Sept. 17, 1963 M. W. SLATE 3,104,384

ALARM SYSTEM

Filed June 4, 1959 2 Sheets-Sheet 1

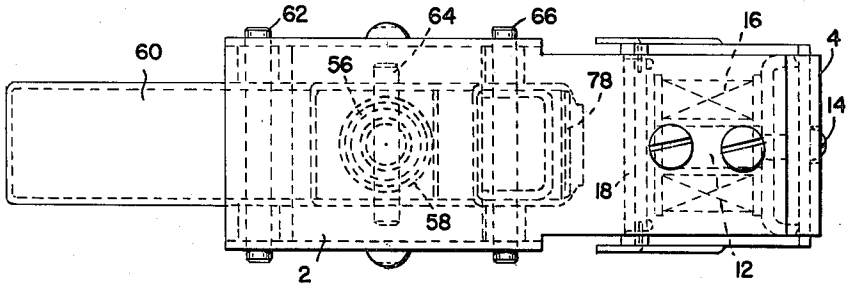

FIG. 2.

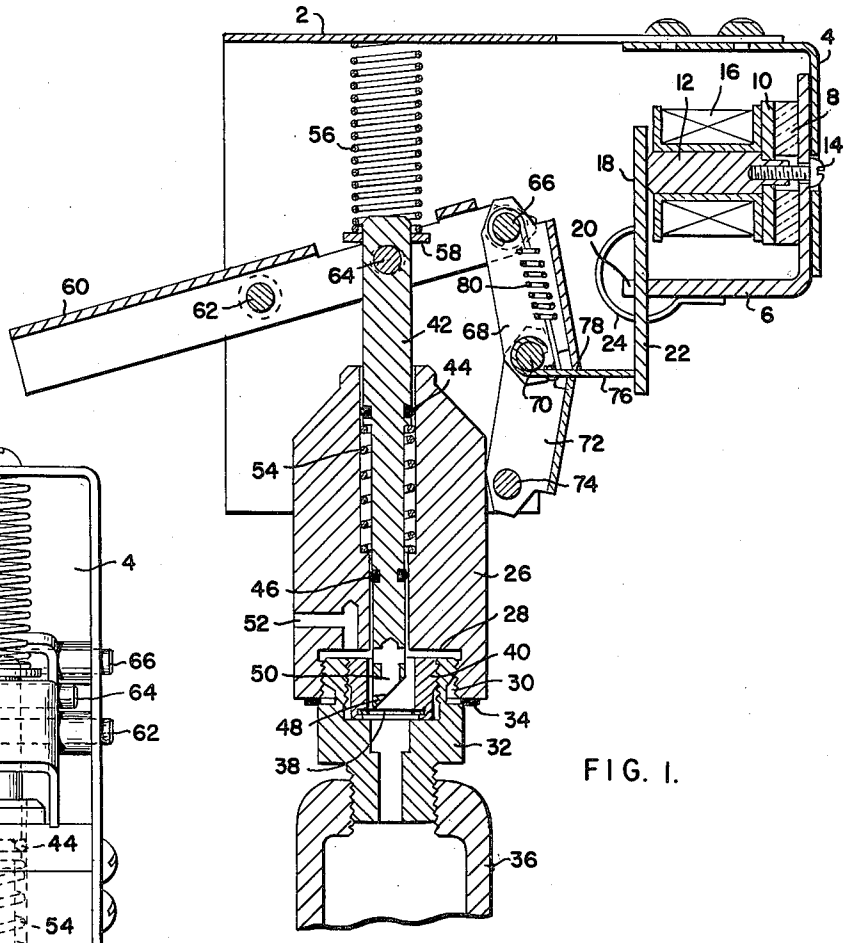

FIG. 1.

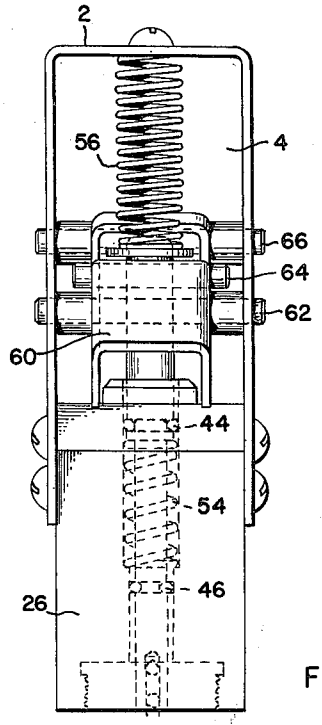

FIG. 3.

