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Hidalgo Salgado(10) **Pub. No.: US 2014/0154017 A1**(43) **Pub. Date: Jun. 5, 2014**(54) **SELF-DRILLING FRICTION BOLT**(30) **Foreign Application Priority Data**(75) Inventor: **Mauricio Antonio Hidalgo Salgado,**
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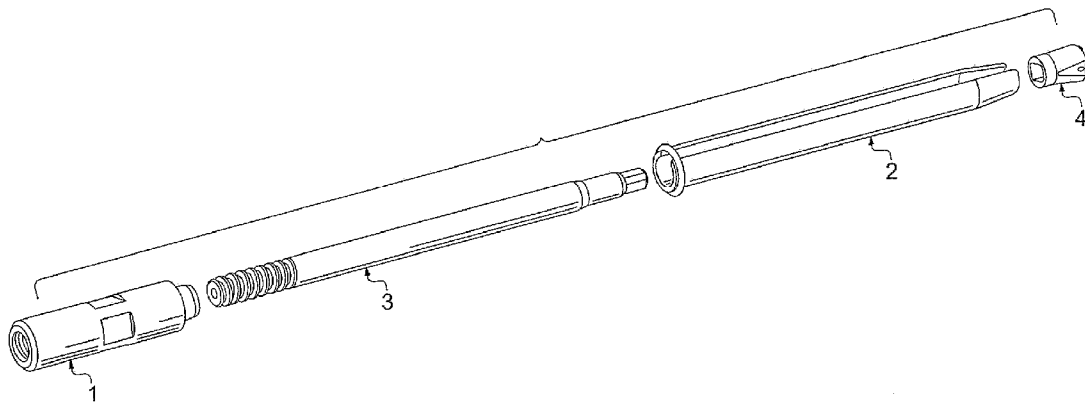
