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(54) A device, charging unit and method of filing a borehole with a explosive material

(57) A device (100) for receiving an explosive material (315) comprises a receptacle unit (103) for receiving the explosive material, and an anchoring unit (104), wherein the anchoring unit is arranged on an outer surface of the receptacle unit, and wherein the anchoring unit is adapted to anchor the flexible receptacle unit in a borehole (313).

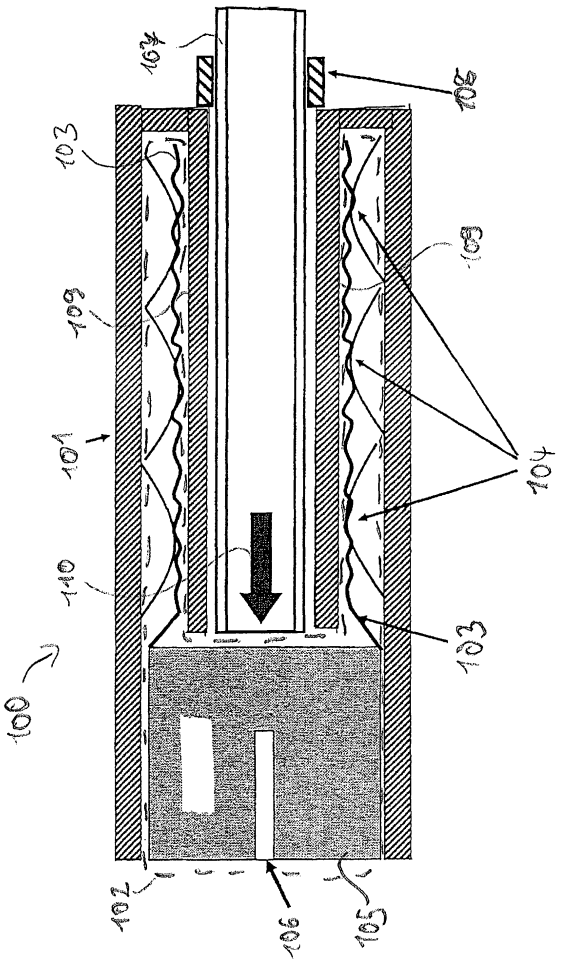

Fig 1

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Description

FIELD OF INVENTION

[0001] The invention relates to a device, in particular a device for receiving an explosive material.

[0002] Beyond this, the invention relates to a charging unit.

[0003] Furthermore, the invention relates to a method of filling a borehole with an explosive material.

BACKGROUND OF THE INVENTION

[0004] Explosive cartridges may be used in many technical fields for any type of rock, rock mass, concrete or comparable material fragmentation.

[0005] GB 1,281,946 discloses an explosive cartridge comprising a casing with electrically conductive end zones. An exploding wire or an electric arc is provided for igniting the explosive charge. The wire or arc can be short circuited by placing a length of removable metal foil between the conductive zones. Individual cartridges can be connected together by interlocking, screwing, by means of a sleeve, or by a bayonet connection. The casing comprises plastics, cardboard or a wound paper strip. The zones comprise metal foil; varnish containing conductive metal, graphite or carbon black powder; or metal deposited chemically, electrolytically, by evaporation in vacuum, or by cathodic projection.

[0006] When detonating in a borehole an explosive cartridge is creating cracks and fragmentation in all directions around the hole. In typical rock production blast this does not cause big problems as the bench face after blasting can be scaled down with mechanical equipment and in that way is made safe for the next blast.

[0007] However, in those situations where a blast is carried out along a final rock wall or where in underground blasting the aim is to create (leave behind) a drift side wall as competent as possible, the strong radial fragmentation all around the borehole is a problem. The amount and length of cracking an explosive charge is creating in a borehole depends amongst other factors on the pressure generated during detonation.

SUMMARY OF THE INVENTION

[0008] It is an object of the invention to provide a device and a method enabling a smooth blasting in surface and underground applications.

[0009] In order to achieve the object defined above, a device, a charging unit and a method of filling or partly filling a borehole with an explosive material according to the independent claims are provided.

[0010] According to an exemplary embodiment of the invention, a device for receiving an explosive material comprises a receptacle unit for receiving the explosive material, and an anchoring unit, wherein the receptacle unit is adapted to be filled with explosive material from outside of a borehole, wherein the anchoring unit is arranged on an outer surface of the receptacle unit, and wherein the anchoring unit is adapted to anchor the flexible receptacle unit in a borehole. In particular, the explosive material may be used in the form of a bulk material or in the form of so-called explosive cartridges.

[0011] According to an exemplary embodiment of the invention, a charging unit comprises a device according to an exemplary embodiment and an elongated container, wherein the device is arranged in the elongated container. In particular, the elongated container may have a cylindrical shape and/or may comprise or may be made of steel or hard plastic.

[0012] According to an exemplary embodiment of the invention a method of filling or partly filling a borehole with an explosive material comprises introducing a device according to an exemplary embodiment into a borehole, and filling the device with an explosive material from outside of the borehole. In particular, the filling may be done by pumping or blowing in the explosive material, like bulk explosives or explosive cartridges. Thus, the explosives may be flexibly chosen from a wide range of possible explosives. For this pumping an additional tube or pipe may be used.

