(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 191 570**
A2

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **86300522.9**

(22) Date of filing: **27.01.86**

(51) Int. Cl.⁴: **E 21 D 15/00**

(30) Priority: **29.01.85 ZA 850687**

(43) Date of publication of application: **20.08.86**
Bulletin 86/34

(84) Designated Contracting States: **AT BE CH DE FR GB IT LI LU NL SE**

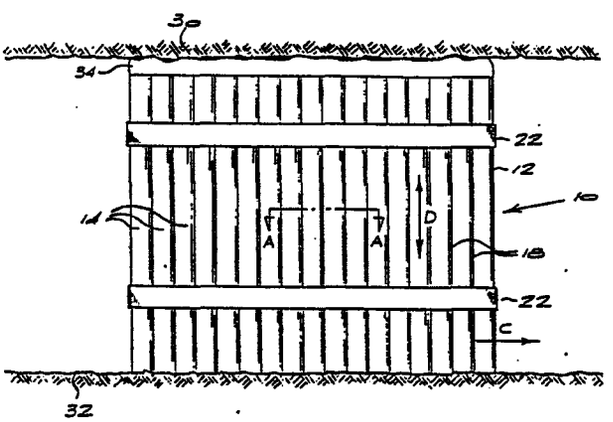
(71) Applicant: **Hall, Alethea Rosalind Melanie, 40 Driefontein Muldersdrift, Krugersdorp Transvaal (ZA)**

(72) Inventor: **Hall, Alethea Rosalind Melanie, 40 Driefontein Muldersdrift, Krugersdorp Transvaal (ZA)**

(74) Representative: **Atkinson, Peter Birch et al, Marks & Clerk Suite 301 Sunlight House Quay Street, Manchester M3 3JY (GB)**

(54) Support member.

(57) A support member (10) capable of bearing an axial compressive load may be used as a support in an underground mine. The support member (10) comprises an elongate tube (12) of a flexible plastics material divided by dividing walls of the flexible plastics material into a plurality of compartments (14) running the length of the tube (12) so that the tube (12) divided into compartments (14) has a honeycomb structure. Some or all of the compartments (14) are filled with a particulate filler material (20) such as sand.



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SUPPORT MEMBER

BACKGROUND OF THE INVENTION

This invention relates to a support member capable of bearing an axial compressive load, which may be used as a support in an underground mine or in the construction industry or the like.

SUMMARY OF THE INVENTION

According to the invention there is provided a support member capable of bearing an axial compressive load which comprises an elongate tube of a flexible material divided by dividing walls of a flexible material into a plurality of compartments running the length of the tube, at least some of the compartment being filled with a particulate filler material.

The support member may include restraining means encircling the outside of the tube to restrain the tube from deformation in a direction transverse to the longitudinal axis of the tube. The restraining means may run the whole or only a part or parts of the length of the tube. The restraining means may comprise any suitable material such as weld mesh, diamond mesh, fencing wire, plastic netting, a plastic mesh such as that covered by South African Patent No. 82/7300, a plastic or metal rope or a plastic or metal tape. In all cases the restraining means must restrain deformation of the tube in a direction transverse to the longitudinal axis of the tube, especially when the support member is placed under an axial compressive load.

As an alternative, the compartments around the circumference of the tube may be left empty to restrain the tube from deformation in a direction transverse to the longitudinal axis of the tube. It has been found that leaving one or more empty compartments around the circumference of the tube increases the strength of the tube to deformation in a direction transverse to the longitudinal axis of the tube.

The flexible material may be any suitable flexible material such as a plastics material, an aluminium foil, paper, paper or plastic laminated aluminium foil, or a thin metal sheeting. The flexible material is preferably a plastics material. The plastics material may be a conventional plastics material, a biaxially oriented plastics material or a woven or non-woven fabric. Suitable plastics include include high and low density polyethylene, polypropylene, styrene based plastics, polyesters and polyvinyl chloride.

The elongate tube divided into compartments preferably has a honeycomb structure. The structure may be made, for example, by the method described in United States Patent No. 4,478,659, by joining a series of non-metallic sheets to each other by welding along their lengths.

