Nov. 19, 1963 N. A. BARRETT ETAL 3,111,656

AUTOMATIC ALARM SYSTEM

Filed Feb. 26, 1960

2 Sheets-Sheet 1

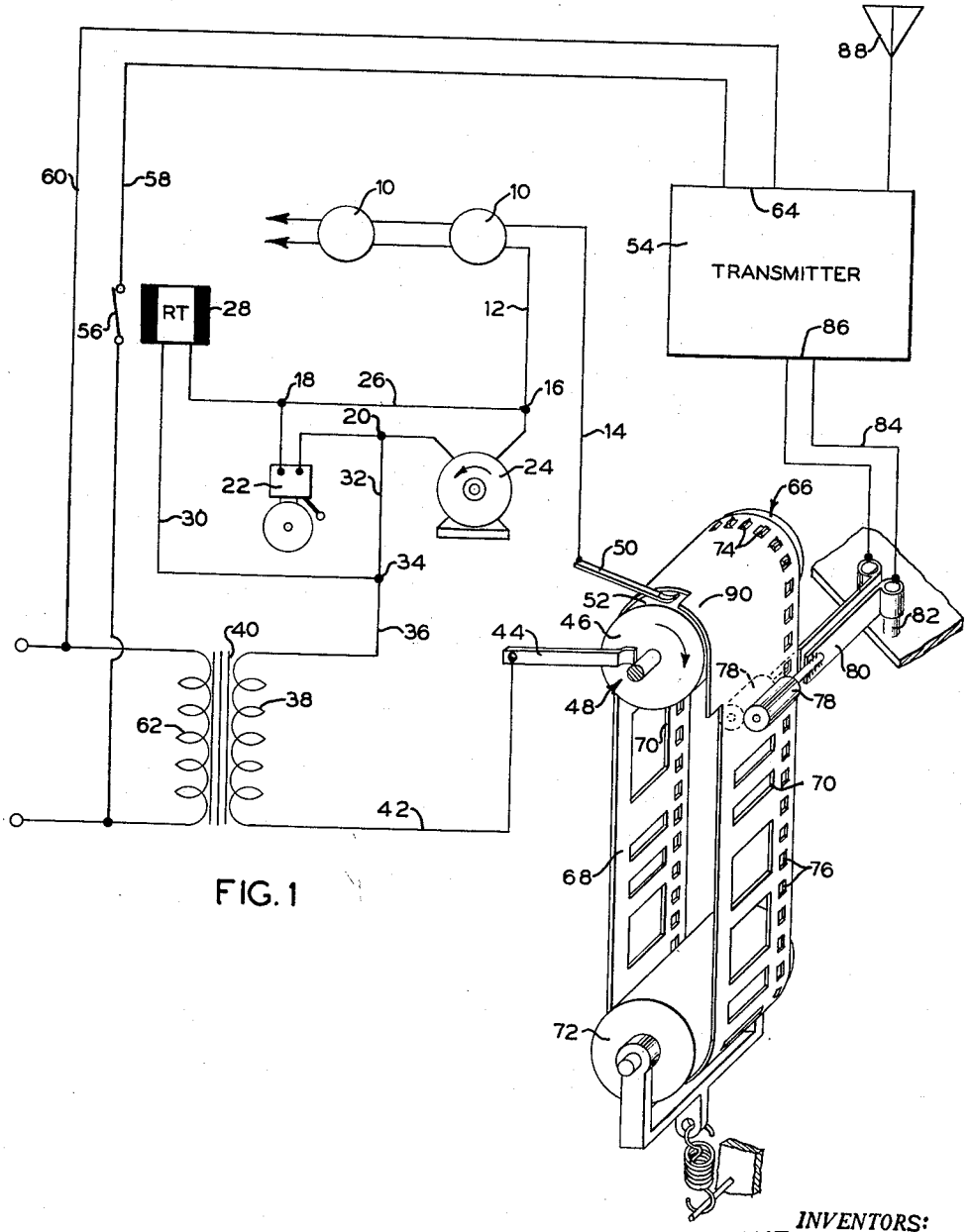


FIG. 1

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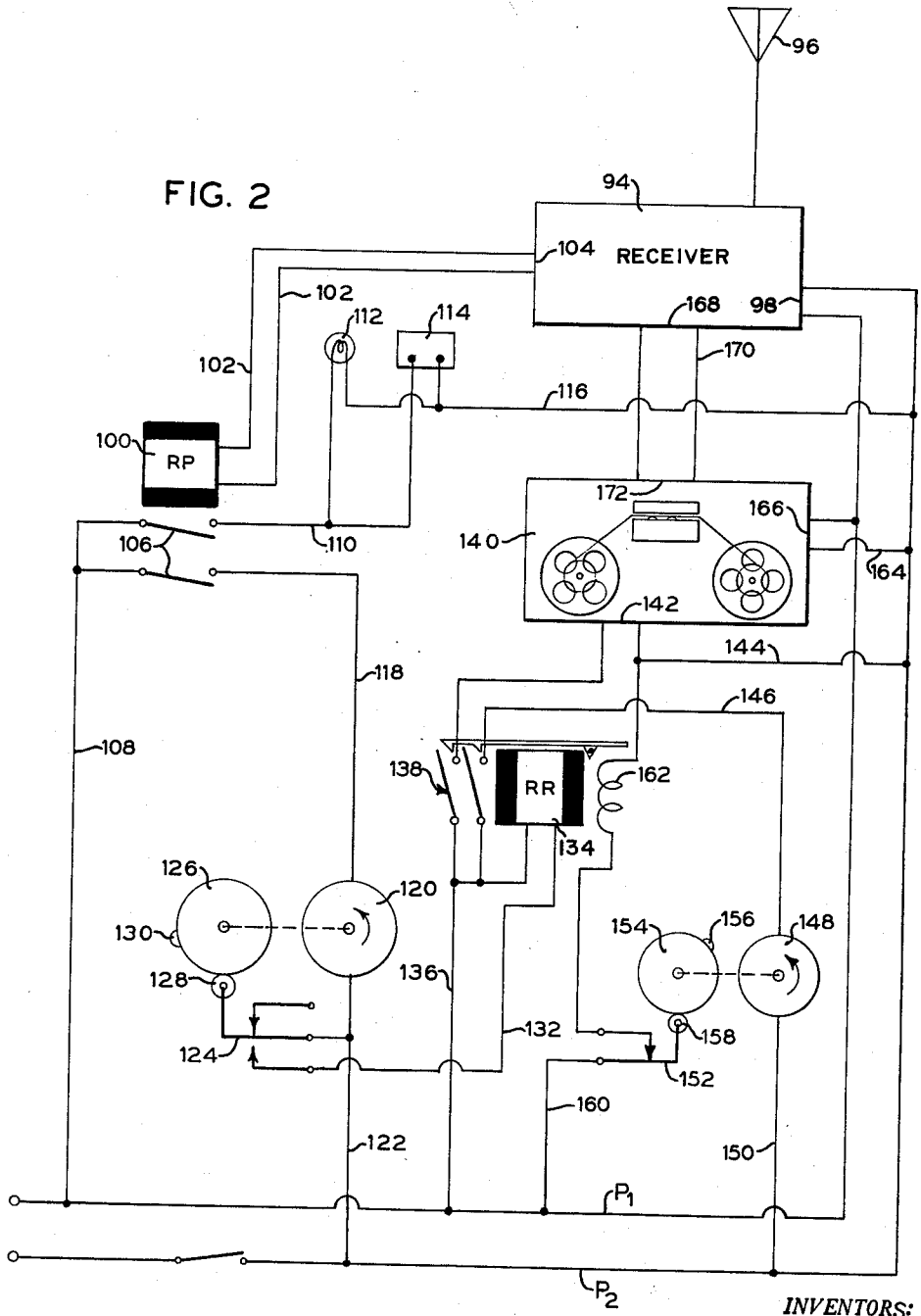
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FIG. 2



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United States Patent Office 3,111,656 Patented Nov. 19, 1963

3,111,656

AUTOMATIC ALARM SYSTEM

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Filed Feb. 26, 1960, Ser. No. 11,241
7 Claims. (Cl. 340—215)

This invention relates to automatic alarm systems and more particularly to an alarm system of the type which transmits a code signal from the point of occurrence of a predetermined condition, such as a rise in temperature as the result of a fire, to a central alarm station whereby both audible and visible alarms are energized and a record of the alarm call is made.

