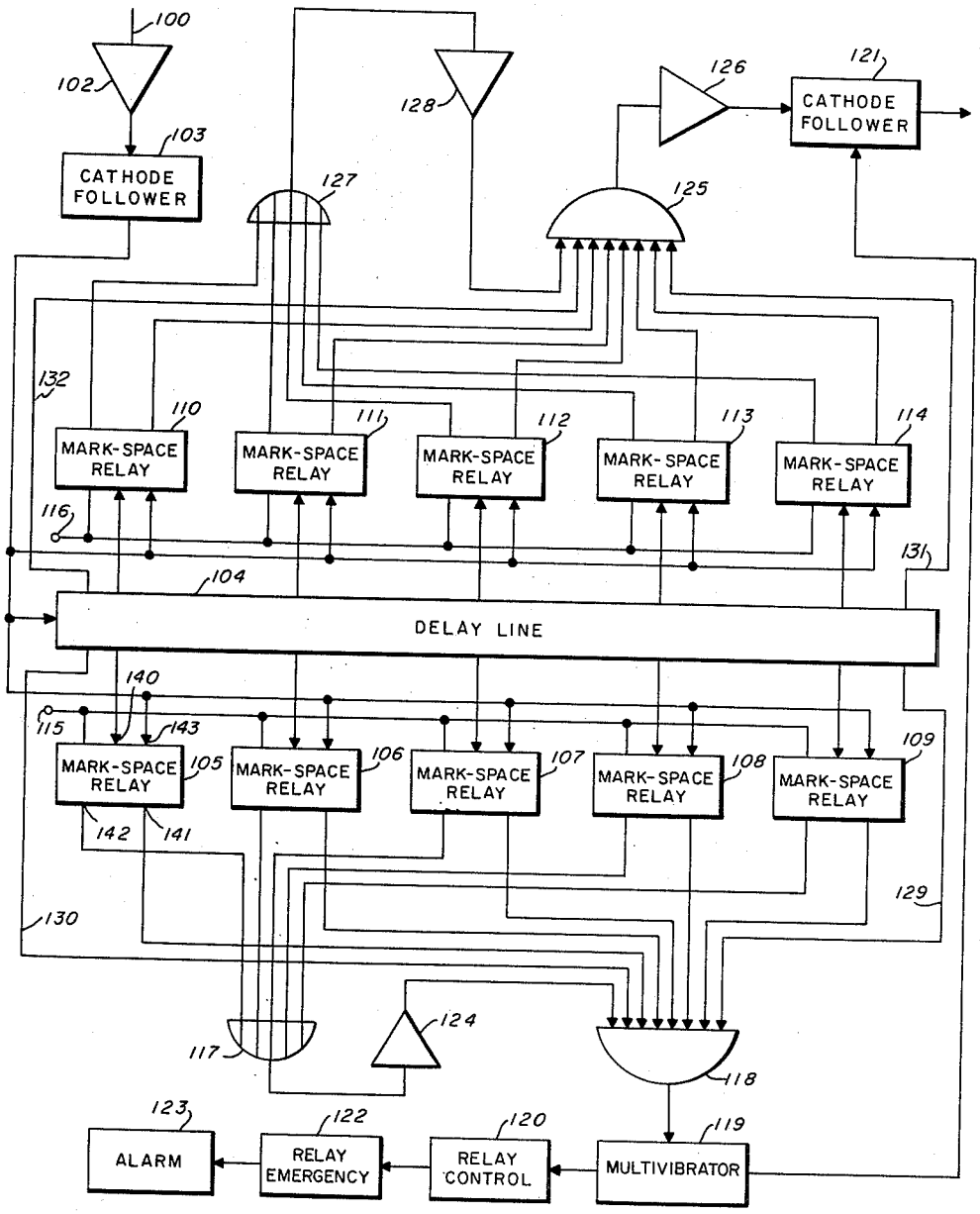
Nov. 10, 1964 P. E. FISKE ETAL 3,156,895

EMERGENCY ALARM SYSTEM FOR IFF SYSTEMS EMPLOYING PULSE-TRAIN DECODER

Filed July 26, 1962



INVENTORS
PAUL E. FISKE
ROYAL V. KEERAN
WILLIS R. DAWIRS
LAWRENCE N. HIGGINS
VERNON E. TERP
BERNARR H. HUMPHERYS
JOSEPH S. SZEWZUK
BY ERNEST W. FISCHER, JR.
JOHN E. NAYLOR

