PNEUMATIC ALARM SYSTEM

Inventors: Horace Gales Edwards; James William Sealey, both of Raleigh, N.C.

Assignee: Fortune Development Corporation, Cary, N.C.

Filed: Sept. 30, 1974

Appl. No.: 510,228

U.S. Cl. 116/65; 116/86; 116/103; 137/68; 251/4

Int. Cl. G08B 1/04; G08B 13/00

Field of Search 116/65, 100, 85, 86, 75, 116/103; 137/68, 557, 251/4, 61.2

References Cited

UNITED STATES PATENTS
2,540,364 2/1951 Adams 251/4
2,673,707 3/1954 McRae 137/68 X
3,045,775 7/1962 Pretini 116/86 X

3,323,531 6/1967 Spellman 137/68
3,780,692 12/1973 Nalley 116/86

Primary Examiner—Richard C. Queisser
Assistant Examiner—Daniel M. Yasich
Attorney, Agent, or Firm—John B. Frisone

ABSTRACT

A pneumatic alarm system in which a single source of gas under pressure is connected to one side of a balanced regulator valve while a plurality of rupturable sensors are connected by a manifold to the other side of the balanced regulator valve which is maintained in an inactive state when the manifold pressure and the source pressure bear a predetermined relationship to each other. When the relationship terminates by the rupture of one or more of the sensors, the valve activates and connects the pressurized single gas source to an audible warning device to cause an alarm to be sounded.

9 Claims, 12 Drawing Figures
PNEUMATIC ALARM SYSTEM

FIELD OF THE INVENTION

The invention relates to alarms in general and more particularly to pneumatic alarms useful for detecting both intrusion or fire and in which a single source of pressurized gas may be used to operate one or more audible alarm devices.

PRIOR ART

Generally, intrusion and fire alarms are either electrical, mechanical or pneumatic. All mechanical alarms have found little acceptance in the past. This is probably due to cost of manufacture and installation, reliability and appearance. Electrically based alarm systems are probably the most popular alarm type system in use. The reasons for this popularity are not generally understood or accepted since such systems are not entirely trouble free. A reliable electrical system must be provided with at least an auxiliary power supply in the event of power failure. These auxiliary supplies are bulky and costly to provide and maintain. Under certain conditions, wiring runs can be complex and expensive to install. Furthermore, the installation is difficult to conceal in existing structures.

Pneumatic systems on the other hand have only been employed on a limited basis and only in large numbers since the availability of pressurized fluid sources such as Freon in pressurized vessels. The systems available have been limited to single alarm devices for detecting fire or excessive temperature at a single location. These systems are bulky and expensive when used to protect a large complex against the threat of fire. The use of pneumatic devices as intrusion alarms has not found general use.

SUMMARY OF THE INVENTION

The invention contemplates an alarm system suitable for detecting excessive temperatures and intrusion into a structure and sounding an audible alarm in the event that condition occurs comprising a fluid manifold, a plurality of rupturable means in sealing communication with said fluid manifold, means for pressurizing said manifold, a supply of pressurized fluid, a fluid operated audible alarm, balance valve means for providing fluid communication between a first port connected to said supply of pressurized fluid and a second port connected to said fluid operated audible alarm and means connected to said pressurized manifold for interrupting communication between the first and second ports as long as said manifold remains pressurized.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic perspective view of a fluid operated alarm system constructed in accordance with the invention;

FIG. 2 is an elevation partially in section of a balanced valve constructed in accordance with the invention and illustrated in the closed position;

FIG. 3 is similar to FIG. 2; however, the valve is illustrated in the open position;

FIG. 4 is a perspective view of a rupturable detector for detecting the unauthorized opening of a door or similar barrier;

FIG. 5 is a side elevation partially in section of the detector illustrated in FIG. 4;

FIG. 6 is a view similar to FIG. 5 in which the detector is illustrated following an unauthorized opening of the door;

FIG. 7 is a perspective view of a rupturable detector for detecting the unauthorized opening of a window or similar device;

