MINE SUPPORT GROUT BAGS AND PACKS

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Appl. No.: 12/668,545
PCT Filed: Jul. 17, 2008
PCT No.: PCT/IB2008/001868
§ 371 (c)(1), (2), (4) Date: Jan. 11, 2010

Publication Classification

Int. Cl. B65D 33/00 (2006.01)
U.S. Cl. ......................................................... 383/105

ABSTRACT

A grout bag (1) is provided having flexible side walls (2) a top (3) and a bottom (4) defining a cavity for receiving settable granular material or grout (5) and an inlet (6) for slurry to be introduced into the interior of the grout bag wherein the flexible side walls are adapted to retain solids within the grout bag. The grout bag has an axis in the general direction in which a filled and set grout bag is adapted to collapse and the grout bag has, in an open but unfilled condition, at least two different cross-sectional sizes to the cavity with respect to the axis of the bag. Typically the different cross-sectional sizes are formed by a truncated conical shaped sidewall section or by a conical insert, or both. A grout pack including such a grout bag and surrounding mesh and/or restraining rings is also provided.
MINE SUPPORT GROUT BAGS AND PACKS

FIELD OF THE INVENTION

[0001] This invention relates to mine support grout bags and packs that, in use, are filled with a cementitious or other settable mix, typically, but not necessarily, including pulverised ore or backfill of processed or barren mined material.

[0002] The term grout bag as used herein is intended to mean a generally permeable bag that is used to contain slurry pumped into it under pressure and to retain the solids whilst allowing excess moisture to permeate through the grout bag that is typically made of a suitable textile material such as a geotextile material.

[0003] The term grout pack as used herein is intended to mean a grout bag that is used in combination with reinforcing surrounding the generally upright walls of the grout bag, the reinforcing being either or both of a reinforcing mesh and a series of peripheral rings typically of metal, encircling the grout bag.

BACKGROUND TO THE INVENTION

[0004] Depending on the type and quality of rock being supported, the depth of mining, the prevalent field stresses, seismicity, stoping width and a number of other factors, stope support can utilise a vast range of materials, configurations and systems, including, gum poles, timber and composite packs, steel props, unmined ore pillars, rock anchors and granular (tailings) type supports.

[0005] Among the granular support media, cemented grout bags and grout packs are increasingly being utilized as combination support products, consisting essentially of a support column formed by cured cemented backfill or a similar cured cementitious grout, contained within a geotextile bag and, in the instance of a grout pack, stiffened against lateral deformation under axial load with external mesh or restraining rings, or both.

[0006] Conventional grout bags are prismatic in shape and are made as closed geotextile containers with a non-return valve for filling the bags. Usually the bags also have some means of suspending them, together with any external restraining rings, on support elongates within the stopes by means of ties or loops prior to the filling operation.

[0007] Of course, any support utilised for the purpose indicated above needs to be capable of collapse as the forces between the hanging wall and footwall increase in order to avoid rock-bursts that tend to be catastrophic. One difficulty that applicant believes is experienced with conventional grout bags and grout packs is that they tend to lend themselves towards rather sudden collapse under certain circumstances. This may be consequent on an inclined shear plane developing across the grout bag or grout pack which in turn apparently results, at least to some extent, from the constant cross-sectional size thereof.

OBJECT OF THE INVENTION

[0008] It is an object of this invention to provide a grout bag and a grout pack embodying same that are better suited to a more controlled collapse.

SUMMARY OF THE INVENTION

[0009] In accordance with one aspect of this invention there is provided a grout bag having flexible side walls, a top, and a bottom defining a cavity for receiving settable granular material or grout and an inlet for slurry to be introduced into the interior of the grout bag and wherein the flexible side walls are adapted to retain solids within the grout bag and the grout bag has an axis in the general direction of which a filled and set grout bag is adapted to collapse, the grout bag being characterised in that, in an open but unfilled condition, the cavity has at least two different cross-sectional sizes.

