, it is seen that when a positive transition signal is applied to the input terminal **39** while a negative potential is applied to the input terminal **41**, a single output is obtained from the multivibrator **12** and, therefore, from the alarm device **36**, until the input signal at the terminal **39** first returns to its −V potential and again rises to a ground potential. In this instance the multivibrator **14** remains unresponsive to the positive signal transition applied to the trigger input **18** through the coupling capacitor **24** from the output **22** of the multivibrator **12** as a result of the −V potential applied to the enable input **20** from the input terminal **41**.

To follow the operation of the alarm circuit **10** when a positive transition input signal **52** is applied to the input terminal **41** commencing at a time t_1 is FIG. **3**, the positive transition is passed by the capacitor **44** to an input of the gate **30**, which in turn applies the positive transition to the trigger input **16** of the multivibrator **12**. The constantly enabled multivibrator **12** is switched to its quasi-stable state and provides a −V potential at the output **22**, which potential is applied to the amplifier **34** to energize the alarm device **36**. Simultaneously, the positive signal **52** appearing at the input terminal **41** is applied to the enable input **20** of the multivibrator **14**, thereby enabling the multivibrator **14** to switch to its quasi-stable state in response to a positive signal transition at its trigger input **18**. After the time interval Δt_1, at time t_2 in FIG. **3** of the drawings, the multivibrator **12** returns to its stable state, providing a positive transition signal (from −V to ground) at its output **22** and deenergizing the alarm device **36**. The positive transition at time t_2 is passed by the capacitor **24** and applied to the trigger input **18** of the multivibrator **14**. Since at this time a ground potential is being applied to the enable input **20** of the multivibrator **14**, the multivibrator **14** responds to the positive transition at the trigger input **18** by switching to its quasi-stable state and providing a −V potential at its output terminal **26**. At time t_3, after the time interval Δt_2, the multivibrator **14** returns to its stable state and provides a positive going signal transition at the output terminal **26** as the potential at the terminal rises from a −V potential to a ground potential.

It is to be noted that during the Δt_2 time interval from t_2 to t_3, the multivibrator **12** remained in its stable state, providing a ground potential at the output **22** and maintaining the alarm device **36** in a de-energized condition. At time t_3 the positive signal transition occurring at the output **26** of the multivibrator **14**, as the multivibrator **14** returns to its stable state, is passed by the capacitor **32** and applied as an input to the gate **30** which in turn applies the positive signal transition to the trigger input **16** of the continuously enabled multivibrator **12**, thereby driving the multivibrator **12** to its quasi-stable state once again, energizing the alarm device **36**, and initiating a repeat of the cycle above described.

As may be seen in FIG. **3** of the drawings, the multivibrators **12** and **14**, upon an application of the positive transition signal **52** to the terminal **41**, will alternately switch from their stable to their quasi-stable states, the multivibrator **14** switching to its quasi-stable state for a time interval Δt_2 upon the return of the multivibrator **12** to its stable state, and the multivibrator **12** switching to its quasi-stable state for a time Δt_1 upon the return of the multivibrator **14** to its stable state, until the signal **52** is returned to a −V potential. When the signal **52** is returned to a negative potential, the signal applied to the enable input **20** of the multivibrator **14** returns to a negative potential from a ground potential, thereby rendering the multivibrator **14** unable to be switched to its quasi-stable state upon the application of a positive transition to its trigger input **18**, and terminating the repetitive alarm cycle upon the return of the signal at the output **22** of the multivibrator **12** to a ground potential after the signal **52** has been returned to a negative potential.

As described above, the alarm circuit **10** provides a single alarm output for a time interval Δt_1 upon the ap-

plication of a positive transition signal **48** to the input terminal **39** by the signal source **43**, and provides an intermittent and repetitive alarm output upon the application of, and for the duration of, a positive transition signal applied to the input terminal **41** by the signal source **45**, the alarm in this instance being energized for intermittent time intervals Δt_1, which time intervals Δt_1 are separated from each other by time intervals Δt_2. It is to be noted that while the time interval Δt_1 provided by the multivibrator **22** and the time interval Δt_2 provided by the multivibrator **14** are shown in a specific embodiment of the invention to be both equal to 500 milliseconds in duration and to each other, it is to be understood that the time intervals Δt_1 and Δt_2 may be either greater than or less than 500 milliseconds and must not of necessity be equal, but may be varied to fit the particular application to which the alarm circuit is put.

