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(71) Applicant(s)
Barclay Mowlem Construction Limited

(72) Inventor(s)
Barry John Sturgeon

(74) Agent/Attorney
CULLEN and CO,GPO Box 1074,BRISBANE QLD 4001

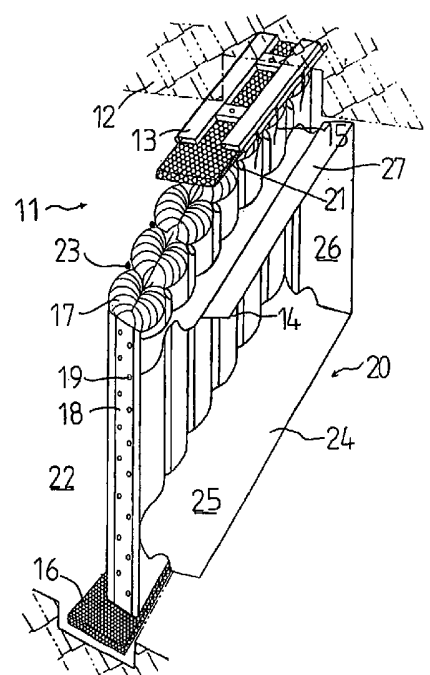
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(21) International Application Number: PCT/AU98/00262 (22) International Filing Date: 14 April 1998 (14.04.98) (30) Priority Data: <table border="0"><tr><td>17883/97</td><td>15 April 1997 (15.04.97)</td><td>AU</td></tr><tr><td>PO 8350</td><td>31 July 1997 (31.07.97)</td><td>AU</td></tr><tr><td>PO 8415</td><td>5 August 1997 (05.08.97)</td><td>AU</td></tr><tr><td>PP 2191</td><td>6 March 1998 (06.03.98)</td><td>AU</td></tr></table> (71) Applicant (for all designated States except US): BARCLAY MOWLEM CONSTRUCTION LIMITED [AU/AU]; 973 Fairfield Road, Moorooka, QLD 4105 (AU). (72) Inventor; and (75) Inventor/Applicant (for US only): STURGEON, Barry, John [AU/AU]; 83/48 Lemke Road, Taigum, QLD 4018 (AU). (74) Agent: CULLEN & CO.; Level 12, 240 Queen Street, Brisbane, QLD 4000 (AU).		17883/97	15 April 1997 (15.04.97)	AU	PO 8350	31 July 1997 (31.07.97)	AU	PO 8415	5 August 1997 (05.08.97)	AU	PP 2191	6 March 1998 (06.03.98)	AU	(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, GW, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>With amended claims.</i>
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(54) Title: DEVICE FOR SEALING AN OPENING (57) Abstract <p>A device (11) for sealing an opening in a mine, the device including at least two vertically aligned subchambers (17) having a substantially circular cross section, each subchamber being at least partially able to be filled with a filler.</p> 														

TITLE

DEVICE FOR SEALING AN OPENING

FIELD OF THE INVENTION

The present invention relates to a device for
5 use in sealing an opening in a mine against the flow of
gas. The present invention also relates to an explosion
resistant device for use in sealing an opening.

The present invention will be described with
particular reference to a device for use in coal mines.
10 However, it will be appreciated that the device of the
present invention may find applications in other than
coal mines and no limitation is intended thereby.

A device of the present invention may be used
to seal any suitable opening. The device may be used for
15 example to seal off flooded portions of a mine or for use
as a bulkhead in metalliferous mines. Bulkheads are used,
inter alia, to seal off sections of a mine which have
been refilled with a slurry of waste material.

BACKGROUND OF THE INVENTION

20 Underground mines normally use ventilation
systems to deliver fresh air to workers within the mine.
In order to maximise operation of the ventilation system,
areas of the mine which are not being used are generally
sealed off from the worked areas. The non-worked areas
25 of the mine are typically sealed by erecting brick and
concrete walls. However, the walls of underground mine
tunnels can constantly undergo movement. This movement
subjects the brick walls to stress and cracking. When
this occurs there is a leakage of gases. Further, in
30 coal mines, coal is present in the tunnel walls. When
coal is subjected to pressure it tends to fret and turn
into a powder. Fretting often occurs where a concrete
wall abuts a tunnel wall.

Still further, the surfaces of mine tunnels are
35 irregular and it is difficult to provide an air tight
seal between a brick wall and a tunnel wall. Typically a
sealant or a grout is applied at the edges of the wall.

Another purpose of ventilation systems in coal

mines is to control the flow and concentration of methane within the mine. Methane is released during working of coal mines. Methane is highly explosive and particularly so when combined with certain concentrations of air. For safety reasons it is very important to constantly monitor and control methane levels.

Occasionally methane levels in certain parts of a mine reach dangerous levels. When this occurs it is desirable to be able to seal off the dangerous part of the mine as quickly as possible. Quick installation of a seal can also assist in controlling fires within a mine.

The concrete walls as described above cannot be erected quickly and thus are unsuitable for quickly sealing dangerous parts of a mine. Inflatable seals having rubber bladders which can be inflated relatively quickly are known. These seals are inflated until they fill a tunnel. However, tunnel walls of a mine are uneven and in practice the inflated bags do not provide a satisfactory gas seal. The seal obtained between the bladder and the tunnel wall may be improved by increasing the air pressure within the bladder. However the maximum pressure which can be tolerated by these known types of bladders is insufficient to provide a good seal. Therefore when installing this type of seal, it is necessary to manually fill the gaps between the tunnel walls and the bladder using grout or other settable fillers. Another disadvantage of these types of bladders is that they must be manually inflated and installed. This requires workers to be present during installation which may be highly dangerous. This is of course undesirable.

Another method of quickly erecting a seal in a mine is to install metal doors which automatically close in response to dangerous gas levels. However, when the metal doors are in the closed position, at least part of the door and/or operating mechanism extends into the tunnel. A common problem occurs when the walls or mechanism are damaged as vehicles and equipment pass by.