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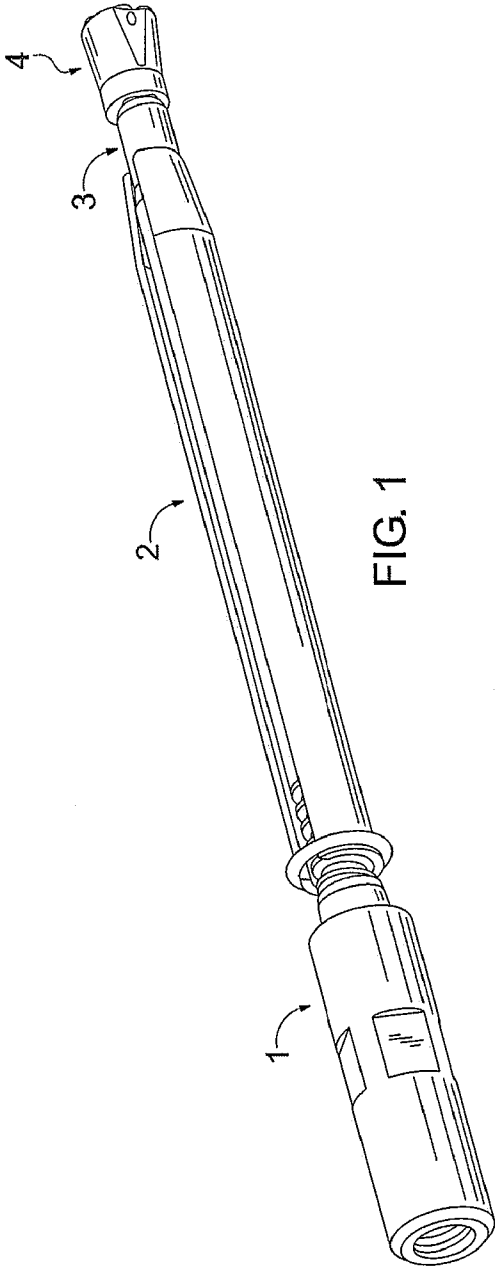
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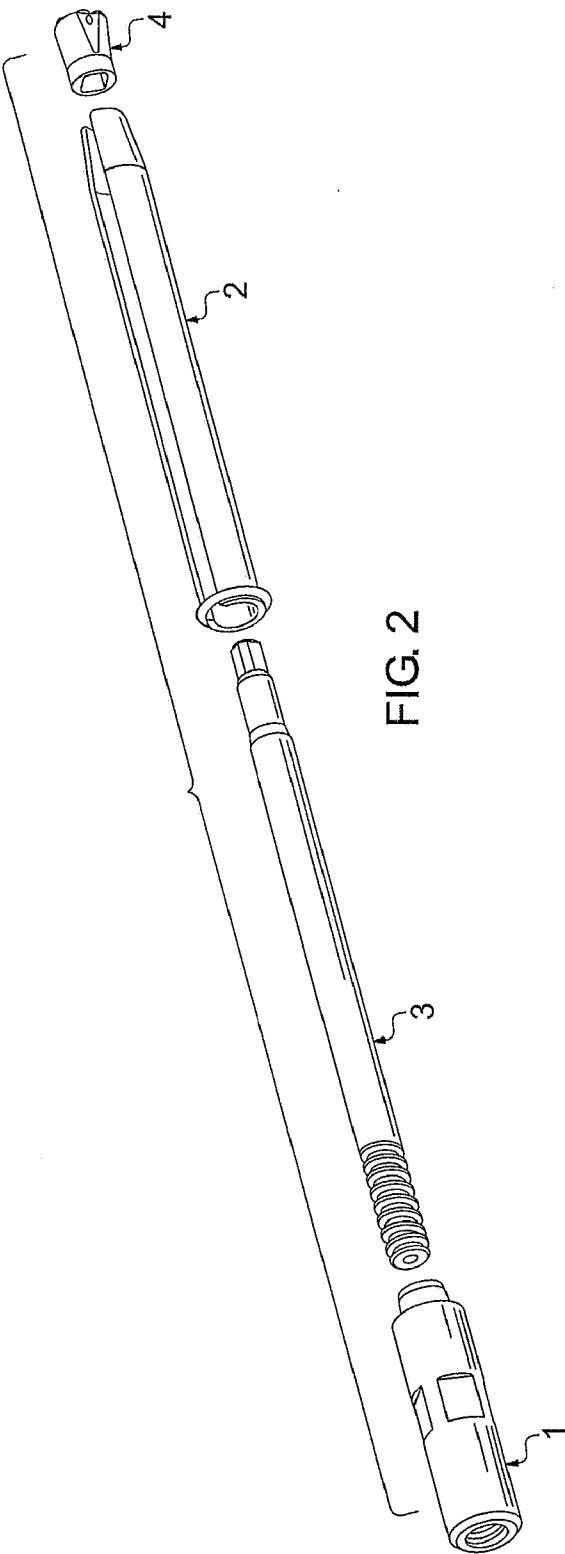
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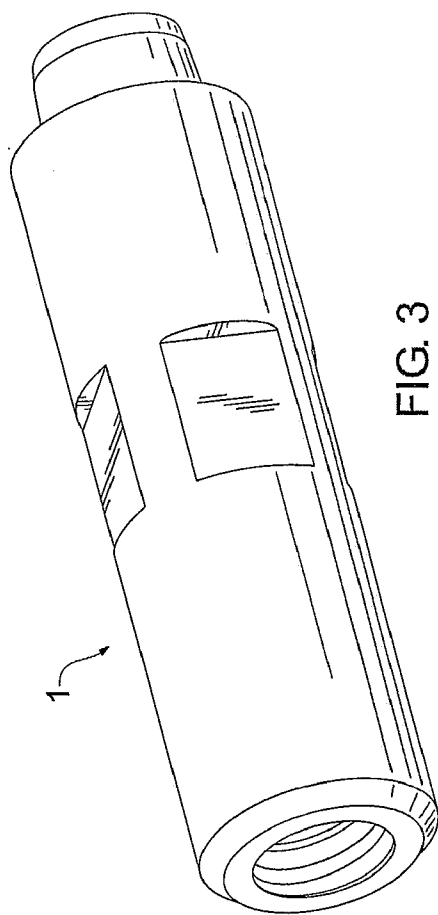
(2), (4) Date: **Jan. 27, 2014**(57) **ABSTRACT**