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Sept. 17, 1963 M. W. SLATE 3,104,384

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Filed June 4, 1959 2 Sheets-Sheet 2

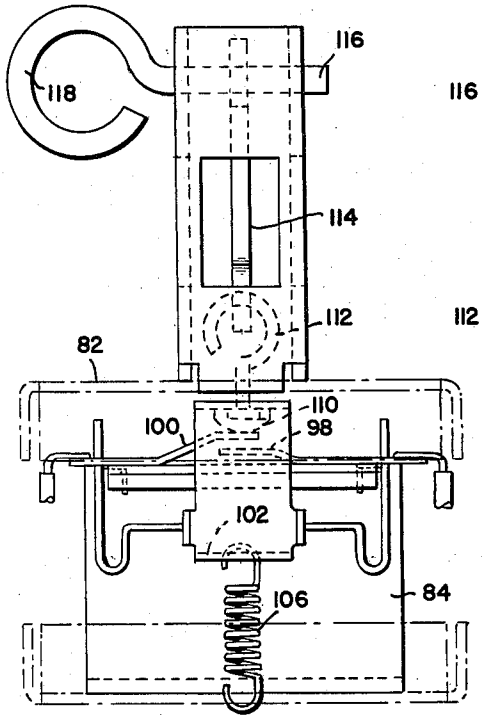

FIG. 4.

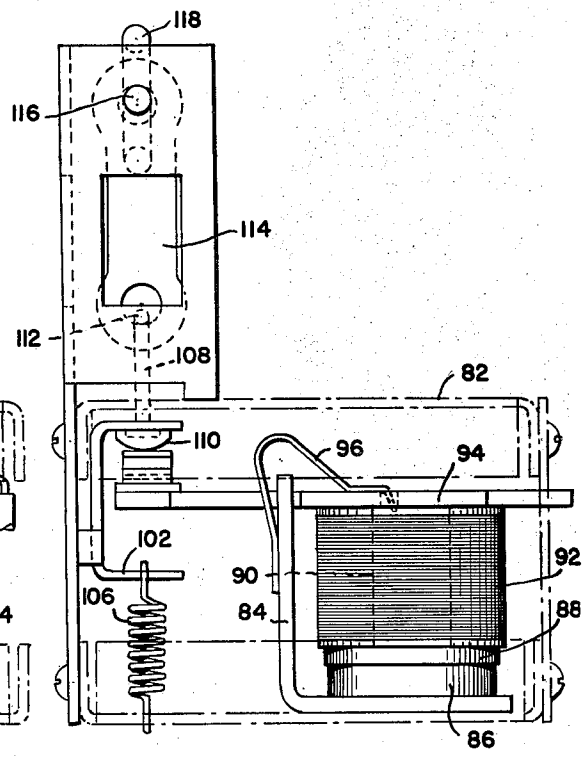

FIG. 5.

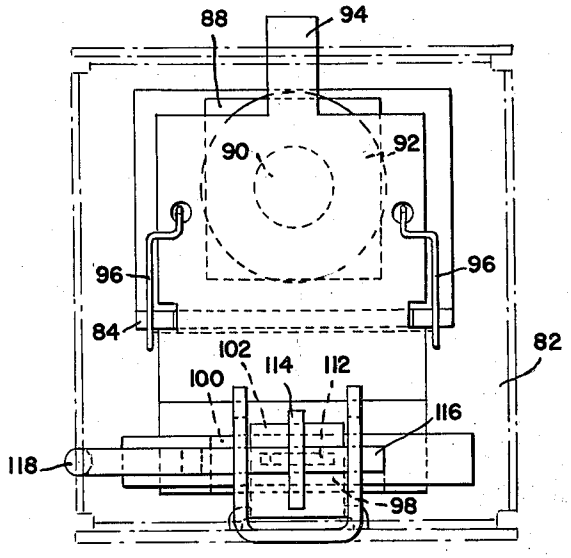

FIG. 6.