Damaged doors do not provide an adequate seal and in some cases may not completely close. Further, these doors are relatively expensive and constant maintenance is required.

5 Another important feature of mine ventilation systems is that fresh air entering the mine is not contaminated by exhaust air. Mines comprise a network of intersecting tunnels and tunnels carrying fresh air may intersect tunnels carrying exhaust air. Structures which
10 are known as overcasts are constructed at these intersections. A typical overcast has a pair of walls. The walls support a top deck which extends across the intersection. Exhaust air passes over the top deck and fresh air passes beneath it.

15 Overcasts are typically constructed by erecting a wire frame which is suspended from the roof by cables. The frame is then sprayed with concrete. There are a number of disadvantages with overcasts constructed in this manner. These disadvantages includes those
20 mentioned above such as the difficulty in providing an air tight seal between the overcast walls and the tunnel walls. This enables exhaust air to contaminate fresh air. Other difficulties are caused by mine tunnels undergoing constant movement which introduces stresses
25 and cracks in the concrete and fretting of coal in the tunnel walls. Further, in the event of a mine explosion, the overcast can collapse and block the intersection. Such a blockage may prevent the exit of workers and equipment from the mine.

30 It is therefore an object of the present invention to provide a device which may at least partially overcome the above disadvantages or to provide the public with a useful or commercial choice.

SUMMARY OF THE INVENTION

35 According to a first broad form of the invention there is provided a device for sealing an opening, the device having at least two subchambers, each subchamber being adapted to be at least partially filled

with a filler.

The device may be of any suitable size or proportions depending upon the opening and/or terrain in which the device is to be installed. Preferably the
5 upper and lower portions of the device which in use abut the ceiling and floor of the opening are loosely constructed such that they adopt a concave configuration when the device is filled. This improves the seal
10 between the device and the floor and ceiling of the opening. Preferably the device is constructed from a non-static vinyl or polyester material.

The filler may be any suitable filler including gaseous fillers for inflation, non-flammable liquids such as water, solid fillers such as stone dust or settable
15 fillers such as grout or concrete. A preferred gaseous filler is air, although other gases including nitrogen or carbon dioxide may be used.

The device includes at least two subchambers. Preferably the subchambers are separated by at least one
20 internal member. The at least one member typically extends laterally between the front and rear walls of the device. Preferably the subchambers are substantially the same size. Preferably, the subchambers are fluidly connected such that the filler can pass between chambers
25 such that only a single filler inlet may be required. The internal member may be in the form of a dividing wall containing one or more apertures so as to allow the flow of filler therethrough. Alternatively the internal member comprises a plurality of spaced horizontally
30 aligned ribs or straps. Preferably the ribs contain apertures.

In an especially preferred embodiment, the internal member(s) have a length which is less than the distance between the front and rear walls. Thus when the
35 members are attached to the walls, the walls are drawn towards each other at that point. Preferably the members are equally spaced to provide vertically aligned chambers of about the same dimensions and which have a

substantially circular cross section. In this embodiment the front and rear walls adopt a scalloped configuration when the device is inflated.

In one embodiment of the invention, the device
5 is adapted for inflation with a gaseous filler. Inflation may be activated automatically and/or remotely in response to a safety hazard such as rising methane levels. Preferably, the device is suspended from the ceiling of the mine tunnel in the uninflated form. The
10 device may be folded and maintained in the folded position by suitable means such as straps or webbing. Typically the straps or webbing are released during inflation. Preferably the device is adapted such that the release can be remotely activated. The device may be
15 suspended from the ceiling by known means. Preferably the device is suspended from a spreader bar. In the event of an emergency, the holding straps are released and the device is inflated so as to quickly seal the tunnel against the flow of gas. Preferably a lower
20 portion of the device is weighted such that the device drops into the desired position when the straps are released.

The inflated device when installed in the opening of a tunnel can provide a suitable seal against
25 the flow of gas in response to an emergency situation. However, the inflated device is not explosion resistant. In an especially preferred form of the present invention the device is further adapted such that after inflation, the gas can be replaced with a settable filler. In this
30 way, the device may be converted to an explosion resistant seal in a relatively quick and efficient manner.

The settable filler may be a plastics material including a urea formaldehyde condensation resin or a
35 grout or cement material. Preferably the filler is a cement material which has been reinforced with a fibrous material for additional strength. When the filler has set the device is substantially explosion resistant.

The explosion resistant device preferably includes internal members such as straps or walls having apertures therein to separate the subchambers. This arrangement has been described above. It is also
5 preferable that the straps or walls are dimensioned so that the front and rear walls of the device adopt a scalloped configuration. This has also been described above. The scalloped walls may facilitate dispersion or deflection of shock waves generated by an explosion.

10 The explosion resistant device need not be adapted to be remotely inflated from a folded form as described above. The uninflated device may be installed in an opening without being folded. In this form of the invention, the device may be used as an explosion
15 resistant seal, in a wall of an overcast or any other underground structure in which explosion resistance is desired. An example of such a structure is known as a safety chamber. A safety chamber is an explosion resistant structure in which workers may shelter during
20 an emergency.

Typically the device is suspended from the ceiling of the opening. Preferably the device is suspended from a spreader bar by a number of chains or wire rope. The chains or rope may extend along one side
25 of the device and the other end may be fixed to the tunnel floor beneath the device. Alternatively the wire or rope may encircle the device. The wire or rope provides added support for the device during inflation and during filling with the filler. Preferably the
30 chains are located at a position corresponding to where the internal members are attached to the walls. Preferably the device further includes vinyl tubes along at least one side. The tubes may be linear or U shaped. The tubes are adapted to be filled with concrete which is
35 allowed to cure before filling the chambers with filler. The concrete filled tubes thus form concrete support pillars for the device.

