

Comments on MSHA - Request for Information
Underground Mine Rescue Equipment and Technology; Proposed Rule
Reference: RIN 1219-AB44

Submitted by:
Dale K. Nash
nashdk@aol.com
(321)-432-4589

The following comments relate to a potential product that could save lives and property in the event of a mine fire. It is a rapidly deploying barricade – Patent Number 5,188,186 – “Barricade For Isolating Open Areas From Spreading Fire Or Smoke”.

Early in my career I worked in mining. In 1981-1982 I worked as a consulting engineer with Emery Mining Company. On December 19, 1984 the Wilberg Mine operated by Emery Mining Co. caught on fire and resulted in 27 deaths. It was from this disaster that I came up with the idea for rapidly deploying barricades that would be installed in mine opening throughout the mine and trigger when fire or an explosion is sensed. The recent disaster at the Sago mine has renewed my interest in how lives can be saved in mine fires and explosions. I believe this product still holds a lot of promise for saving human life and limiting property and resources in mine fires and explosions.

Barricading has long been recognized as a way to preserve air for miners trapped in a mine, and as a method of helping contain or put out fires in mines. The product I propose would take this old but proven method and utilize the technologies available today to make the barricades:

- Near instantaneous with air-bag gas generators and high expansion foam
- With sensors able to detect fires/CO long before humans, and detect explosions before the shockwave hits
- Able withstand ventilation airflows and blasts with strong materials like Kevlar
- With high expansion foams rapidly fill the barricade, make an air-tight seal of the barricade and perimeter, and solidify in 90 – 180 seconds
- Stand-alone with long-life batteries and trickle charge capacitors for initiation
- Provide a safe passageway through the barricade with Velcro
- With light weight materials the barricades can be quickly installed keep up with the expanding mine operations, or be easily deployed as needed in a mine rescue

This product could provide a fail-safe method, (like air bags in cars or hatches in ships), of saving lives and capital property in mine fires and explosions. With the barricades installed throughout the mine with enough density (especially in active working areas) in the event of a fire; miners would be provided both time and distance as the barricades deploy. The miners would have many hours if not days of good air to make an escape or wait until rescue. The barricades would continue to deploy around the fire containing it, beginning to extinguish it by lack of oxygen, and allowing mine rescue/fire fighting teams to approach the fire and put it out by conventional means (water or foam).

Specifically addressing the questions in the “Request For Information”:

A. Rapid Deploy Systems

1. This system would be in place and would deploy rapidly to protect miners
2. Explained above and in following patent and mine drawing
3. This system is not currently available, but the technology is. It could be developed and tested by a joint MSHA/Industry team.

B. Breathing Apparatus

1. This is not a breathing apparatus but the barricades could provide a safe haven for miners to reach within the time limits of their breathing apparatus.

C. Self-Contained Self-Rescuers (SCSR)

1. This is not a Self-Contained Self-Rescuer but the barricades could provide a safe haven for miners to reach within the time limits of their SCSR.

D. Rescue Chambers

1. Rescue chambers should be considered for coal mines but mining operations can cover many miles of underground opening. It still may be very difficult for miners to reach a rescue chamber in a fire or explosion. The barricades places throughout the mines can provide a virtual rescue chamber anywhere in the mine and provide both time and distance for miners to escape or be rescued.
2. Rescue chambers will have to be mobile or new ones built to keep up with the ever changing and expanding mine operations. The barricades would be mobile and expand with the mine, much like roof support and ventilation.
3. The Barricades could provide many hours if not days of breathable air for trapped miners, while containing the fire at the same time.
4. The barricades could seal off large portions of the mine.
5. The barricades could be placed every 200 – 500 ft throughout the working mine opening providing significant protection to miners. It would take a large density of rescue chambers to provide the same protection and any fire would still be propagating within the mine hampering escape or rescue attempts.

E. Communications

1. It may be feasible to tie the barricade sensors into a remote monitoring system that will indicate to a control center when barricades have fired.

F. Robotics

1. If the barricades are tied into a remote monitoring system the barricades could be deployed by a central control center in conjunctions fire fighting or rescue efforts.

G. Thermal Imagers and Infra-Red Imagers

1. The sensors from the barricades feed data into a remote monitoring system indicating CO levels, temperature levels, and overpressures experienced from explosions.