[0013] According to an exemplary embodiment of the invention a method of filling a borehole with an explosive material comprises introducing a charging unit according to an exemplary embodiment into a borehole, and charging the device of the charging unit with an explosive material and removing the elongated container. In particular, the method may further comprise fixing the explosive charging element to the elongated container. For example, the charging element fixing unit may be used to fix the explosive charging element to the elongated container. In particular, the charging or filling of the device may be made while the elongated container is removed, i.e. at the same time, and/or the charging itself may cause that the elongated container is removed or that the filled device is removed (pressed) out of the elongated container, e.g. by pumping the explosives into the device under application of a relatively high pressure.

[0014] By providing a device having an anchoring unit it may be possible to anchor the receptacle unit at a given predetermined distance to the wall of the borehole, e.g. a centrally positioning may be possible, so that the receptacle unit is arranged centred with respect to the borehole. Since investigations have shown that leaving a gap, e.g. an annulus gap, between the explosive charge, the receptacle can be filled with, and the borehole wall may strongly reduces the damage or fragmentation the explosives is creating, the anchoring of the receptacle unit in the borehole may enable a smooth blasting in surface and underground applications, like mining, tunnel construction, or tunnel driving. The use of a receptacle unit which may be adapted to receive an explosive material and having an anchoring unit attached thereto, may be an efficient way to enable a smooth blasting in surface and underground applications even in strongly inclined

boreholes or even in vertical boreholes. In particular, the use of a device according to an exemplary embodiment may possibly be advantageous over a partly filling of the borehole with bulk explosives, i.e. explosives not filled into receptacle units or cartridges, which filling with bulk explosives may be done by pulling an explosive charging hose during charging out of a borehole quicker than the filling with explosives is done, since this can be done in general only with horizontal or slightly inclined boreholes. In particular, the use of a device according to an exemplary embodiment may possibly be even advantageous over the use of small diameter explosive cartridges of about 20 mm to 25 mm which are charged into boreholes of 40 mm to 50 mm, which also leads to the fact that the boreholes are just partly filled with explosives. The use of a device according to an exemplary embodiment of the invention may possibly be more efficient to ensure that the borehole is just partly filled with explosives to reduce the detonating pressure inside the borehole and thereby possibly reducing the fragmentation around the boreholes. In particular, according to an exemplary embodiment it may be possible to build a continuous column charged with explosive material.

[0015] Furthermore, the use of a device having an anchoring unit may enable that the receptacle unit, e.g. explosive cartridge, string emulsion or a tubular member filled with bulk explosives, may not be in contact with parts of the borehole wall, and may even enabling that the receptacle unit filled with an explosive charge is centred inside the borehole, which may improve a decoupling of the explosive charge and the borehole wall. Additionally, it may be possible to ensure a more constant degree of a borehole filling by using a device according to an exemplary embodiment, even under difficult and varying conditions, so that a more constant decoupling may be enabled. Furthermore, the cross section of the explosive may be more constant when using a device according to an exemplary embodiment compared to the conventional use of a bulk explosive. Thus, a detonating condition may be more constant as well, so that the risk that the detonation stops in the borehole due to a not constant cross section may be reduced when using a device according to an exemplary embodiment.

[0016] In particular, the provision of at least one anchoring unit may reduce the risk that the explosives the receptacle unit is filled with and/or the receptable unit itself is washed out, when the device is used in water bearing strata.

[0017] Additionally, the use of an device according to an exemplary embodiment may reduce the risk that small diameter receptacle units in larger boreholes are overlapping, which possibly would reduce the decoupling effect, or the risk of a gap between the receptacle units, which possibly would produce a stop of the detonation, since the device according to an exemplary embodiment comprises the anchoring unit which may fix the positions of receptacle with respect to each other.

[0018] The term "receptacle unit" may particularly denote a unit which is adapted to be charged with explosives. That is, an explosive cartridge may not be called a "receptacle unit" in this sense, since an explosive cartridge is already filled with explosives, but may be used to fill or charge a receptacle unit.

[0019] Next, further exemplary embodiments of the device will be explained. However, these embodiments also apply to the charging unit, and the methods of filling a borehole with an explosive material.

[0020] According to another exemplary embodiment of the device the receptacle unit is a flexible receptacle unit. In particular, the flexible receptacle unit may be a foldable receptacle unit.

[0021] A flexible receptacle unit may be in particular suitable to be filled with an explosive material while ensuring that a borehole can be evenly filled with the flexible receptacle unit. In particular, the provision of a foldable receptacle unit may enable that the device is folded in a container which can be easily introduced into a borehole and which can be removed after the device is placed into the borehole while by removing the folded receptacle unit will be unfolded.

[0022] According to another exemplary embodiment of the device the anchoring unit is a centring unit. In particular, the device may comprise a plurality of centring units. The centring unit(s) may be adapted to centre the receptacle unit in a hole, borehole or the like. Furthermore, the centring unit(s) may be glued, welded or vulcanized to an outside of the receptacle unit, e.g. a flexible hose.