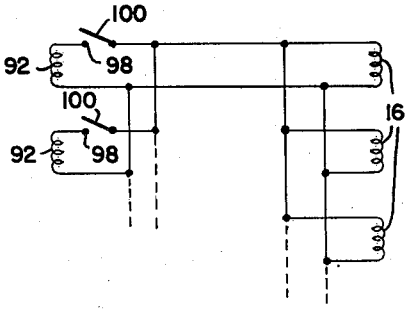

FIG. 7.

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United States Patent Office 3,104,384 Patented Sept. 17, 1963

3,104,384

ALARM SYSTEM

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Filed June 4, 1959, Ser. No. 818,072
6 Claims. (Cl. 340—215)

This invention relates to an alarm system and is particularly adapted to fire alarms though it may be used in other systems.

One of the objects of the present invention is to provide an alarm system of the type involving the transmission of electrical signals without, however, involving the necessity for reliance on an electrical power supply provided by the electrical mains or by batteries. In accordance with the invention, one or more transmitters are arranged to produce current pulses which serve to operate one or more receivers which in turn may provide audible signals or which may trigger fire extinguishing means, or the like. Provisions are made for resetting both the transmitting and receiving means. In particular, high reliability is attained.

The general objects of the invention as well as subsidiary objects particularly relating to details of construction and operation will become apparent from the following description, read in conjunction with the accompanying drawings in which:

FIGURE 1 is a vertical section taken through a preferred form of receiver responsive to signals emitted from one or more transmitters;

FIGURE 2 is a plan view of the same;

FIGURE 3 is an elevation of the same looking toward the right in FIGURE 1;

FIGURE 4 is an elevation of a transmitter;

FIGURE 5 is a side elevation of the same;

FIGURE 6 is a plan view of the same; and

FIGURE 7 is a wiring diagram showing the interconnections between a plurality of transmitters and a plurality of receivers.

Reference will be first made to FIGURES 1, 2, and 3 showing a receiver. A frame 2 which may be mounted at any convenient location includes a bracket 4 which supports a magnet assembly consisting of a frame 6, a disc-shaped permanent magnet 8, a washer 10, and a core 12 secured together by a clamping screw 14. The elements 6, 10, and 12 may be of low retentivity steel. Permanent magnetism is provided by the permanent disc magnet 8 of a ceramic material such as one of the barium ferrites, or such as is commercially available under the trademarks "Indox 1," "Cromag," or the like having a high coercive force. Permanent magnets of this type have special characteristics of which those utilized here are the following:

The permanent magnetism is not destroyed even if the magnet is subjected to an opposing field which serves not only to reduce the net magnetic field to zero but which may provide a considerable reversal of field. When such a magnetizing field is removed, the permanent magnet returns to and maintains its original strength. Utilized here, as will become apparent, is the neutralizing of the permanent magnet field by an electromagnetic field to reduce the net magnetic field to zero.

Another property of ceramic magnets of this type is that of retention of strong magnetism when the magnetic field is across a relatively short dimension such as between the faces of the disc 8. In other words, one face of the disc constitutes the north pole of the magnet and the other face the south pole. As will be evident, therefore, from FIGURE 1, the magnet disc 8 is in magnetic series with the other portions of the core structure comprising the elements 6, 10 and 12.

A magnet winding 16 is supported by a spool surrounding the central core element 12.

An armature 18 of steel is pivoted in a slot 20 provided in the element 6 and is urged lightly toward magnetic circuit closing position by a spring 24. A tail portion 22 of the armature extends downwardly as shown.

The frame 2 mounts a bonnet 26 which is provided with a lower opening 28 threaded at 30 to receive the cap 32 of a cartridge 36, a gasket 34 being provided for gas tightness. The cartridge 36 contains a fluid under pressure such as carbon dioxide, Freon or the like, capable of yielding a substantial volume of gas upon release. A sealing member 38 normally closes the cartridge being held in the cap by the threaded annulus 40. A plunger 42 is mounted to slide in a bore in the bonnet 26, sealing being provided by the O-rings 44 and 46. The lower end of the plunger 42 is cut off to provide a sharp edge at 48 suitable for penetration of the sealing member 38. Openings 50 are provided in the lower end of the plunger to permit free escape of gas, if the penetration occurs, and to the upper part of the opening 28 and then to an outlet at 52 which may be connected by tubing an element to be actuated to sound an alarm or effect other operation. For example, the connection may lead to a horn, to a bell actuator, to a fire door release, or such other device as may be desirably used as the response-actuated means.