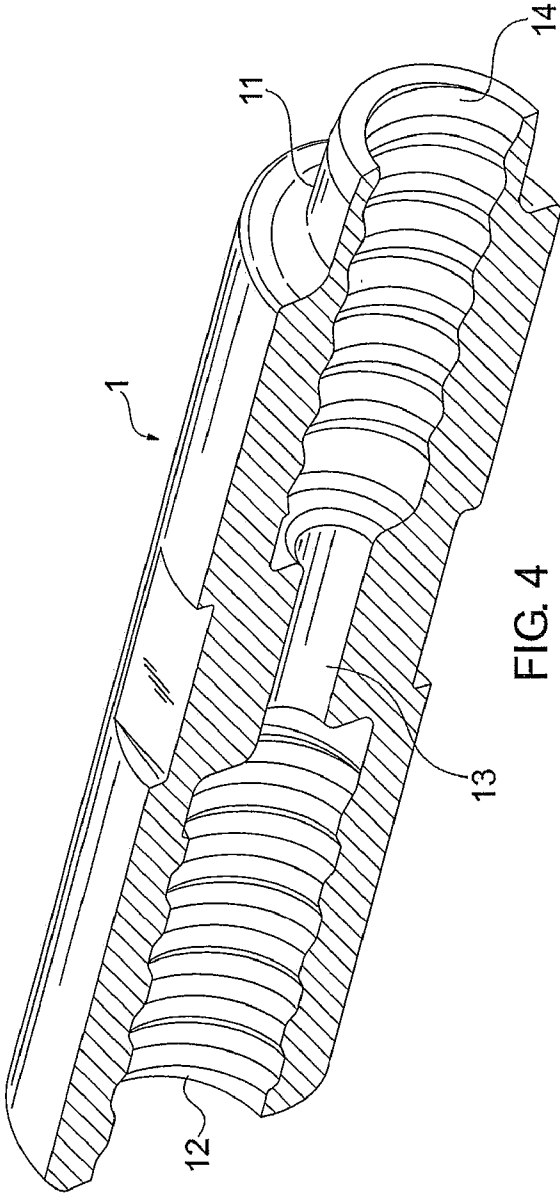
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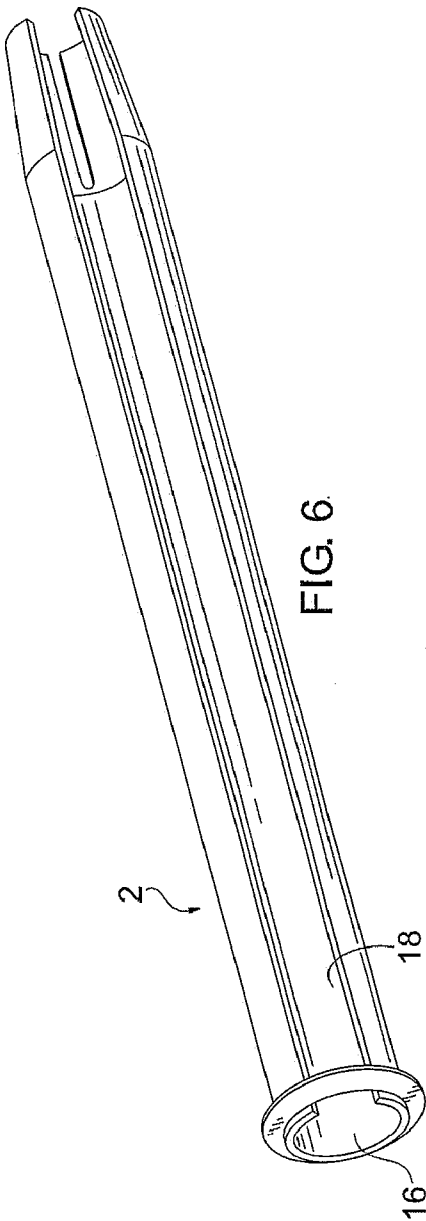
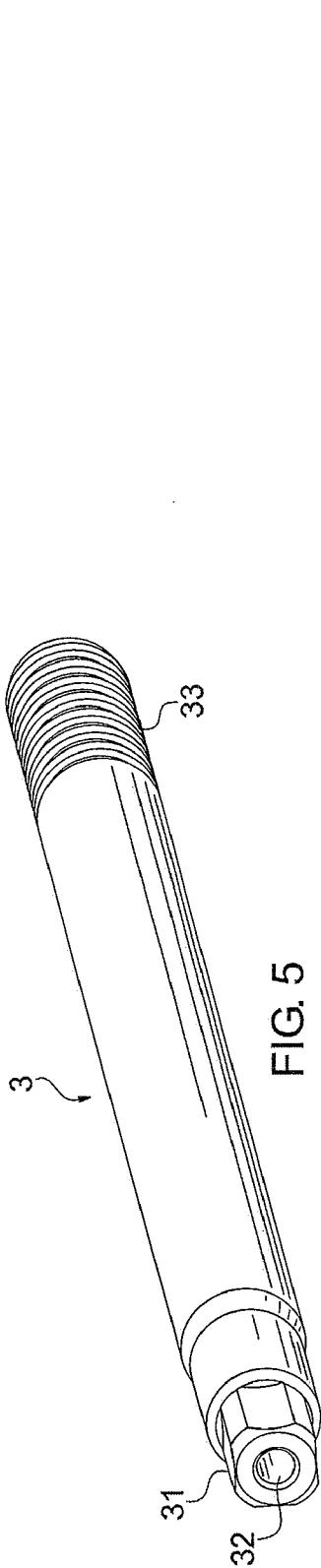