The particulate filler material which is used to fill the compartments may be any suitable particulate material such as sand, cement, crushed stone, a particulate containing sludge or slurry, mine tailings, fly ash, river bed sediment, or bentonite, or a mixture of two or more thereof.

Some or all of the compartments may include a rigid filler item such as a wood, cement or metal pillar or prop. The area around the pillar or prop in a compartment is then filled with the particulate filler material. Such a pillar or prop serves to provide rigidity to the support member especially before all the compartments have been filled with the particulate material.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a front view of a support member according to the invention; and

Figure 2 is a cross-sectional view along the line A-A in Figure 1.

DESCRIPTION OF PREFERRED EMBODIMENTS

Referring to the drawings, a support member 10 comprises an elongate tube 12 of a flexible material divided by dividing walls into a plurality of compartments or cells 14. The elongate tube 12 divided into compartments 14 has a honeycomb structure as can be seen from Figure 2. This honeycomb structure is created by joining sheets of the flexible material 16 to each other along join lines 18.

At least some of the compartments 14 are filled with a particulate filler material 20.

The support member 10 includes restraining means 22 being metal or plastic bands located around the circumference of the elongate tube 12 to restrain the support member 10 from deformation in a direction C which is transverse to the longitudinal axis D of the tube 12.

A method of constructing the support member 10 for supporting a hanging wall 30 in a mine will now be described. Firstly, the tube 12, which is open at both ends, is located in position between the foot wall 32 and the hanging wall 30 of the mine, with a gap of a few centimetres between the top of the tube 12 and the hanging wall 30. As the tube is flexible, it requires to be supported initially either by locating a wood, concrete or metal pillar or prop in one or more of the compartments 14, or by attaching the tube 12 to the hanging wall 30 so that it hangs down therefrom, or by any other suitable means. Once the tube 12 is in position, and any pillars or props to be used are in position, the particulate filler material 20 is filled into the compartments 14, e.g. by pumping the particulate material 20 in. The particulate filler material 20 may be vibrated in order to ensure that it settles and consolidates sufficiently. The restraining means 20 are then located around the tube 12. Thereafter, the gap between the top of the support member 10 and the hanging wall 30 may be filled with wooden blocks or wedges or an inflatable pillow 34 or the like. The inflatable pillow 34 may also be filled with the particulate filler material. The support member 10 is now in a position to bear an axial compressive load.

As stated above, the elongate tube and dividing walls of the support member of the invention are made of a flexible material which may be a plastics material, thin metal sheeting, paper, or a laminate of

one or more of these. The flexible material is preferably a plastics material which may be a conventional plastics material, a biaxially oriented plastics material or a non-woven fabric.

Where the flexible material is a non-magnetic material, the elongate tube divided into compartments is preferably made by the method described in United States Patent No. 4,478,659. This patent discloses, inter alia, a method of joining a first sheet of two sheets of a non-magnetic material which are joined to each other along a join line to a third sheet of a non-magnetic material along a join line. This method comprises the steps of locating the three sheets close to a magnet with the third sheet adjacent the first sheet, locating a body which is attracted by the magnet between the first sheet and the second sheet so that the first sheet and the third sheet are brought together in a zone between the magnet and the body with the second sheet below the body, causing the first sheet and the third sheet to be moved through the zone, and joining the third sheet to the first sheet in the zone or immediately after the third sheet and the first sheet have passed through the zone to form the join line. Generally the first sheet and the second sheet are joined to each other along two substantially parallel join lines and the third sheet is joined to the first sheet along a join line which is intermediate the join lines of the first and second sheets. The result of this is a honeycomb structure. The sheets, when they comprise a plastics material, may be joined to each other by heat welding or by ultrasonic welding which creates a continuous welded join line along the length of the sheets. Thus, preferably each compartment of the elongate tube of the support member of the invention comprises a cell in the honeycomb structure formed between two adjacent sheets of a suitable material. Each cell may have a round, square, diamond or hexagonal shape or any other suitable shape.

A similar honeycomb structure may be created in other ways. For example, where the flexible material is paper, the honeycomb structure may be formed by glueing the adjacent sheet of material to each other along join lines.