H. Developing New Mine Rescue Equipment

1. This product will probably only be developed by a joint MSHA/Industry effort. The economics of the product will be hard to justify unless MSHA/Government is part of the development process and helps fast track the approval process for use in coal mines. And industry will be reluctant to develop a product that may become null and void if MSHA regulations drive

the mining companies to multiple rescue chambers and great expanses of SCSRs being placed throughout the mines. A joint MSHA/Industry team could develop and test this product in short time frame to prove whether its a viable as “Fail-Safe” mine safety & rescue system or not.

I. Mine Rescue Teams

1. These barricades could be a very valuable asset for teams as they re-enter a mine. It would help the teams seal off hot spots and quickly re-establish ventilation as they proceed deeper into the mine.

J. Government Role

1. This barricade system is one of the technologies that MSHA/Government should promote for mine safety and rescues. It could be much more effective and less costly than many other systems under consideration.
2. This system would be just as effective in small remote mines as in large centrally located mines, because each barricade is a stand-alone self-contained unit.
3. A joint MSHA/Industry development team could establish the standard.
4. Training would be minimal on this product other than training for the proper installation, and routine inspections, (much like fire extinguishers).
5. The barricades should be part of the standard rescue materials at each mine. They should be excellent sealing and ventilation requirements during a rescue.
6. This product should be given serious consideration as a further step to be taken in improving mine rescue equipment and technology.

For the past 24 years my career has been in aerospace and I have not been able to get this product off the drawing board. With each mine fire and disaster, (most of which are in developing countries), I keep trying to think of a way to at least get prototypes of this product developed and tested.

Hopefully, with this submittal to your RFI, someone in government or industry will be interested enough to help get the product to a development and test stage. If it works like I believe it will it could do for mining what airbags have done for automobiles – provide the means to have a bad accident/fire and the occupants/miners walk away alive.

Below are several relevant pages from the patent covering the proposed barricade system.

Dale K. Nash
nashdk@aol.com
(321) 432-4589
Titusville, FL



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United States Patent [19]

[11] Patent Number: **5,188,186**

Nash

[45] Date of Patent: **Feb. 23, 1993**

[54] BARRICADE FOR ISOLATING OPEN AREAS FROM SPREADING FIRE OR SMOKE

[76] Inventor: **Dale K. Nash**, 970 W. 3925 North, Pleasant View, Utah 84414

[21] Appl. No.: **614,257**

[22] Filed: **Nov. 16, 1990**

[51] Int. Cl.⁵ **A62C 2/10; A62C 2/24; A62C 2/18**

[52] U.S. Cl. **169/48; 169/54; 169/56; 169/64; 160/40**

[58] Field of Search **169/48, 54, 56, 64; 98/50; 299/12; 160/40**

[56] References Cited

U.S. PATENT DOCUMENTS

3,645,337	2/1972	Livingston	
3,764,641	10/1973	Ash	
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3,831,318	8/1974	Richmond	
3,877,525	4/1975	Husson et al.	169/48
3,960,216	6/1976	Isobe	169/48
3,990,464	11/1976	Jenkins	
4,023,372	5/1977	Preslar et al.	
4,036,024	7/1977	Dreker et al.	
4,077,474	3/1978	Hattori	
4,102,138	7/1978	Dreker et al.	
4,565,222	1/1986	Lundman	
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FOREIGN PATENT DOCUMENTS

