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(56) Documents cited
**GB 1090002 A GB 0935753 A GB 0567117 A
US 4659267 A US 4290337 A**

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UK CL (Edition J) **B3N N9J2, F2H HTD
INT CL⁴ F16B**

(54) **Apparatus for consolidating rock strata**

(57) The apparatus comprises a rock bolt having a threaded end 11 provided with a projecting tab 12. A tool is provided for spinning the bolt and has a hexagonal socket 22 for receiving a nut (not shown). At the bottom of the socket is a slot 26 for receiving the tab. The tool is rotated to cause simultaneous spinning of the nut and bolt to insert the bolt in a drilled hole and rupture a resin capsule in the hole. The tab 12 is fracturable at a predetermined torque caused by resistance as the resin sets, so that the nut is caused to rotate relative to the bolt to tighten the nut on the bolt against a rock face.

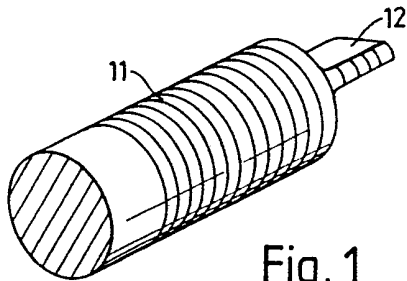


Fig. 1

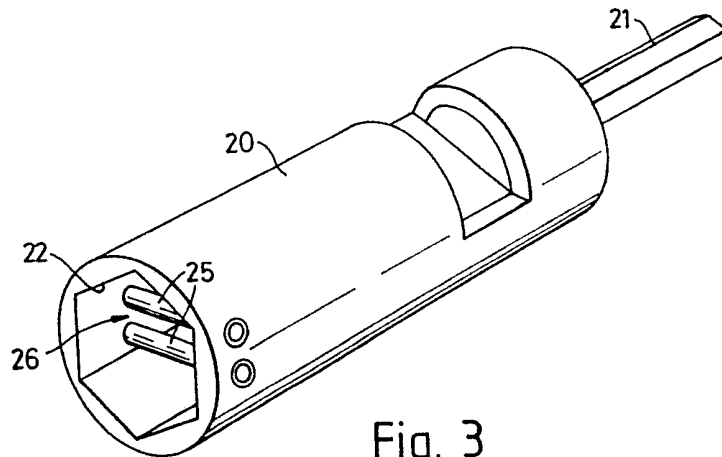


Fig. 3

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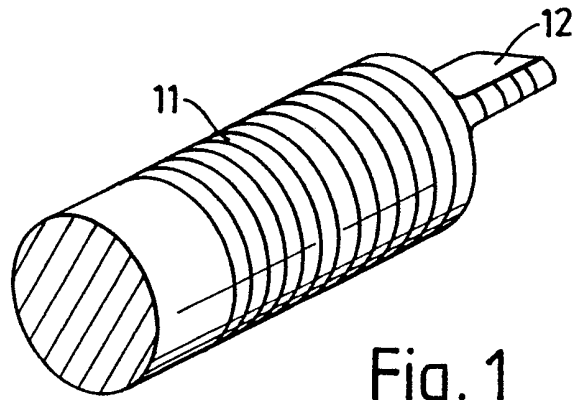


