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(54) **UNDERGROUND MINE RESCUE POD**

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**ABSTRACT**

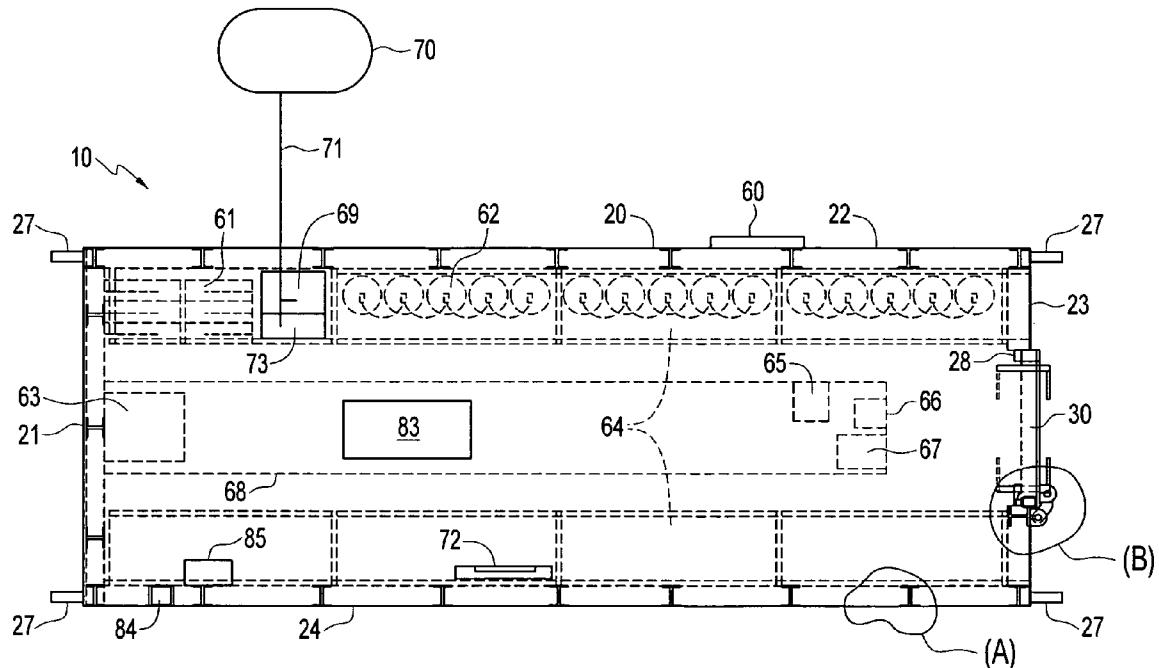
(21) Appl. No.: **11/711,800**

An rescue pod is disclosed having walls providing a substantially airtight interior, a transponder for communication, interior and exterior atmospheric monitoring systems. The disclosed rescue pod also has support equipment, systems for powering the equipment, and a connection for providing access to external communications and power sources. The rescue pod also comprises a positive air pressure system.

(22) Filed: **Feb. 28, 2007**

**Related U.S. Application Data**

(60) Provisional application No. 60/776,954, filed on Feb. 28, 2006.