FIG. 8A is a side elevation partially in section of the detector illustrated in FIG. 7;

FIG. 8B is similar to FIG. 8A but shows the detector after an unauthorized opening of the window;

FIG. 9A is an elevation partially in section of a thermal detector for detecting temperatures above some predetermined value;

FIG. 9B is a view similar to FIG. 9A but illustrates the temperature detector after the ambient temperature exceeds the above said predetermined value; and

FIG. 10 is a schematic diagram of an alternate detector suitable for use in the disclosed alarm system.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 illustrates a pneumatic alarm system suitable for detecting fires or excessive temperatures and intrusions. The system is provided with a source of fluid under high pressure 10, such as a conventional pressurized Freon container, connected by a conduit 11, such as plastic tubing, to one port 12 of a balance valve 14. A second port 15 of the balance valve 14 is connected to a fluid operated audible alarm 16 of conventional design by a conduit 17 which may also be made of plastic tubing. The valve 14 is in addition connected to a manifold 18 which may also be made of plastic tubing with suitable “T” or “X” connectors 19 and 20, respectively, to facilitate assembly. The construction of valve 14 is illustrated in FIGS. 2 and 3 and will be described in detail below.

A pressure gauge 21 is connected to the manifold 18 by a T connector to provide a visual check of the manifold pressure. A check valve 22 of conventional design, such as those used for inflating automobile tires, is connected to the manifold 18 by a T connector. The valve is located adjacent the gauge and is utilized to pressurize or repressurize the manifold in conjunction with an air pump or other source of pressurized fluid, not shown. A plurality of fire or temperature detectors 23 are connected to the manifold 18 by T connectors. The detectors 23 are conventional and are provided with fusible elements which rupture when subject to predetermined temperatures. These detectors are shown in greater detail in FIGS. 9A and 9B. The manifold 18 is also connected to detectors for detecting the unauthorized opening of a door 24 or a window 25. These detectors are illustrated in FIGS. 4-6 and 7, 8A, 8B and 10, respectively.

FIGS. 2 and 3 illustrate in detail the construction and operation of the balance valve 14. The valve has a cylindrical body 27 open at either end. An end cap 28 fits over one end of the cylindrical body 27 and attached thereto by a press fit. The end cap 28 on its flat circular end wall 29 is provided with the two ports 12 and 15. The port 12 is centrally located in the circular end wall. The ports 12 and 15 are provided with bushings 30 and 31, respectively. These bushings retain conduits 11 and 17 by either frictional engagement or by cement or other equivalent attaching means. Another end cap 32 fits over the other end of cylindrical body 27 thus forming a unitary valve body. End cap 32 includes a port 33 with a bushing 34 centrally located in its flat circular
3,921,563

end wall 35. A bellows 36 preferably constructed of metal is assembled and contained within valve body 27 and end caps 28 and 32. The bellows 36 has a centrally located opening in its flat circular end wall 37. Manifold 18 passes through the opening in bushing 34 and is attached by conventional means within the opening in end wall 37 of bellows 36. The other end wall 38 of bellows 36 engages centrally located bushing 30 and seals the ports when the bellows is extended as illustrated in FIG. 2. The bellows 36 is forced into the extended position when the manifold 18 is pressurized as previously described. If for any reason, the pressure in the manifold falls due to rupture of one of the detectors described above, the bellows will retract, as illustrated in FIG. 3, in view of the pressure from high pressure source 10. When the bellows retract, fluid communication is established between ports 12 and 15 and the high pressure fluid from source 10 will operate the audible alarm 16.