[0023] By centring the receptacle unit in the centre of the borehole it may be possible to ensure that the decoupling between the receptacle unit and the wall of the borehole may be maximized so that fragmentation and damage around the borehole may be reduced.

[0024] According to another exemplary embodiment of the device the receptacle unit is formed as a flexible hose, in particular as a plastic hose. Specifically, the flexible hose may be formed by a thin plastic material which is adapted to withstand a pressure of several bars, e.g. between 5 bar and 15 bar, in particular about 10 bar, and/or to withstand a force of gravity of the filled hose itself, e.g. in case the filled hose is arranged in a vertical borehole, which force may be up to 20 kN, in particular, about 10 kN. A suitable thickness of a plastic hose or plastic foil may be some tenth of a mm, e.g. a plastic foil having a thickness between 0.1 mm and 2 mm, in particular about 0.5 mm. A length of the receptacle unit, e.g. a plastic hose or any other suitable hollow or tubular member, like a tube or a hollow cylinder, may be chosen in such a way that it is about 20 cm longer than a borehole that is to be charged by the plastic hose. For example, the length may be between 0.1 m and 100 m, in particular the length may be between 1 m and 30 m. Due to the great possible length of the receptacle unit the receptacle unit may also be called an endless or continuous receptacle unit. In case a plastic hose is used the hose may be stored on a barrel from which the hose may be un-

winded by pumping the explosives into the hose.

[0025] According to another exemplary embodiment of the device the anchoring unit is formed as a springlike element. In particular each anchoring unit may comprise a central annular part, which is adapted in such a way that the receptacle unit is accomodatable into the annular part, and may further comprise a flexible part, which is adapted in such a way that the flexible part is able to fix the receptacle unit in a borehole. Suitable materials, for the springlike element may be steel or plastic with an elastic deformation behaviour which is high enough so that the springlike elements really act like a springlike element, i.e. after a deformation return to the state before the deformation. In particular, a plurality of anchoring units or elements may be arranged or fixed on the receptacle unit, e.g. a plastic hose. The anchoring units may have a distance from each other which is chosen to be between 5 cm and 2 m, in particular between 10 cm and 1 m.

[0026] According to another exemplary embodiment of the device the flexible part is formed by a plurality of rod like elements. In particular, the rod like elements may be formed by stiffeners, springs, legs or small bars comprising and/or made of metal or plastic. In general, the term "flexible part" may particularly denote every element which is adapted to have a pre-tension which is releasable in order to fix the receptacle unit in a borehole. For example, each anchoring unit may comprise between three and ten legs, in particular a minimum of three or six legs, wherein the legs may be arranged in an equidistant arrangement along a circumferential of the annular part, e.g. the angle distance between neighboring legs is constant, e.g in the case of three legs between each pair of legs an angle of 120° is provided.

[0027] According to another exemplary embodiment the device further comprises an explosive booster unit, wherein the explosive booster unit is attached to the receptacle unit. In particular, the explosive booster unit may be attached to an end of the receptacle unit in such a way that this end is sealed by the explosive booster unit. For example, the explosive booster unit may be glued in such a way to one end of a receptacle unit, which is formed by a hose, that this end is sealed by the explosive booster unit. In particular, the explosive booster unit may have a detonator hole which is adapted to receive a detonator. The explosive booster unit may comprise or may be made of a highly explosive material like TNT or PETN explosives. The provision of such an explosive booster unit may be suitable measure to already provide an ignition mechanism so that no additional preparation of the explosive charge may be necessary. This may lead to the fact that the application of such a device is simple so that even a non-expert person may be able to use it.

[0028] Next, further exemplary embodiments of the charging unit will be explained. However, these embodiments also apply to the device, and the methods of filling a borehole with an explosive material.

[0029] According to another exemplary embodiment of the charging unit the elongated container comprises two walls which are arranged concentrically with each other, and the device is substantially placed between the two walls. In particular, the two walls may be cylindrical. More specifically, the receptacle unit and the anchoring units or anchoring elements are arranged in a space built between the two walls. That is, an outer one of the two walls has a greater diameter while an inner one of the two walls has a smaller diameter so that a space between the outer and the inner wall is formed into which the device can be placed. The wall thickness of the container, which may also be called a protection container, may be in the range between 0.1 mm and 10 mm, in particular, between 0.5 mm and 5 mm and more particular in the range between 1 mm and 3 mm. Preferably, an outside dimension or diameter of the elongated container is sufficiently smaller than the borehole to be charged with a decoupled charge so that it can be easily inserted into the borehole.

[0030] According to another exemplary embodiment of the charging unit the device is placed between the two walls, in such a way that the anchoring unit is pre-tensioned. In particular, the term pre-tensioned may denote that the anchoring or centring unit or units, e.g. the flexible part, like springs or small elastic bars, has a pre-tension when arranged between the walls which pre-tension will be released when the elongated container is removed and thus the centring unit vacate or leave the space between the two walls. In particular, the pre-tensioned state may be distinguishable from a neutral state or released state.