A spring 54 urges the plunger upwardly but is opposed by a strong spring 56 acting on the stop collar 58 carried by the upper end of the plunger. A restoring lever 60 is pivoted at 62 to the frame and is pivoted to the plunger 42 by a pin 64 providing a loose connection. Pivoted to the inner end of lever 60 by pin 66 is a link 68 in turn pivoted by pin 70 to a second link 72 which has its lower end pivoted to the frame by pin 74. A link 76 loosely mounted on pin 70 is urged upwardly by a tension spring 80 connected between it and the pin 66 to cause it to abut the edge 78 at the lower end of the link 68.

At this point it would be convenient to describe the operation of the receiver. In its set condition which is illustrated in FIGURE 1, the toggle comprising the links 68 and 72 would collapse under the action of the strong spring 56 and the plunger 42 would be forced downwardly, if it were not for the abutment of the right-hand end of link 76 with the tail portion 22 of the armature 18 which is retained in the position illustrated by the permanent magnetic field provided by the magnet 8, in the absence of current flowing through the wiring 16. Tripping is effected by producing through the wiring 16 a momentary pulse sufficient to provide an electromagnetic field opposing that of the permanent magnet 8 to produce momentarily a zero net magnetic field and, accordingly, release of the armature 18. It has been found that the pulse duration serving to effect release of the armature may be very short. Once the field is reduced to or near zero and the armature moves to produce only a very small air gap between it and the core element 12, even though the pulse then terminates, the effective force to return the armature is very much less than the force which holds it in contact with the core.

Assuming the existence of such a momentary releasing pulse, the force exerted by the link 76 under the action of the spring 56 is so much greater than the force exerted by the light spring 24 and any magnetic force which may be produced by the pulse in reversing the previous magnetic field, that the armature will be swung counterclockwise with the collapse of the toggle and forcing of the link 76 by the cam action of the sloping armature below the lower end of the armature. The armature is then free to return under the action of spring 24 and is again clamped by the action of the magnetic field provided by magnet 8. The link 76 then lies below the tail 22 of the

armature being held yieldingly upwardly and against it by the spring 80.

With collapse of the toggle, the spring 56 overcomes the action of the relatively light spring 54 and drives the sharp lower edge of the plunger through the member 38 thereby releasing gas from the cartridge 36 to effect the desired operation. While gas pressure is exerted on the lower end of the plunger 42, and might be utilized to restore the system to its set condition, it is generally more desirable to provide manual resetting by using a spring 56 which is sufficiently strong to prevent automatic resetting. Manual resetting is effected by pulling downwardly on the left-hand end of lever 60 which will lift the plunger, straightening out the toggle linkage and thereby moving the link 76 sufficiently to the left to clear the armature 18 so that it will be resorted to its armature-abutting position under the action of spring 80.

It will be evident from the foregoing description of operation, that the receiver may be operated by a pulse of current in the proper direction through the wiring 16. This pulse may originate in any desired fashion, from momentary closure of a direct current circuit or by momentary closure of an alternating current circuit, since it is found that release will be effected so quickly that it will occur during the half wave of a 60 cycle supply which is in the proper direction to oppose and neutralize the field of the permanent magnet 8. While, therefore, the receiver is of quite general utility even when conventional direct or alternating power supplies are available to produce releasing pulses, the arrangement is of particular value when an electrical pulse of even very short duration may be supplied from a transmitting device which operates independently of a conventional current source. Such operation is particularly desirable for safety purposes, since a conventional source may fail, by neglect of batteries, or by the opening of an alternating supply circuit by some phenomenon such as a fire, which should be responsible for the tripping of the receiver.

FIGURES 4, 5 and 6 show a transmitter which is particularly desirable for use for the actuation of a receiver such as that just described. As illustrated, the transmitter is responsive to heat through the use of a fusible link, but it will become evident that it may be otherwise tripped, such as by a device in the nature of a burglar alarm, a detector of radiation, or the like.