ATTORNEYS

United States Patent Office

3,156,895

Patented Nov. 10, 1964

3,156,895

EMERGENCY ALARM SYSTEM FOR IFF SYSTEMS EMPLOYING PULSE-TRAIN DECODER

Paul E. Fiske, 1059 Devonshire Drive, San Diego 7, Calif.; Royal V. Keeran, 1637 N. Laurel, Upland, Calif.; Willis R. Dawirs, 1070 Novara, San Diego, Calif.; Lawrence N. Higgins, 1265 Trieste Drive, San Diego 7, Calif.; Vernon E. Terp, 3637 Warner St., San Diego 6, Calif.; Bernarr H. Humpherys, 719 Golden Rod, Escondido, Calif.; Joseph S. Szewzuk, 6951 51st St., San Diego 20, Calif.; Ernest W. Fischer, Jr., 1431 Cascade Place, El Cajon, Calif.; and John E. Naylor, 3698 Zola St., San Diego 6, Calif.

Filed July 26, 1962, Ser. No. 212,750

3 Claims. (Cl. 340—164)

(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

The present invention relates to an alarm unit and more particularly, to an emergency alarm circuit, and specifically, to an alarm system to be utilized with an IFF system.

The emergency alarm system of the present invention is to be used in conjunction with standard radar and IFF equipment which may be used without modification by connecting the emergency alarm to the output of the IFF receiver. In using IFF it is desired that a secure system be provided and that a system be used that would not only decode emergency replies and indicate such replies but also that the system decode Modes I, II, and III and display these as well. Modes I and II are used by the military to interrogate the transponders on the aircraft while Mode III is the civil interrogation code. The three modes differ in the spacing between pulses i.e. Mode I pulses are spaced by three microseconds; Mode II by five microseconds and Mode III by eight microseconds. The transponder on the respective aircraft, when interrogated by any of the three modes, replies with a particular code corresponding to that mode. It is also desired that the equipment utilized for pulse train coding and decoding be practicable to install, maintain, and operate.

Heretofore, there is no known system used in such an environment to accomplish this result.

An object of the present invention is to provide a pulse train coding-decoding system which incorporates provision for emergency code indication.

A further object of the invention is to provide an emergency alarm for use with IFF systems.

Another object of the invention is to provide an emergency alarm system which is practicable to install, maintain and operate.

A further object of the invention is to provide an emergency alarm system which indicates only specified signals of a certain characteristic.

An additional object of the invention is to provide an emergency alarm system which indicates only signals of specified characteristics and which will substantially eliminate false signals, spurious noise, or signals possessing other characteristics.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood from the following description taken in connection with the accompanying drawing which is a block diagram of a pulse-train decoder embodying the emergency alarm system of the present invention.

The pulse-train decoder as set forth in the block diagram is intended for use with an IFF Mark X interrogator-responsor. The IFF Mark X interrogator-responsor is in

wide use at the present time, therefore, the details of the system are not gone into.

In the figure, positive video pulse trains comprising separated video from a video distribution unit are applied via coaxial cable 100 to the input of amplifier 102 where a stage of amplification takes place. The output of the amplifier 102 is then coupled to the input of a cathode follower 103 for isolation purposes. The output of the cathode follower 103 is coupled to the input of a delay line 104 which has a multiplicity of output taps thereon which will be referred to subsequently.

A plurality of mark-space relays 105, 106, 107, 108 and 109 are coupled to a first set of output taps on delay line 104 corresponding to the emergency alarm circuitry while a second set of mark-space relays 110, 111, 112, 113 and 114 are coupled to a second set of output taps on the delay line and comprise a portion of the all-mode circuit. The mark-space relays 105–109 are set in either the mark or space position by means of a control input on line 115 from a remote emergency code relay control on a remote code selection box (not shown). The mark space relays 110 through 114 are set in either the mark or space position by means of pulses applied on line 116 from an all-mode code relay control on a mode selector circuit (not shown).