[0010] Further features of the invention provide for the grout bag, in the open but unfilled condition, to include a section of sidewall of generally truncated conical shape with the axis of such section being generally coincident with the grout bag axis; for the grout bag to be made of a textile material, in particular, a geotextile material that may be stitched together from panels or made from a tubular textile material having end panels of the required cross-sectional shape secured thereto and a tuck in the tubular textile material forming a section of smaller diameter than the full diameter of the tubular textile material in which instance a tapering tuck may be used to form a generally truncated conical section of sidewall; or, in the alternative or in addition to a truncated conical shaped section, for a tapering insert to be provided at either or both top and bottom ends of the grout bag to form a section of varying cross-sectional size; and for the inlet to have a nonreturn inlet valve.

[0011] In accordance with a second aspect of the invention there is provided a grout pack including a grout bag as defined above together with either or both of an external peripheral supporting mesh conforming substantially to the outer shape of the grout bag in the open and unfilled condition and a series of operatively axially spaced support rings.

[0012] Further features of this aspect of the invention provide for at least some support rings to be dimensioned to fit one within the other in the axially collapsed condition of the unfilled grout pack.

[0013] In order that the above and other features of the invention may be more fully understood various embodiment of the invention will now be described with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] In the drawings:

[0015] FIG. 1 is a schematic side elevation of one embodiment of grout bag according to the invention in an operative position between a hanging wall and a footwall;

[0016] FIG. 2 is a schematic three-dimensional view thereof;

[0017] FIGS. 3, 4, 5, 6 and 7 are each a schematic side elevation of a second, third, fourth, fifth and sixth embodiment of grout bag according to the invention;

[0018] FIG. 8 is an exploded schematic three-dimensional view of a seventh embodiment of grout bag according to the invention;

[0019] FIG. 9 is a similar view of an eighth embodiment of grout bag according to the invention;

[0020] FIG. 10 is a schematic three-dimensional view of a first embodiment of grout pack according to the invention;

[0021] FIG. 11 is a sectional elevation thereof in the operative condition;

[0022] FIG. 12 is a plan view thereof showing the different diameter of reinforcing rings and;
[0023] FIGS. 13, 14, 15, 16 and 17 are each a schematic three-dimensional view of second, third, fourth, fifth and sixth embodiments of grout pack according to the invention.

DETAILED DESCRIPTION WITH REFERENCE TO THE DRAWINGS

[0024] In the embodiment of the invention illustrated in FIGS. 1 and 2, a grout bag (1) has flexible side walls (2), a top (3), and a bottom (4) defining a cavity for receiving settable granular material or grout indicated by numeral (5) in FIG. 1. A nonreturn inlet valve (6) is provided for the introduction of granular material or grout in the form of a slurry to be introduced into the cavity of the grout bag, in the usual way.

[0025] The grout bag may be manufactured from a series of panels stitched together or it may be made from a tubular textile material having end panels secured thereto of the required shape defining the top and bottom with a tuck (7) in the tubular textile material forming a section of smaller diameter than the full diameter of the tubular textile material.

[0026] The fabric from which the grout bag is manufactured may be any suitable fabric and, in particular, a geotextile is considered to be particularly suitable, at least for the flexible side walls that are adapted to retain solids within the grout bag and allow water to permeate through it as may be required.

[0027] In this particular embodiment of the invention a tapering tuck (7a) is used to form a squat generally truncated conical section (8) of the sidewall intermediate its ends. This truncated conical section forms a connecting section between a larger diameter right circular cylindrical section (9) and a smaller diameter right circular cylindrical section (10) formed by the tuck (7).

[0028] Whatever the construction, the axes of each section are substantially coincident with each other and with the grout bag axis (11) being the axis in which a filled and set grout bag is adapted to collapse. The cavity defined by the walls thus has at least two generally coaxial sections of different cross-sectional sizes interconnected by the truncated conical section.

[0029] It will be understood that the shape of the grout bag described above applies to its shape in an open but unfilled condition, that is to say, in a condition in which it is not distorted by the weight of any slurry or grout material introduced into it as may well happen in the instance of a grout bag that is unsupported externally.

[0030] It will be understood that, in the installed condition and filled with set grout material, the smaller diameter section will tend to collapse first and, because of this, there is a substantially reduced risk of the entire grout bag failing along an inclined plane passing through the entire transverse dimension of the grout bag.

[0031] A similar result can be achieved in numerous different ways and utilising numerous different designs.

[0032] Thus, the bag could have an outwardly flared truncated conical section (12) at an end of a right circular cylindrical section (13), as shown in FIG. 3.