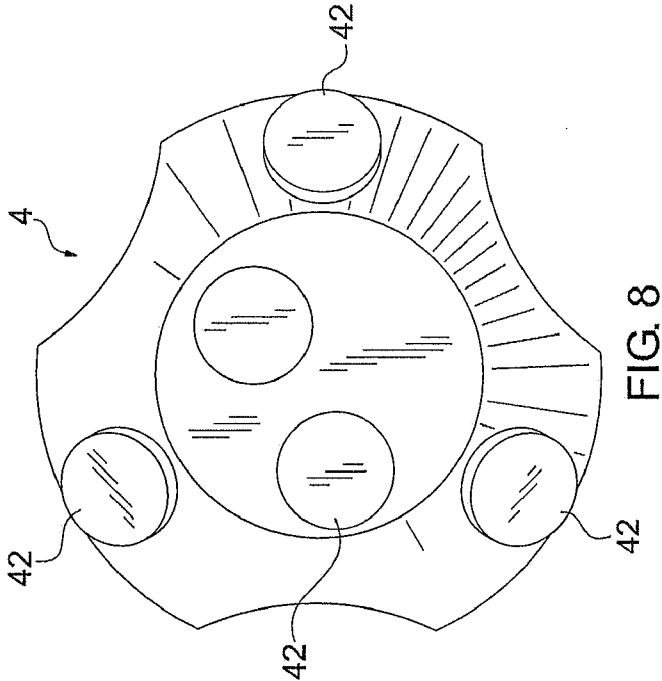
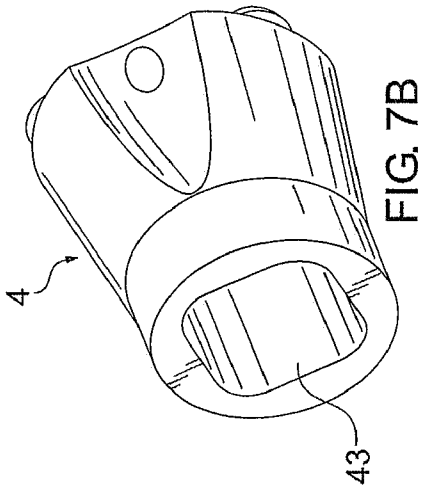
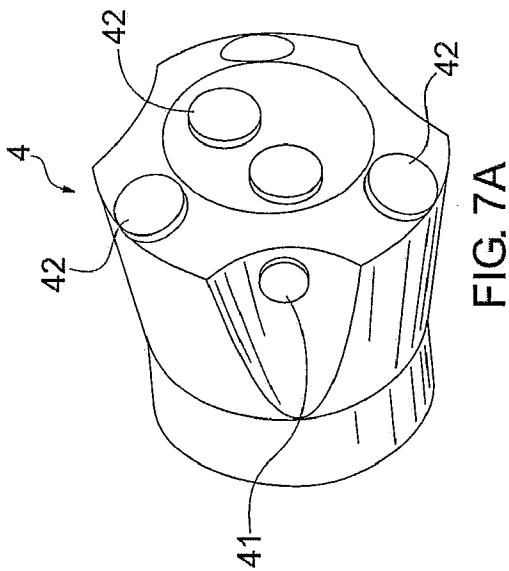












