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(71) Applicant
Societe Anonyme D'Explosifs et de Produits Chimiques

(Incorporated in France)

61 rue Galilee, 75008 Paris, France

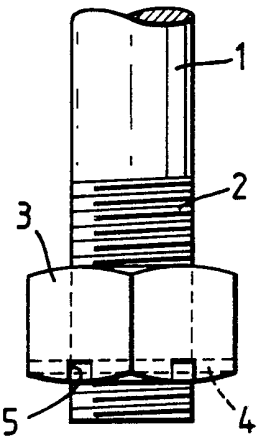
(72) Inventor
Stuart Woodlock

(74) Agent and/or Address for Service
Haseltine Lake & Co
Hazlitt House, 28 Southampton Buildings, Chancery Lane, London, WC2A 1AT, United Kingdom

(54) Installation of tensioned rockbolts

(57) A rockbolt assembly in which the nut employed in applying a torque to the rockbolt after the latter has been fixed in a borehole can be rotated with the rockbolt as a unitary member below a predetermined torque but which will permit the nut to rotate with respect to the rockbolt at or above said predetermined torque comprises an elongate rockbolt 1 having a threaded end portion 2 on which a nut 3 is engaged. The threaded end portion 2 is provided with shear means, such as a shear pin 4, which is located in a cylindrical bore drilled through the bolt, and the ends of which protrude therefrom. The shear pin 4 engages the nut 3 by means of castellated indentations 5 formed on the lower surface of the nut in which the protruding ends of the shear pin 4 can be accommodated. Alternatively, the shear pin can be located in a drill hole in both the bolt and nut (Fig 2).

Fig. 1.



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1982.

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Fig. 1.

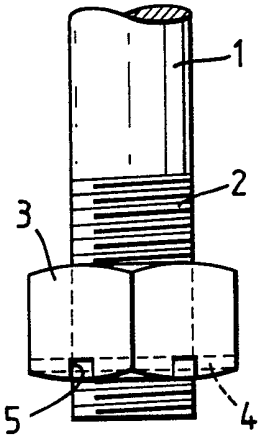
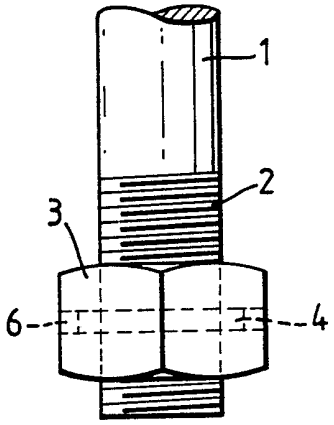


Fig. 2.



IMPROVEMENTS IN AND RELATING TO THE INSTALLATION OF TENSIONED ROCKBOLTS

This invention relates to rockbolts of the kind used for strata reinforcement in mine roofs and the like.

In the installation of such rockbolts, a bonding agent, generally a settable resinous composition contained in one or more frangible cartridges, is placed at the closed end of a borehole drilled in the rock strata and a rockbolt having a threaded end portion is inserted into the borehole with its threaded end portion protruding from the end of the borehole. A washer (or bearing plate) and a nut are positioned on the threaded end portion and the bolt is then rotated so as to be driven into the borehole and thereby puncture the resinous cartridge and cause the settable resinous composition to be distributed around at least the end of the rockbolt. The rockbolt is then held in a fixed position for a short time to allow the resinous composition to harden and thereby fix the bolt in the borehole. Thereafter a tension can be applied on the bolt by tightening the nut on to the bearing plate.

In one known rockbolt system, the initial rotation of the rockbolt is effected by applying a relatively low torque to the nut, which is modified, for example, by the incorporation of indentations or plastics inserts in the thread of the nut, in order to prevent the nut from running up the threaded end portion of the bolt at the low torque applied. When the rockbolt is fixed in the borehole, a higher torque is applied to the modified nut which is sufficient to overcome the resistance which prevented the nut from running up the thread during the initial rotation period and is sufficient to tighten the nut on to the bearing plate so as to tension the bolt.

Various ways have been tried of modifying such nuts to prevent the nut from rotating under the low torque initially applied. The nut can, for example, be provided with a thread pitch which is sufficiently different from that of the threaded end portion of the bolt to permit rotation of the nut and the rockbolt as a unitary member below a predetermined torque. Alternatively, the nut may be provided with deformations, such as by crimping, so as to increase to a predetermined value the torque required to screw the nut on to the bolt. Another way of preventing the nut from rotating below a predetermined torque is to provide the nut with a plastic insert which extends only part of the way into the threaded interior of the nut and which is capable of being retained within the nut until a predetermined torque is applied after the rockbolt has been fixed in the borehole.

According to the present invention, there is provided a rockbolt assembly comprising an elongate rockbolt having a threaded end portion and its other end adapted to be anchored in a borehole, a nut capable of threadedly engaging said threaded end portion in a free running manner, a bearing plate having an aperture therein of a size sufficient to allow it to be positioned on the threaded end portion of the rockbolt so as to be capable of being forced against a surface by rotation of the nut to cause tensioning of the rockbolt when in use, and wherein the threaded end portion of the rockbolt is provided with shear means capable of engaging the nut so as to enable rotation of the nut and rockbolt as a unitary member to be effected in use below a predetermined torque without affecting the position of the nut on the threaded end portion but which will permit the nut to rotate with respect to the rockbolt so as to be tightened against the bearing plate when a torque equal to or greater than said

predetermined torque is applied to the nut after the rockbolt has been anchored in a borehole.