FIGS. 4, 5 and 6 illustrate the construction and operation of a detector suitable for detecting the unauthorized opening of a door or similar barrier. A base 40 is attached by conventional fasteners not shown to the stationary door frame 41 of a door 42. A generally cylindrical protrusion 43 extends from the base 40. The cylindrical protrusion is provided with an opening 44 in its cylindrical wall. A cylindrical member 45 having an inner diameter larger than the outer diameter of protrusion 43 is mounted concentrically over protrusion 43. Member 45 is also provided with an opening 46 in its wall. The member 45 is positioned so that the openings 44 and 46 are in alignment. A termination on the manifold 18 is inserted through both openings as illustrated in FIG. 5. The termination of manifold 18 may be sealed in many ways. If the manifold is constructed from plastic tubing, locally applied heat may be used to fuse the tubing walls together to provide a fluid tight seal of the manifold termination. The cylindrical member 45 is also provided with another opening 47 which will be engaged by a key operated actuating arm 48 supported on the door 42. When the key 49 is rotated to the alarm activating position, the arm 48 also rotates and engages opening 47 in member 45. Once the member 45 is moved to this position, the door 42, if opened, will cause the member 45 to move relative to protrusion 43. This movement will shear the manifold 18, as illustrated in FIG. 6, causing a loss of pressure in the manifold 18 which in turn will result in an alarm being sounded as previously described.

FIGS. 7, 8A and 8B illustrate the construction and operation of a detector suitable for detecting the unauthorized opening of a window or similar barrier. A pair of conventional sashes 50 and 51 are arranged in conventional manner for relative movement with respect to each other. Each sash 50 and 51 is mounted on its own right angle bracket 52. The brackets 52 are provided with openings 53 and are mounted on the sashes 50 and 51 in back-to-back relationship with their openings 53 in alignment. The brackets may be attached to the sashes by screws 54 or other suitable attachment means. A sealed manifold 18 termination is inserted through both of the aligned openings 53. When the manifold termination is thus inserted, opening either of the sashes will cause the manifold to be ruptured as illustrated in FIG. 8B. When this occurs, the manifold 18 will become depressurized and the alarm will be sounded as previously described.

FIGS. 9A and 9B illustrate the construction and operation of a detector suitable for detecting fire or excessive temperatures. A generally conical body 56 is provided with a fusible plug 57 sealing one end of an internal passageway 58 which is adapted to receive and retain an unsealed termination of manifold 18. When the ambient temperature exceeds a predetermined limit or range, the fusible plug 57 melts or ruptures causing a loss of pressure in the manifold 18 resulting in the sounding of the alarm as described above. The conical body 56 may be attached to a ceiling or wall 59 in any convenient manner and the manifold 18 may be inserted into the opening 88 through a small clearance hole 60 in the ceiling or wall 59.

In FIG. 10, the flexible tubing used for manifold 18 is folded at an open end and inserted in a cylindrical support 70 which is flared at one end to facilitate insertion of the folded manifold. The fold seals the manifold and prevents pressure loss. Member 70 is attached to the door frame by clamp 71 and the manifold is also attached to the door frame by a second clamp 71'. Clamps 71 and 71' are spaced a substantial distance from each other and the manifold 18 is provided with sufficient slack between the clamps to cause it to bow out and thus providing clearance for a key operated actuator 73 which may be similar to actuator arm 48 described above. Thus, when an unauthorized entry is attempted, actuator 73 withdraws the folded manifold 18 from member 70 permitting the manifold to unfold causing a loss of pressure which operates the alarm as described above. This detector is advantageous since a test accidental use will not damage the manifold. The system may be rearmed simply by folding and reinserting manifold 18 into member 70 and represurizing the manifold 18.

The plastic tubing comprising manifold 18 may itself constitute a continuous fire or temperature detector. The tubing material and the preset pressure in the manifold may be selected such that the tubing will rupture at a specified temperature and pressure. In this event, the alarm will be sounded as soon as the specified temperature or temperature range is exceeded since the tubing will burst causing a loss of pressure in the manifold and resulting in a sounding of the alarm as previously described.