SELF-DRILLING FRICTION BOLT**CROSS REFERENCE TO RELATED APPLICATION**

[0001] This application claims the benefit of Chilean Patent Application No. 2065-2011, filed Aug. 23, 2011.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to reinforcement systems and, more particularly, to a self-drilling friction bolt for mining and civil applications.

[0004] 2. Description of Related Art

[0005] There are various reinforcement techniques and elements currently in use for strata control. Reinforcement systems can be classified in a variety of ways. Reinforcement systems can be classified according to work force, including Passive Anchors (ref. Antonio Ros, Dissertation project, pg. 142); Active Anchors (ref. Antonio Ros, Dissertation project, pg. 142); and Mixed Anchors (ref. Antonio Ros, Dissertation project, pg. 142). Reinforcement systems can also be classified according to the support mechanism, including Adherence Anchors (ref. Antonio Ros, Dissertation project, pg. 142) and Friction Anchors (ref. Antonio Ros, Dissertation project, pg. 142). With Adherence Anchors, the annular space between the bolt and the perforation or borehole is filled with mortar made out of resin or cement, which, upon setting, ensures sufficient adherence to solidify the rod to the ground. Friction bolt arrangements make use of the resistance generated against the rock as their fastening method, taking advantage of the friction or rubbing between the rock and the element as the latter is deformed during installation made through impact with a shank or adapter. The conventional way in which these elements are installed is as follows: first, drilling takes place in the rock using a suitable drilling system, followed by placement of the bolt in the machine that installs it. The bolt is positioned in the newly made perforation and percussion installs the element.

SUMMARY OF THE INVENTION

[0006] For strata control tasks in both mining and civil applications, reinforcement systems are required that provide greater reliability and improved installation times, thus increasing safety and reducing the time involved in performing these duties.

[0007] One embodiment of the present invention relates to a reinforcement system that employs the principle of a friction bolt, self-installed or self-drilled, thus simplifying previous tasks associated with current conventional systems that initially involve suitable drilling, followed by the bolt's installation in the recently made perforation.

[0008] In one embodiment, a reinforcement system includes an adapter, a friction bolt, a drilling rod coupled to the adapter, and a drill bit configured to drill an opening optimally sized for receiving the friction bolt. The drilling rod has a diameter that allows for introduction of the drilling rod into the friction bolt.