It is, therefore, an object of this invention to provide a fire alarm system wherein a local temperature responsive code transmitter is energized by the occurrence of a fire to transmit a predetermined code signal representative of the location of the fire to a central alarm station.

Another object of this invention is to provide a novel code keying actuator and circuit in the local temperature responsive transmitter.

Another object of this invention is to provide a fire alarm system having a local temperature responsive transmitter for sounding an alarm at a remote station simultaneously with a local alarm.

Still another object of this invention is to provide a fire alarm system having at least one local condition responsive transmitter and a remote receiver at a central alarm station wherein the local transmitter includes a code sequence keying device comprising a pattern perforated belt for operating a set of keying contacts to effect the transmission of a predetermined code sequence in response to the occurrence of a fire or other predetermined condition.

Still another object of this invention is to provide a fire alarm system having a radio receiver located at a central alarm station for receiving coded signals from remote locations for indicating the presence of a fire or the like at any particular one of the locations.

Still another object of this invention is to provide a fire alarm system of the local transmitter-central receiver type wherein the receiver has a novel energization cycle for receiving coded alarm signals, providing an audible and visible indication of their reception and automatically recording that portion of the alarm code which designates the location of the fire.

Still another object of the invention is to provide a fire alarm signal system of the local transmitter-central receiver type wherein in response to the reception coded alarm signal transmitted in response to a fire at the location of one of a plurality of local transmitters, the central receiver will be automatically switched on to energize audible and visible alarms at the central station and simultaneously energize a local recording means for a predetermined time period following which both the alarms and the recording means are automatically de-energized.

These and other objects of the invention will become apparent by reference to the following specification and drawings which illustrate a preferred embodiment of the invention.

In the drawings:

FIGURE 1 is a schematic representation of a local alarm and code keyed transmitter as utilized in the invention.

FIGURE 2 is a schematic representation of a central receiver with audible and visible alarms and automatically energized recording means.

Basically, the invention comprises a fire or other condition responsive alarm system wherein local sensing means energize a local transmitter and a code sequence keying means which modulates the output of the local transmitter to effect the transmission of a radio frequency code signal to a central alarm station. At the central station a radio receiver is provided which after a predetermined call code delay period included in the code signal energizes a plurality of alarms at the central station and switches on a tape recorder or the like to record that part of the code signal which gives the location of the occurrence of the fire or other detected condition and then after a predetermined time de-energizes the alarms and the recorder.

Transmitter

Referring in detail to the drawings, FIGURE 1 shows a local condition responsive means including temperature responsive switches 10 or the like.

The temperature sensing switches 10 are connected across a pair of leads 12 and 14 of which line 12 extends to terminal 16 of a plurality of common terminals 16, 18, 20 between parallel connected alarm bell 22 and electric motor 24. Terminals 16 and 18 are interconnected by a line 26 between the alarm bell 22 and electric motor 24 which further extends to one terminal of a relay coil 28 in relay RT. The other terminal of the relay coil 28 is connected through a line 30 and a line 32 to the remaining common terminal 20 between the parallel connected alarm bell 22 and electric motor 24. Both lines 30 and 32 are connected at junction 34 through a line 36 to one terminal of the secondary 38 of a power input transformer 40.

The other side of the secondary 38 of the transformer 40 is connected through a line 42 to a contact brush 44 which is in sliding contact with the end face 46 of a conductive rotating cylinder 48 driven, through a connection not shown, by the electric motor 24.

The circuit through the temperature responsive switches 10 is completed through line 14 which is connected to a second contact brush 50 mounted in sliding contact with the peripheral surface 52 of the conductive cylinder 48.

The energization of the local transmitter 54 is controlled by the contacts 56 of the relay which are operated by the energization of the above described relay coil 28. The relay contacts 56 are located in a line 58 which in cooperation with a line 60 extends from the primary side 62 of the supply transformer 40 to the power input terminals 64 of the transmitter 54.