While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. An alarm system suitable for detecting an alarm condition upon the occurrence of an event and for sounding an audible alarm upon the detection of said alarm condition comprising:
   a substantially fluid tight manifold;
   a plurality of alarm condition detector means positioned proximate said manifold and arranged to interrupt said fluid tight condition upon detecting an alarm condition;
   means for pressurizing said manifold;
   a supply of pressurized fluid;
   a fluid operated audible alarm;
   a balance valve means connected to said manifold for providing fluid communication between a first and a second port in a wall of said value means when said valve is in a first state and including pressure
responsive means for interrupting fluid communication between said first and second ports when said valve is in a second state;
means for connecting said supply of pressurized fluid to said first port;
means for connecting said audible alarm to said second port; and
said pressure responsive means being within said balance valve means connected to said manifold for maintaining said valve in said second state as long as said manifold pressure exceeds a predetermined value and permitting said valve to assume its said first state when said manifold pressure is below said predetermined value whereby said audible alarm is sounded.

2. An alarm system as set forth in claim 1 in which said balance valve means includes a fluid tight body having said first and second ports located therein, and said pressure responsive means is located within said body and is maintained in sealing arrangement with said first port when subjected to a pressure above the said predetermined value.

3. An alarm system as set forth in claim 2 in which said pressure responsive means comprises a bellows, the interior of which is in fluid communication with said manifold and expands into fluid sealing engagement with said first port when the manifold pressure is maintained above the said predetermined value.

4. An alarm system as set forth in claim 3 in which at least one of said detectors is adapted to detect the unauthorized opening of a movable closure in a fixed structure and comprises
a first member having an opening therein attached to said fixed structure,
a second member having an opening therein supported on said first member,
said openings being aligned for admitting a portion of said manifold and selectively displacable means mounted on said movable closure for selectively engaging said second member whereby said second member is moved with respect to said first member when said closure is opened thus rupturing said manifold and causing the manifold pressure to fall to atmospheric pressure.

5. An alarm system as set forth in claim 3 in which at least one of said detectors is adapted to detect the unauthorized opening of movable closures arranged in juxtaposition and comprises
a first member having an opening therein attached to one of said closures,
a second member having an opening therein attached to the other of said closures,
said members being attached and arranged so that the openings are in alignment for receiving a portion of said manifold whereby said manifold is ruptured by shearing when either closure is moved with respect to the other.

6. An alarm system as set forth in claim 3 in which said manifold is constructed of flexible plastic tubing and at least one of said detectors is adapted to detect the unauthorized opening of a movable closure in a structure and comprises
a holder attached to said structure and adapted to hold a folded termination of said manifold, and means attached to said closure for selectively engaging said manifold and withdrawing said folded manifold from said holder when said closure is moved with respect to said structure whereby the pressure in said manifold falls to atmospheric pressure.

7. An alarm system as set forth in claim 1 in which at least one of said detectors is adapted to detect the unauthorized opening of a movable closure in a fixed structure and comprises
a first member having an opening therein attached to said fixed structure,
a second member having an opening therein supported on said first member,
said openings being aligned for admitting a portion of said manifold and selectively displacable means mounted on said movable closure for selectively engaging said second member whereby said second member is moved with respect to said first member when said closure is opened thus rupturing said manifold and causing the manifold pressure to fall to atmospheric pressure.

8. An alarm system as set forth in claim 1 in which at least one of said detectors is adapted to detect the unauthorized opening of movable closures arranged in juxtaposition and comprises
a first member having an opening therein attached to one of said closures,
a second member having an opening therein attached to the other of said closures,
said members being attached and arranged so that the openings are in alignment for receiving a portion of said manifold whereby said manifold is ruptured by shearing when either closure is moved with respect to the other.

9. An alarm system as set forth in claim 1 in which said manifold is constructed of flexible plastic tubing and at least one of said detectors is adapted to detect the unauthorized opening of a movable closure in a structure and comprises
a holder attached to said structure and adapted to hold a folded termination of said manifold, and means attached to said closure for selectively engaging said manifold and withdrawing said folded manifold from said holder when said closure is moved with respect to said structure whereby the pressure in said manifold falls to atmospheric pressure.