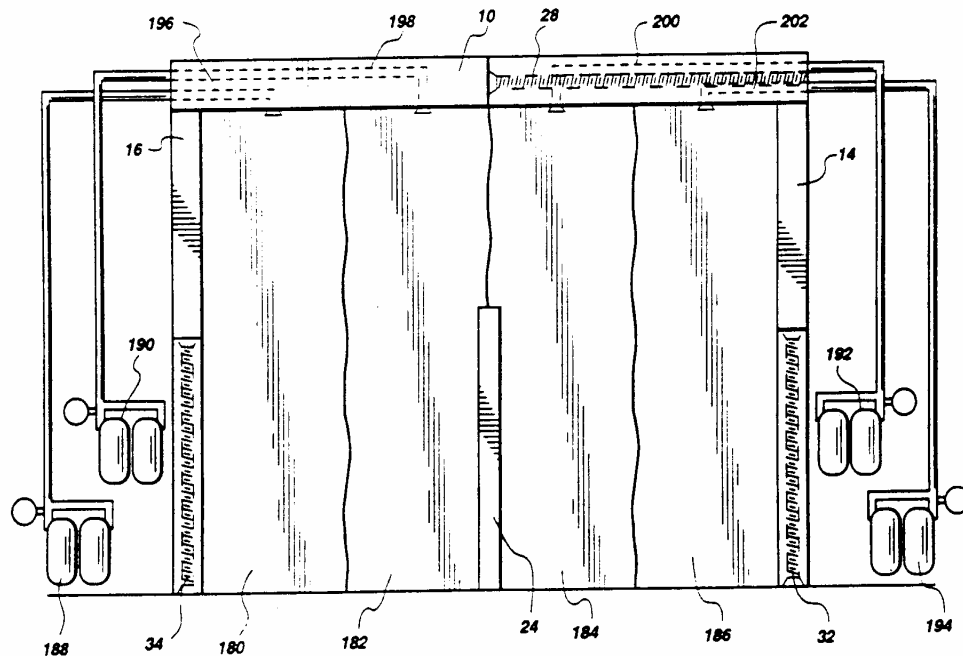
2650274	5/1978	Fed. Rep. of Germany	169/48
2524327	10/1983	France	169/64
605984	5/1978	U.S.S.R.	98/50
682656	8/1979	U.S.S.R.	98/50
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Primary Examiner—Charles A. Marmor
Assistant Examiner—James M. Kannofsky
Attorney, Agent, or Firm—Trask, Britt & Rossa

[57] ABSTRACT

An expandable barrier for isolating a mine entry or similar open area is disclosed wherein the expandable barrier includes an expandable hollow curtain or bag housed within a horizontal brace member connected to the roof of an entry, the expandable hollow curtain being connected to vertical brace members adjacent to the walls of the mine entry. The expandable bag fills with a material capable of expanding the bag, such as a foam-like material, and expansion of the bag causes the bag to descend downwardly from the first horizontal brace member. The bag fills with distensible material in response to a stimulus detected by a monitor associated with the containers which contain the distensible material. A closeable opening or flap is disposed in the bag to allow passage of people or equipment therethrough. The expandable barrier may also be oriented in a horizontal position for use in vertical shafts.