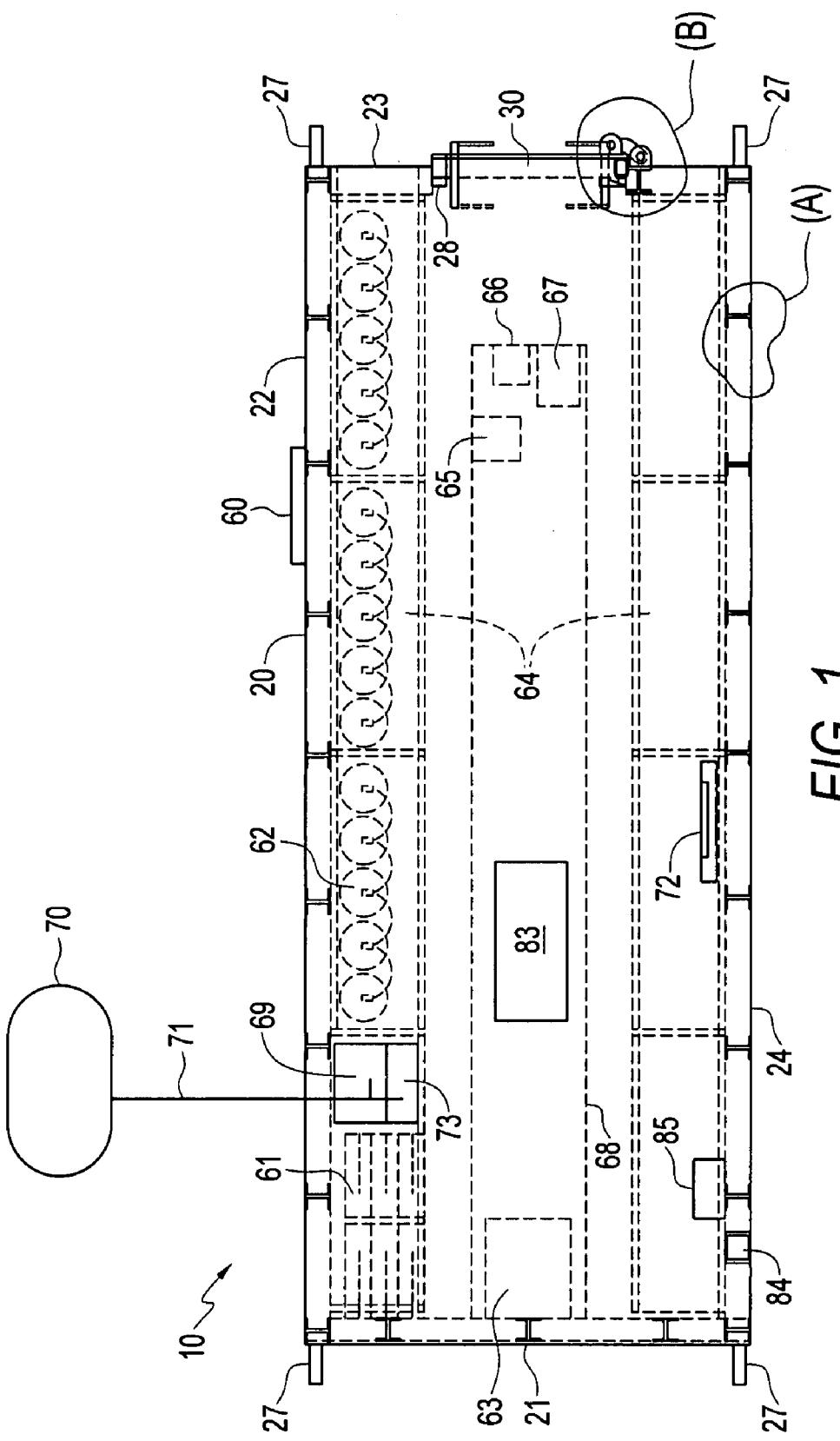


FIG. 1

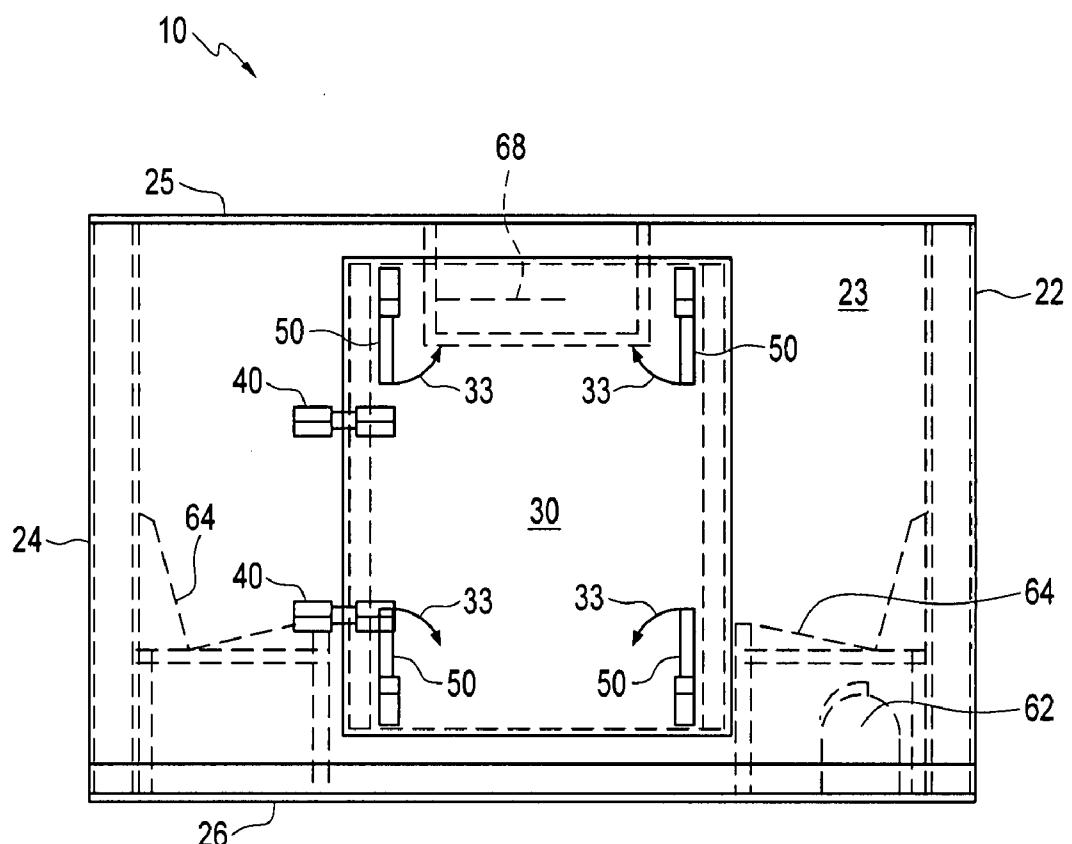


FIG. 2

