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MINE ROOF WARNING DEVICE

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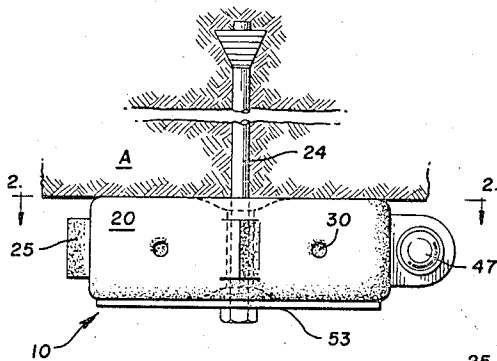


FIG. 1

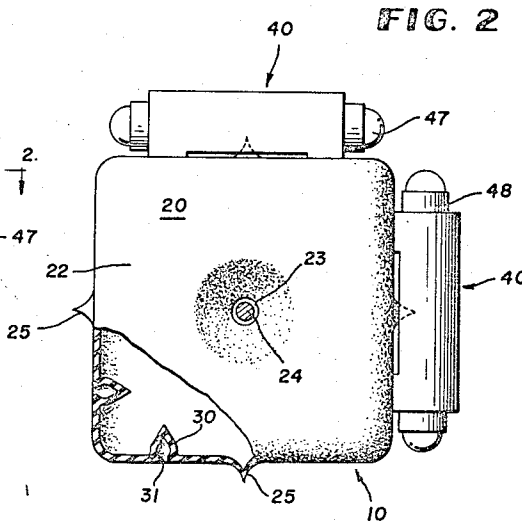


FIG. 2

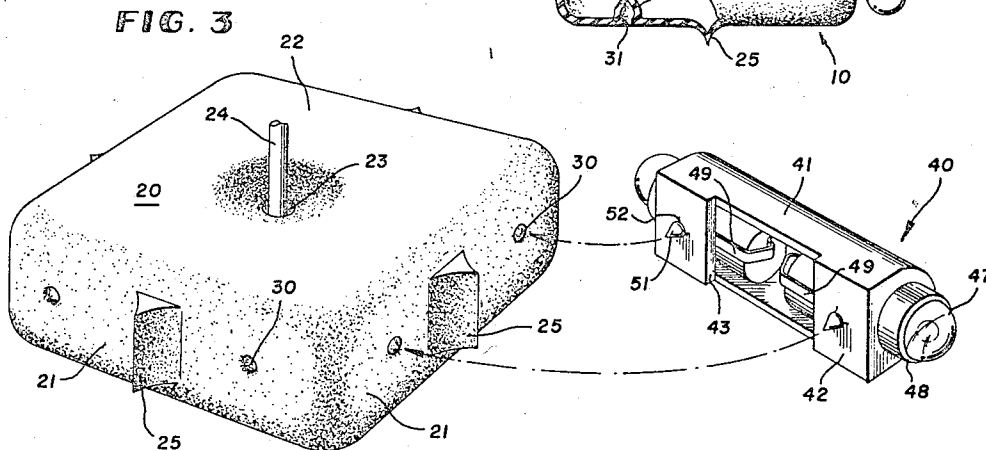


FIG. 3

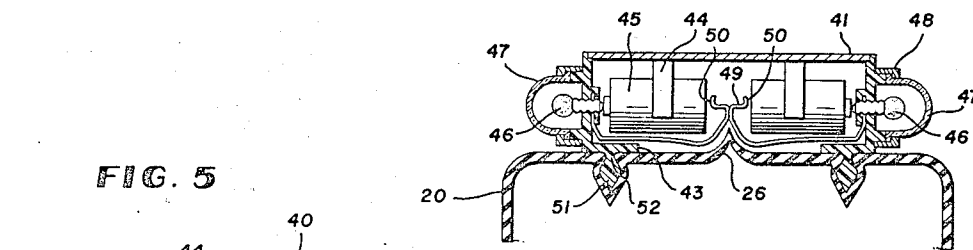


FIG. 4

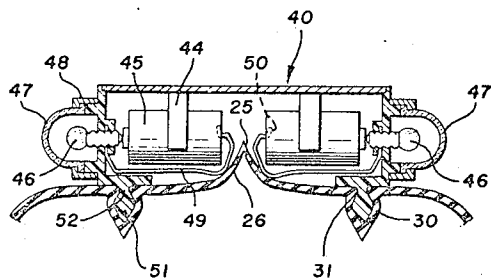


FIG. 5

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 200/52, 85, 153  
 262/34

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3,111,655

**MINE ROOF WARNING DEVICE**

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4 Claims. (Cl. 340-213)

This invention relates to new and useful improvements in mine safety devices and more particularly to a mine roof warning device for signalling the settling of the roof of a mine, tunnel, or other underground excavation.