16 Claims, 8 Drawing Sheets



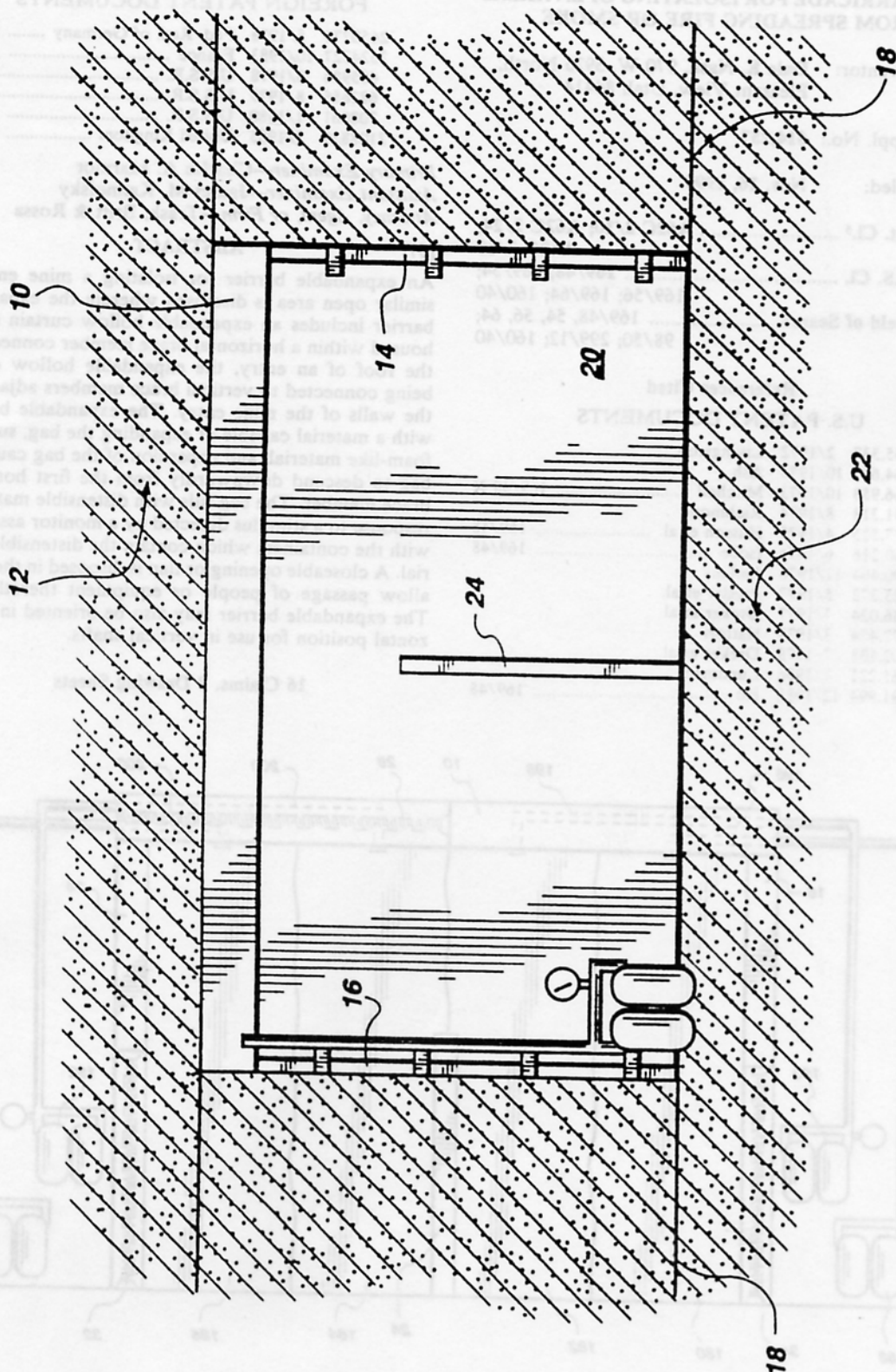


Fig. 1

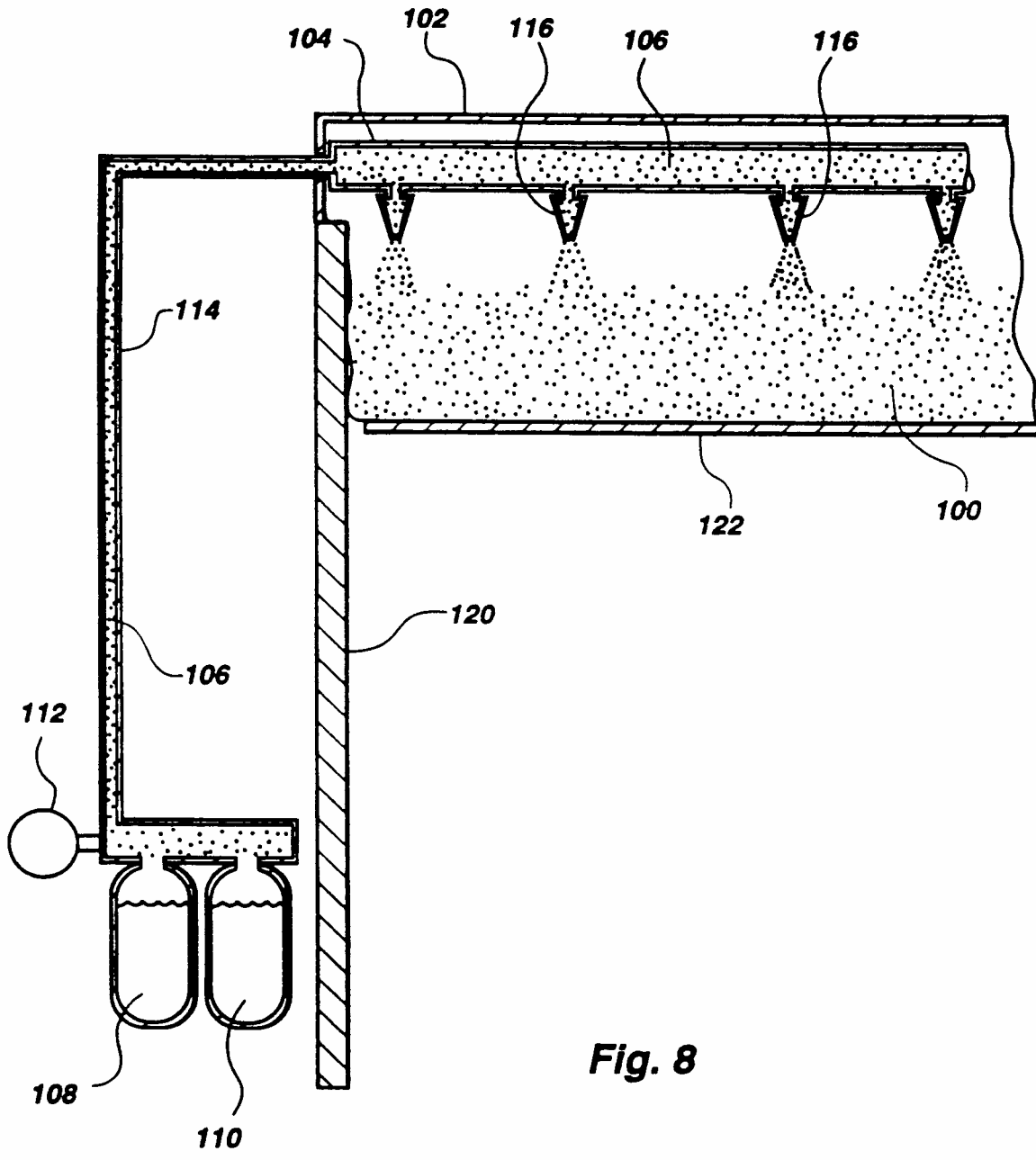


Fig. 8

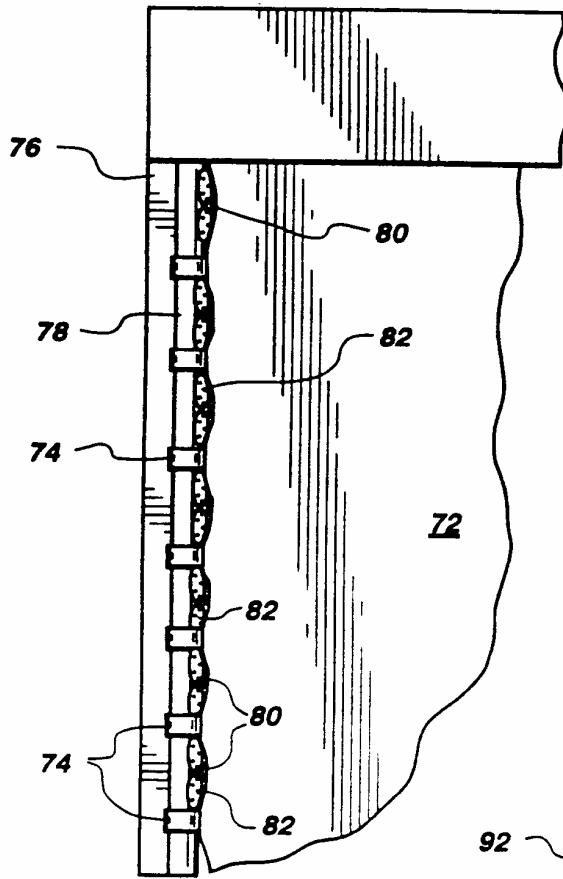


Fig. 6

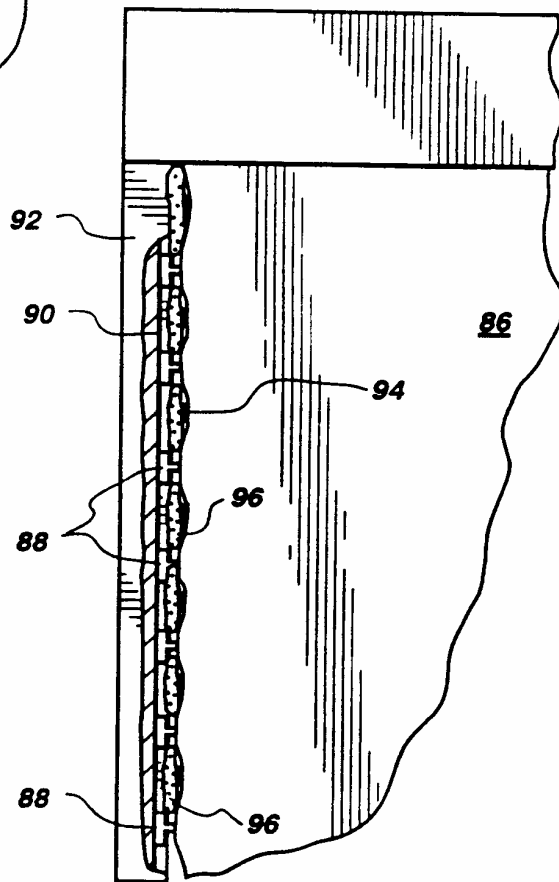


Fig. 7

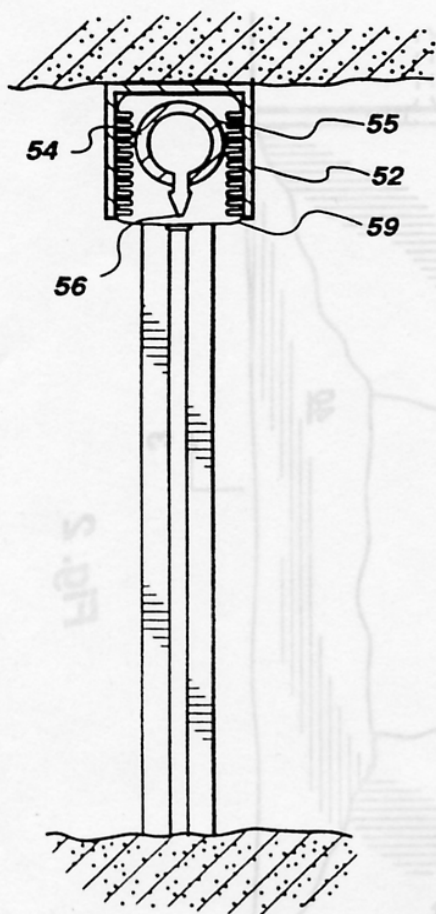


Fig. 3

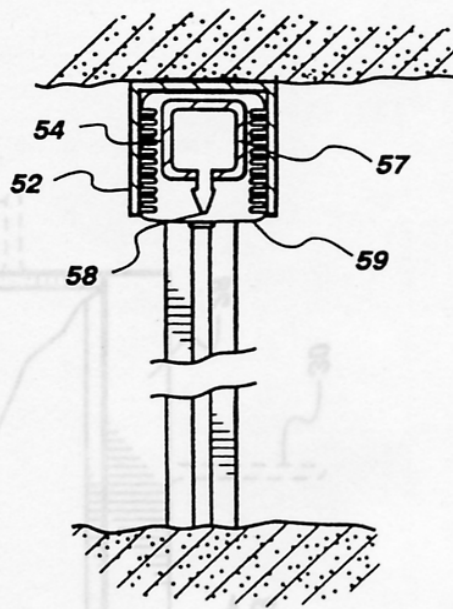


Fig. 4

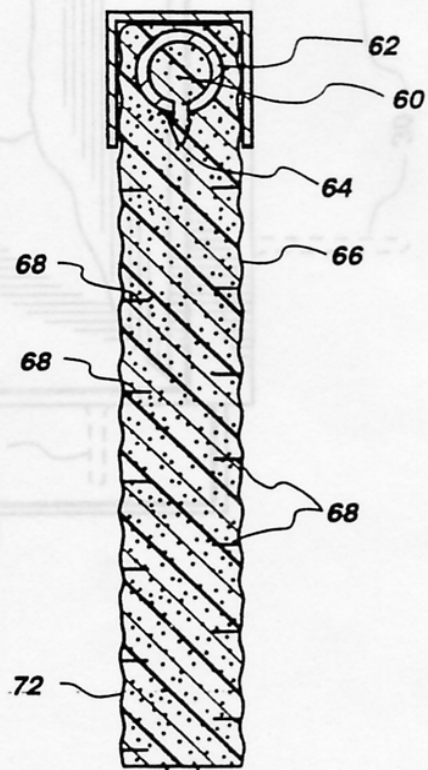


Fig. 5

BARRICADE FOR ISOLATING OPEN AREAS FROM SPREADING FIRE OR SMOKE

BACKGROUND OF THE INVENTION

1. Field of Invention

This invention relates to the obstruction or barricading of confined open areas, such as underground mine entries, tunnels, subways and the like, to isolate fire or smoke generated in one location from spreading to other areas. More particularly, this invention relates to expandable barricades for obstructing an entry opening.

2. State of the Art

Every year hundreds of lives are lost or endangered in mine disasters because of fires or explosions which cannot be contained to a specific area. Additionally, fires in mines, if not contained to one area, can damage interconnected mine entries and make access to the mine difficult or impossible. Also, the spread of uncontrolled fires in coal mines, for example, consumes large quantities of valuable coal, and destroys large amounts of valuable equipment and infrastructure.