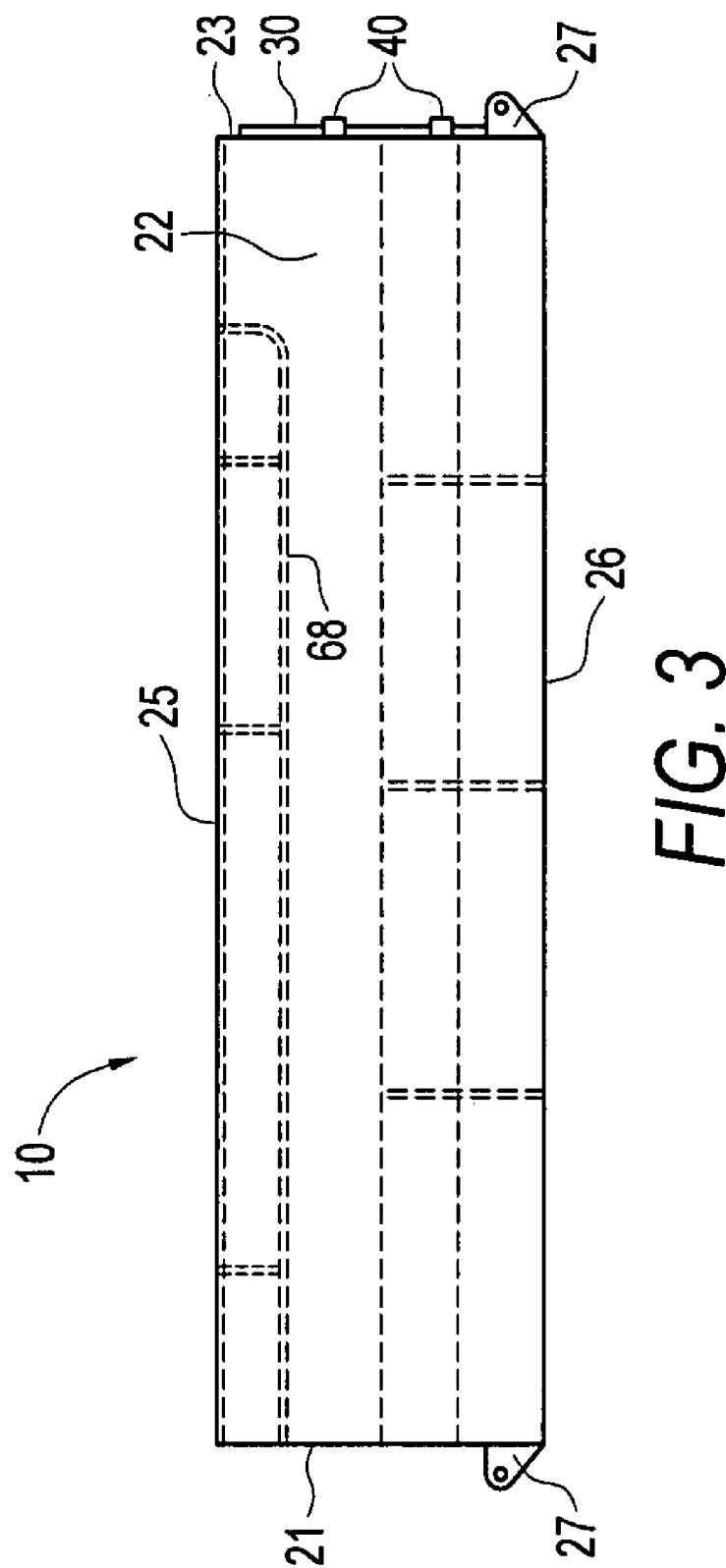
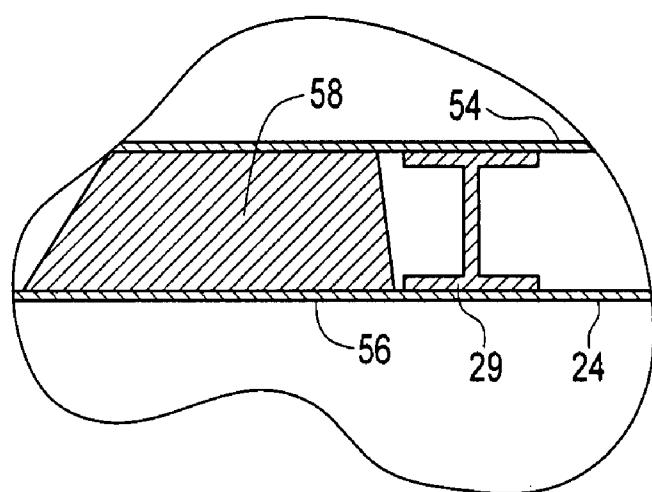
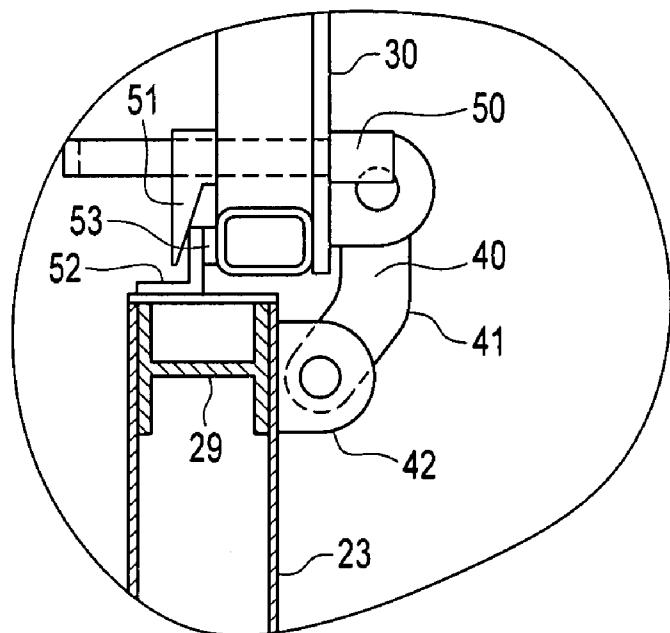


