July 17, 1956 A. F. SPERRY 2,754,788

FLUID OPERATED ALARM SYSTEM

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Fig. 1.

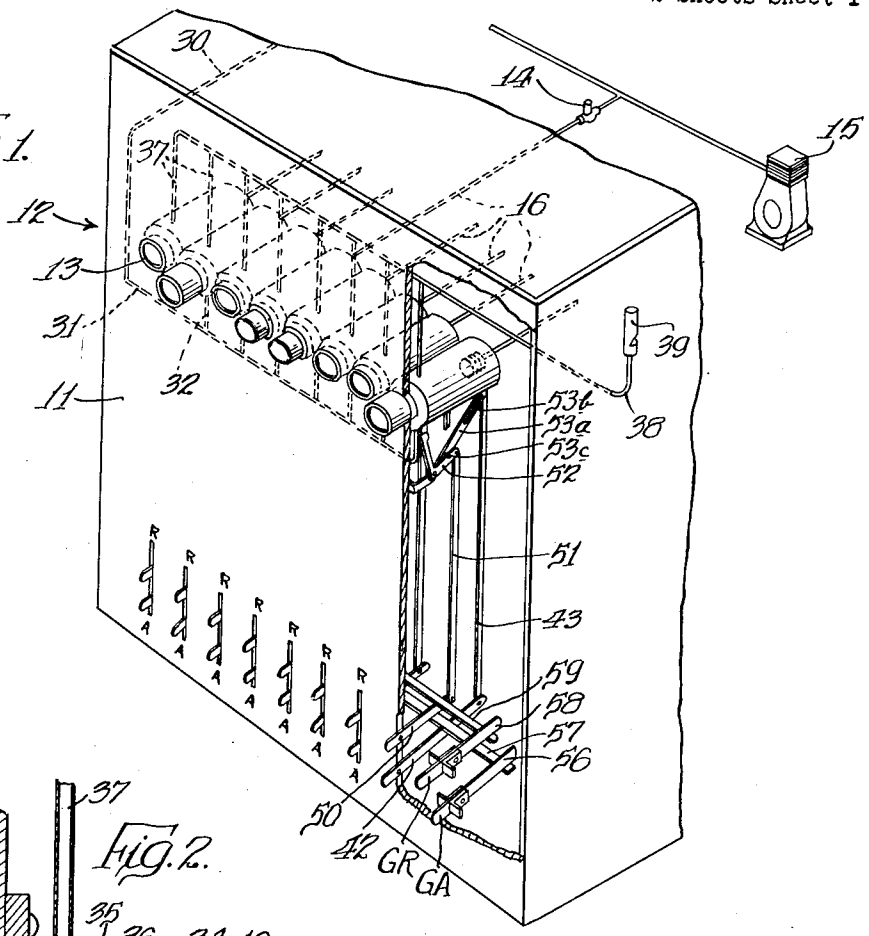


Fig. 2.

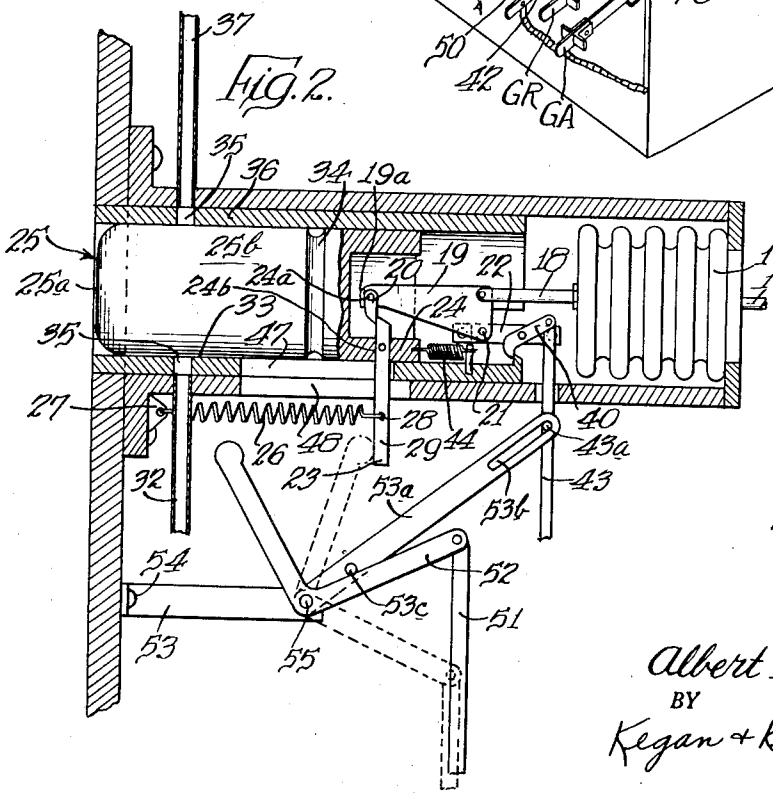
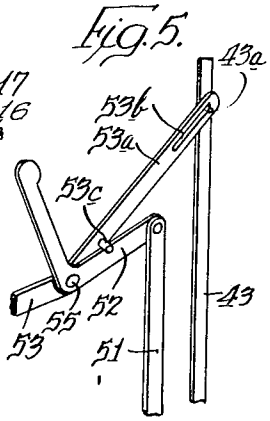