[0033] Alternatively, it may have an inwardly tapered truncated conical section (14) at an end of a right circular cylindrical section (15), as shown in FIG. 4.

[0034] The grout bag may consist exclusively of two oppositely tapering truncated conical sections (16) whereby the larger diameter is located in the centre of the height of the bag, as illustrated in FIG. 5.

[0035] Alternatively, a pair of oppositely tapering truncated conical sections (17) may be arranged with the smaller diameter ends in the centre of the height of the grout bag and the larger diameter ends at the extremities of the height, as illustrated in FIG. 6.

[0036] The grout bag (18) may have a simple truncated conical shape over its entire height, as illustrated in FIG. 7.

[0037] As shown in FIG. 8, the grout bag (19) may have a right circular cylindrical outer shape with the tapering cross-sectional shape being created by a conical insert (20) arranged coaxially with the cylindrical outer shape.

[0038] Of course, a conical insert (21) could be used with any other outer shape of grout bag and FIG. 9 illustrates a grout bag of the shape illustrated in FIG. 7 fitted with such a conical insert.

[0039] Numerous other shapes of grout bag are possible within the scope of the invention. Also, it is to be noted that any of the shapes described above could be used in an inverted orientation, as may be required.

[0040] Turning now to the second aspect of the invention, a grout pack may be formed utilising a grout bag as described above together with either or both of an external peripheral supporting mesh conforming generally to the outer shape of the grout bag in the open and unfilled condition and a series of operatively axially spaced support rings.

[0041] Thus, as illustrated in FIGS. 10 and 11, a mesh (22) and axially spaced support rings (23) may be arranged to encircle a grout bag (24) of the shape described with reference to FIGS. 1 and 2. It will be understood that the different sized support rings can fit one within the other in the totally collapsed condition of a grout pack prior to installation thereof and for purposes of transport and storage. FIG. 12 illustrates this feature.

[0042] FIG. 13 illustrates a grout pack including a grout bag of the shape illustrated in FIG. 7. FIG. 14 illustrates a grout pack including a grout bag of the shape illustrated in FIG. 3 (the larger diameter support ring (25) being particularly useful for suspending the grout pack preparatory to filling thereof); FIG. 15 illustrates a grout pack including a grout bag of the shape illustrated in FIG. 4; FIG. 16 illustrates a grout pack including a grout bag of the nature illustrated in FIG. 8; and FIG. 17 illustrates a grout pack including a grout bag of the nature illustrated in FIG. 9.

[0043] Numerous other shapes and configurations are possible within the scope of the invention.

1. A grout bag having flexible side walls adapted to retain solids within the grout bag, a top and a bottom wherein the sidewalls, top and bottom define a cavity for receiving settable granular material or grout and an inlet for slurry to be introduced into the cavity and wherein the grout bag has an axis in the general direction of which a filled and set grout bag is adapted to collapse, wherein the cavity in an open but unfilled condition of the grout bag, has at least two different cross-sectional sizes at different positions on the axis.

2. A grout bag as claimed in claim 1 in which the grout bag, in the open but unfilled condition, includes a section of sidewall of generally truncated conical shape with the axis of such section being generally coincident with the axis of the grout bag.

3. A grout bag as claimed in claim 1 in which the grout bag is made of a textile material stitched together from panels.

4. A grout bag as claimed in claim 1 in which the grout bag is made from a tubular textile material having end panels of a required cross-sectional shape secured thereto and a tuck in
the tubular textile material forming a section of smaller diameter than the full diameter of the tubular textile material in which instance a tapering tuck is used to form a generally truncated conical section of sidewall.

5. A grout bag as claimed in claim 1 in which a tapering insert is provided at either or both of the top and bottom ends of the grout bag to form a section providing said different cross-sectional sizes at different positions on the axis.

6. A grout bag as claimed in claim 1 in which the inlet is a nonreturn inlet valve.

7. A grout pack including a grout bag as claimed in claim 1 together with an external peripheral supporting mesh conforming generally to the outer shape of the grout bag in the open and unfilled condition and a series of operatively axially spaced support rings.

8. A grout pack as claimed in claim 7 in which at least some support rings are dimensioned to fit one within the other in the axially collapsed condition of the unfilled grout pack.