Fig. 1

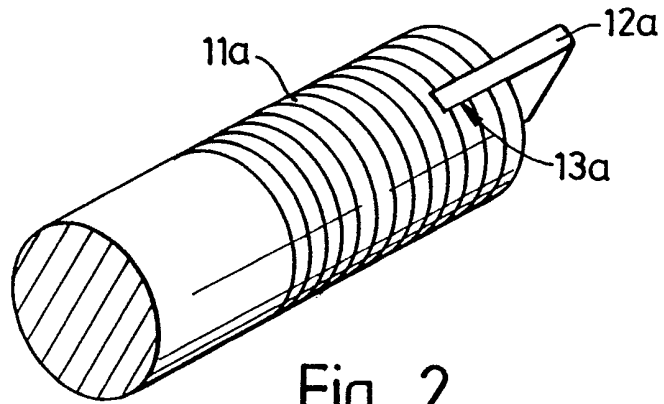


Fig. 2

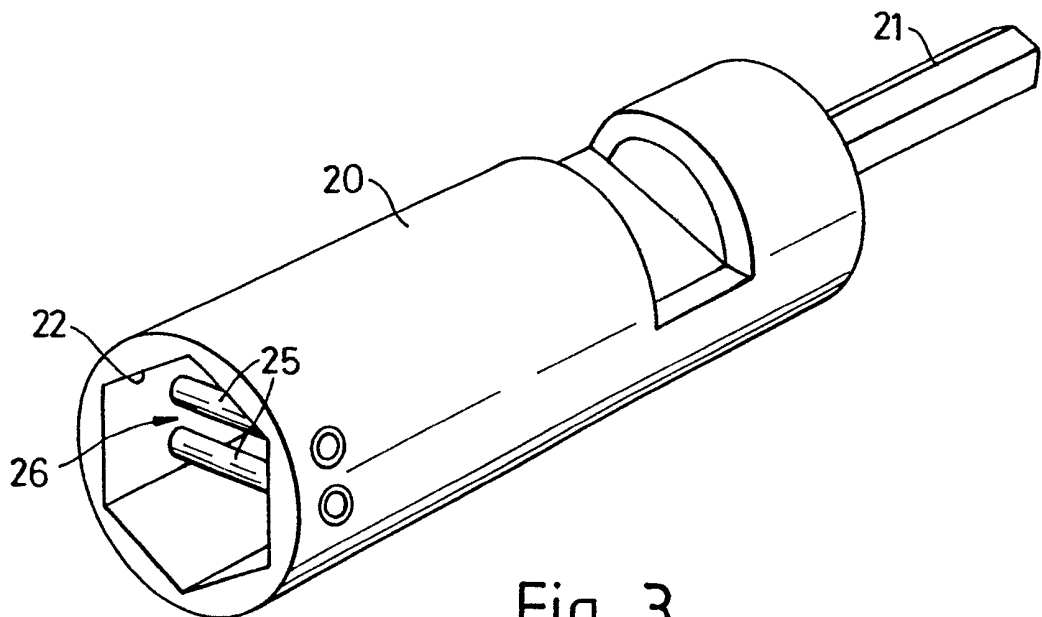


Fig. 3

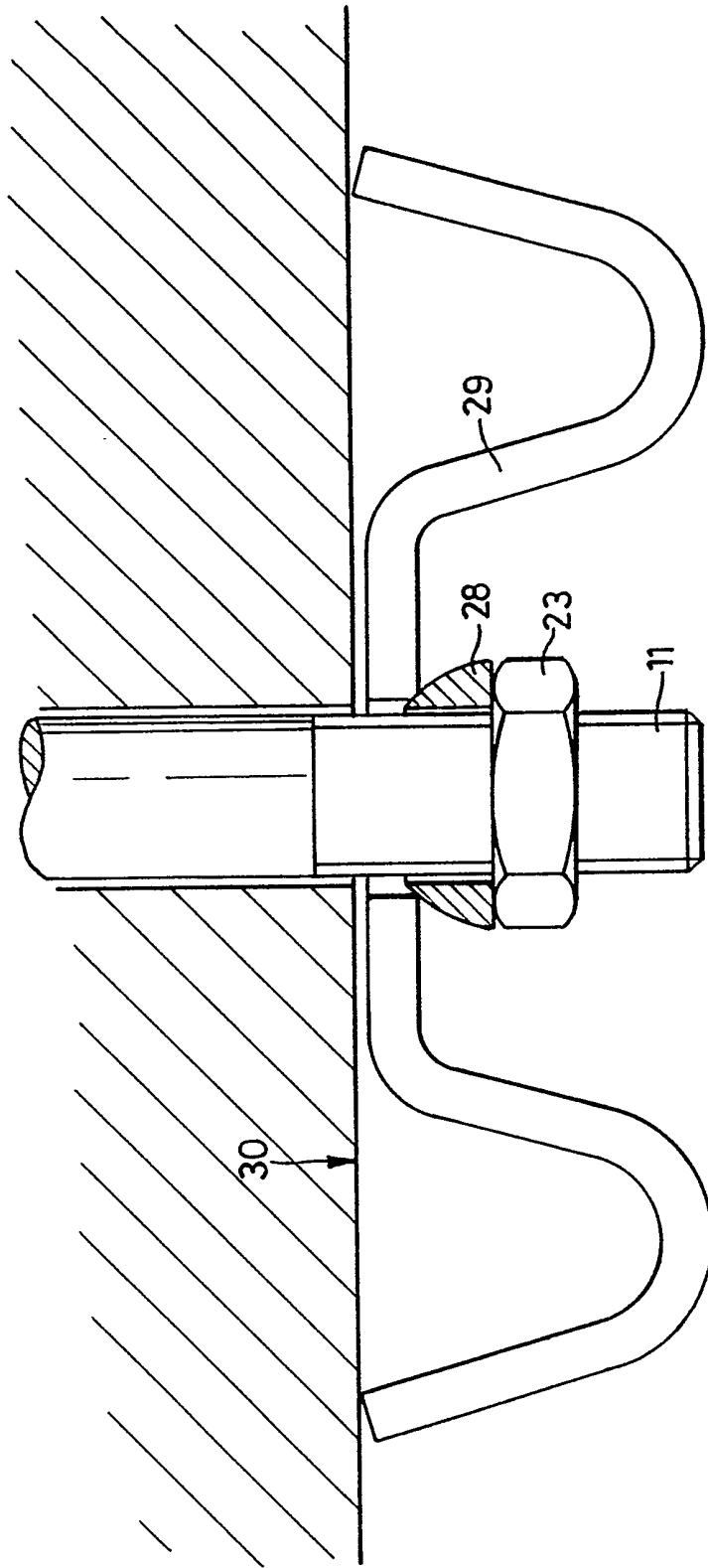


Fig. 4

APPARATUS FOR CONSOLIDATING ROCK STRATA

This invention relates to apparatus for consolidating rock strata.

It is necessary for such consolidation to be carried out extensively in mines and quarries and elsewhere to prevent rock fall. Consolidation is usually carried out by securing a bolt in a hole through the strata by means of a set resin. The bolt has a threaded external end on which a nut is tightened against the rock face.

One or more capsules of resin and catalyst are usually inserted in a drilled hole and the bolt is inserted by being engaged in a tool and rotated. The bolt is designed to break the capsules so that the resin and catalyst are mixed by the bolt and spread around the bolt. A rapid setting resin is used and the same tool is used to tighten the nut on the bolt.

It is usual to rotate the bolt through the nut, which is engaged with the threaded end of the bolt. The nut is designed so that it will not rotate relative to the bolt until a given torque is exceeded, so that, until the resin has set, the bolt and nut rotate together. There are disadvantages with this arrangement. The specially designed nuts (called prevailing torque nuts) are expensive, having regard to the large number used. In practice, the torque resistance of such nuts varies substantially. Sometimes the resistance is too high, so that the rotary drive to the rotary tool is incapable of

overcoming the resistance. Sometimes the resistance is too low, so that poor mixing of the resin and catalyst occurs and/or the resin is poorly spread.

The present invention overcomes these problems and provides apparatus in which the torque at which the nut begins to rotate relative to the bolt can be more accurately predetermined and which is substantially cheaper to operate, permitting the use of standard nuts, instead of prevailing torque nuts.

The present invention provides apparatus for consolidating rock strata comprising a bolt and a settable resin for insertion in a hole in a rock face, a nut screw-engagable with the bolt for tightening against the rock face after the resin has set in the hole around the bolt, a tool for rotating the nut, and a fractureable element for interconnecting the tool and the bolt whereby the bolt and nut rotate together, the element being fractureable at a predetermined torque between the bolt and the tool to permit relative rotation between the nut and bolt.