Fig. 5.



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Fig. 3.

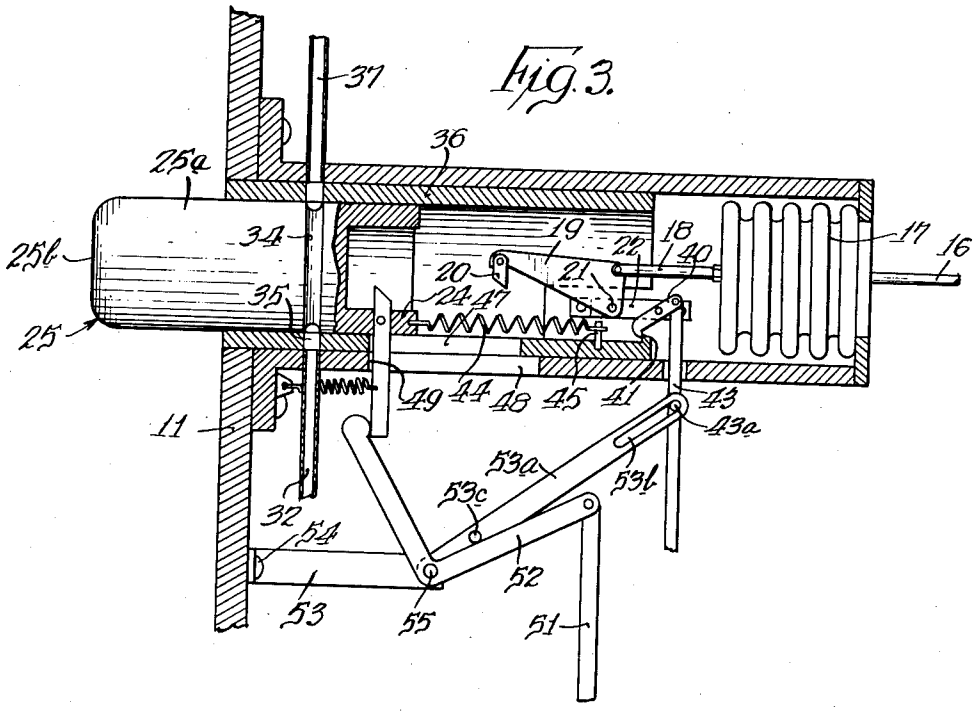
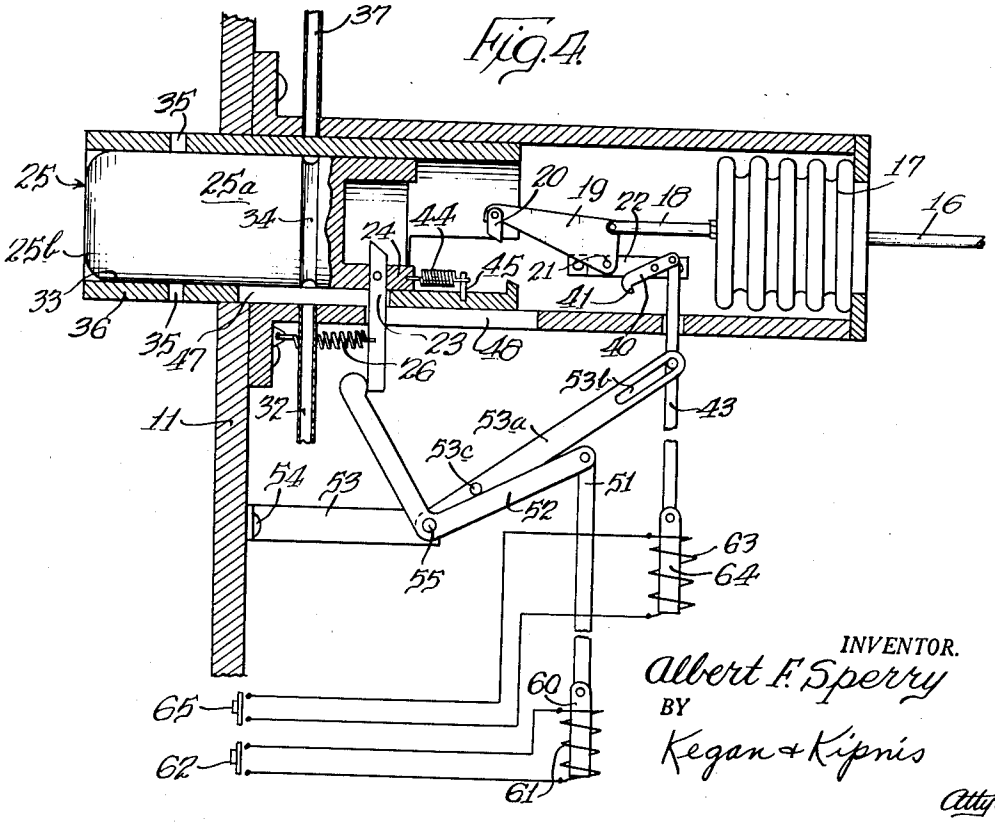