[0031] According to another exemplary embodiment the charging unit further comprises an explosive charging element, wherein the explosive charging element is adapted to fill the device with an explosive material. In particular, the explosive charging element may be an explosive charging hose. The explosive charging hose may be adapted to be insertable into the device or in a space formed by the inner wall of the cylindrical container.

[0032] According to another exemplary embodiment the charging unit further comprises a charging element fixing unit, wherein the charging element fixing unit is adapted to fix the charging element to the elongated container.

[0033] Summarizing an exemplary aspect of the invention may be seen in the fact that a possibly more efficient smooth blasting process is proposed in which process bulk explosives is charged inside a charging unit, which may be called a continuous blast charging unit (CONT-BLAST charging unit). The CONT-BLAST charging unit may comprise a foldable plastic hose, expandable centring units, an explosives booster, and a cylindrical protection container. When charging bulk explosives with the help of the CONT-BLAST charging unit into a borehole, in particular from outside of the borehole, a continuous cylindrical 100% decoupled explosives column which may be automatically centred in the borehole may be formed. The diameter of the charge formed in the bore-

hole may be easily adapted to the desired decoupling ratio by just changing the diameter of the foldable plastic hose. The foldable plastic hose may be made of any type of thin plastics, able to withstand a charging pressure in the range of several bars and the pulling forces acting on the hose in vertical holes. The length of the plastic hose may be about 20 cm longer than the borehole charged, between 1 m and 30 m, for example. The thin plastic hose may carry on its outside at distances between 10 cm and 100 cm small expandable centring units, which may centre the plastic hose charged with explosives inside the borehole. The expandable units may be of such a nature that the plastic hose may be kept from pulled out of the borehole during the charging process and from sliding down inside the borehole due to gravity forces. At the bottom the CONT-BLAST charging unit may carry an explosives booster with a small hole in it for putting in a detonator before charging. The explosives booster may be attached, e.g. glued, to the foldable plastic hose. The foldable plastic hose and the expandable centring units may be stored inside a protection container before charging.

[0034] The aspects defined above and further aspects of the invention are apparent from the exemplary embodiment to be described hereinafter and are explained with reference to this exemplary embodiment. It should be noted that elements described in association with different embodiments or aspects may be combined.

BRIEF DESCRIPTION OF THE DRAWINGS

[0035] The invention will be described in more detail hereinafter with reference to examples of embodiment but to which the invention is not limited.

Fig. 1 schematically illustrates an explosives charging unit according to an exemplary embodiment of the invention.

Fig. 2 schematically illustrates expandable centring units which may be used in an exemplary embodiment of a device.

Fig. 3 schematically illustrates a borehole charged with an explosives charging unit according to an exemplary embodiment of the invention.

DESCRIPTION OF EMBODIMENTS

[0036] The illustration in the drawing is schematically. In different drawings, similar or identical elements are provided with similar or identical reference signs.

[0037] In the following, referring to **Fig. 1**, an explosives charging unit 100, according to an exemplary embodiment is described. Fig. 1 schematically shows a cross-sectional view of the explosives charging unit 100 which comprises a cylindrical protection container 101. In the cylindrical protection container 101 a device 102 is arranged, comprising a foldable plastic hose 103, expandable or elastic centring units 104 and an explosives booster 105. The expandable centring units 104 and the explosives booster 105 are attached, e.g. glued, to the foldable plastic hose 103. Into the explosives booster 105 a detonator hole 106 is formed which is adapted to accommodate a detonator for ignition of the explosives booster 105. As shown in Fig. 1 the foldable plastic hose 103 and the expandable centring units 104 are arranged between two walls of the cylindrical protection container 101 in such a way that the expandable centring units 104 are compressed and pre-tensioned. Furthermore, an explosives charging hose 107 is shown in Fig. 1 which is attached to the cylindrical protection container 101 by a charging hose fixing unit 108. The explosives charging unit 104 is introduced between inner walls 109 shown in the cross-sectional view of Fig. 1 and which are formed by an inner cylinder of the cylindrical protection container 101. The explosives charging hose 107 can be used to charge the foldable plastic hose 103 with explosives, which is indicated by the arrow 110.

[0038] **Fig. 2** schematically shows an expandable centring unit 104 in an enlarged view. Fig. 2a shows a cross-sectional view of the expandable centring unit 104. The expandable centring unit 104 comprises a central annular part 211 and a plurality of legs 212 which are sticking out from the central annular part 211. In Fig. 2a three legs 212 are shown, however in principle any suitable number is possible like six or even more than six. Preferably, the minimum number of legs is three. Fig. 2b shows a schematic longitudinal sectional view of an expandable unit 104, which also shows the central annular part 211 and a plurality of legs 212. The legs 212 are glued, welded or vulcanized to the foldable hose 104 and may be made of steel or plastic with high elastic deformation behavior.