The cross-sectional area of each cell of the honeycomb structure may vary according to the use to which the support member is to be put. Generally, each cell will have a diameter of 100mm to 1 metre or larger.

Where the flexible material comprises a flexible plastics material, it may comprise a plastics film having a thickness of 50μm to 500μm. The length of the elongate tube may be any desired length, for example 1 metre to 1000 metres.

The flexible material may be micro-perforated to permit the egress of liquid from the tube but not the egress of the particulate filler material.

The particulate filler material which is used to fill the compartments may be any suitable particulate material such as sand, cement, crushed stone, a particulate-containing sludge or slurry such as a mine sludge or slurry, mine tailings, fly ash, river bed sediment, or bentonite or other clays or the like.

In addition, some or all of the compartments may include a rigid filler item such as a wood, cement or metal pillar or prop. The area around the pillar or prop in a compartment is then filled with the particulate filler material. Such a pillar or prop serves to provide rigidity to the support member especially before all the compartments have been filled with the particulate material.

Each restraining means illustrated in Figure 1 of the drawings, run only a part of the length of the tube. However, restraining means may be used which runs the whole of the length of the tube. The restraining means illustrated in Figure 1 is a plastic or metal tape. However, the restraining means may also comprise weld mesh, diamond mesh, fencing wire, plastic netting, or a plastic mesh such as that covered by South African Patent No. 82/7300 or a plastic metal or rope.

It is not necessary to use restraining means. In particular, it is not necessary to use restraining means where the ratio of the diameter of the support member to the height of the support member is sufficiently great. For example, where the diameter or width of the support member is 8 times the height of the support member, no restraining means will generally be required.

As a further alternative, to obviate the need for restraining means, the compartments around the circumference of the tube may be left empty. This provides additional restraint against deformation in a direction transverse to the longitudinal axis of the tube.

The support member gains its great strength under an axial compressive load because of the fact that most or all of the compartments are adjacent two or more other compartments which are also filled with the particulate filler material. This prevents the compartments from rupturing as they are simultaneously supported by their neighbours and provide support to their neighbours.

The support member may be used as a support in an underground mine as illustrated in the drawings to support a hanging wall in the same manner that a conventional mat pack is used. The support member may

also be used in the construction industry as a load-carrying support member. For example, it may be used in the construction of buildings or as a support for a bridge or the like. It may also be used to form ballast for a railway line, in which case the support will generally be between 0,5m and 1m in height.

The support member of the invention has several advantages. Firstly, it is easy and cheap to manufacture. Secondly, it may be assembled on site, e.g. down a mine, which has considerable logistical advantages. For example, the empty tube divided into compartments may be folded up and easily transported down the mine. There it may be placed in position and then filled with a particulate filler material which is available on site. Thirdly, the support member is able to bear high compressive loads.

CLAIMS

1.

A support member (10)capable of bearing an axial compressive load comprises an elongate tube (12)of a flexible material divided by dividing walls of a flexible material into a plurality of compartments (14) running the length of the tube (12), at least some of the compartments (14) being filled with a particulate filler material (20).

2.

A support member (10) according to claim 1 which includes restraining means (22) encircling the outside of the tube (12) to restrain the tube (12) from deformation in a direction transverse to the longitudinal axis of the tube (12).

3.

A support member (10) according to claim 2 wherein the restraining means (12) is selected from weld mesh, diamond mesh, fencing wire, plastic netting, plastic mesh, a plastic or metal rope or a plastic or metal tape.

4.

A support member (10) according to claim 1 wherein the compartments (14) around the circumference of the tube (12) are left empty to restrain the tube (12) from deformation in a direction transverse to the longitudinal axis of the tube (12).

5.
A support member (10) according to any one of claims 1 to 4 wherein the flexible material is selected from a plastics material, an aluminium foil, paper, a paper or plastic laminated aluminium foil or a thin metal sheeting.

6.
A support member (10) according to claim 5 wherein the flexible material is a flexible plastics material.

7.
A support member (10) according to any one of claims 1 to 6 wherein the elongate tube (12) divided into compartments (14) has a honeycomb structure.

8.
A support member (10) according to any one of claims 1 to 7 wherein the particulate filler material (20) comprises sand, cement, crushed stone, a particulate-containing slurry, mine tailings, fly ash, river bed sediment or bentonite or a mixture of two or more thereof.