It is not necessary that the device be inflated

prior to filling with a settable filler. The device may be filled directly with the settable filler. In this case the two or more subchambers may be open topped vertical tubes. The tubes may be formed separately and
5 joined together. In this way the width of the device can be modified as desired. Alternatively the device may have a series of vertical seams which join opposing walls to produce a series of verticle tubes. Preferably the device includes wire ropes or chain which pass through
10 the centre of each tube. The upper end of the wire rope or chain may be attached to the roof of the opening or a spreader bar. The lower end of the wire rope or chain may be bolted to the floor. The device may be installed by suspending the device from a spreader bar and affixing
15 the wire rope or chain to the floor. Each tube is then filled with a settable filler through the top opening. When the filler has cured, the device includes a series of concrete columns, each having a wire or chain reinforcement passing therethrough.

20 In the preferred embodiment in which the device includes a series of vertically aligned subchambers, the device may further include a steel bar or rod extending through about the centre of the subchamber. The ends of the rods extend above and below the device. Holes are
25 drilled in the floor and ceiling of the tunnel to receive the ends of the rods. The rod ends are loosely received by the recesses so as to accommodate tunnel movement. The presence of the rods provides additional reinforcement to the device.

30 In a further preferred form of the explosion resistant device, the device further includes a sealing member which sealingly engages the periphery of the opening. The sealing member is able to at least partially adapt to the movement of the tunnel walls so as
35 to retain a gas seal during such movement. The sealing member may also reduce the amount of stress borne by the filler during such ground movement.

The sealing member may be in the form of a

resilient material such as a foam or rubber.

Alternatively or in addition to, the sealing member may also be in the form of a chamber or chambers at least partially filled with a non-flammable fluid. The
5 sealing member may have any number of chambers depending on the intended use of the device.

The chamber or chambers of the sealing member can hold any non-flammable fluid which will enable the sealing member to sealingly engage the periphery of the
10 opening. Water is a particularly preferred fluid. Typically the chambers are provided with inlets for filling the chamber. This allows the chambers to be filled on site. It will be appreciated that in some cases it may not be necessary to completely fill each
15 chamber and for all chambers to be filled. Preferably the chamber or chambers are located such that in use the entire periphery of the opening is in contact with a fluid filled portion of a chamber.

The device may be installed by filling with a
20 gas or settable filler until the device fills the opening and the sealing member engages the periphery of the opening.

In a preferred device of the present invention, the device further includes means for retaining the
25 device in position relative to the opening during filling and in particular during inflation.

According to a further broad form of the invention there is provided a device for sealing an opening, the device comprising a portion adapted for
30 inflation by a gas and means for retaining the inflatable portion in position relative to the opening during inflation of the inflatable portion.

In a particularly preferred embodiment, the retaining means centres and holds the device in position
35 sufficiently such that inflation can be activated and monitored from a remote site such as the mine surface. This is particularly advantageous as it allows the device to be erected remotely in response to dangerous

conditions within the mine. Such remote activation is not possible with known inflatable bladders as they require manual operation during inflation. Remote activation may be important where the conditions within the mine are considered dangerous.

The retaining means can be of any suitable construction which will retain the device relative to the opening during inflation. Preferably the retaining means can be attached to the periphery of the opening and includes projections extending or depending therefrom which can hold the device in position during inflation.

The device of the present invention may also be used in the construction of an overcast.

According to a further broad form of the invention there is provided an overcast for a tunnel intersection in a mine, the overcast including opposing panels each panel including a device of the first broad form.

Preferably the opposing panels include a sealing member as described above such that when the overcast is installed in a tunnel intersection, the sealing member can accommodate minor movement in the tunnel walls so as to retain a gas seal. When the mine is a coal mine, the presence of the sealing member between the panels and coal lined tunnel wall may reduce the fretting of the coal.

The overcast panels are typically constructed on site by pumping a settable material such as a grout into a chamber. The panels are constructed by providing a bladder which is first inflated with a gas and the gas is then replaced by a settable filler. When the device is used in construction of an overcast, the height of the side walls may be set to a desired height by suspending the bladder from the roof of the tunnel at a selected height prior to inflation.

BRIEF DESCRIPTION OF THE FIGURES

Figure 1 is a schematic view of a preferred device of the present invention in the form of an

explosion resistant seal.

Figure 2 is a cross-sectional view of the seal of Figure 1.

Figure 3 is an exploded view of the device of Figure 1.

Figure 4 is a cross-sectional view of a further preferred seal of the present invention.

Figure 5 is a schematic view of a further preferred device of the present invention in the form of an overcast.

Figure 6 is a schematic view of a further preferred device of the present invention prior to inflation with air.

Figure 7 is a plan view cross-section of the device of Figure 6 after inflation.

Figure 8 is a detail of the cross-section of Figure 7.

Figure 9 is a cross-section of a further preferred device of the present invention.

BEST MODE

Figure 1 illustrates a preferred device 11 of the present invention in the form of an explosion resistant seal. The device 11 extends across a mine tunnel. The device 11 is suspended from the ceiling 12 of the tunnel by a spreader bar 13. The spreader bar may be fixed to the ceiling by known means such as chemical anchors.

The device 11 comprises a bladder 14 which is attached to the spreader bar 13 by straps 15. The bladder 14 is initially inflated with air. The air is then replaced with a settable filler such as grout or cement. The bladder 14 is divided into a number of subchambers 17 by a series of spaced longitudinal straps 18 having apertures 19 therein. The chambers are fluidly connected by apertures 19. The straps are dimensioned so that they draw the inner side faces of the bladder towards each other. This causes the front and rear faces of the device to adopt a scalloped configuration.

On one side 20 of the bladder 14 are located a series of spaced vertical support columns 21. These columns 21 are also filled with a concrete filler. On the other side 22 of the bladder at locations opposing the support columns 21 are vertically spaced wire ropes 23. The wire ropes 23 are attached to the spreader bar at one end and run vertically along the outer wall of the bladder. The other end of the wire rope 23 is located between the tunnel floor and lower part of the bladder and is bolted and concreted in place. The device also includes a vinyl surround 24. The surround has base 25, side 26 and head 27 wings. These wings are bolted to the floor, side walls and roof of the tunnel respectively. The wings assist in centering the bladder and holding the bladder in place during inflation of the bladder during installation. This will be described in further detail below.