[0009] The adapter of the reinforcement system may include first and second threaded portions, and a neck that acts as a guide and impact element for installing the friction bolt. The first threaded portion of the adapter may be positioned at one end of the adapter, with the second threaded portion positioned at the other end of the adapter. The drilling

rod may include a threaded portion engaged with the second threaded portion of the adapter. The adapter may define a central passageway along the entire length of the adapter to enable circulation of water or air from a drilling machine. The friction bolt may define a passageway that receives a portion of the drilling rod. The drilling rod may be coupled to the drill bit. The drill bit may define a polygonal-shaped recess and the drilling rod may include a polygonal-shaped projection, with the polygonal-shaped recess of the drill bit configured to receive the polygonal-shaped projection of the drilling rod.

[0010] In a further embodiment, a method of installing a friction bolt includes drilling a borehole using a drill bit coupled to a drilling rod, with the drilling rod coupled to an adapter, and installing a friction bolt simultaneously while drilling the borehole. The method may further include removing the adapter and the drill rod from the friction bolt. The method may further include leaving the drill bit in the borehole. The friction bolt may be installed by impacting the friction bolt while drilling the borehole.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. 1 is a perspective view of a self-drilling friction reinforcement system according to one embodiment of the present invention.

[0012] FIG. 2 is an exploded perspective view of the system of FIG. 1.

[0013] FIG. 3 is a perspective view of a shank or adapter according to one embodiment of the present invention.

[0014] FIG. 4 is a cross-sectional view of the shank or adapter of FIG. 3 showing the threads contained within and the impact area for the friction bolt.

[0015] FIG. 5 is a perspective view of a modified drill rod according to one embodiment of the present invention.

[0016] FIG. 6 is a perspective view of a friction bolt according to one embodiment of the present invention.

[0017] FIG. 7A is a perspective view of a rock drill bit according to one embodiment of the present invention showing the water cut detail.

[0018] FIG. 7B is a further perspective view of the rock drill bit of FIG. 7A showing the rod connection.

[0019] FIG. 8 is a top view of the rock drill bit of FIG. 7A showing the distribution of hardened inserts, such as tungsten.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0020] For purposes of the description hereinafter, the terms "upper", "lower", "right", "left", "vertical", "horizontal", "top", "bottom", and derivatives thereof, shall relate to the invention as it is oriented in the drawing figures. However, it is to be understood that the invention may assume various alternative variations and step sequences, except where expressly specified to the contrary. It is also to be understood that the specific devices and processes illustrated in the attached drawings, and described in the following specification, are simply exemplary embodiments of the invention. Hence, specific dimensions and other physical characteristics related to the embodiments disclosed herein are not to be considered as limiting.

[0021] One embodiment of the present invention is a system that enables optimal drilling and the installation of friction bolts, which are well known and employed in the sector, in a simultaneous fashion, subsequently enabling recovery of

the devices employed after the maneuver. These are the shank and the drilling rod, in order that they may be subsequently employed in the installation of more friction bolts. The only thing lost in the installation process is the drill bit responsible for breaking the rock. The system shall be described below in detail.

[0022] Referring to FIGS. 1-8, a reinforcement system, including a self-drilling friction bolt, according to one embodiment is disclosed. This system incorporates the typical characteristics of a friction bolt, adding to it the capability to simultaneously drill rock while it is installed, generating the work load instantaneously, and eliminating the need to drill before installing the bolt, as is currently done in the conventional installation of this type of element. The system includes a shank 1, a friction bolt 2, a drilling rod 3, and a drill bit 4.

[0023] Referring to FIG. 4, the shank 1 includes a first threaded portion 12 for receiving a drilling machine (not shown), a central passageway 13 to enable the necessary flow of air and water to execute drilling from the drilling machine, and a second threaded portion 14 for receiving the drilling rod 3. The shank 1 further includes a neck or rabbet 11 that acts as an impact zone to be able to install the friction bolt 2.

[0024] Referring to FIG. 5, the drilling rod 3 is a steel rod having a threaded portion 33 at one end that is received by the second threaded portion 14 of the shank 1 and a polygonal-shaped projection 31, such as a square-shaped projection, at the opposite end of the rod 3 that is configured to receive the drill bit 4, shown in FIG. 7B. Furthermore, the rod 3 defines a central passageway 32 along its entire length, with the goal of enabling the circulation of air or water needed in the drilling operation. The rod 3 has a diameter that allows for its insertion along the interior of the friction bolt 2, as shown in FIG. 1.