9.
A support member (10) according to any one of claims 1 to 8 wherein one or more of the compartments (14) includes a rigid filler item.

10.
A support member (10) capable of bearing an axial compressive load which comprises an elongate tube (12) of a flexible plastics material divided by dividing walls of a flexible plastics material into a plurality of compartments (14) running the length of a tube (12) so that the elongate tube (12) divided by dividing walls having

a honeycomb structure, the flexible plastics material having a thickness of 50μm to 500μm, at least some of the compartments (14) being filled with a particulate filler material (20).

11.
A support member (10) according to claim 10 wherein the diameter of the support member (10) is greater than the height of the support member (10).

12.
An elongate tube (12) of a flexible material divided by dividing walls of a flexible material into a plurality of compartments (14) running the length of the tube (12), for use in a support member (10) of any one of claims 1 to 11.

FIG. 1

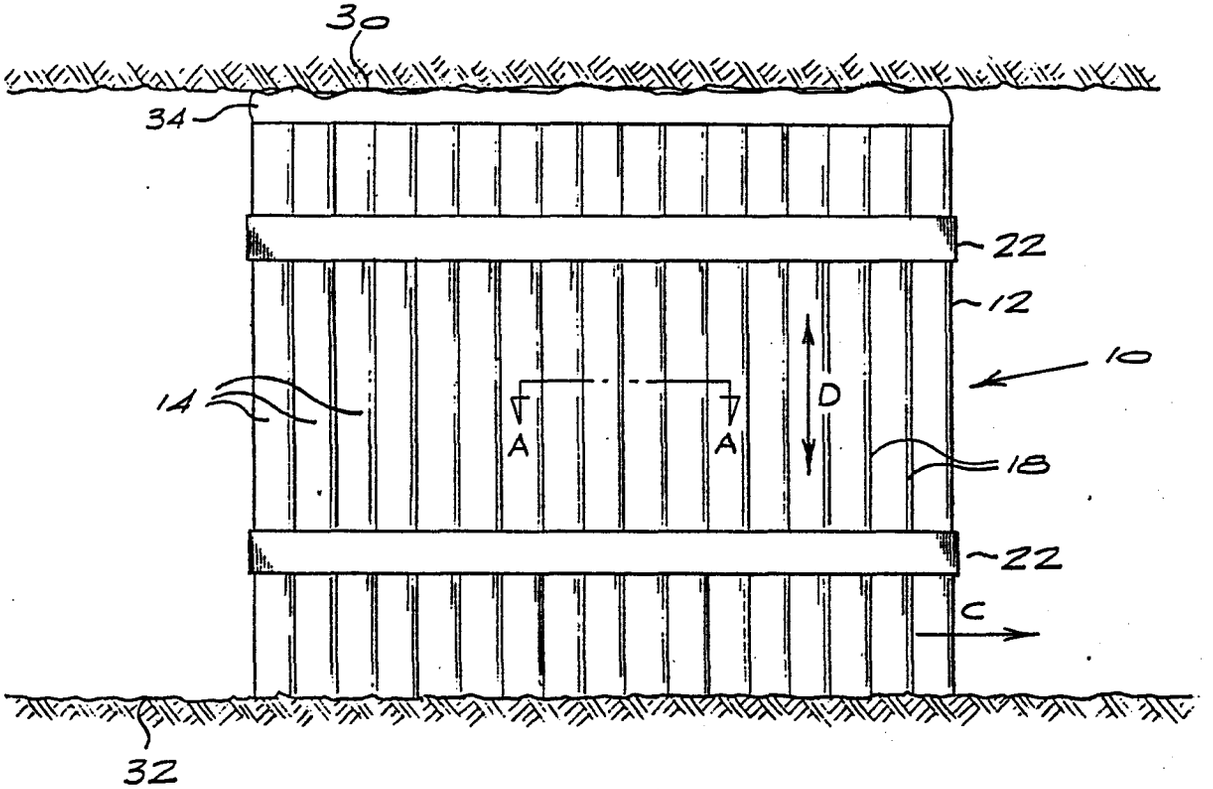

FIG. 2