[0039] In **Fig. 3**, the explosives charging unit 100 of Fig. 1 is shown after being introduced in a borehole and charged with explosives. Thus, Fig. 3 shows a borehole 313 in a rock mass 314. Into the borehole 313 the explosives charging unit 100 is introduced, however since the device 102 is already charged with explosives the cylindrical protection container 101 of Fig. 1 is removed. The foldable plastic hose 103 of the device 102 is charged with an explosive 315. Since the cylindrical protection container 101 of Fig. 1 is removed the compressed expandable centring units 104 of Fig. 1 are expanded and fixing the device into the borehole 313. In particular, the foldable plastic hose 103 is centred in the borehole 313. Furthermore, a detonator 316 is introduced in the detonator hole 106 of the explosives detonator 105. For ignition of the detonator an electric cable or a so-called non electric shock tube 317 is attached to the detonator 316.

[0040] In the following some geometrical dimensions and material properties of the charging unit 100 are explained. The outside diameter of the protection container 101 is sufficiently smaller than the borehole 313 to be charged with a decoupled charge, so that it can be easily inserted into the borehole. The wall thickness of the pro-

tection container is in the range of 1 mm to 3 mm and may be made of steel or hard plastic. Preferably, the explosives booster consists of a cast PETN explosives or TNT or any other type of high explosives. It has a slightly smaller diameter than the inner diameter of the protection container. So it can be inserted into the bottom of the protection container. The booster is glued to the foldable plastic hose.

[0041] The diameter of the foldable plastic hose is in minimum around 10 mm smaller than the inner diameter of the protection container. The actual size depends both on the diameter of the borehole and the decoupling ratio desired, e.g. ration between borehole diameter and charge diameter. The foldable plastic tube may be made of a strong thin, e.g. some tenth of a mm, plastic foil, which is able to withstand a pumping pressure of the explosives in the range of several bars and able to withstand also the pulling forces of the weight of the explosives when charged into a vertical hole.

[0042] The expandable centring units are glued, welded or vulcanized outside on the foldable plastic hose at distances sufficient to centre it in the borehole during charging. The expandable centring units work like springs. They may be made of steel or plastic with a high elastic deformation behavior. They are of such a nature that they can be compressed and stored inside the protection container. When they are pulled out of the protection container they bounce up and tight themselves against the borehole wall. Typically they have in minimum three or six legs, looking into one or two directions after bouncing up.

[0043] Furthermore, the explosives charging hose is small enough to be inserted into the Continuous-Blast charging unit (CONT-BLAST charging unit). It is attached to the CONT-BLAST charging unit through a small detachable fixing unit.

[0044] In the following some working principles of the CONT-BLAST charging unit will be explained in more detail.

1. Putting a detonator, e.g. electric, non electric or electronic, into the small hole in the booster at the bottom of the CONT-BLAST charging unit.
2. Inserting an explosives charging hose, which is connected to an explosives charging/manufacturing unit (for site sensitized or site mixed emulsion explosives or cartridges) into the CONT-BLAST charging unit and fixing the explosives charging hose to the charging unit by a fixing unit.
3. Inserting the explosives charging hose with the CONT-BLAST charging unit at the front end into a borehole until it reaches the bottom of the borehole.
4. Pumping bulk emulsion explosives through the charging hose into the CONT-BLAST charging unit by the explosives manufacturing unit.
5. The pumping pressure pushes first the booster out of the protection container and at the same time the foldable plastic tube is continuously pulled out of the protection container while being filled with explosives.
6. Every 10 cm to 100 cm one centring unit is pulled out of the protection container by the foldable plastic tube and bounces up centring the foldable plastic tube full with explosives inside the borehole.
7. When the explosives charging reaches the end of the borehole, the foldable plastic tube carrying at the end one last centring unit is completely pulled out of the protection container. The borehole is now filled with a centred decoupled explosive charge, ready to be fired.
8. Detaching the charging hose from the empty protection container, which might be re-used.

[0045] Summarizing a device for receiving an explosive material according to an exemplary embodiment may enable that a decoupled continuous explosives charge is centred automatically in the borehole and is not in contact with borehole walls so that the decoupling may be ideally. Furthermore, a decoupled charge with a continuous cylindrical cross section may be formed which may be also formed in vertical and inclined holes. In particular, the device may enable that the degree of borehole filling, which corresponds to the decoupling ration, under production conditions may be realized precisely. Additionally, the cross section of the explosives may be cylindrical and constant and therefore the detonating conditions may be constant as well, thus possibly also reducing the risk that the detonation stops in the borehole. Moreover, the contact between the initiation booster and the decoupled charge may be full and ideal for a good initiation or ignition. Due to the anchoring or centring units of the device the explosives may not be washed out of the borehole when working in water bearing strata and there may be no risk of a gap in the explosives column. Beyond this, the system may be easily used with existing emulsion explosives and charging units while the system itself may be manufactured at low cost.

[0046] It should be noted that the term "comprising" does not exclude other elements or features and the "a" or "an" does not exclude a plurality. Also elements described in association with different embodiments may be combined. It should also be noted that reference signs in the claims shall not be construed as limiting the scope of the claims.

Claims

1. A device for receiving an explosive material, the device comprising:

   a receptacle unit for receiving the explosive material, and
   an anchoring unit,

   wherein the receptacle unit is adapted to be filled

with explosive material from outside of a borehole, wherein the anchoring unit is arranged on an outer surface of the receptacle unit, and
wherein the anchoring unit is adapted to anchor the flexible receptacle unit in a borehole.