[0025] Referring to FIG. 6, the friction bolt 2 is an elongate body defining a central passageway 16 and having a longitudinal slit 18 to allow the friction bolt 2 to compress upon installation, thereby securing the friction bolt 2 within a borehole via friction.

[0026] Referring to FIGS. 7A, 7B, and 8, the rock drill bit 4 has the needed diameter to obtain a perforation or borehole in the rock, such that maximum resistance can be achieved in terms of the load by the friction bolt 2. The drill bit 4 defines cavities or perforations 41 aimed at enabling the flow of air or water traveling through the system's interior, which is needed to remove the loose material generated during the drilling process. The drill bit 4 has a polygonal-shaped recess 43, such as a square-shaped recess, that fits the corresponding polygonal-shaped projection 31 of the drilling rod 3. The rock drill bit 4 further includes hardened material inserts 42, such as tungsten carbide, for breaking through rock. In one non-limiting embodiment, three of the inserts 42 are arranged in a wider diameter and two of the inserts 42 are arranged in the center, specifically on the flat face as shown in FIG. 8, which enables drilling through rock with the required diameter.

[0027] Referring to FIG. 1, the system is used by engaging the first threaded portion 12 of the adapter or shank 1 with a drilling machine (not shown) and drilling a borehole in strata

with the drill bit 4. As noted above, water or air may be used to clear the drilled strata via the passageway 13 of the adapter 1, the central passageway 32 of the drilling rod 3, and the cavities 41 of the drill bit 4. The friction bolt 2 is simultaneously installed while the borehole is being drilled by impacting the friction bolt 2 with the neck 11 of the adapter 1. After drilling the borehole, the adapter 1 and the drilling rod 3 are uncoupled from the drill bit 4 and removed from the friction bolt 2. In particular, the drilling rod 3 is removed from the passageway 16 of the friction bolt 2. Thus, the drilling rod 3 and the adapter 1 can be subsequently used for further installations, while only leaving the drill bit 4 in the borehole.

1. A reinforcement system comprising:

an adapter;

a friction bolt;

a drilling rod coupled to the adapter, the drilling rod having a diameter that allows for introduction of the drilling rod into the friction bolt; and

a drill bit configured to drill an opening optimally sized for receiving the friction bolt.

2. The reinforcement system of claim 1, wherein the adapter includes first and second threaded portions and a neck that acts as a guide and impact element for installing the friction bolt.

3. The reinforcement system of claim 2, wherein the first threaded portion of the adapter is positioned at one end of the adapter and the second threaded portion is positioned at the other end of the adapter.

4. The reinforcement system of claim 2, wherein the drilling rod includes a threaded portion engaged with the second threaded portion of the adapter.

5. The reinforcement system of claim 4, wherein the adapter defines a central passageway along the entire length of the adapter to enable circulation of water or air from a drilling machine.

6. The reinforcement system of claim 3, wherein the friction bolt defines a passageway that receives a portion of the drilling rod.

7. The reinforcement system of claim 2, wherein the drilling rod is coupled to the drill bit.

8. The reinforcement system of claim 2, wherein the drill bit defines a polygonal-shaped recess and the drilling rod includes a polygonal-shaped projection, the polygonal-shaped recess of the drill bit is configured to receive the polygonal-shaped projection of the drilling rod.

9. A method of installing a friction bolt comprising:

drilling a borehole using a drill bit coupled to a drilling rod, the drilling rod coupled to an adapter; and

installing a friction bolt simultaneously while drilling the borehole.

10. The method of claim 9, further comprising removing the adapter and the drill rod from the friction bolt.

11. The method of claim 10, further comprising leaving the drill bit in the borehole.

12. The method of claim 9, wherein the friction bolt is installed by impacting the friction bolt while drilling the borehole.

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