A frame 82 supports a magnetic assembly generally similar to that previously discussed and comprising a bracket 84, a permanent cylindrical ceramic magnet 86 of the type referred to above, a washer 88 and a core 90, held in assembled relationship. A winding 92 surrounds the core 90. An armature 94 pivoted to the upper end of bracket 84 is urged toward closed position against the core 90 by the light spring 96.

The tail portion of the armature 94 carries a pair of insulated contact springs 98 and 100 which are normally sprung so as to be separated as illustrated in these figures. A yoke 102 is urged downwardly by a strong spring 106 connected between it and the frame. Downward movement is resisted by connections to the upper end of the yoke consisting of the link 108 which is hooked at 112 through a lower eye of a fusible link 114, the upper eye of which is held by a pin 116 passing through openings in the frame and provided with a loop 118 by which it may be withdrawn and reinserted. An insulating button 110 provided on the lower end of link 108 overlies the upper spring contact 100.

The electrical connections between a plurality of transmitters and a plurality of receivers are shown in FIGURE 7 in which the transmitter coils are indicated at 92 and the receiver coils are indicated at 16. As will be seen from FIGURE 7 the receiver coils are connected in parallel and this is also true of the transmitter coils in which, however, the coils 92 are normally disconnected from the circuit by the normally opened contacts 98 and 100. The circuit of FIGURE 7 shows how a number of

receivers may be actuated by the tripping by any one of a number of transmitters; but it will be evident that a single set of one transmitter and one receiver may be associated. When a plurality of receivers are used, the windings must, of course, be designed so that the transmitted signals are ample to effect operations of all the receivers.

The operation of a transmitter is as follows:

Upon failure of the fusible link 114, or by some other action which will release the link 108, as, for example, by the pulling out of a pin such as 118 by the opening of a door (in a burglary protective system), or the like, the spring 106 will snap downwardly the yoke 102, causing the button 110 first to produce engagement by the contacts 98 and 100 and secondly to rock the armature 94 away from the core 90. The rapid establishment of an air gap in the magnetic circuit and consequent collapses of the magnetic field will produce a pulse of current serving to energize momentarily the one or more windings 16 as previously described, thereby effecting operation of the one or more receivers. By reason of the fact that only the contacts 98 and 100 of the transmitter which is tripped will be closed, the other transmitter coils, if there be more than one transmitter, will be cut out of the circuit and, accordingly, will not shunt the output.

The normal condition of a transmitter may be restored by replacing the fusible link, the link 108 being raised in this operation or by some other restoring operation against the action of spring 106. In this restoring operation, it may be noted, even if the receivers have been reset, the polarity of the pulse emitted from the coil 92 by the closure of its magnetic circuit will be of opposite polarity from that capable of effecting tripping of receivers. It will be obvious that proper polarity conditions must be observed so that upon tripping of any trinsmitter the connected receiver or receivers will be tripped by the current pulse neutralization of their permanent magnetic fields.

It will be evident that various changes in details of construction and operation may be made without departure from the invention.

What is claimed is:

1. The combination comprising a permanently magnetized magnetic core, a movable armature normally associated with said core in a position substantially closing the magnetic circuit of said core and held thereby in said position, signalling means connected to said armature, said signalling means being operable by movement of the armature from said position in a direction to open said magnetic circuit, means biasing said armature in opposition to the holding action thereon of said magnetic core, a winding associated with said core and adapted to be energized to produce a field neutralizing the permanent field thereof, thereby to effect release of the armature and operation of said signalling means, a second permanently magnetized magnetic core, a movable armature normally associated with said second core in a position substantially closing the magnetic circuit thereof, a winding on said second core, means operable to move the second-mentioned armature to a position to open the magnetic circuit of said second core, thereby to generate an electrical pulse in the second-mentioned winding, and a circuit for transmitting said pulse to the first-mentioned winding to effect the aforesaid release of the first-mentioned armature.