The upper and lower portions of the bladder 14 are constructed loosely such that they expand during inflation and/or filling with a settable filler. This expansion facilitates formation of a seal between the device and the tunnel walls.

Around the base, sides and upper portion of the bladder is a sealing member comprising a foam material 16. The sealing member is able to compensate for movement of the tunnel walls. This reduces the likelihood of any gas leaking past the device and/or stressing and possible fracture of the grout or concrete filler.

The device may be installed by first fixing the spreader bar to the tunnel ceiling. The foam layer 16 is fixed to the perimeter of the tunnel. The bladder with the attached vinyl surround is suspended from the spreader bar 13 by straps 15. The wings are attached to the head, floor and sides of the tunnel. The bladder is then inflated with air. Because the subchambers are fluidly connected, only a single air inlet is required. After inflation, the support columns 21 are filled with a

settable material such as grout or cement. When the filler in support columns 21 has cured, the air in the bladder is replaced with grout or concrete. The support columns provide support to the bladder walls during
5 filling and whilst the filler is curing. The filler is typically an expandable filler. This further forces the walls of the bladder against the foam so as to facilitate a seal.

Figure 2 illustrates a plan view cross-section
10 of the device 11 in Figure 1. It can be seen from Figures 1 and 2 that the installed device is a series of vertical columns separated by straps 18. The straps also assist in reinforcing the concrete. The exterior faces of the device have a scalloped configuration. This may
15 assist in dispensing the force of an explosion.

Figure 3 illustrates a plan view cross-section of a further preferred device 11 of the present invention. The device 11 in Figure 3 is similar to that illustrated in Figures 1 and 2 except that the support
20 columns 21 are U shaped and extend along the sides and below the device. Wire rope or chains (not illustrated) may also pass through the support columns to provide reinforcement.

The device 11 in Figure 4 further includes a
25 water filled member 29. The device illustrated in Figure 4 may be partially installed at any time. The member 29 and foam layer are fixed to the periphery of the opening by chemical anchors. When desired, the bladder is inflated with air. The bladder retaining members 30
30 serve to centre the bladder during inflation. It is preferred that an adhesive settable compound is applied between the retaining member 30 and the tunnel wall during inflation. This provides an additional seal. The surfaces of the member 29, retaining member 30 and
35 bladder have a rough texture to allow frictional engagement between components. The bladder can be inflated to seal openings of different sizes and the pressure can be varied as required.

In the event of a minor explosion, the member can rupture to release water and create a water barrier. This water barrier dampens air borne coal dust and reduces the possibility of the coal dust igniting.

5 Further, in the event that the mine is considered to be unstable, workers can be evacuated and the bladder can be activated remotely from the mine surface. Thus the presence of the water filled sealing member provides an additional safety factor.

10 After the bladder has been inflated it may then be filled with a settable material as described above.

Figure 5 illustrates an overcast 40 in which panels are formed by a device of a preferred method of the present invention. The overcast 40 is located over
15 an intersection 41 of two 42, 43 mine tunnels. The overcast has two opposing side walls 44, 45 which are located across tunnel 43. The walls 44, 45 extend from the tunnel floor and terminate below the tunnel roof. A space is located between the top of the walls 44, 45 and
20 the roof of the tunnel. Recesses are drilled into the side walls and floor of the tunnel 43 to accommodate the sides and base of walls 44, 45.

The overcast 40 has a top deck 50 which is supported by walls 44, 45. The top deck supports two
25 opposing wings 51, 52. The wings are located in tunnel 42. A water filled member and a layer of foam 16 are also located between wings 51, 52 and the tunnel roof (not illustrated). The water filled members are made from an anti-static vinyl material. Each member has a
30 pair of bladder retaining members 30, 31. These retaining members assist in centering the walls during installation.

In use, fresh air is directed through tunnel 42 and below top deck 50. Exhaust air is withdrawn through
35 tunnel 43 and over top deck 50. Mine workers can access parts of the mine through tunnel 42. In the event of an emergency it may be necessary for the workers to exit the mine through tunnel 43 and ladders 53 are provided for

this purpose.

Straps (not illustrated), are suspended from the tunnel roof and support walls 44, 45. These straps supports the walls during installation as described
5 below. Also, in the event of an explosion and the walls crack, the straps support the wall and may prevent it from collapsing and blocking the intersection.

The overcast 40 may be installed in the intersection as follows: The foam and empty water member
10 are first attached to the tunnel periphery. The member is then filled with water. The side walls are constructed by placing two vinyl bladders at desired locations. The bladders may be similar to those described in Figures 1 to 4. The bladders are attached
15 to spreader bars (not illustrated) which are suspended from the ceiling. The height at which the spreader bars are suspended corresponds to the desired height of the walls. The vinyl bladders are then inflated with air such that the bladders extend from the floor to the
20 spreader bar. Grout is then pumped into the bladder and allowed to set. Alternatively, the bladders may be replaced by a series of open topped vertical tubes. These tubes may be filled with grout through the open top.

A support structure ie. Bondeck or Acroprops
25 and open topped boxed section is installed across the top between walls 44 and 45. The concrete for top deck 50 is poured. Wings 51, 52 are then installed. Wings 51, 52 may be installed in a similar manner to walls 44, 45.

Figures 6 to 9 illustrate a further preferred
30 device of the present invention which is adapted to be automatically inflated in response to an emergency situation.

Figure 6 illustrates the device 11 in a folded form. The device is typically suspended from a ceiling
35 or a recess therein, by a spreader bar. The device 11 is suspended from the spreader bar, not illustrated, by webbing straps 32. The device is maintained in its folded form by retaining straps 33. The retaining straps

33 have free ends which are joined together beneath the folded device by a hook and loop type fastener (not illustrated). These fasteners are released during inflation.