The transmitter 54 is keyed to transmit a coded alarm signal sequence by the code sequence generator generally shown at 66.

The code sequence generator 66 comprises a dielectric belt 68 having a plurality of longitudinally spaced perforations 70 therein. The perforations 70 are of variable size and sequence to represent a plurality of code characters.

The perforated dielectric belt 68 is of the continuous type and is mounted over the conductive rotating cylinder 48 at one end and a spring biased idler cylinder 72 at the other end, whereby the belt 68 is tightly stretched between the two cylinders. The cylinder 48 is provided with sprocket teeth 74 which drive the belt 68 through means of a series of cooperating perforations 76 in the belt 68.

Two basic switching functions are performed by the perforated dielectric belt 68. The first function is to code key the transmitter 54 through means of the perforations 70 which permit a pair of roller type contacts 78 to close for variable spaced periods of time as the belt 68 is driven past them by the conductive rotating cylinder 48.

The rolling contacts 78 are mounetd one on each side of the belt 68 and are of such a size that they fit within the perforations 70, whereby the contacts 78 are brought

into juxtaposition each time they register with one of the perforations 70. The rolling contacts 78 are each mounted on one of a pair of spring arms 80 fixed, respectively, to each of a pair of terminal posts 82 whereby the spring bias necessary to effect a positive electrical contact is provided. The terminal posts 82, and thus the contacts 78, are connected through a pair of lines 84 to the code keying terminals 86 of the transmitter 54. Thus, when the contacts 78 are closed, a circuit is completed across the code keying terminals 86 of the transmitter 54 and a signal is transmitted from the antenna 88 as long as the contacts 78 remain closed.

After a complete signal cycle has been transmitted by way of the belt 68 and code keyed transmitter 54, the second switching function of the belt 68 is to de-energize the belt driving motor 24 and the local alarm bell 22. This is accomplished by means of a short switching segment 90 which is a rectangular segment extending outward from the side of the belt 68 such that at the end of the code sequence on the belt, the switching segment 90 is driven between the sliding contact brush 50 and the peripheral surface 52 of the conductive rotating cylinder 48 to break electrical contact therebetween and open the alarm and motor circuit.

Receiver

Referring now to FIGURE 2, the receiving means at the central alarm station includes a radio receiver 94 having an antenna 96 for the reception of the code keyed radio frequency signals from any one of the plurality of local transmitters. Power for energizing the receiver is taken from a pair of power input leads P1 and P2 connected to the power input terminals 98.

When a transmitted signal is detected by the receiver, a relay coil 100 of plate relay RP is energized through a pair of lines 102 from the output terminals 104 of the receiver 94. The magnetic action of the energized coil 100 causes the contacts 106 of the relay RP to close and complete a pair of parallel circuits, to be hereinafter described, across power lines P1 and P2.

The first of these circuits is an alarm circuit comprising a line 108 extending from power line P1 through a line 110 to one side of a parallel combination of a visual alarm 112 and an audible alarm 114 and from the other side of the alarm combination through a line 116 to the other power line P2.

The second circuit is completed through the line 108 from power line P1 to a line 118 which is connected to one side of a first timing motor 120 which is connected at its other side through a line 122 to the other power line P2.

The timing motor 120 in response to a received signal of predetermined duration operates a set of contacts 124 through a time delay cam 126 and follower 128 which cooperates with a switch closing detent 130 on the cam 126 to close the contacts 124.

When the contacts 124 close, a circuit is completed from power line P2 through line 122 and switch contacts 124, line 132, relay coil 134 and line 136 to power line P1, whereby the relay coil 134 of the recorder relay RR is energized.

Energization of the coil 134 of the recorder relay RR causes the relay contacts 138, thereof, to close and complete two more parallel circuits, to be hereinafter described, which are maintained in their closed circuit condition by means of a latching means, not shown, included in the relay RR and acting on the contacts 138 thereof to hold them closed.

One of the circuits completed by the relay RR is the motor circuit of a tape recorder which extends from one power line P1 through line 136 and relay contacts 138 to one of the motor terminals 142 of the tape recorder. The other motor terminal is connected through a line 144 to the other power line P2.