While one specific embodiment of the invention has been described in detail, it will be obvious that various modifications may be made from the specific details described without departing from the spirit and scope of the invention. For example, negative logic employing ground to +V potential signals may be used instead of positive logic employing −V to ground potential signals as described. In this instance, it would merely be necessary to substitute an AND-gate for the OR-gate **30**, to substitute two multivibrators, which are responsive to a negative input signal transition to switch to their quasi-stable state and which provide a positive signal transition at their output upon switching to their quasi-stable state, for the two multivibrators **12** and **14**, and to substitute an alarm device which is responsive to a +V potential input to energize and to a ground potential input to de-energize.

What is claimed is:

1. A selectively regenerative circuit, which comprises:

first and second means for producing a single output pulse after first and second predetermined times, respectively, in response to an input signal;

means for applying a first input signal to the first pulse producing means only, in order to actuate the first pulse producing means to produce an output pulse therefrom;

an indicator responsive to the output pulse from the first pulse producing means to provide an indication;

means for applying a second input signal to both the first and the second pulse producing means in order to actuate the first pulse producing means in order to produce an indication;

said second pulse producing means responsive to the coincidence of the output of the first pulse producing means and the second input signal for actuating the second pulse producing means to produce a single output pulse the second predetermined time after the output of the first pulse producing means; and

means coupling the output of the second pulse producing means for actuating the first pulse producing means to provide a second output pulse therefrom the first predetermined time after the output of the second pulse producing means, thereby providing repetitive indications.

2. A circuit as recited in claim **1** wherein the first and second output pulse producing means are first and second monostable multivibrators, the first multivibrator having a trigger input and the second multivibrator having both a trigger input and an enabling input.

3. A circuit as recited in claim **2**, wherein:

the first input signal applying means comprises a first input signal line and a gate, the first input signal line providing an input to the gate and the gate providing an input to the trigger input of the first multivibrator; and

the second input signal applying means comprises a second input signal line connected to the enable input of the second multivibrator and a capacitor connected between the second input signal line and an input to the gate.

4. A circuit as recited in claim **3**, wherein the means responsive to the output of the first pulse producing means and the second input signal for actuating the second pulse producing means comprises a capacitor connected between the output of the first pulse producing means and the trigger input of the second pulse producing means.

5. A circuit as recited in claim **4**, wherein the means responsive to the output of the second pulse producing means for actuating the first pulse producing means comprises a capacitor connected between the output of the second pulse producing means and an input to the gate.

6. A circuit as recited in claim **5**, wherein the indicator is an audible alarm.

7. A selectively regenerative circuit, which comprises:

first and second monostable multivibrators, each capable of receiving an input signal and generating an output pulse of a predetermined length in response thereto, the first multivibrator having a trigger input and the second multivibrator having both a trigger and an enabling input;

means for coupling the output of the first multivibrator to the trigger input of the second multivibrator to provide an input thereto to trigger the second multivibrator upon the termination of the output pulse from the first multivibrator;

a gate, the output of the gate being connected to the trigger input of the first multivibrator to provide an input thereto;

means for coupling the output of the second multivibrator to the gate to provide a first input thereto to trigger the first multivibrator upon the termination of the output pulse from the second multivibrator;

an indicator device for receiving output pulses from the first multivibrator and for providing an output in response thereto;

first and second input lines, the first input line connected to provide a second input to the gate and the second input line providing an input to the enabling input of the second multivibrator;

means for coupling the second input line to the gate to provide a third input thereto; and

means for selectively applying an input signal to the first or the second input lines, whereby an input signal on the first input line operating to trigger the first multivibrator to provide a single output from

the indicator device, and an input signal on the second input line operating to both trigger the first multivibrator, and to enable the second multivibrator, so that the termination of the output from the first multivibrator operates to trigger the second multivibrator and so that the termination of the output from the second multivibrator operates to trigger the first multivibrator, the first and second multivibrators thereby being alternately triggered to provide a repetitive output from the indicator device in response to the repetitive triggering of the first multivibrator.

8. A circuit as recited in claim **7**, wherein at least one of the coupling means comprises a capacitor.

9. A circuit as recited in claim **8**, wherein each coupling means comprises a capacitor.

10. A circuit as recited in claim **9**, wherein the first multivibrator is constantly enabled to provide an output pulse in response to an input signal.

11. A circuit as recited in claim **10**, wherein:

the indicator device is an audible alarm device;

an amplifier is connected to provide an input to the alarm device in response to an input signal to the amplifier; and

the output pulse of the first multivibrator provides an input signal to the amplifier.

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