2. Means for operating a signalling means comprising a container of compressed gas adapted to be punctured for release of the gas, a puncturing member, means mounting said member for movement into engagement with a portion of said container to be punctured, a strong spring biasing said member toward said container portion, a permanently magnetized core, a movable armature normally associated with said core in a position substantially closing the magnetic circuit of said core and held thereby in said position, a toggle linkage connected to said member adapted to be held in a normal position re-

stricting movement of said member under the influence of said spring and to be released to permit such movement, said toggle linkage being held in said normal position by said armature when the same is held in said position substantially closing the magnetic circuit of the core, and means for releasing said armature from the core, thereby to release said toggle linkage, comprising a coil associated with the core and means producing a current pulse through said coil to produce a field neutralizing the permanent field of the core.

3. Means for operating a signalling means as defined in claim 2 comprising a permanently magnetized second core, a second movable armature normally associated with said second core in a position substantially closing the magnetic circuit thereof, a winding on said second core coupled to a transmitting circuit, and means operable to move said second armature to a position to open said magnetic circuit, thereby to generate the electric pulse and effect operation of said signalling means, said transmitting circuit transmitting said pulse to said coil.

4. The combination comprising a permanently magnetized magnetic core, a movable armature normally associated with said core in a position substantially closing the magnetic circuit of said core and held thereby in said position, signalling means connected to said armature, said signalling means being operable by movement of the armature from said position in a direction to open said magnetic circuit, means biasing said armature in opposition to the holding action thereon of said magnetic core, a winding associated with said core and adapted to be energized to produce a field neutralizing the permanent field thereof, thereby to effect release of the armature and operation of said signalling means, a second permanently magnetized magnetic core, a movable armature normally associated with said second core in a position substantially closing the magnetic circuit thereof, a winding on said second core, a normally open switch, means providing a series circuit including said switch and the windings on the first-mentioned and second cores, and means operable substantially concurrently to close said switch and move the second-mentioned armature to a position to open the magnetic circuit of said second core, thereby to generate an electrical pulse in the second-mentioned winding, said pulse being transmitted by said circuit to the first-mentioned winding to effect the aforesaid release of the first-mentioned armature.

5. The combination comprising a plurality of first permanently magnetized cores, each of said first cores having a winding associated therewith and adapted to be energized to produce a field neutralizing the permanent field thereof, said windings being connected in a parallel circuit, a plurality of second permanently magnetized cores, each of said second cores being provided with a winding having associated in series therewith a normally open switch, each second-mentioned winding and its associated switch being connected in a parallel circuit with the other said second-mentioned windings and their associated switches, a circuit connecting the first and second-mentioned parallel circuits for the transmission of electrical pulses from the second to the first-mentioned windings, a plurality of movable armatures each normally associated with one of said first cores in a position substantially closing the magnetic circuit of the core and held thereby in said position, a plurality of signalling means each connected to one of said armatures, each of said signalling means being operable by movement of its associated armature in opposition to the holding action thereon of its magnetic core, the said winding of each of said first cores being adapted to be energized to produce a field neutralizing the permanent field thereof, thereby to effect release of its associated armature and operation thereby of signalling means, a plurality of second movable armatures each associated with one of said second cores in a position substantially closing the magnetic circuit thereof, and means for producing an electrical pulse from any of said second-mentioned windings comprising means operable substantially concurrently to close the said switch in series therewith and to move its associated armature to open the magnetic circuit of the core, said pulse being transmitted to the first-mentioned windings to effect operation of said signalling means.

6. The combination comprising a permanently magnetized ceramic core, a movable armature normally associated with said core in a position substantially closing the magnetic circuit of said core and held thereby in said position, signalling means connected to said armature, said signalling means being operable by movement of the armature from said position in a direction to open said magnetic circuit, means biasing said armature in opposition to the holding action thereon of said ceramic core, a winding associated with said core and adapted to be energized to produce a field neutralizing the permanent field thereof, thereby to effect release of the armature and operation of said signalling means, a second permanently magnetized ceramic core, a movable armature normally associated with said second core in a position substantially closing the magnetic circuit thereof, a winding on said second core, means operable to move the second-mentioned armature to a position to open the magnetic circuit of said second core, thereby to generate an electrical pulse in the second-mentioned winding, and a circuit for transmitting said pulse to the first-mentioned winding to effect the aforesaid release of the first-mentioned armature.

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