A number of barriers have been designed to block off mine entries or other types of passageways after an explosion or fire has occurred. For example, U.S. Pat. No. 4,077,474 to Hattori discloses a curtain of fire-resistant fabric releasable from a frame above an entry. U.S. Pat. No. 3,831,318 to Richmond discloses a series of inflatable bags which, when inflated with air, converge together to block the opening or passageway. Similarly, U.S. Pat. Nos. 4,102,138 and 4,036,024 to Dreker disclose an inflatable bag, initially filled with air, which is later filled with a material of a type which permanently blocks the mine passageway. U.S. Pat. No. 3,645,337 to Livingston discloses an overhead chamber through which a gel is excreted to form a curtain of synthetic material which dries into a solid blockade. And U.S. Pat. No. 4,023,372 to Preslar discloses a partially inflatable wall of fabric which allows passage therethrough.

SUMMARY OF THE INVENTION

The present invention encompasses an expandable barricade for blocking passageways, especially underground passageways. The invention includes a horizontal brace member positioned along the roof of a mine or similar passageway, and two vertical brace members which are attached to the walls of the mine passageway and which are connected to either end of the horizontal brace to form an opening therethrough. The vertical brace members and the horizontal brace member form a frame of the invention. The vertical and horizontal brace members may be anchored to the mine walls and roof, respectively, by, for example, bolt means. Alternatively, the vertical brace members may be bolted to the walls of the mine while the horizontal brace is supported by the vertical brace members. In a preferred embodiment, the vertical brace members are expandable in a longitudinal direction, and may be braced with sufficient force against the roof and floor to support the horizontal member without the aid of any attachment means to the walls and roof of the mine.

An expandable means in the form of a double-walled curtain is maintained proximate the frame formed by the horizontal and vertical brace members. The double-walled curtain is maintained proximate the frame prior to operation of the barrier system. The curtain generally comprises a front panel and a back panel joined together and sealed about the edges to form a hollow screen of

material. That is, the double-walled curtain is generally hollow, such as a bag, and is capable of expanding when filled with a suitable fluid or solid material. The double-walled curtain generally forms a barrier having a width equal to the opening between the two vertical brace members and a length equal to the distance between the horizontal brace member and the floor of the mine entry. The depth of the curtain, as measured between the two panels, may be from about two to about eight inches.

In a preferred embodiment, the double-walled curtain (also referred to herein as a bag) generally has an upper edge connected to the horizontal brace member, sides which are attachable to the vertical brace members, and a lower edge which contacts the floor when the curtain is completely lowered to the floor. The curtain may also have a plurality of internal or external structural members or baffles which help to stabilize the form of the curtain while filling or expanding. When the curtain is activated it moves downwardly and when totally expanded, it forms a barrier which completely obstructs the opening formed between the brace members and the floor. The curtain, prior to filling with expansible material, is maintained adjacent to the first horizontal brace member in a compact and folded manner. The curtain remains stored adjacent to the first horizontal brace member until signalled to begin filling and/or descending from the roof of the mine entry.

In an alternative embodiment, the double-walled curtain may be maintained proximate at least one of the vertical brace members prior to being expanded. The bag of this embodiment has a front panel and a back panel joined together to form sides about the periphery. An upper side of the curtain is attached to the horizontal brace member, and a lower side of the curtain extends along the floor of the mine entry when the curtain is deployed. When activated, the double-walled curtain of this embodiment moves transversely across the passageway to form a barricade which completely blocks the passageway.

Material for filling the double-walled curtain is maintained in containment means which are in communication with the hollow interior of the curtain. In response to proper stimuli, such as an increase in toxic gases or an explosion, the barrier begins to fill with the expansible material. The expansible material may be any suitable fluid or solid material, including liquid materials and gelatinous or foam-like materials. In a preferred embodiment, the material used for expanding the curtain is a foam material which exists as non-reacted precursor chemicals maintained in separate containers. In response to a proper stimulus, the precursor chemicals admix together to form a material which expands greatly to fill the curtain.

In a preferred embodiment, the curtain is released from within the housing or frame formed by the horizontal and vertical members in reaction to a stimulus. For example, a small explosive charge or compressed gas discharge generated by means associated with the invention may cause the curtain to be released from the frame. Alternatively, mechanical means may cause latching means holding the curtain in place during storage to disengage thereby allowing the curtain to be deployed. Alternatively, the curtain may be released manually.

The action of the double-walled curtain being filled with material typically facilitates deployment of the