Fig. 4.



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FLUID OPERATED ALARM SYSTEM

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13 Claims. (Cl. 114—4)

This invention relates to fluid operated alarm systems, to a novel alarm system in which both a visual signal and an audible signal are given whenever a critical or abnormal condition is reached in the area being supervised, and to an alarm system which readily identifies the area in which the critical or abnormal condition occurs. Such alarm systems are used where electric circuits are hazardous or prohibited.

In fluid operated systems of this kind, the signal is transmitted by means of a change in fluid pressure in the line connecting the alarm unit to the supervised area. In a room which may be remote from the field, an attendant recognizes the signal which notifies that the abnormal condition exists, marks the location of the condition, and acknowledges the alarm signal. After the abnormal condition has been corrected, the attendant resets the alarm unit to its initial condition.

Since many areas may be under supervision at one station, it is necessary to distinguish those alarms which have not been acknowledged from the earlier alarms in acknowledged condition. Also, it is important to reset only that alarm which has had its abnormal condition corrected, while not inadvertently or prematurely extinguishing the other alarms.

Accordingly, it is an important object of this present invention to provide an alarm system which visually distinguishes between acknowledged and unacknowledged signals, and which also has an audible signal to command an attendant's attention to an unacknowledged signal.

Another important object of this invention is to provide an alarm system which allows reset of the individual alarms for the corrected supervised areas while not extinguishing other alarms.

Another object is to provide a fluid alarm system for use in hazardous locations, minimizing the use of valves and other special fittings, and affording protection fully equivalent to the usual electric alarm systems.

And still another object of this invention is to provide a compact alarm receiving unit which readily adapts itself to either pneumatic or hydraulic pressure activation, which may be mass produced, and which is applicable to all alarm purposes.

In the present invention these objects are achieved by an instrument unit, usually provided in multiples to form a bank or series of alarm units, with a single small fluid actuated bellows in each unit. There is also provided in each unit a button having brightly colored sides which become visible when an abnormal condition occurs. Surrounding this button is a slidable white sleeve, which is visible when the alarm is acknowledged. Between the

button and the actuator bellows a simple mechanism is provided, serving the purpose, along with the slidable sleeve, of controlling an added audible alarm device such as a signal whistle. The mechanism also serves the further purpose of acknowledging or silencing the audible alarm, and resetting the button and sleeve to their normal position upon restitution of normalcy in that which is being supervised.