The other of the circuits completed through the contacts 138 of the relay RR is that of a second timer motor 148. The circuit extends from power line P1, through line 136, contacts 138, line 146, second timer motor 148 and line 150 to the other power line P2.

The second timer motor 148 controls the actuation of a pair of release contacts 152 after a suitable delay through a time cam 154 driven by the motor 148. A switch closing detent 156 is provided on the cam 154 to engage a cam follower 158 and thereby close the release contacts 152.

The release contacts 152, upon closing, complete a circuit from one power line P1 and line 160 through a latch release relay coil 162 included in the recorder relay RR and thence through line 144 to the other power line P2. The energization of this relay coil releases the latch means (not shown) holding the contacts 138 of the relay RR in closed position and allows them to open, thus shutting off the recorder 140 after a period of time determined by the second timing motor and switch combination 148—152.

Power for the playback amplifier in the tape recorder is provided by a pair of lines 164 connected between amplifier power supply terminals 166 on the recorder 140 and the power lines P1 and P2.

Once the recorder has been energized, the signals to the recording head thereof are conducted from output terminals 168 of the transmitter 94 through a pair of leads 170 to the recording head input terminals 172 on the recorder 140.

Operation

Referring now to FIGURE 1 and assuming that at the particular location of the alarm signal transmitter shown therein a fire has started within the effective sensing range of the temperature detector switches 10, the switches 10 will now be actuated to close a circuit across the lines 12 and 14.

Since the input power to the primary side 62 of the power transformer 40 is always maintained, the closing of the switch or any one of the switches 10 closes the secondary circuit 38 of the transformer and causes energization of all of the actuable devices therein. This circuit extends from the switch 10 through line 12 to common terminals 16 and 18 and thence through three parallel branches including, respectively, relay coil 28 of the transmitter energizing relay RT, local alarm bell or other suitable signal device 22, and the code belt driving motor 24; common terminal 34 on the other side of the parallel combination described above through line 36, secondary 38 of the transformer 40, line 42, brush 44, conductive rotating cylinder 48, brush 50 and line 14 back to the temperature detector switch 10.

When this circuit is closed the code belt 68 is in the position shown with the brush contact 50 in contact with the cylinder 48 just past the point where that contact would have been broken by the switching segment 90 on the belt 68. This allows maximum use of the available belt length.

Also upon the closing of the secondary circuit the coil 28 of the transmitter energizing relay RT is energized, causing the relay contacts 56 to close and complete a power supply circuit through lines 58 and 60, transformer primary 62 and power input terminals 64 of the transmitter 54 whereby the transmitter is energized and commences to warm up.

Concurrent with the energization of the relay RT the local alarm bell is sounded and the belt driving motor 24 is energized. As soon as the motor 24 is energized, the conductive cylinder 48 is rotatably driven thereby, through a connection not shown, and the belt is driven in the direction of the arrow on the end face 46 of the cylinder 48 by means of the sprocket teeth 74 on the cylinder which cooperate with the series of perforations 76 in the belt 68.

At this time, the rolling contacts 78, which in cooperation with the code perforations 70 in the belt 68 control

the sequence of signal transmission periods of the transmitter 54, are on opposite sides of the unperforated portion of the tape 68 which at the start of the code cycle is shown extending from the rollers 78 over the conductive cylinder 48. Thus, no contact being made, there is no signal transmitted from the transmitter 54.

Since the belt is driven at constant speed, the code symbols are determined by the sequence and length of the trains of carrier frequency alternations which are periodically transmitted in accordance with the perforated sequence on the belt, the length being determined by the size of the perforations and the sequence by the relative position thereof.

From the start position, the above defined unperforated area of the belt 68 is of such a length as to allow adequate warm up time for the transmitter 54. A period of thirty seconds, for example, would ordinarily be more than adequate.

The first perforation in the belt allows the rolling contacts 78 to close the transmission circuit of the transmitter 54 through the terminals 86 and effect the transmission of the carrier frequency wave therefrom for a definite predetermined period such as, for example, four seconds. The function of this signal is to energize a time delay relay set for a minimum response time in the radio receiver located at the central alarm station to be later described with respect to FIGURE 2.