In underground mining there is constant danger both to the mine workers and the expansive mining machinery of a shift in the strata above the mine passage or tunnel eventually resulting in a cave-in if precautionary measures are not taken. Minor shifts of the strata in the mine ceiling indicative of pending disaster are not always noticeable to the naked eye of even an experienced mining engineer.

Mine roof warning devices have previously been suggested to sense these shifts and activate some sort of signal means but these have not been too successful due to their great size and expense. All of the previous devices known extended from the mine floor to the ceiling and took up valuable floor space hampering the operation of mobile mining machinery.

It is an object of the present invention to provide a mine roof warning device which is attached to the ceiling of a mine shaft and is held firmly thereto without the need of a support therebeneath and which will initiate a warning signal on the slightest movement of the strata above the mine.

Another important object of this invention is to provide a small mine roof warning device which may be easily carried in the hand and put in position using common mine roof fittings in a minimum amount of time.

A still further object of the invention is to provide a relatively small, efficient warning device to detect shifts in the mine strata which takes up a minimum amount of roof space and which provides no obstruction at all on the floor of the mine thereby permitting mine machinery to be utilized directly below the device if desired.

Another object of this invention is to provide a mine roof warning signal which is multi-directional and will give adequate warning of strata shifts to miners working in any direction from the installed signal.

Other objects of the invention are to provide a mine roof warning device bearing the above objects in mind which is of simple construction, has a minimum number of parts, is inexpensive to manufacture, and is at all times efficient, reliable, and safe in operation.

For other objects and for a better understanding of the invention, reference may be had to the following detailed description taken in conjunction with the accompanying drawing in which:

FIGURE 1 is a side elevational view of an embodiment of the present invention showing the device in place in a mine;

FIGURE 2 is a horizontal sectional view of the warning device taken upon the plane of the section line 2-2 of FIGURE 1 with a corner of the casing broken away to show in detail the construction thereof;

FIGURE 3 is a perspective view of the warning device showing the manner in which a signal unit may be attached thereto;

FIGURE 4 is a detail sectional view of a signal unit attached to the casing and showing the circuit in its open or inoperative position;

FIGURE 5 is a sectional view similar to FIGURE 4 but showing the circuit in its closed or operative position.

Reference is now made more specifically to the drawing, wherein like numerals designate similar parts through-

out the several views and wherein the warning device constituting the subject matter of this invention is designated generally at 10.

The main body or casing of the device 20 is an air-tight casing filled with a liquid or gas but preferably air, and has at least three and preferably four flat sidewalls 21, an upper face 22 and a lower face (not shown). The casing may be made of rubber, plastic, or any other pliable resilient material. A cylindrical passageway 23 is formed centrally of the casing and extends from the lower to the upper face for reception of roof bolt assembly 24.

A wedge-shaped actuating projection 25 is formed integrally with the casing on each of the sidewalls 21 and preferably centrally on each sidewall. As may best be seen in FIGS. 4 and 5, the inner wall surface 26 of each of these projections is in communication with the interior of the casing 20 so that any increase in the pressure of the air or other gas within the casing will cause projections 25 to move outwardly. On the sidewalls on either side of each projection 25 a socket 30 is formed for reception of a complementary mounting stud on the signal unit 40. It will be noted upon close examination of FIGS. 2, 4 and 5 that socket 30 has a restricted opening 31 for yieldably engaging the neck of the mounting stud on the signal unit 40.

As best shown in FIGS. 3-5, the signal unit 40 of the present invention comprises a housing 41 which may be made of sheet metal, plastic, or any other suitable material, having a plane rear face 42 provided with an opening 43 therein for a purpose later to be described. Spring holders 44 are fixed within the housing and yieldably grip electrical potential sources such as the dry cell batteries 45. In the embodiment of the signal unit shown in the drawings small light bulbs 46 serve as the signal means and are secured in the ends of the housing in the usual and well known manner with their base ends each in contact with a terminal of battery 45. A plastic or glass dome 47 covers each bulb and is secured to the end of the housing by a retaining ring or collar 48.

It should be noted that a battery operated bell, buzzer, vibrator, or flasher could equally as well serve as the signal means if desired, such modification involving only substitution therefor for the bulbs shown in the drawing.