Other objects will become evident from the following detailed description.

In the drawings:

Figure 1 is a fragmentary perspective view of an instrument panel containing a plurality of individual alarm units;

Figure 2 is a sectional view of an individual alarm unit in normal operating position;

Figure 3 is a sectional view similar to Figure 2 with the unit indicating an abnormal condition in the field;

Figure 4 is a view similar to Figures 2 and 3, showing the unit in alarm-acknowledged position, and showing a modification of the reset and acknowledgment actuating mechanism; and,

Figure 5 is a perspective view of a means permitting acknowledgment and reset in one operation.

Referring to Figure 1, the invention includes a panel **11** having a bank of instruments, indicated generally at **12**. The individual alarm units **13** are mounted in alarm unit casing **10** and are each connected to a separate normally open field valve or monitor **14** which will respond to signal the occurrence of any abnormal condition in the field. A pressure source **15** supplies the connecting lines **16** with compressed fluid, so that under normal conditions the pressure remains constant. An abnormal condition in the field opens a bleeder in the field valve **14**, causing a pressure drop in the corresponding line **16**. This pressure drop actuates a signal in the alarm unit **13**.

Referring to Figures 2, 3, and 4, which show a single alarm unit, bellows **17** is normally expanded by the pressure in line **16**. When a pressure drop in line **16** occurs, the bellows **17** immediately collapses, thereby pulling rod **18** and turning bellcrank **19** to raise detent **20**. Detent **20** is pivotally connected to bellcrank **19** in such a manner that it is permitted to rotate only counterclockwise from its position, as shown in Figure 2, with the bellcrank end **19***a* adjacent thereto preventing clockwise rotation. Bellcrank **19** is pivotally connected at **21** to stationary support bar **22**. A central slide button **25** is provided to give a visual signal warning of the abnormal condition. The spring escapement mechanism for slide button **25** comprises engagement arm **23** rigidly attached to the end **24** of slide button **25**, and normally expanded spring **26**. Arm **23** is held in fixed position on end **24** by pin **24***a* and the sides of the aperture **24***b* through which it passes. Spring **26** is connected at **28** to the depending portion **29** of arm **23**, and at its other end it is connected to the alarm unit frame at **27**. Detent **20** is so positioned in the alarm unit as to engage arm **23** when bellows **17** is in normally expanded position.

As detent **20** is raised and tripped by the contracting bellows **17**, which occurs when an abnormal condition happens in the field, spring **26** urges slide button **25** forward to the position shown in Figure 3. An aperture **48** is provided in the alarm unit casing **10** to allow button **25** and arm **23** to move forward until stopped by the casing

at 49. A visual signal thus appears on the face of the panel 11, warning of the abnormal condition, and giving the location of such condition. The sides 25*a* of slide button 25 may be painted a brilliant red, while the end 25*b* appears white. Thus, the red alarm color is visible only when the unit is in the alarm position shown in Figure 3.

An audible signal also is provided, since the attendant may not be at the bank of instruments 12 to see the visual signal when it occurs. Air pressure is fed from a constant pressure source through line 30 to header 31. Individual take-offs 32 are supplied to each alarm unit 13. When signal button 25 is in its normal position within panel 11, the passage of the compressed air is blocked off by the button side 33. When, however, button 25 is in its extended alarm position, as shown in Figure 3, a small diametric port 34 communicates with line 32 through ports 35—35 in sleeve 36, permitting compressed air to pass through lines 37 and 38 to alarm whistle 39.

Outer concentric sleeve 36, adapted to fit slidably about the outer perimeter of button 25, permits an uninterrupted passage of air to whistle 39, until the alarm signal is acknowledged. As shown in Figures 2 and 3, ports 35—35 are aligned with lines 32 and 37 both before and after an alarm is given, with port 34 completing the air passage once an alarm unit 13 responds to give its signal. This type of valving is capable of transmitting pressure at a considerable level. Care should be taken, however, to accurately machine slide button 25 and sleeve 36 and their respective ports 34 and 35 in order to prevent leakage of air. To assure that an air leakage will not occur, a conventional gasket or seal, such as an O-ring, is usually used.