FIG. 3



DET (A)

FIG. 4



DET (B)

FIG. 5

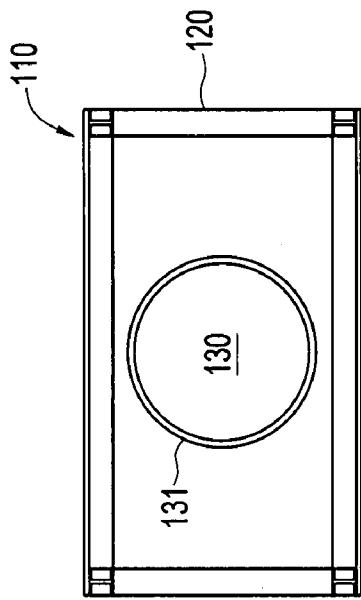
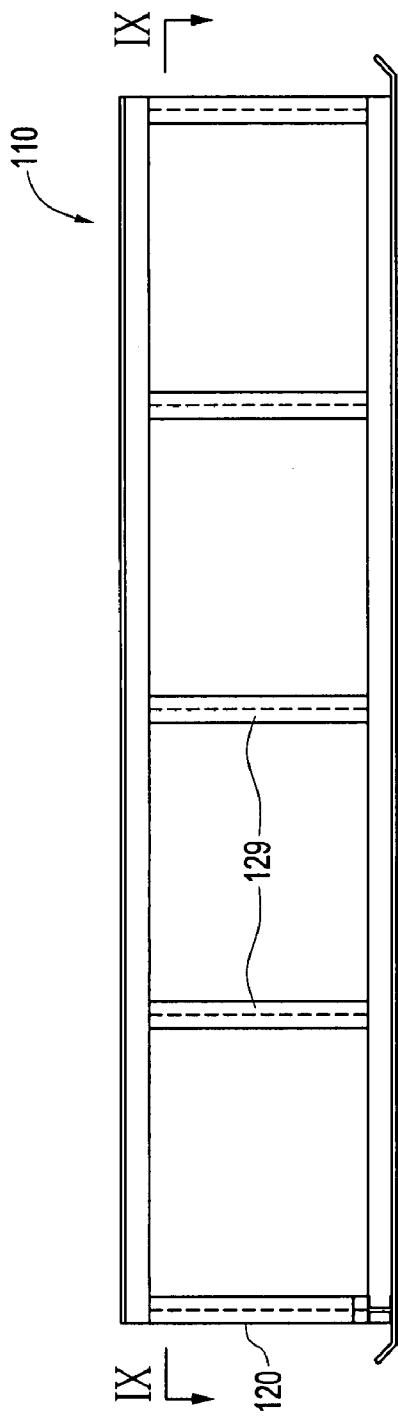
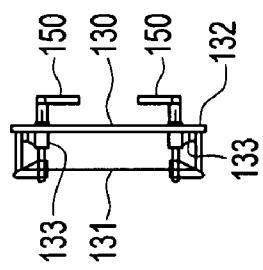