5 Figures 7 and 8 illustrates a cross-section of the inflated device. Subchambers 17 are separated by internal ribs or straps 18 which extend from the front to the rear face of the device. The ribs are stitched to the front and rear faces so as to pull the faces together
10 at the joining point. This causes the front and rear faces to adopt a scalloped configuration. Vinyl reinforcing flaps 28 are welded to the faces of the device.

 Figure 9 illustrates a further device 11 of the
15 present invention installed in a mine tunnel. The device includes a bladder 14 which has been first inflated with air and the air then replaced with a grout filler as described above. The bladder has an air inlet 62, air outlet 61 and grout inlet valves 60. A layer of foam 16
20 is located between the device and tunnel periphery. A water filled member 29 is sandwiched between the bladder 14 and the foam 16. The water filled member and foam are attached to the tunnel periphery by anchors. The water filled member has a water inlet 63. A bladder retaining
25 member 30 extends from each side of the upper and lower portions of the water filled member.

 It can be seen that the provision of internal members which separate the subchambers may provide a number of advantages. First, when the device is for use
30 as an inflatable seal, the internal members provide support during inflation. This enables the device to be inflated to higher pressures than the known single bladder seals. This higher pressure enables a more efficient gas seal to be formed between the device and
35 walls of a mine tunnel. In a preferred embodiment in which the subchambers are in the form of vertical columns and are filled with a settable grout, the columns may be more resistant to explosion than a single chamber

bladder. The columns are also able to be reinforced with wire rope, chains or steel rods. Additional structural support may be provided by external, grout filled support columns. The internal members also assist in providing
5 internal support. Still further, when the device has a scalloped shaped outer surface, the scalloped shape may assist in dissipation of energy from an explosion.

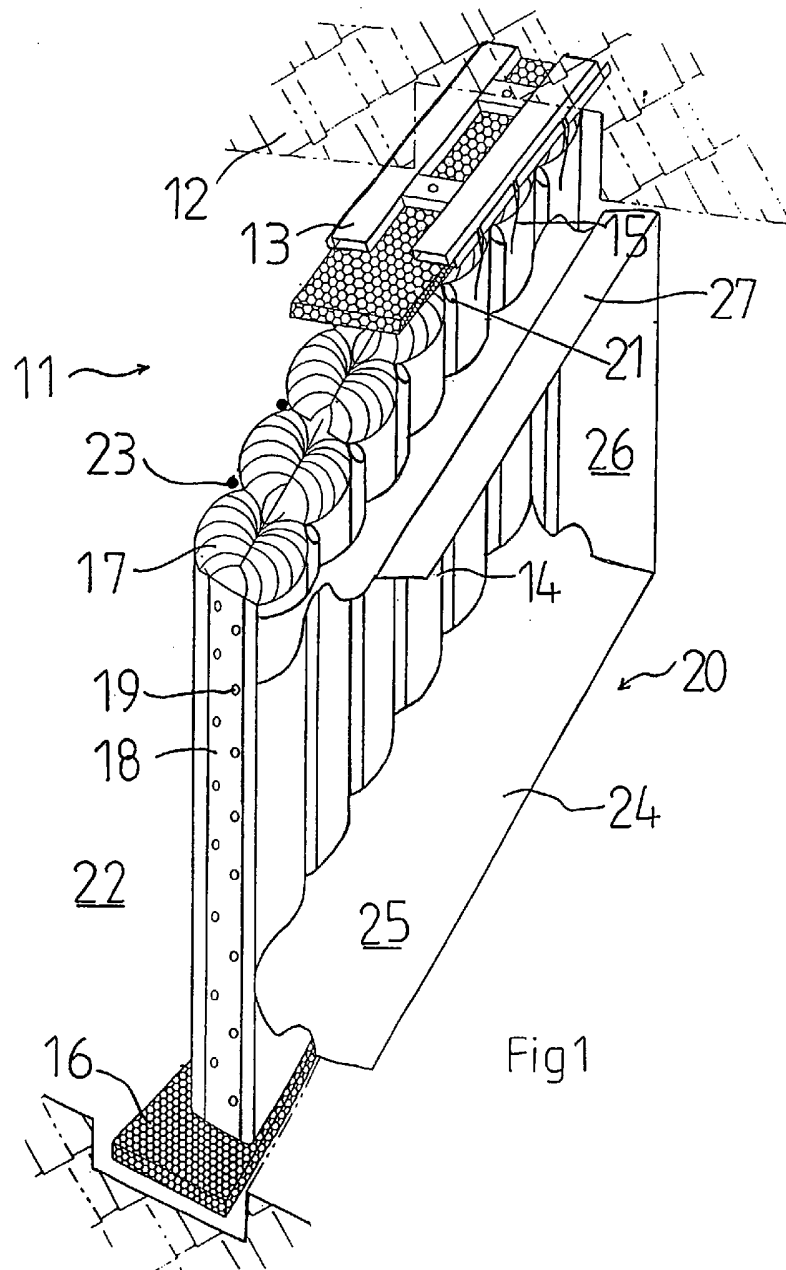
The present invention also relates to a device having a sealing member for facilitating a gas seal
10 between the device and the tunnel walls. The sealing member is also able to accommodate movement of the mine tunnel walls. This maintains a gas seal during such movement. It is also able to minimise cracking or stress of the concrete or grout of the device and also fretting
15 of the coal in the mine tunnel walls. It can also be seen that the bladder retaining means of another form of the present invention assists in centering and maintaining the device in position during inflation and filling. This can enable the device to be filled
20 remotely and may avoid the need for workers to be present during inflation and/or filling. This may be important to the safety of workers in the presence of dangerous conditions such as rising methane levels.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A device for sealing an opening, the device including at least two adjacent subchambers, and when the device is installed in an opening the subchambers are substantially vertical and each subchamber is able to be at
5 least partially filled with a settable filler.
2. The device of claim 1, wherein the device includes means for securing the device to the floor of the opening.
3. The device of claim 1 or claim 2, wherein each subchamber has reinforcement means extending through the subchamber.
- 10 4. The device of claim 3, wherein the reinforcement means is a chain
5. The device of any one of claims 1 to 4, wherein the subchambers are defined by internal straps.
6. The device of any one of claims 1 to 5, in which the
15 subchambers are open topped tubes.
7. The device of any one of claims 1 to 6, wherein the external side faces of the device having a substantially scalloped configuration.
8. The device of any one of claims 1 to 7, wherein the filler is a grout or concrete.
- 20 9. The device of any one of claims 1 to 8 which further includes a sealing member for sealingly engaging the periphery of the opening.
10. The device of claim 9, wherein the sealing member includes a resilient material.
11. The device of claim 9, wherein the sealing member includes at
25 least one chamber for holding a non-flammable fluid.
12. A device for sealing an opening, substantially as hereinbefore described with reference to the figures.
13. A method of sealing an opening, having the method including the steps of placing the device of claim 1 in an opening, securing the device to
30 the top and to the bottom of the opening, filling each subchamber with a settable filler and allowing the filler to set.