A leaf spring member 49 is provided for each battery which functions as a switch and has one end thereof connected to the threaded portion of the light bulb and extends generally parallel to and alongside the battery adjacent the opening 43 in the rear face 42. A fish-hook bend is made at the other end of each spring member and a lip 50 is formed at the tip end thereof adapted to make electrical contact with the base terminal of the battery. With this construction it will be noticed that the two spring members 49 join together to form a V adjacent opening 43 when in the open circuit position of FIGURE 4. Movement of the springs so that lips 50 contact the base terminals of the batteries will close each of the two circuits and ignite the filaments of the light bulbs 46.

In order to attach the signal unit to the casing 20, two studs 51 are formed on the rear face 42 of the housing 41, one stud on either side of the opening 43. Each of these studs has a reduced diameter neck 52. The configuration of these studs is such as to cooperate with the sockets 30 in resilient casing 20 so that the restricted opening 31 of the socket fits tightly around neck 52 of the stud. A slight pull outwardly on the signal unit will spread the opening 31 and allow stud 51 to be removed from socket 30.

In attaching the mine roof warning device to the ceiling of a mine, only conventional mine ceiling appliances need be used. A conventional roof bolt 24 of the expansion type and a steel plate 53 are the only fittings needed and

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are used throughout the mining industry for a variety of purposes. The casing supporting plate 53 has a central hole therein which is aligned with the passageway 23 in the casing 20 and the bolt assembly 24 passed therethrough after which it is anchored in the ceiling A in the conventional and well known manner as best seen in FIG. 1. The device could be used on any roof bolt in the mine roof bolt pattern or at a special bolt in the center of the mine entry. The number to be used would be at the discretion of the mine operator.

In use, one or more of the signal units 40 may be attached to each casing as the situation requires. It would, of course, only be necessary to use one signal unit, however, if necessary up to four such signal units could be employed with the casing shown in the drawing, each facing in a different direction.

Upon installing the mine roof warning device, the bolt assembly 24 would be tightened just enough to cause a build up of pressure in casing 20 sufficient to actuate the leaf spring switch 49 thereby closing the circuits and turning on the lights, bells or other signal means. The bolt would then be backed off until the circuits open shutting off the signal means, thereby readying the device for use. Any movement of the strata A will then cause pressure to be exerted on the casing 20 causing it to expand and actuate the signal units 40 by means of the actuating projections 25. If, after the signal or warning is emitted, the safety engineer decides that the strata shift is not of a dangerous nature, the bolt assemblies holding the devices may be backed off again slightly and the device would again be ready to operate.

While we have shown and described a preferred embodiment of the invention, it is to be understood that the drawings and detailed disclosure are to be construed in an illustrative rather than a limiting sense since various modifications and substitutions of equivalents may be made by those skilled in the art within the spirit and scope of the invention as defined in the appended claims.

What we claim as new and desire to protect by Letters Patent of the United States is:

1. Apparatus for giving warning of a shift in the strata above a mine roof or the like comprising in combination; a sealed flexible fluid filled casing, a wedge shaped actuator formed on said casing, support means tightly holding said casing against the strata of the mine roof, whereby any shift in the strata will place pressure on the casing causing expansion of said casing and outward movement

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of said actuator, signal emitting means attached to said casing, a source of electrical potential, circuit means connecting said source and said signal emitting means, normally open switch means in said circuit adapted to cooperate with said wedge shaped actuator, said actuator closing said switch means upon expansion of the casing to actuate said signal.

2. Apparatus for giving warning of a shift in the strata above a mine roof or the like comprising in combination; an airtight fluid-filled flexible casing having upper and lower parallel faces and at least three vertical sidewalls, a wedge-shaped actuating projection formed on each sidewall centrally thereof, socket means provided on each sidewall, adjustable support means tightly holding said casing against the strata of the mine roof, whereby any shift in said strata will place pressure on the casing causing expansion thereof and outward movement of said projections; a signal unit for each sidewall, each signal unit comprising an elongated housing having an opening in the side thereof, mounting stud means on either side of the opening adapted to be removably seated in the respective socket means on the casing sidewall so that the actuating projection of the casing extends into the housing, an electrically operated signal means and a battery cell mounted within said housing, normally open circuit means connecting said battery and said signal means, switch means in the circuit within the housing adjacent said opening and said projection and actuated by said projection to close said circuit.

3. Apparatus according to claim 2 wherein the electrically operated signal means comprises a light bulb.

4. Apparatus according to claim 2 wherein the switch means comprises a resilient leaf spring member normally biased away from a terminal of said battery and which is forced against said terminal by movement of said wedge-shaped actuating projection.

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