In the emergency circuit an output from each of mark-space relays 105–109 is coupled to an OR gate 117. Another output from mark-space relays 105–109 is coupled to an AND gate 118. The output of AND gate 118 is coupled to a multivibrator 119 the output of which is coupled to a relay control 120 and also coupled to a cathode follower 121 in the all-mode circuit. The output of the relay control is coupled to an emergency relay 122 the output of which is coupled to an alarm 123 which may be a light, bell or any other suitable alarm device.

The output or OR gate 117 comprises an inhibit pulse and is coupled to the input of a killer amplifier 124 the output of which is coupled to an input of AND gate 118.

In the all-mode circuitry the mark-space relays 110 through 114 have one output from each coupled to AND gate 125 the output of which is coupled to an inverter amplifier 126. The output of inverter amplifier 126 is coupled to cathode follower 121. The output of cathode follower 121 comprises decoded video and is supplied to a suitable display unit (not shown).

Another output from mark-space relays 110–114 is coupled to an OR gate 127 the output of which is coupled to a killer amplifier 128. The output of killer amplifier 128 is coupled as an inhibit pulse to AND gate 125.

Start and stop pulses from the delay line 104 for the emergency alarm circuitry are coupled to AND gate 118 on lines 129 and 130, respectively. In the all-mode circuit the start and stop pulses from the delay line are coupled to AND gate 125 on lines 131 and 132, respectively.

Operation

In the operation of the system, positive video pulse trains from the distribution unit (not shown) are applied to the input of the decoder unit via coaxial cable 100. They are amplified in amplifier 102, changed to low impedance in a cathode follower 103 and inverted and applied as negative pulse trains to the delay line 104, approximately 20 μsec. long. There are seven outputs from the delay line, each spaced from the adjacent tap by 2.82 microseconds. The five center intelligence pulse outputs are passed through mark-space relays 105–109 in the alarm circuitry and 110–114 in the all-mode circuitry which are adjusted remotely to the proper code configuration, i.e., mark or space.

The connection and operation of relays 105–109 and the

relays in the all-mode circuitry will be set forth with respect to relay **105**. When the relays are set to the "mark" position point **140** is connected to point **141**. When the relays are set to "space" position point **140** is connected to point **142** and point **143** is connected to point **141**. The input video from the cathode follower **103** is also coupled to each of the mark-space relays **105** through **109**. This is done so that when the relays, which are in actuality, double pole double throw switches are set to the space position, there will be an output from the respective relays to the AND gate, for instance AND gate **118**, when, for instance, a code comprising a mark and the rest spaces is set into the relays. In the space position point **143** connected to point **141** and point **140** is connected to point **142**, therefore, an output is coupled from **143** to **141** to the AND gate **118**. Should a mark appear in the delay line **140** it will be coupled to **142**, through OR gate **117** and through the killer amplifier **124** to the AND gate **118** as an inhibit pulse and no output will result from the AND gate.

These pulses together with the start and stop pulses on lines **129–130** and **131–132**, respectively, are applied to two separate coincidence circuits **113** and **125**, one for the emergency code and the other for codes of Modes I, II, and III, respectively.

In the emergency circuit, the intelligence pulses are coupled to the AND gate **118** and if the proper pulses are present in the AND gate, the output triggers the grid circuit of the 20 μsec., one-shot multivibrator **119**. If all pulses are present which should be there according to the setting of the mark-space relays, the multivibrator **119** is triggered into operation, producing a positive output pulse. If all such pulses are not present, the multivibrator is not triggered and no output is produced.

If one or more pulses appear at the taps of the delay line where only spaces should be present they are passed through OR gate **117** and then through the killer amplifier **124** and appear as an inhibit pulse at the input to AND gate **118**.

Any output from the multivibrator **119** is applied to the relay control **120** which is coupled to the emergency relay **122**. The relay contacts are connected to an alarm **123** which produces an alarm from a series of emergency decodes but is not activated from a single decoded noise train i.e., relay control **120** contains an integrator circuit which responds to a train of decode pulses rather than a single decode pulse.