Acknowledgment of the alarm is effected at the instrument panel by flipping the toggle A corresponding to the signalling alarm unit. Another small detent 40, pivotally connected to stationary support bar 22, is adapted to engage the back end 41 of concentric sleeve 36, thereby retaining sleeve 36 within the instrument panel after an alarm is given. When toggle A is flipped upwardly, detent 40 is raised and tripped by means of acknowledgment bar 42 and connecting lever 43, and concentric sleeve 36 becomes free to be moved forward by spring 44. A slotted aperture 47 is provided in sleeve 36, allowing it to move past arm 23. Arm 23 also limits the forward motion of sleeve 36.

As best shown in Figure 2, spring 44 in its normal position is at rest. As slide button 25 moves to its position shown in Figure 3, however, spring 44 is put under tension, since it is connected to the back end 24 of button 25. The other end of spring 44 is connected at 45 to concentric sleeve 36 which in its extended position gives a visual signal that the alarm has been acknowledged. Side 46 of sleeve 36 cuts off the passage of air to whistle 39, thereby silencing the audible signal. In practice sleeve 36 is usually the same color as end 25*b* of slide button 25, thereby presenting an all white signal in the alarm acknowledged position (Figure 4) as well as the normal operating position (Figure 2).

Resetting the alarm unit 13 to normal position is effected by a second toggle R which, by means of reset bar 50, connecting lever 51, reset bellcrank 52 and arm 23, displaces both slide button 25 and concentric sleeve 36 back to their normal cocked positions within the instrument panel. Support arm 53, connected to panel 11 by bolt 54, provides a fulcrum point 55 for bellcrank 52.

Alarm units mounted low enough to reach may be reset by merely pushing button 25 and sleeve 36 in by hand. The advantage of such an arrangement is that the reset toggle and its linkage may thus be eliminated.

A cross arm 53*a* extends between lever 43 and bellcrank 52, thereby tying the acknowledgment linkage to the reset mechanism. One end of cross arm 53*a* is pivotally connected at point 55 while the other end has a

slotted aperture 53*b* adapted to engage pin 43*a* on rod 43. Projection 53*c* rigidly associates cross arm 53*a* to bellcrank 52 as lever 43 is pulled down. Accordingly, acknowledgment of a signalling alarm unit pulls lever 43 down, and, by means of cross arm 53*a*, causes bellcrank 52 to pivot and displace both button 25 and sleeve 36 to their respective normal positions. If the condition which caused the alarm has not been corrected, detent 20 remains raised and button 25 is urged forward by spring 26, thus putting spring 44 under tension. Since detent 40 is raised, sleeve 36 is free to be urged forward by spring 44 to signal an acknowledged alarm. If, on the other hand, the abnormal condition has been removed, detent 20 engages arm 23 to retain button 25, and the signalling unit is both acknowledged and reset in one operation.

The invention, of course, is not limited to acknowledging and resetting the alarm unit at the instrument panel. It is adaptable to solenoid actuation of detent 40 and bellcrank 52, as well as being adaptable to acknowledgment and reset toggles at any desired location. As shown in Figure 4, reset solenoid actuation is accomplished by securing plunger 60 of solenoid 61 to lever 51. The closing of switch 62, which may be placed at any convenient location, energizes solenoid 61, pulling plunger 60 and lever 51 downward, and thereby resetting the alarm unit. In the same manner, acknowledgment may be accomplished through the use of solenoid 63, plunger 64 attached to connecting lever 43 and switch 65. If a completely fluid operated alarm unit is desired, an alternate method of acknowledging and resetting would be to use pressure actuated bellows in place of solenoids 61 and 63.

It will be observed that there is a safety feature in each alarm unit which prevents restoration of an actuated alarm unit to normal operating position until correction of the abnormal condition causing the alarm. As long as an abnormal condition exists, there is a pressure drop in line 16. This pressure drop causes bellows 17 to collapse, raising detent 20, and thereby releasing slide button 25. Thus, if through error, reset toggle R is flipped in an unacknowledged signalling alarm unit, slide button 25 is immediately free to reappear on signal panel 11.