FIG. 8



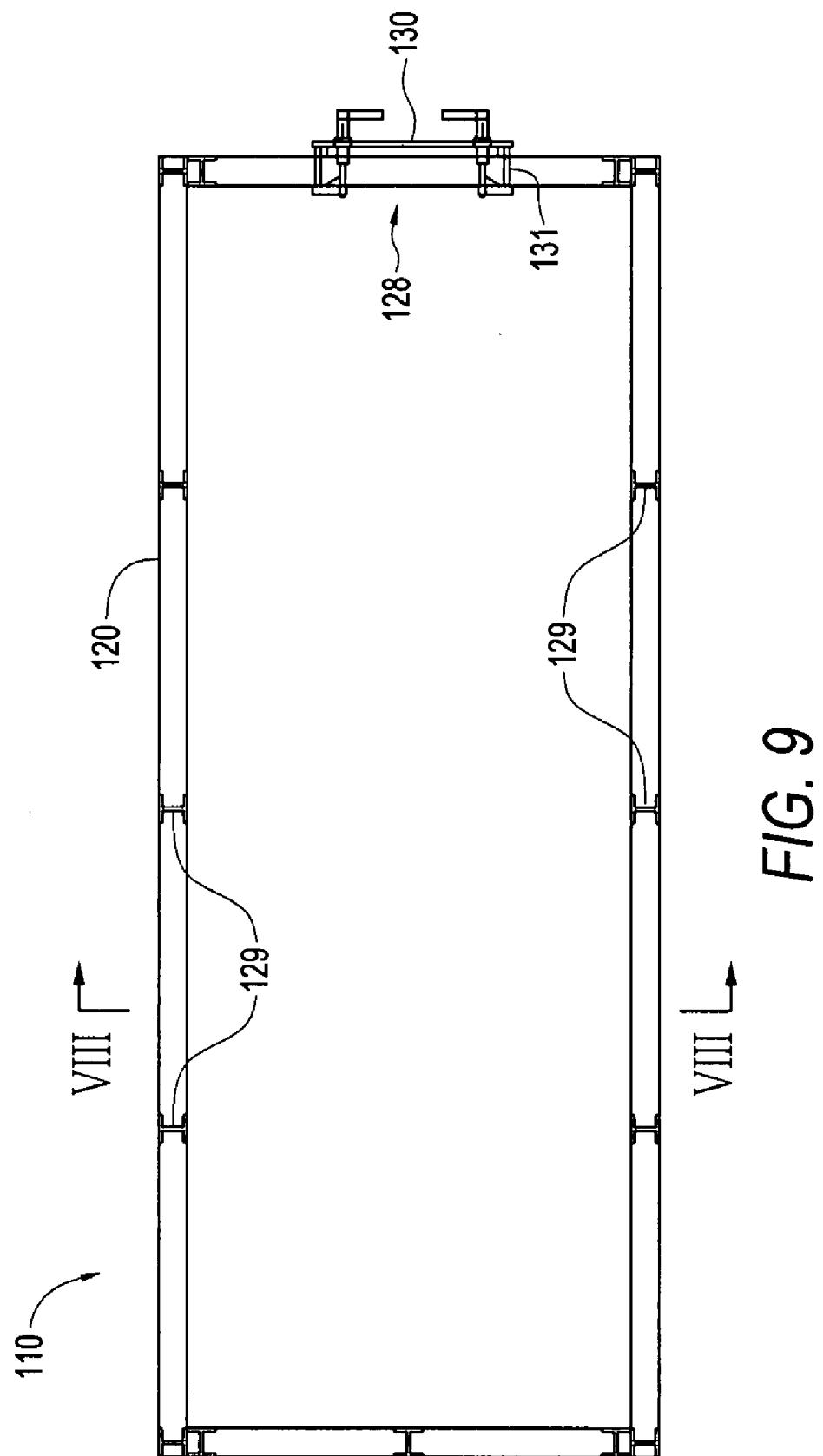


FIG. 9

## UNDERGROUND MINE RESCUE POD

[0001] This application claims benefit to U.S. Provisional Application 60/776,954, filed on Feb. 28, 2006, which is herein incorporated by reference.

### BACKGROUND

[0002] The invention generally relates to mine safety and more specifically to an emergency safety pod developed for the purpose of sustaining the lives of miners in case of disaster.