The shear means can conveniently be a shear pin which is designed to shear or deform at a predetermined load. The shear pin, which may be solid or tubular, may be formed from any suitable material, for example a metal, or plastics or ceramic material, and may have any suitable size and cross-section, for example a circular or rectangular cross-section. The shear pin will normally be located in a transverse cylindrical space formed in the threaded end portion of the rockbolt with the ends of the pin protruding beyond each end of the cylindrical space. In order for the shear pin to engage the nut, the latter can be suitably modified, for example by being provided with castellated indentations on the lower end surface thereof, or by having a transverse cylindrical space drilled therethrough so as to accommodate the protruding ends of the shear pin.

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawing in which:

Figure 1 is a side view of the threaded end of a rockbolt assembly provided with a shear pin engaging a castellated nut in accordance with the invention; and

Figure 2 is a side view of the threaded end of another rockbolt assembly provided with a shear pin which is located in a drill hole in the nut and rockbolt in accordance with the invention.

Referring now to the drawing, one embodiment of a rockbolt assembly in accordance with the invention is shown in Figure 1 thereof. The assembly comprises a rockbolt 1 having a threaded end portion 2, the other end of the rockbolt (not shown) being adapted to be anchored in a borehole by means of a bonding agent,

such as a settable resinous composition. The assembly further comprises a bearing plate (not shown) which is normally adjacent to a nut 3 threadedly engaged with the threaded end 2 of the rockbolt 1. A solid cylindrical shear pin 4 is located in a cylindrical bore drilled through the bolt. The shear pin 4 is made of nylon and is designed to shear under an applied torque of 60pdl ft (2.5Nm). The nut 3 is formed with castellated indentations 5, two of which accommodate the protruding ends of the shear pin 4 so as to hold the nut in a fixed position relative to the rockbolt.

In use the assembly shown in Figure 1 (including a bearing plate) is inserted in a conventional manner in a borehole drilled in rock strata, for example, a mine roof, after a bonding agent, normally a cartridged settable resinous composition, has been located at the inner closed end of the borehole. A relatively low torque below the predetermined shearing torque of the shear pin 4 is applied to the nut 3 by means of a tightening spanner. The resulting rotation of the rockbolt drives the bolt into the borehole and into contact with the bonding agent cartridges which are consequently destroyed so that the contents thereof are mixed and allowed to set around the end of the rockbolt which, after a short time, becomes fixed in the borehole.

A higher torque above the said predetermined shearing torque of the shear pin, for example a torque of 100 pdl ft (4.2Nm), is then applied to the nut 3 so as to cause the shear pin 4 to shear off and thereby allow the nut 3 to rotate, with respect to the bolt and thereby force the adjacent bearing plate against the rock face. Because the nut 3 is substantially free running, substantially all the torque applied to the nut is converted into tensioning the bolt, so that the highest possible tension in the bolt for a given torque

can be achieved and there is substantially no torsion in the bolt which would reduce the axial loading of the bolt.

Another embodiment of the invention is shown in Figure 2, in which like numerals indicate like parts with respect to Figure 1. In the embodiment shown in Figure 2, the shear pin 4 is located in a drill hole 6 formed in the end of the bolt 1 and in the nut 3. This embodiment can be used in a manner similar to that described with reference to Figure 1.

Claims:

1. A rockbolt assembly comprising an elongate rockbolt having a threaded end portion and its other end adapted to be anchored in a borehole, a nut capable of threadedly engaging said threaded end portion, a bearing plate having an aperture therein of a size sufficient to allow it to be positioned on the threaded end portion of the rockbolt so as to be capable of being forced against a surface by rotation of the nut to cause tensioning of the rockbolt when in use, and wherein the threaded end portion of the rockbolt is provided with shear means positioned in said threaded end portion and capable of engaging the nut so as to enable rotation of the nut and rockbolt as a unitary member to be effected in use below a predetermined torque without affecting the position of the nut on the threaded end portion but which will permit the nut to rotate with respect to the rockbolt so as to be tightened against the bearing plate when a torque equal to or greater than said predetermined torque is applied to the nut after the rockbolt has been anchored in a borehole.

2. A rockbolt assembly as claimed in Claim 1, wherein the shear means is a shear pin located in a transverse cylindrical space formed in the threaded end portion of the rockbolt with the ends of the pin protruding beyond each end of the cylindrical space respectively.

3. A rockbolt assembly as claimed in Claim 2, wherein the nut is provided with castellated indentations on its lower end surface capable of engaging the protruding ends of the shear pin.

4. A rockbolt assembly as claimed in Claim 2, wherein the nut has a transverse cylindrical space drilled therethrough capable of accommodating the protruding ends of the shear pin.

5. A rockbolt assembly substantially as hereinbefore described with reference to, and as shown in, Figure 1 or Figure 2 of the accompanying drawings.

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