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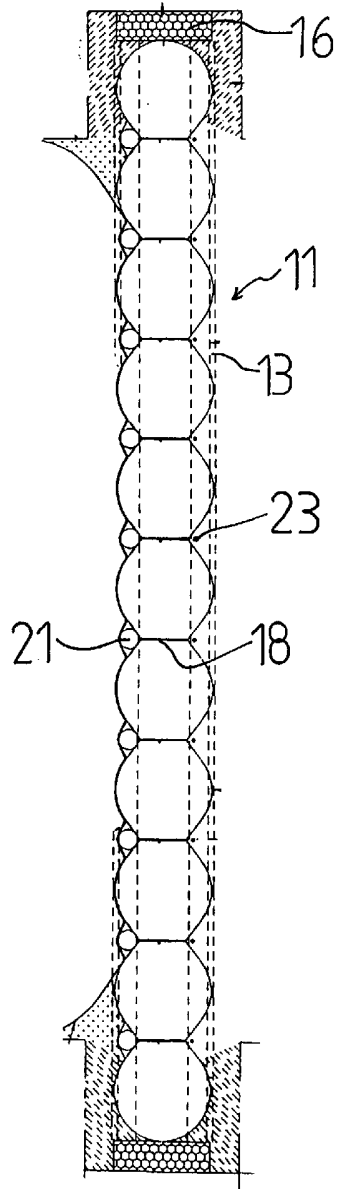


Fig 2

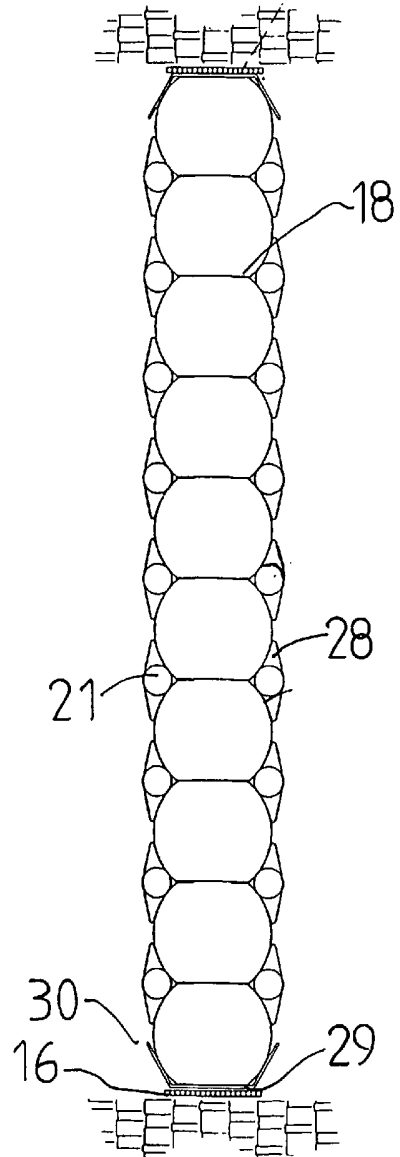
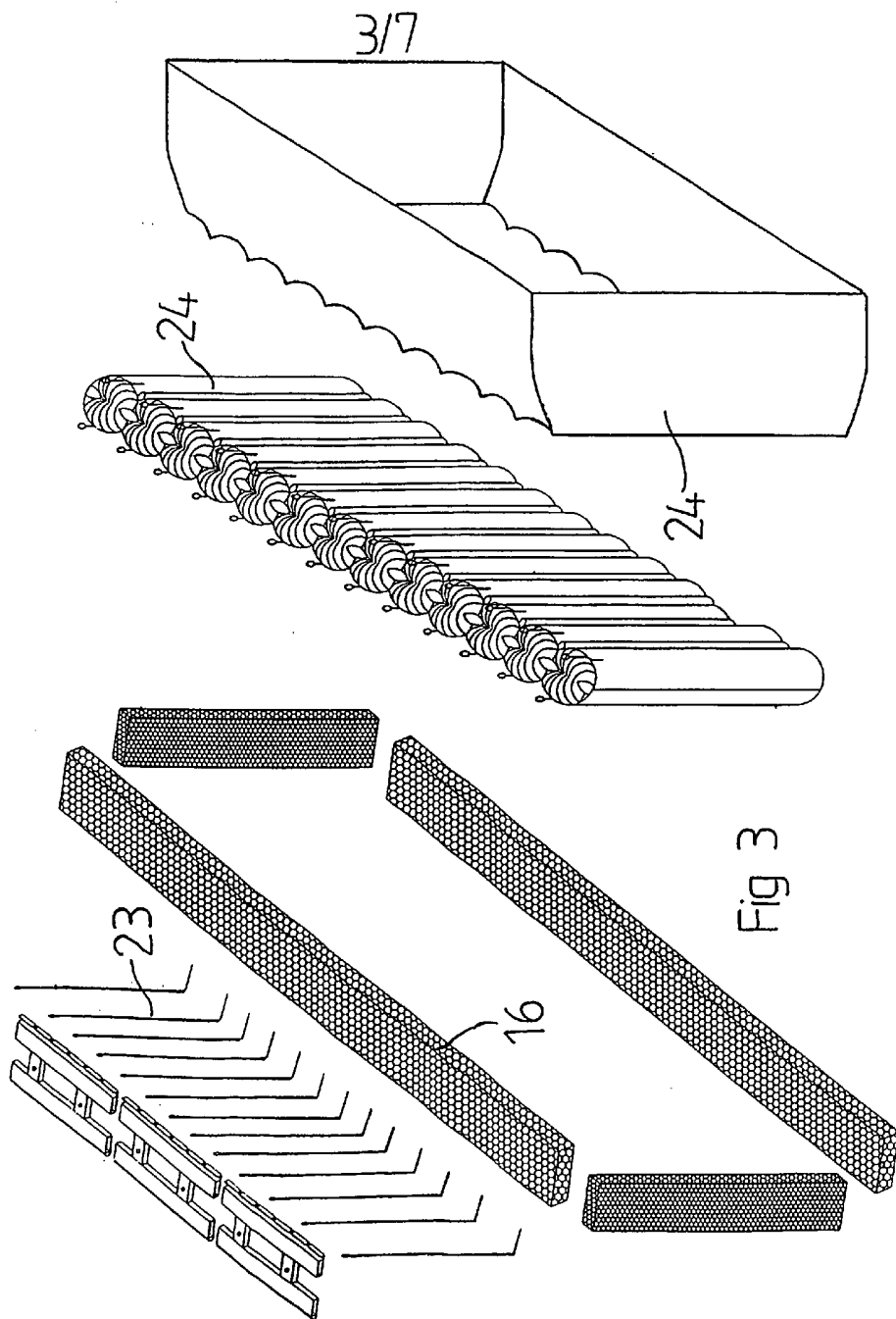