2. The device according to claim 1,
wherein the receptacle unit is a flexible receptacle unit.

3. The device according to claim 1 or 2,
wherein the anchoring unit is a centring unit.

4. The device according to any one of the claims 1 to 3,
wherein the receptacle unit is formed as a flexible tight or perforated hose.

5. The device according to any one of the claims 1 to 4,
wherein the anchoring unit is formed as a springlike element.

6. The device according to any one of the claims 1 to 5,
wherein each anchoring unit comprises a central annular part, which is adapted in such a way that the receptacle unit is accomodatable into the annular part, and
wherein the anchoring unit further comprises a flexible part, which is adapted in such a way that the flexible part fixes the receptacle unit in a borehole.

7. The device according claim 6,
wherein the flexible part are formed by a plurality of rod like elements.

8. The device according to any one of the claims 1 to 7, further comprising:

an explosive booster unit,

wherein the explosive booster unit is attached to the receptacle unit.

9. A charging unit comprising:

a device according to any one of the claims 1 to 8, and
an elongated container,

wherein the device is arranged in the elongated container.

10. The charging unit according to claim 9,
wherein the elongated container comprises two walls which are arranged concentrically with each other, and
wherein the device is substantially placed between the two walls.

11. The charging unit according to claim 10,
wherein the device is placed between the two walls, in such a way that the anchoring unit are pre-tensioned.

12. The charging unit according to any one of the claims 9 to 11, further comprising:

an explosive charging hose,

wherein the explosive charging hose is adapted to charge the device with an explosive material.

13. The charging unit according to claim 12, further comprising:

a charging element fixing unit,

wherein the charging element fixing unit is adapted to fix the charging element to the elongated container.

14. A method of filling a borehole with an explosive material, the method comprising:

introducing a device according to any one of the claims 1 to 8 into a borehole, and
charging the device with an explosive material.

15. The method according to claim 14,
wherein the explosive material is in the form of bulk explosives or in the form of explosive cartridges.

16. A method of filling a borehole with an explosive material, the method comprising:

introducing a charging unit according to any one of the claims 9 to 13 into a borehole, and
filling the device with an explosive material while removing the elongated container.

17. The method according to claim 16, further comprising:

fixing the explosive charging element to the elongated container.