Next on the belt, are two identical sets of perforations in predetermined sequence which allow the rolling contacts 78 to key the transmitter 54 and effect the transmission of duplicate code sequences which identifies, at the receiver in the central alarm station, the location of the particular local transmitter 54. The sending in duplicate is to avoid error at the receiver.

As soon as the first signal of the code sequence, as defined in conjunction with the operation of FIGURE 1, is received by the radio receiver 94 in FIGURE 2, the output of the receiver through terminals 104 and lines 102 energizes relay coil 100 of the plate relay RP, closing contacts 106 and energizing the first timing motor 120. If the received signal is truly the first of the code sequence from one of the local transmitters as shown in FIGURE 1 associated with the central alarm station of FIGURE 2, the first timing motor 120 will be energized for the, as stated in the above example, four second duration of the signal, which is the time delay sufficient to bring the contact detent 130 on the cam 126 driven by said motor 120 into active engagement with the cam follower 128 and will thereby close switch contacts 124.

Simultaneously, the contacts 106 of the plate relay RP also close the circuits through the audible and visible alarm means 114 and 112, respectively, to notify the operator of the central station that an alarm signal is being received.

If the first timing motor 120 is sufficiently energized to close the contacts 124, then a circuit is thereby completed which energizes the coil 134 of the tape recorder energizing relay RR whereby contacts 138 thereof are caused to close and be latched in closed position by a latch means not shown.

The closing of contacts 138 of the recorder energizing relay RR turns on the tape recorder 140 in preparation for the reception of the transmitter location identifying code sequence. This sequence is brought into the recording head terminals 172 of the recorder over lines 170 from the output terminals 168 of the receiver.

Concurrent with the energization of the tape recorder 140, the closing of contacts 138 completes the circuit through the second timing motor 148 which starts a time delay cycle that determines the length of time which the recorder 140 remains energized. This delay is calculated to be sufficient to record both of the duplicated code sequences from the transmitter.

As soon as the second timing motor 148 drives the cam 154 to the position wherein the cam detent 156 engages the follower 158 and closes the contacts 152, a circuit is completed through the latch release relay coil 162. Thus, the latch means, not shown, holding the contacts 138 of the recorder relay RR is released by the energization of the latch release coil 162 and the contacts 138 are allowed to open. This de-energizes the recorder and completes the transmit-receive cycle of the alarm system.

The recorded location signal may now be played back and decoded if the signal could not be decoded from the intermittent buzzing of the audible alarm 114 or the flashing of the visible alarm 112. A permanent record of alarm calls is also kept by the recorder for administrative purposes.

It is emphasized here that the recorder is only energized by a proper length code character preceding the location sequence whereby spurious or improper signals will not be recorded.

As can be seen from the foregoing specification and drawings, this invention provides a simple, readily adaptable and foolproof alarm system. It is to be understood that the embodiment shown and described herein is for the purpose of example only and is not intended to limit the scope of the appended claims.

What is claimed is:

1. A condition responsive alarm system comprising a plurality of radio transmitters placed in a respective plurality of localities adapted to be individually energized in response to a predetermined condition at that respective locality to transmit a code signal sequence including a continuous alert signal having a predetermined time interval and a pair of duplicate sequential signal groups indicative of the location of the energized transmitter at the locality of said predetermined condition, and a central alarm station common to said plurality of transmitters comprising a radio receiver for said transmitted code sequence, first relay means connected across a first set of output terminals of said receiver actuated by said receiver upon the reception of signals thereby, a pair of power lines, alarm means connected across said power lines by said relay when said relay is energized to indicate the reception of a signal, and a recording means for recording the duplicate location sequence of the transmitted alarm signal comprising, first timing means energized by said first relay and fully responsive only to a continuous signal over the minimum time interval of said continuous alert signal from said transmitter, second relay means, switch means actuated by said first timing means to energize said second relay means in response to the reception of said continuous alert signal, a recorder, latch controlled switch means actuated by said second relay means for connecting said recorder in circuit with said power lines to energize and maintain said recorder in an energized state, second timing means energized by said latch controlled switch means for an effective time interval sufficient to receive said pair of duplicate sequential location signal groups, whereby said signal groups may be recorded by said recorder, third switch means actuated by said second timing means at the end of said effective time interval, and releasing means for said latch controlled switch actuated by the closing of said third switch means to release said latch controlled switch to open position whereby said recorder is de-energized.