[0003] The mining industry is subject to distinct and inherent risk of extremely hazardous and often fatal catastrophes which may occur with little or no warning. Consequently, mining accidents account for thousands of deaths each year, particularly in developing countries. Such accidents vary widely in magnitude and origin, ranging from seismic activity, poisonous gas and ignition of flammable gas, to sudden flooding, dust explosions and collapsing shafts.

[0004] In the face of a sudden, life-threatening emergency, the unfortunate individuals closest to the danger may be unable to reach an exit of the mine or the chamber in time. Accordingly, some mines may include life-saving pods which may be installed within the mine and transported to remain within the vicinity of areas where miners plan to carry out their work. A known life protection enclosure for mines is shown in U.S. Pat. No. 4,815,363 ("the '363 patent"). The enclosure of the '363 patent, however, is lacking in several respects. For example, the '363 patent does not provide means for monitoring interior and exterior atmospheric conditions, does not include a system for maintaining a positive interior air pressure, nor does it include a equipment for aiding in locating potentially buried pods, such as a system employing a transponder or the like. A life-saving pod capable of installation and transportation within a mine, for providing protection against the aforementioned dangers and other hazards, and remedying the above listed deficiencies is desired.

### SUMMARY

[0005] The underground Mine Rescue Pod ("pod") is an emergency safety pod developed for the purpose of sustaining lives of miners in case of disaster. The pod's exterior rigid steel frame, which may for example be constructed to MSHA canopy standards, is designed to withstand a typical mine-roof fall and to protect miners against possible secondary explosions and noxious atmospheric elements. Use of fire-resistant insulation creates heat-resistant walls for the pod. The pod also has a substantially airtight interior.

[0006] The pod's interior provides an atmosphere-controlled environment, housing emergency equipment such as an oxygen generator, nourishment, and a transponder for communication between occupants of the pod and persons and/or equipment outside the pod, such as a rescue team. Additionally, the pod is equipped with both interior and exterior air quality sensors for monitoring levels of various gases inside and outside the shelter, and other air quality characteristics.

[0007] In one aspect, the invention provides a pod comprising a substantially airtight structure, including an oxygen

supply system, batteries, charging equipment and equipment for monitoring the interior atmosphere of the pod.

[0008] In another aspect, the invention provides a pod comprising a substantially airtight structure, including an oxygen supply system, batteries, charging equipment and equipment for monitoring the atmosphere in the vicinity of the exterior of the pod and relaying the information to the interior of the pod.

[0009] In another aspect, the invention provides a pod comprising a substantially airtight structure, including an oxygen supply system, batteries, charging equipment and equipment for maintaining a positive air pressure within the interior atmosphere of the pod. These and other features and advantages of the invention will be more clearly understood from the following detailed description and drawings of preferred embodiments of the present invention

### BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. 1 is a plan view of an underground mine rescue pod according to a preferred embodiment of the invention.

[0011] FIG. 2 is a front view of the pod of FIG. 1.

[0012] FIG. 3 is a side view of the pod of FIG. 1.

[0013] FIG. 4 is a view of detail A of FIG. 1.

[0014] FIG. 5 is a view of detail B of FIG. 1.

[0015] FIG. 6 is a cross-sectional elevation view of an underground mine rescue pod according to an alternate embodiment of the invention.

[0016] FIG. 7 is a cross-sectional view of a door of the pod of FIG. 6.

[0017] FIG. 8 is a view taken along section line VIII-VIII of FIG. 9.

[0018] FIG. 9 is a view taken along section line IX-IX of FIG. 6.

### DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0019] In the following detailed description, reference is made to the accompanying drawings which form a part hereof, and in which are shown by way of illustration preferred embodiments of the invention. These embodiments are described in sufficient detail to enable those skilled in the art to make and use them, and it is to be understood that structural, logical or procedural changes may be made.

[0020] Refer now to FIG. 1, there being shown an underground mine rescue pod, generally designated by reference numeral 10, according to a preferred embodiment of the invention. The pod 10 is generally rectangular in shape having walls 20, including sidewalls 22 and 24, a front wall 23, back wall 21, a top wall 25 (FIG. 2) and a bottom wall 26. The front wall 23 has an aperture 28 sealable by a door 30. The pod 10 contains supplies and equipment for life support for miners or other persons in emergency situations. The equipment includes a number of non-gas-emitting type batteries 61 for providing power to the pod 10. Suitable charging equipment 69 for charging the batteries 61 is also provided. Typically, the pod 10 will be placed at or near a substation 70 for each such unit in the mine, or where power is available. A connection 71 may be provided on the pod 10 for connecting the pod 10 through power and communications equipment 73 into available power and communication

lines at the substation 70. The charging equipment 69 is also connectable with the substation 70.