Fig 4



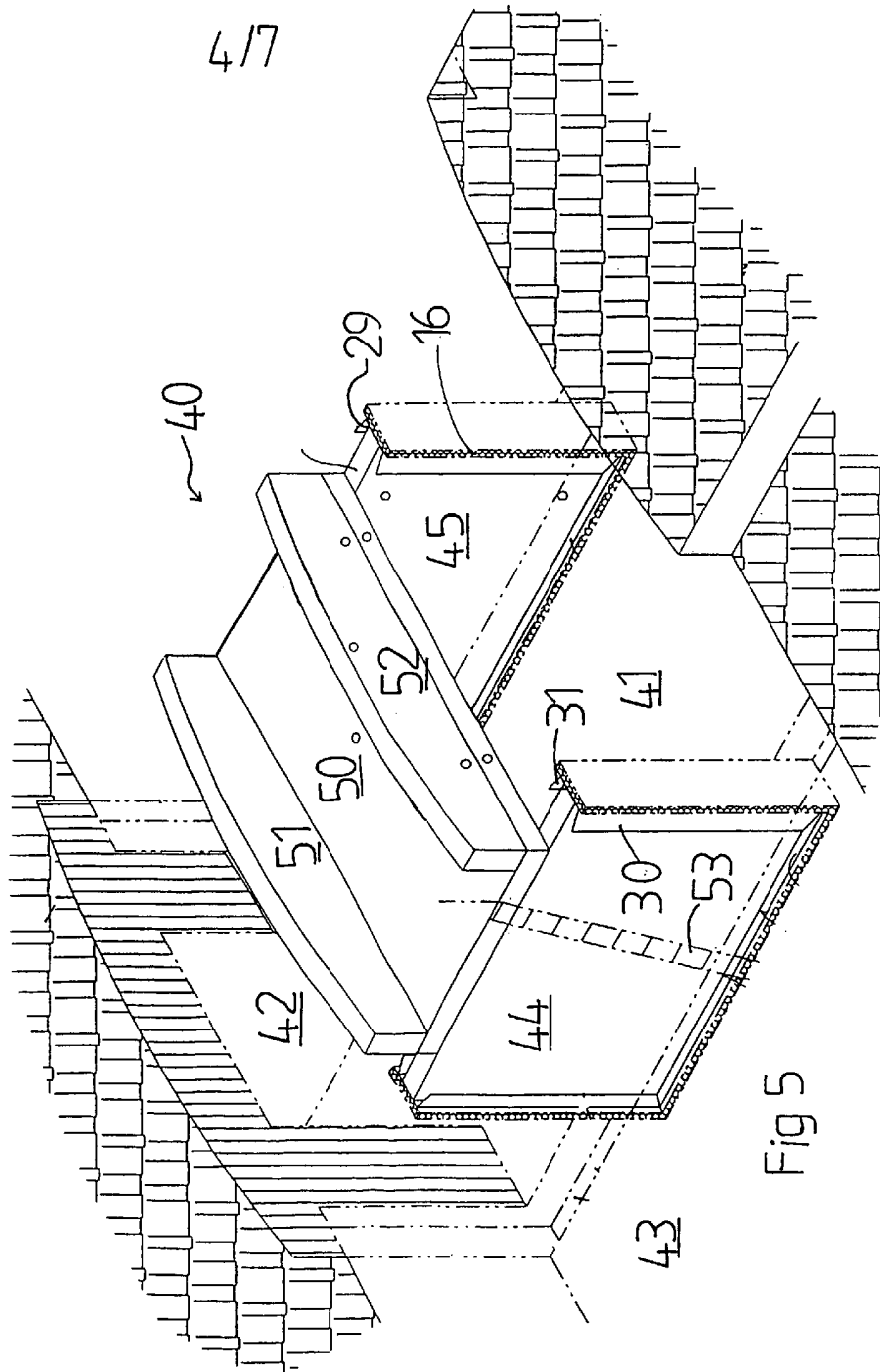


Fig 5

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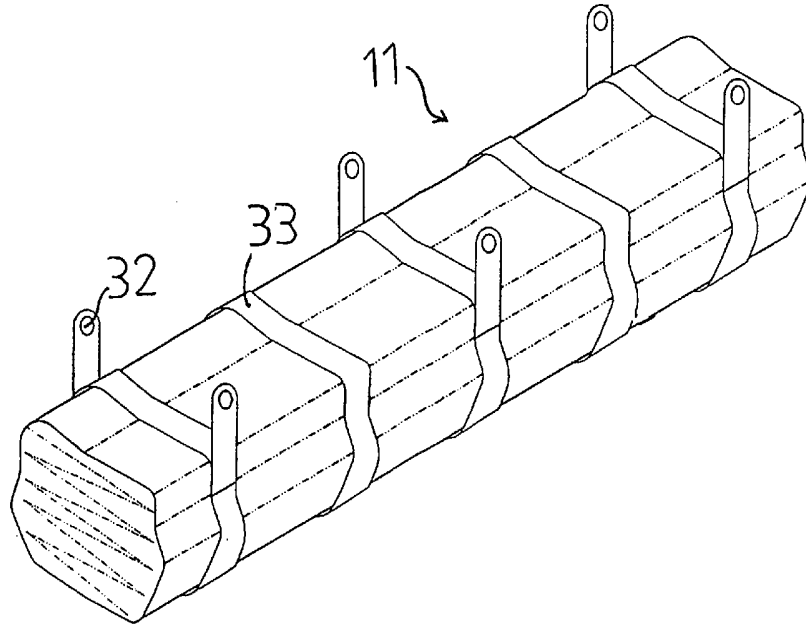


Fig6

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