2. In a condition responsive alarm system including a plurality of radio transmitters placed in a respective plurality of locations adapted to be individually energized in response to a predetermined condition at that respective locality to transmit a code signal sequence including a continuous alert signal having a predetermined time interval and a pair of duplicat sequential signal groups indicative of the location of the energized transmitter at the locality of said predetermined condition, a code keying means for each of said transmitters comprising, an output keying circuit, a power supply, a condition responsive switch means, an electric motor connected across

said power supply through said switch means whereby said motor is energized upon the occurrence of a predetermined condition, a first cylinder of electrically conductive material rotatably driven by said motor and connected in circuit therewith by a pair of brushes contacting one on the periphery and one on the end face of said cylinder, a second cylinder spaced from said first cylinder, a perforated code belt on said cylinders and driven by said first cylinder, and a pair of contacts located one on either side of the web of said belt in cooperation with the coded perforations on said belt and connected to close the output keying circuit of said transmitter whereby upon the occurrence of a perforation said contacts close said keying circuit and energize said transmitter to transmit a signal for a period of time determined by the length of said perforation.

3. The device as described in claim 2 including a relay operated switch connected in parallel with said motor and simultaneously actuated therewith whereby said transmitter is connected to said power supply.

4. The device as described in claim 2 including an alarm means connected in parallel with said motor and simultaneously actuated therewith whereby a local indication of said predetermined condition is provided.

5. In a condition responsive alarm system including a plurality of radio transmitters placed in a respective plurality of locations adapted to be individually energized in response to a predetermined condition at that respective locality to transmit a code signal sequence including a continuous alert signal having a predetermined time interval and a pair of duplicate sequential signal groups indicative of the location of the energized transmitter at the locality of said predetermined condition, a code keying means for each of said transmitters comprising an output keying circuit, a power supply, a condition responsive switch means, an electric motor connected across said power supply through said switch means whereby said motor is energized upon the occurrence of a predetermined condition, a first cylinder of electrically conductive material rotatably driven by said motor and connected in circuit therewith by a pair of brushes contacting one on the periphery and one on the end face of said cylinder, a second cylinder spaced from said first cylinder, a perforater code belt on said cylinders and driven by said first cylinder, and a pair of contacts located one on either side of the web of said belt in cooperation with the coded perforations on said belt and connected to close the output keying circuit of said transmitter whereby upon the occurrence of a perforation said contacts close said keying circuit and energize said transmitter to transmit a signal for a period of time determined by the length of said perforation, said belt having a protruding switching segment on one edge thereof located at the end of the perforated code sequence thereon adapted to be positioned between said brush contacting the peripheral surface of said first cylinder and said surface whereby at the completion of the transmission of said code sequence, said switching segment breaks the contact between the said brush and the said surface to de-energize said motor and prevent further signal transmission.

6. In an automatic alarm system having a plurality of radio transmitters located at a respective plurality of localities for individually transmitting a code signal sequence comprising an alert signal and a location sequence in response to a predetermined condition at a particular locality identified by said location sequence, a central alarm station responsive to the transmitted code signals from any one of said transmitters comprising a radio receiver, recording means connected with said receiver for recording said location sequence of said transmitted signal, and means connected intermediate said receiver and said recorder selectively responsive to the output of said receiver comprising a first time delay means selectively responsive to said alert signal to energize said recorder, and second time delay means energized by said first means simultaneously with the energization of said recorder to maintain said recorder in an energized condition for a period of time sufficient to record said location sequence.

7. The invention defined in claim 6, wherein said central alarm station further includes a code signal sequence responsive alarm means connected to the output of said receiver and energized thereby in response to the reception of said code signal sequence, to provide an audible and visible indication of said location sequence simultaneously with the recording thereof.

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