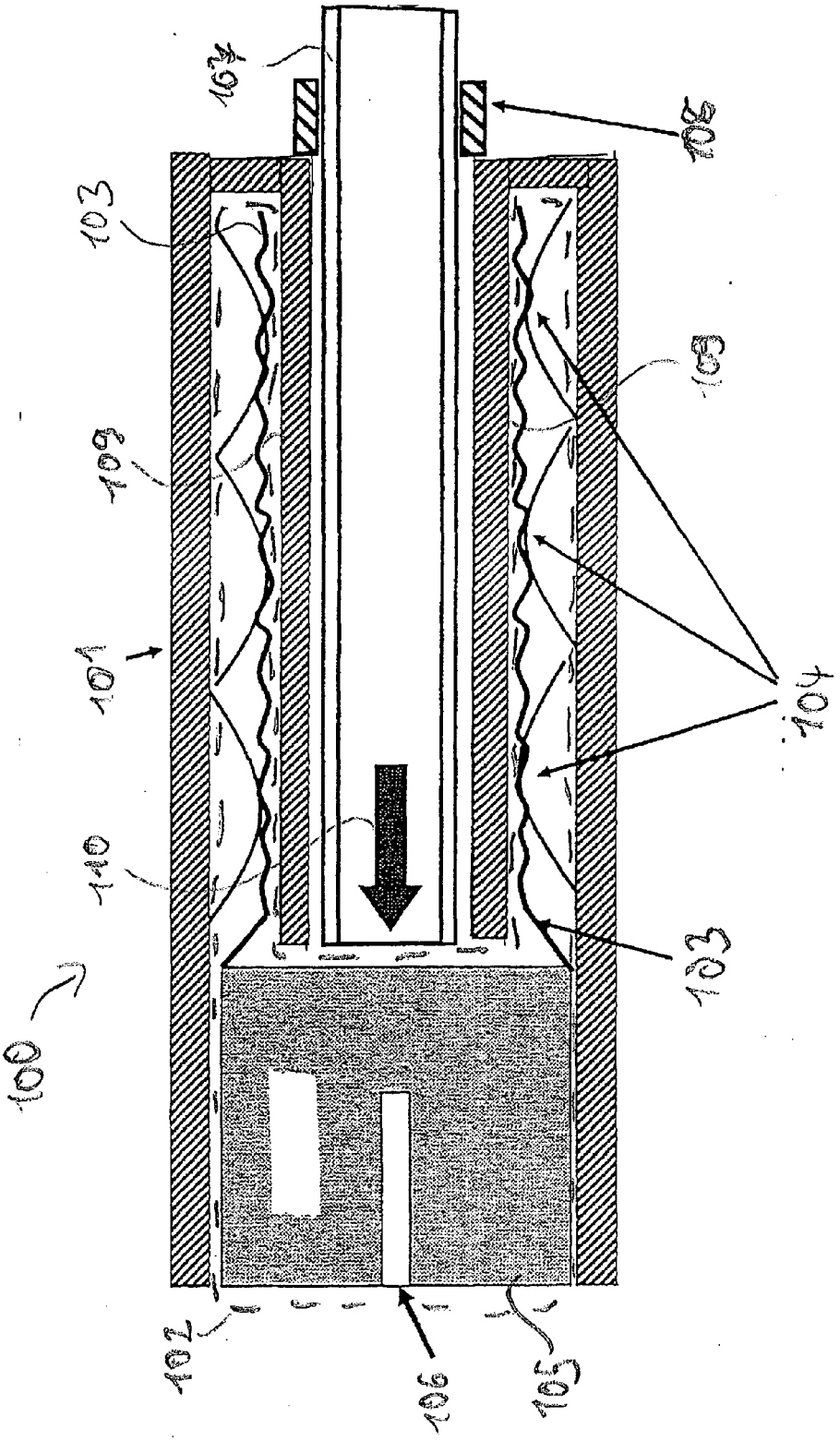

Fig 1

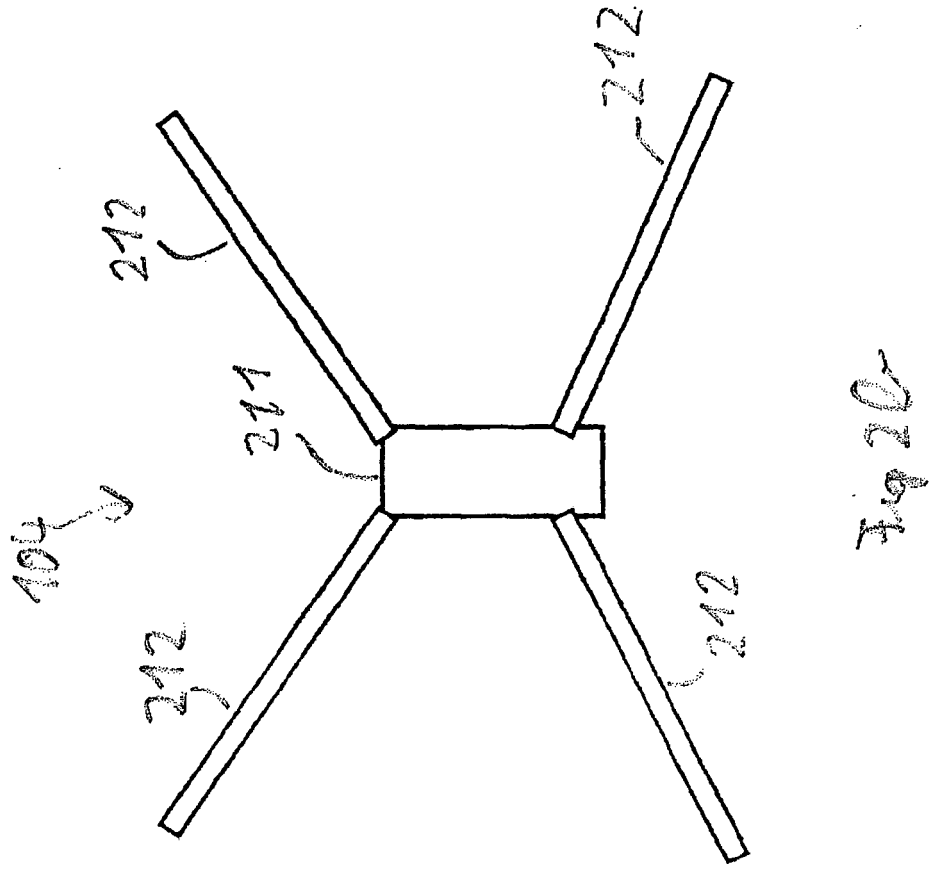

Fig 2b

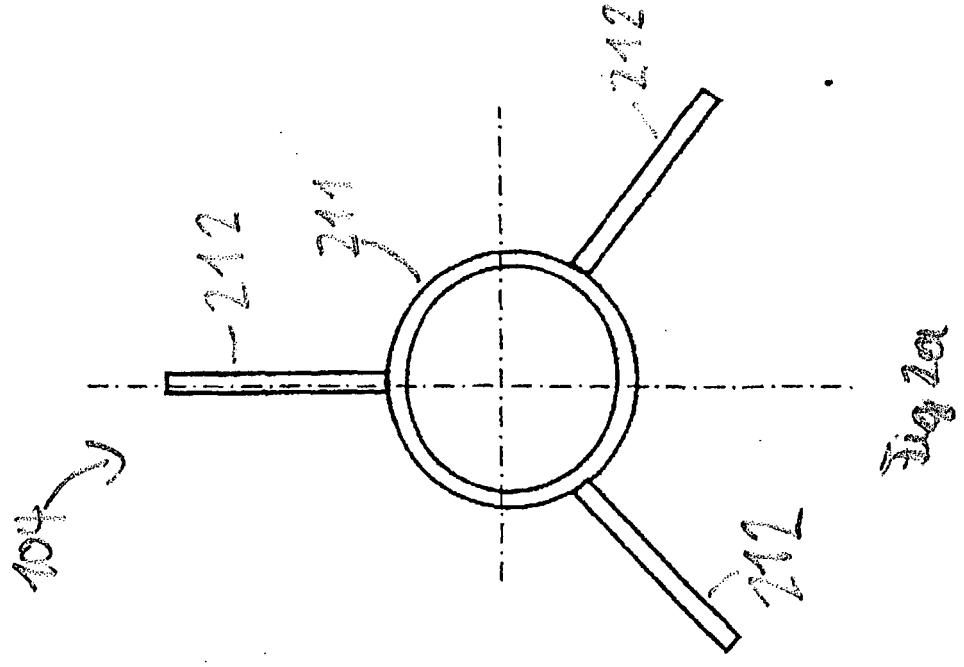

Fig 2a

Fig 2

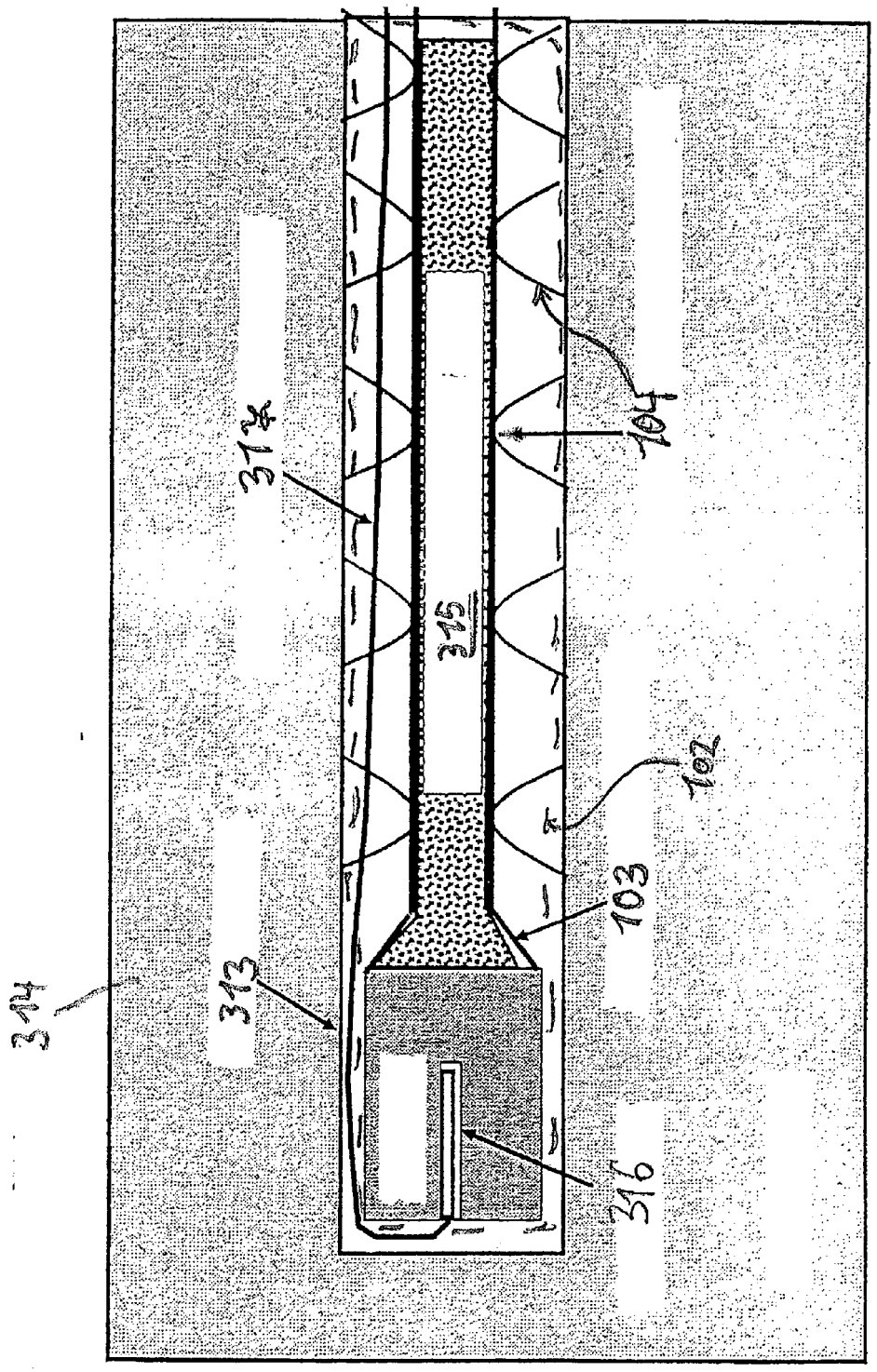

Fig 3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 01 0995

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 4 040 330 A (MATZEN NILS DENNY) 9 August 1977 (1977-08-09) * the whole document *	1-4,8,9, 14-17	INV. F42D1/08 F42D1/10
Y		5,6	F42D1/12
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