[0021] An oxygen supply system 62 may include tanks of oxygen or one or more oxygen generators. Suitable oxygen generators could include, for example, those provided by Chembio Shelter Inc. of Allentown, Pa. Alternatively, an oxygen candle and carbon monoxide (CO) curtain (not shown) may be used in the oxygen supply system 62. An oxygen candle is a canister that, when activated, emits oxygen as a result of a chemical reaction. A CO curtain absorbs CO and is typically flat and flexible, and may be rolled up for storage. Suitable example of oxygen candles and CO curtains are also provided by Chembio Shelter, Inc. [0022] Also within the pod 10 are a chemical commode 63, line communication equipment 67, which may be telephone equipment, and a location beacon 66, which may be, for example, a transponder. Moveable components may be placed in an interior overhead shelf 68 that may also hold food and water. In use, the location beacon 66 may emit a signal to aid searchers, rescuers or other miners in locating the pod 10.

[0023] Along the sides of the pod are bench seats 64. The oxygen supply system 62 and other equipment may be stored under the seats 64. The pod 10 may be made corresponding to the dimension of the mine shaft, in a preferred embodiment. In the illustrated embodiment, the pod 10 is about sixteen feet long, about fifty inches high and about seventy-seven inches wide. This size should be able to hold about fourteen people and support them for about ninety-six hours. Alternatively, the pod 10 may be sized to shelter sixteen people for approximately 600 hours. Other sizes could be used.

[0024] An exterior air quality display 65 provides information from an exterior air quality sensor 60 regarding the atmospheric and air quality conditions outside of the pod 10. An interior air quality sensor and display unit 72 monitors and provides information regarding the atmospheric conditions within the pod 10. As an additional safety measure, and in particular against any cracks or faults in the integrity of the pod 10, an air pressure system 83 may be provided, such as a valve 84 responsive to a pressure sensor 85 to release oxygen at a rate to maintain a positive air pressure within the pod 10. In use, the positive air pressure equipment maintains a slightly higher pressure inside the pod 10 as compared with air pressure outside the pod. As such, the air pressure system 83 minimizes the risk of noxious gases that may exist exterior of the pod from seeping into the interior of the pod 10, and further endangering the occupants.

[0025] Referring now to FIG. 2, the door 30 is shown in greater detail. In the illustrated embodiment, the door 30 has two hinges 40. Four lever locks 50 are provided, one at each corner of the door 30. In a preferred embodiment, the bottom wall 26 is lined with mild steel, which may be  $\frac{5}{8}$  inch mild steel, which functions as a sled when the pod 10 is moved. A pull eye 27 (FIG. 3) is provided at each bottom corner, for example, for moving the pod 10. FIG. 3 shows a side view of the pod 10. The top wall 25, side walls 22, front wall 23 and back wall 21 are made of one-inch thick mild steel plate in a preferred embodiment.

[0026] With reference to FIG. 4, the wall construction of detail A (FIG. 1) is shown. The walls in a preferred embodiment may include structural H-beams 29 having faces, and plates 54 and 56. In a preferred embodiment, all of the walls 21, 22, 23, and 25 of the pod 10 are of similar construction.

The space between the plates 54 and 56 is filled with a fire resistant insulation 58. The fire resistant insulation 58 may be blown into the space as foam and allowed to harden. In one embodiment, the H-beams 29 are four-inch H-beams that are rated 14 pounds per foot.

[0027] With reference to FIG. 5, detail B (FIG. 1) of a portion of the door 30 is described. Hinges 40 include arms 41 that extend to pivot in the eye 42 attached to the front wall 23, preferably proximate an H-beam 29. The locks 50 can be rotated to engage the angled catch 51 with the angle iron 52 to lock the door 30 to seal the aperture 28. A fire resistant door gasket 53 is compressed upon the engagement of the angle iron 52 by catch 51. The gasket 53 may be similar to gasket materials used in oven doors. In use, the locking arrangement of FIG. 5 should result in an air-tight attachment of the door 30 to the wall 23 of the pod 10.

[0028] Refer now to FIGS. 6 through 9, there being shown an underground mine rescue pod, generally designated by reference numeral 110, according to an alternate embodiment of the present invention. The pod 110 has wider spacing along its walls 120 between the H-beams 129, as compared with the pod 10. Also, the pod 110 has a circular door that is shown in its locked position in FIG. 7. The door 130 has a groove 132 that engages an edge of a ring 131 of the pod 110. The door 130 also has inner protrusions 133 that provide alignment with the ring 131. The door 130 may be hinged (not shown).