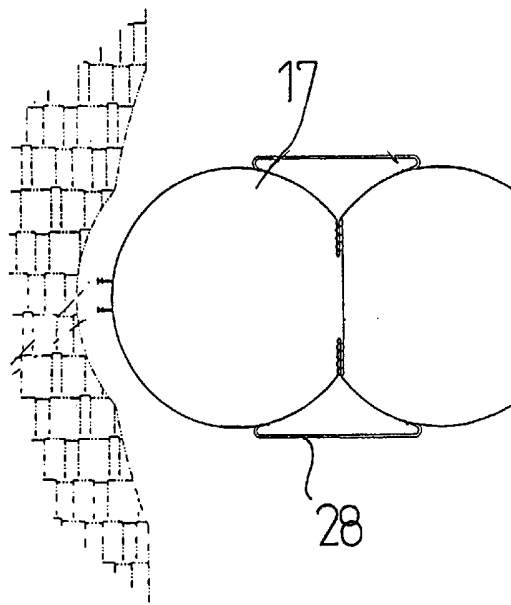


Fig 8

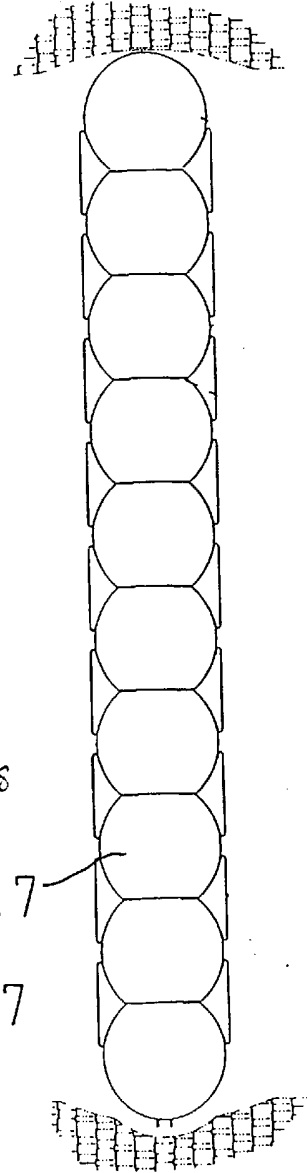


Fig 7

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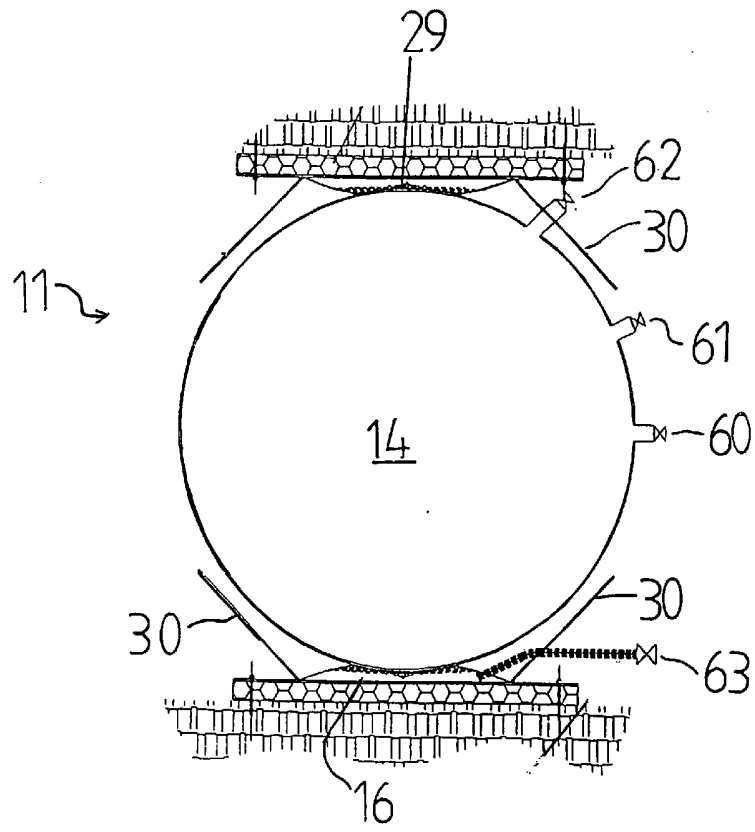


Fig9