The all-mode coincident circuitry and killer circuitry is exactly the same for the emergency circuit. However, the output of AND gate **125** is applied to an inverter amplifier tube instead of a multivibrator. This tube conducts normally but is cut off by the output of AND gate **125** which produces positive output pulses which are applied to the cathode follower **121**. The positive 20 μsec. pulses from the multivibrator **119** are also applied to the cathode follower for display at the output of the unit.

The alarm circuitry coupled with the pulse decoder provides a system which enables an alarm to be displayed in a very simple and easy manner. This is important in that the operator, while watching the scope which may be heavily "fruited" or cluttered, may lose track of the emergency indication on the display scope. The fact that the alarm is a visual or audible one overcomes the operator inertia or fatigue and produces a response when an emergency code is received.

Obviously, many modifications and variations of the present invention are possible in the light of the above teachings. It is, therefore, to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. An emergency alarm system for IFF systems comprising; input means adapted for coupling separated video thereto; delay means having an input and outputs and having said input operatively coupled to the input means for coupling separated video thereto; a multiplicity of mark-space switching means having inputs and outputs therefrom and having an input coupled to the outputs from said delay means; a first set of said mark-space switching means having inputs operatively coupled to the outputs of said delay means for producing output pulses therefrom when the mark-space switching means are set for a particular code configuration corresponding to an emergency alarm; coincidence means having inputs and outputs therefrom, said coincidence means having inputs operatively coupled to one of said outputs from said first set of mark-space switching means and adapted to produce a pulse when inputs are coincident thereto and wherein said output pulse indicates the presence of an emergency code; an OR gate having inputs and an output therefrom, said inputs to said OR gate being operatively coupled to other outputs from first set of mark-space switching means and wherein said output from said OR gate is operatively coupled to an input on said coincidence means so that a pulse from said OR gate means functions as an inhibit pulse for said coincidence means; emergency code indicating means operatively coupled to the output of said coincidence means for indicating the presence of a pulse at the output of said coincidence means corresponding to an emergency alarm.

2. An emergency alarm system for IFF systems as set forth in claim 5 and further including; another set of mark-space switching means having inputs and outputs; one input on each of said other set of mark-space switching means being operatively connected to an output on said delay means, another input on said mark-space switching means being operatively connected to said separated video coupled to said input means, another coincidence means having an output and inputs; said inputs on said other coincidence means being operatively coupled to an output on said mark-space switching means, said output from said other coincidence means being adapted for connection to a display means for displaying decoded video corresponding to an output pulse from said other coincidence means when inputs are coincident to said other coincidence means; another OR gate having inputs and an output therefrom corresponding to an inhibit pulse; said inputs to said OR means being operatively connected to other outputs from said other set of mark-space switching means, said output from said OR gate being operatively connected to an input on said other coincident means for inhibiting said coincidence means when pulses are present at the input to said OR gate.

3. An alarm system comprising: input means adapted for receiving separated video; delay means having an input and outputs, said input to said delay means being operatively coupled to said input means so that separated video is coupled to said delay means and delayed; selecting means comprising a plurality of mark-space switching means which are adapted to be set to positions corresponding to a mark and space operatively coupled to the output of said delay means for selecting a particular code configuration from said delay means; coincidence means operatively connected to said selecting means for producing an output pulse when pulses from said selecting means are simultaneously present at the input to said coincidence means; alarm means operatively connected to the output of said coincidence means for indicating the presence of a particular code configuration; other mark-space relay means having inputs and outputs and having inputs coupled to other outputs from said delay means; additional coincidence means having inputs and an output therefrom and having inputs coupled to outputs from said mark-space switching means for providing a pulse when outputs from said mark-space switching means are coincident at the input to said additional coincidence means; another OR gate having inputs and an output and having said inputs coupled to other outputs from said mark-space switching means and having said

output coupled to an input on said additional coincidence means so that when inputs are present to said other OR gate the output functions as an inhibit pulse for said additional coincidence means; the output of said additional coincidence means being adapted for coupling to display means wherein said output corresponds to the decoded video corresponding to the different mode configurations.

References Cited in the file of this patent

UNITED STATES PATENTS

2,641,698	Gloess et al.	June 9, 1953
2,711,526	Gloess	June 21, 1955
2,942,193	Tryon	June 21, 1960
2,950,463	Brunn	Aug. 23, 1960
3,018,449	Farrelly	Jan. 23, 1962