The invention also resides in a tool for use in the apparatus and in a rock bolt for use in the apparatus.

Reference is now made to the accompanying drawings, wherein:-

Fig. 1 is a perspective view of an end part of a rock bolt according to the present invention;

Fig. 2 is a similar view of a modified rock bolt.

Fig. 3 is a perspective view of a tool according to the present invention.

fig. 4 is a diagrammatic sectional view showing the rock bolt secured in a rock face.

Referring to Fig. 1, the bolt shown is of conventional construction except at the threaded end shown. The bolt is of elongate, solid construction with a sharpened inner end part (not shown), for rupturing a capsule of resin when the bolt is spun in a hole. The threaded end is 11 machined to provide a fracturable element in the form of a tab 12.

The threaded end 11 is cylindrical and the tab 12 forms an axial projection from the cylindrical end. The width of the tab is equal to the diameter of the cylindrical end, but the depth of the tab is substantially reduced relative to the diameter. The depth of the tab will break away from the cylindrical end under a predetermined torque applied to the tab, e.g. 50 to 70 ft-lbs.

Fig. 2 illustrates a modification, in which the cylindrical end 11a is provided with a slot 13a in which is secured a separately formed element 12a. This arrangement enables the element to be of any desired material, different from the material of the bolt.

The resin may be an epoxy resin and separate capsules of resin and catalyst may be provided. Alternatively the capsule may have separate compartments for resin and catalyst.

Fig. 3 shows a tool for use in inserting the rock bolt and tightening up a nut on the bolt.

The tool comprises a hollow cylindrical body 20 having a polygonal, axial shaft 21 fixed at one end. The shaft is engagable in a clutch of a drive (not shown) for rotating the tool.

At the opposite end, the body has a hexagonal socket 22 for receiving a nut 23 (fig. 4). The bottom of the socket is defined by a pair of spaced, parallel, cylindrical rods 25 fixed transversely in the hollow body. In use the nut seats on the rods.

The rods 25 are spaced to define a slot 26 of a width sufficient closely to receive the tab 12 of a rock bolt, with the rock bolt end 11 threadedly engaged in the nut.

Spaced away from the socket 22, a transverse opening 27 is provided to the hollow of the body 20. In use, as described hereafter, the tabs 12, 12a of bolts are fractured and fall into the hollow body, the opening 27 permitting removal of the tabs.

The depth of the socket 22 is twice the thickness of the nut 23 and the tightening movement of the nut along the threaded end 11 of the bolt is the thickness of the nut or less.

In use, one or more resin/catalyst capsules is inserted in a drilled hole in a rock face. A rock bolt, e.g. as shown in Fig. 1, has a nut 23 engaged on its threaded end and the nut is engaged in the socket 22 of the tool and the tab 12 of the bolt engaged in the slot 26 at the bottom of the socket. In a mine roof, the socket will provide a good support for the bolt as the latter is inserted in the drilled hole. The tool is desirably rotated so that the nut is rotatably driven by engagement of the rods 25 with the tab 12. The rotation facilitates full insertion of the bolt in the drilled hole and causes rupture of the capsule so that the resin is mixed and spread around the bolt.

Once the resin begins to set, there is an increasing resistance to rotation of the bolt and, when a predetermined torque is exceeded, the tab 12 fractures. This permits the nut to rotate relative to the bolt, so that the bolt is tightened on the threaded end 11 of the bolt against the rock face.

In practice, as is conventional, a centering washer 28 and a washer plate 29 are mounted on the rock bolt prior to insertion in the drilled hole. The nut 23 is tightened against the centering washer 28 and the washer plate 29 spreads the load on the rock face, 30 (Fig. 4).