A second safety feature in each alarm unit guards against inadvertent actuation of a non-signalling alarm unit. The pressure in line 16 remains constant as long as the supervised area continues to experience normal conditions. With bellows 17 in its extended position, detent 20 holds slide button 25. Thus, if acknowledgment toggle A is raised in a non-signalling alarm unit, nothing happens, since detent 20 holds slide button 25 and spring 44 is not extended to pull sleeve 36 forward.

In addition to the individual acknowledgement and reset toggles A and R, gang acknowledgement toggle GA and gang reset toggle GR are also provided. When toggle GA is flipped upwardly, gang acknowledgement bar 56 causes gang acknowledgement lever 57 to move downwardly. This forces the individual acknowledgement bars 42 to move downwardly, and, in turn, acknowledges the individual alarm units which have signaled the occurrence of an abnormal condition. Non-signalling alarm units remain in their normal position, since no pressure drop exists in their corresponding line 16. Signalling units which have had their abnormal conditions corrected are reset by the action of lever 43 on cross arm 53*a*, causing bellcrank 52 to move button 25 and sleeve 36 to normal position. It thus is apparent that acknowledgement and reset of an entire bank of instruments, as illustrated in Figure 1, may be effected through the use of a single gang acknowledgement toggle GA if such operation is desired.

When the gang reset toggle GR is raised, gang reset bar 58 causes gang reset lever 59 to move downwardly. The downward movement of lever 59 forces the individual reset bars 50 down, and, in turn, resets those alarm units

13 which have already been acknowledged. If an alarm unit 13 has not been acknowledged, it continues to signal that an abnormal condition exists. This is due to the fact that detent 20 in the unacknowledged alarm unit remains raised as long as the pressure drop exists in line 16.

The operation of an alarm annunciator briefly is as follows: An abnormal condition causes the bleeder in field valve 14 to open, and the pressure drop in line 16 allows bellows 17 to collapse. Detent 20 is raised, thereby releasing slide button 25, which is urged forward by spring 26. The passage of air through lines 32 and 37 is completed by aligning ports 34 and 35, and an audible signal is given by whistle 39 while slide button 25 provides a visual signal on panel 11. Acknowledgement of the signal raises detent 40, allowing sleeve 36 to be urged forward by spring 44. Sleeve 36 cuts off the passage of air to whistle 39 while giving a visual signal that the alarm has been acknowledged. After correcting the cause of the abnormal condition, the alarm unit may be reset to its normal position.

The invention is not limited to the specific device described above. Since it may be described in a variety of expressions, it is to be understood that the embodiment herein described is for the purpose of illustration only, and not intended to limit and define the invention. For example, the device is readily adaptable to instances where the bellows is normally collapsed and becomes extended upon the occurrence of an abnormal condition in the field.

I claim:

1. A fluid operated alarm unit operatively connected to a field sensing station and pressure source by a pressure line, comprising a bellows having an inlet connected with said line and responsive to pressure changes caused in said line by the field sensing station; a first indicator normally held in a cocked position by said bellows; biasing means anchored to said first indicator, whereby pressure changes actuate said bellows and trip said indicator for movement to an alarm position; a second indicator normally held in a cocked position; a latch normally retaining said second indicator in said cocked position; second biasing means anchored to said second indicator; and linkage to trip said latch and release said second indicator for movement to alarm-acknowledged position.

2. Apparatus as described in claim 1, further characterized by the fact that said second indicator comprises a sleeve surrounding said first indicator; said apparatus additionally including a tubular housing wherein said indicators are slidable and concentric with each other and said housing, thereby presenting a small and compact alarm unit.

3. Apparatus as described in claim 1, wherein said second biasing means is normally at rest and anchored at one end to said first indicator and at the other end to said second indicator, thereby preventing actuation of said second indicator until after said first indicator has been moved.

4. Apparatus as described in claim 2, and additionally including a pressure-actuated audible alarm, a pressure connection from said pressure source to said alarm unit, a pressure connection from said alarm unit to said audible alarm, a conduit in said first indicator positioned to connect said pressure connections when said first indicator is in alarm position, thereby sounding said alarm, and means to seal said pressure connections when said first indicator is cocked.

5. Apparatus as described in claim 4 and additionally including means on said second indicator to seal said pressure connections when said second indicator is in alarm-acknowledged position.