[0029] While the invention has been described in detail in connection with preferred embodiments known at the time, it should be readily understood that the invention is not limited to such disclosed embodiments. Rather, the invention can be modified to incorporate any number of variations, alterations, substitutions or equivalent arrangements not heretofore described, but which are commensurate with the spirit and scope of the invention.

What is claimed as new and desired to be protected by Letters Patent of the United States is:

1. A mine rescue pod for placement in underground mines and for providing protection to miners, comprising:
  - a substantially airtight structure including walls forming an enclosed interior and an exposed exterior;
  - an opening in at least one of said walls for providing a passage for miners from the exterior to the interior of the pod and vice versa, said opening being sealable by a door which maintains the substantially airtight structure;
  - an oxygen supply system for providing oxygen to the interior of the pod;
  - an air quality sensor for monitoring the interior atmosphere of the pod;
  - batteries contained within the interior of the pod for providing power to at least said air quality sensor;
  - charging equipment contained within the interior of the pod to charge said batteries; and
  - a connecting portion for connecting an external power source to said charging equipment, and for connecting communication lines interior of the pod to the exterior of the pod.
2. The rescue pod of claim 1, wherein the oxygen supply system comprises oxygen tanks.
3. The rescue pod of claim 1, wherein the oxygen supply system comprises oxygen candles or carbon monoxide curtains.

4. The rescue pod of claim 1, wherein the oxygen supply system comprises an oxygen generator.
5. The rescue pod of claim 1, wherein the walls comprise structural H-beams disposed between opposing steel plates.
6. The rescue pod of claim 5, further comprising a fire resistant insulation installed between the opposing steel plates.
7. The rescue pod of claim 1, further comprising air sensing equipment for monitoring atmosphere exterior to the pod and relaying information obtained from said monitoring to the interior of the pod.
8. The rescue pod of claim 1, further comprising communication equipment for connection to said communication lines, for communicating with the exterior of the pod.
9. The rescue pod of claim 1, further comprising a transponder contained within the interior of the pod for emitting a beacon signal to aid in locating the pod.
10. A mine rescue pod for placement in underground mines and for providing protection to miners, comprising:
  - a substantially airtight structure including walls forming an enclosed interior and an exposed exterior;
  - an opening in at least one of said walls for providing passage for miners from the exterior to the interior of the pod and vice versa, said opening being sealable by a door which maintains the substantially airtight structure;
  - an oxygen supply system for providing oxygen to the interior of the pod;
  - air sensing equipment for monitoring the atmosphere exterior of the pod and relaying information obtained from said monitoring to the interior of the pod;
  - batteries contained within the interior of the pod for supplying power to at least said air sensing equipment; and
  - charging equipment contained within the interior of the pod to charge said batteries.
11. The rescue pod of claim 10, wherein the oxygen supply system comprises oxygen tanks.
12. The rescue pod of claim 10, wherein the oxygen supply system comprises oxygen candles or carbon monoxide curtains.
13. The rescue pod of claim 10, wherein the oxygen supply system comprises an oxygen generator.
14. The rescue pod of claim 10, wherein the walls comprise structural H-beams disposed between opposing steel plates.
15. The rescue pod of claim 14, further comprising a fire resistant insulation installed in between the plates.
16. The rescue pod of claim 10, further comprising air sensing equipment for monitoring the interior atmosphere of the pod.
17. The rescue pod of claim 10, further comprising a transponder contained within the interior of the pod for emitting a beacon signal to aid in locating the pod.
18. A mine rescue pod for placement in underground mines and for providing protection to miners, comprising:
  - a substantially airtight structure including walls forming an enclosed interior side and an exposed exterior side;
  - an opening in at least one of said walls for providing passage for miners from the exterior to the interior side of the pod and vice versa, said opening being sealable by a door which maintains the substantially airtight structure;
  - an oxygen supply system for providing oxygen to the interior of the pod;
  - a positive pressure system for maintaining positive atmospheric pressure within the interior of the pod, wherein said positive air pressure is greater than atmospheric pressure outside the pod; and
  - a power supply contained within the interior of the pod for powering said positive pressure system.
19. The rescue pod of claim 19, wherein the oxygen supply system comprises oxygen tanks.
20. The rescue pod of claim 19, wherein the oxygen supply system comprises oxygen candles and carbon monoxide curtains.
21. The rescue pod of claim 19, wherein the oxygen supply system comprises an oxygen generator.
22. The rescue pod of claim 19, wherein the walls comprise structural H-beams disposed between opposing steel plates.
23. The rescue pod of claim 22, further comprising a fire resistant insulation installed in between the plates.
24. The rescue pod of claim 19, further comprising a transponder contained within the interior of the pod for emitting a beacon signal to aid in locating the pod.
25. The rescue pod of claim 19, further comprising charging equipment contained within the interior of the pod to charge said batteries.

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