CLAIMS

1. Apparatus for consolidating rock strata comprising a bolt, and a settable resin for insertion in a hole in a rock face, a nut screw-engagable with the bolt for tightening against the rock face after the resin has set in the hole around the bolt, a tool for rotating the nut, and a fractureable element for interconnecting the tool and the bolt whereby the bolt and nut rotate together, the element being fractureable at a predetermined torque between the bolt and the tool to permit relative rotation between the nut and the bolt.
2. Apparatus according to Claim 1, wherein the fractureable element is provided on the bolt and the tool has means for engaging the element.
3. Apparatus according to Claim 2, wherein the fractureable element is a projection from a threaded end part of the bolt and the tool has a socket for receiving and engaging the nut and a slot in the bottom of the socket for receiving the element.
4. A tool for use in apparatus according to Claim 3, comprising a body provided with means at one end to engage rotary driving means, a socket at the opposite end for receiving and engaging a nut for rotating the nut, and a slot at the bottom of the socket,

whereby a threaded end part of a bolt may be screwed engaged in a nut received in the socket, with a fracturable element of the bolt engaged in the slot.

5. A tool according to Claim 4, wherein the body is elongate and hollow with a pair of spaced parallel, cylindrical members mounted in the hollow to define the slot.
6. A tool according to Claim 5, wherein body has a transverse outer access aperture opening into the hollow to facilitate removal of fracturable elements broken from bolts.
7. A rock bolt for use in apparatus according to Claim 3, the bolt comprising an elongate body having a screw threaded end part for screw engagement in a nut, and an element projecting longitudinally from the threaded end part, the element being fracturable under a predetermined torque applied to the bolt through the element.
8. A rock bolt according to Claim 8, wherein the fracturable element is an integral part of the bolt.
9. A rock bolt according to Claim 8, wherein the fracturable element is formed separately from the body of the bolt and is secured thereto.
10. A rock bolt according to Claim 9, wherein the body of the bolt has a slot receiving the element.

11. A rock bolt substantially as herein described with reference to the accompanying drawings.

12. A tool substantially as herein described with reference to the accompanying drawings.

13. Apparatus according to Claim 3 including a tool according to any one of claims 4, 5, 6 and 12 and/or a rock bolt according to any one of Claims 7, 8 and 9.

CLAIMS

Amendments to the claims have been filed as follows

1. Apparatus for consolidating rock strata comprising a bolt, and a settable resin for insertion in a hole in a rock face, a nut screw-engagable with the bolt for tightening against the rock face after the resin has set in the hole around the bolt, a tool for rotating the nut, and a fracturable element for interconnecting the tool and the bolt whereby the bolt and nut rotate together, the element being fracturable at a predetermined torque between the bolt and the tool to permit relative rotation between the nut and the bolt.
2. Apparatus according to Claim 1, wherein the fracturable element is provided on the bolt and the tool has means for engaging the element.
3. Apparatus according to Claim 2, wherein the fracturable element is a projection from a threaded end part of the bolt and the tool has a socket for receiving and engaging the nut and a slot in the bottom of the socket for receiving the element.
4. A tool and rock bolt combination for use in apparatus according to Claim 3, the tool comprising a body provided with means at one end to engage rotary driving means, a socket at the opposite end for receiving and engaging a nut for rotating the nut, and a slot at the bottom of the socket, the rock bolt comprising an elongate body having a screw threaded end part for screw engagement in a nut received in the socket of the tool, and an element projecting longitudinally from the threaded end part, the

element being engagable in the slot of the tool and being fracturable under a predetermined torque applied to the bolt through the element.

5. A tool and rock bolt combination according to Claim 4, wherein the tool body is elongate and hollow with a pair of spaced parallel, cylindrical members mounted in the hollow to define the slot.
6. A tool according to Claim 5, wherein the body has a transverse outer access aperture opening into the hollow to facilitate removal of fracturable elements broken from bolts.
7. A tool and rock bolt combination according to Claim 6, wherein the fracturable element is an integral part of the bolt.
8. A tool and rock bolt combination according to Claim 6, wherein the fracturable element is formed separately from the body of the bolt and is secured thereto.
9. A tool and rock bolt combination according to Claim 8, wherein the body of the bolt has a slot receiving the element.
10. A tool and rock bolt combination substantially as herein described with reference to the accompanying drawings.