6. A device as described in claim 5 and additionally comprising apparatus to reset said indicators to normal cocked position, including a pivoted arm positioned to engage said indicators, and means to move said arm.

7. A device as described in claim 6 and additionally including electrical means to actuate said latch and said reset apparatus, comprising a first solenoid; a plunger associated with said first solenoid and connected to said latch linkage; a second solenoid; a plunger associated with said second solenoid and connected to said pivoted arm, whereby energization of said first solenoid trips said latch to permit said second indicator to assume an alarm-acknowledged position, and energization of said second solenoid pivots said arm to reset both indicators.

8. In a fluid actuated alarm system for the protection of a plurality of supervised areas, the combination including a plurality of monitor devices, one for each area; a plurality of alarm units, one for each monitor; a pressure source; means connecting each monitor to the pressure source; a common audible alarm operatively associated with the alarm units; means connecting each alarm unit with said audible alarm; a housing for each alarm unit; a pressure header having individual take-offs into each housing; means connecting the pressure header to the pressure source; a bellows in each housing; a plurality of pressure lines, one connecting each bellows to one of said monitor devices, whereby each bellows is responsive to pressure changes caused in the line connected thereto by the respective monitor; an indicator in each housing for visually signalling an alarm, each indicator being normally retained in a cocked position within its respective housing by the respective bellows therein; a spring anchored to said indicator and operating thereon; a second indicator in each housing normally retained within said housing in a cocked position; a second spring anchored to said second indicator at one end and to said indicator at the other end; means normally retaining said second indicator in a cocked position; a valve in each housing for the actuation of said audible alarm, said second indicator having paired openings and said indicator having a channel which upon movement of said indicator to alarm position completes a passage between said openings, thereby permitting passage of fluid from said header to said audible alarm; a valve cut-off in said second indicator to stop said passage of fluid; and linkage to trip said retaining means, whereby after said indicator is released by said bellows and urged out of said housing to visually and audibly signal an alarm, said second indicator is released and urged out of said housing, cutting off said audible alarm, to visually signal a modified alarm.

9. Apparatus as described in claim 8 wherein each alarm unit has reset mechanism comprising a pivoted arm positioned to engage and move said indicators to normal position, and a lever to move said arm.

10. In a fluid actuated alarm unit having a pressure responsive bellows and a pair of alarm indicators, the combination of an alarm indicator and actuating assembly including a first normally biased spring anchored to the first indicator and operating thereon; a lever normally retaining said first indicator in a cocked position, said lever being pivotally attached to the bellows and tripable thereby to release the first indicator to announce a first condition, comprising an alarm; a second spring anchored at one end to the first indicator and at the other end to the second indicator, said second spring thereby being biasable by movement of said first indicator; a second lever having means to normally retain the second indicator in a cocked position, said second lever being operable to trip said means and permit said second indicator to announce a second condition, comprising an acknowledged alarm; and a third lever pivotally positioned adjacent said indicators to engage and move said indicators to their respective cocked positions to announce a third condition, comprising a normal condition.

11. Apparatus as described in claim 10 and additionally including a cross arm extending between and operatively connected to said second and third levers, whereby operation of said second lever to trip said means moves said cross arm to pivot said third lever and places said indicators in their normal cocked position.

12. In a fluid actuated alarm system, the combination

of an audible alarm; a plurality of field sensing devices, each of which generates a pressure change in response to an abnormal condition; means whereby each of said sensing devices actuates said audible alarm in response to said abnormal condition; a plurality of alarm visual signals; a first visual alarm indicator in each of said visual signals; means in each of said visual signals, engageable with the respective first visual alarm indicator therein, operatively connected to one of said sensing devices, and responsive to said pressure change to actuate said first visual indicator; a second visual indicator in each visual signal; means to simultaneously silence said audible alarm

and to actuate said second indicator; and means to return both indicators to normal position.

13. In an alarm unit, means responsive to a pressure change caused by an abnormal condition; an alarm indicator normally releasably held in cocked position by said means for actuation by a spring upon the happening of said pressure change; a second indicator normally releasably held in cocked position for actuation by a second spring; means to normally hold and to release said second indicator; and means to return both indicators to normal position.

No references cited.