Jan. 10, 1967 C. I. WILLIAMS 3,296,919

RETAINING DEVICE FOR ROCK BOLTS

Filed Oct. 26, 1964

FIG. 1

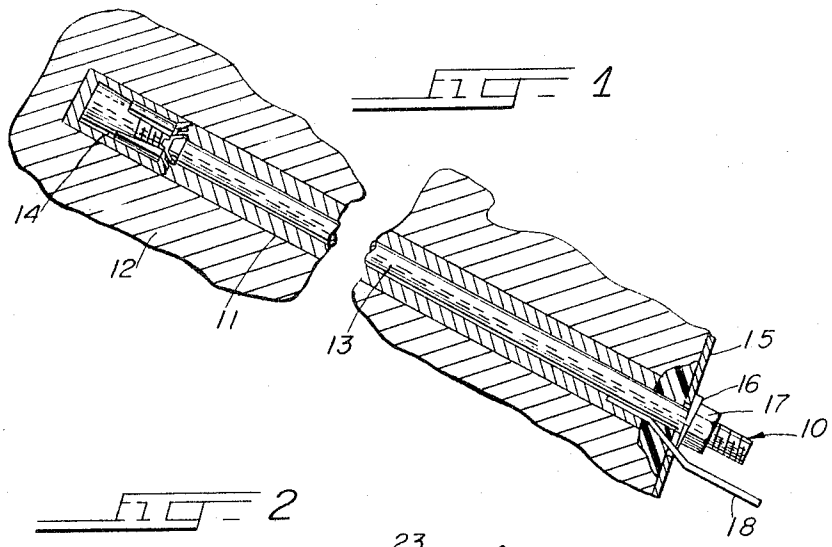


FIG. 2

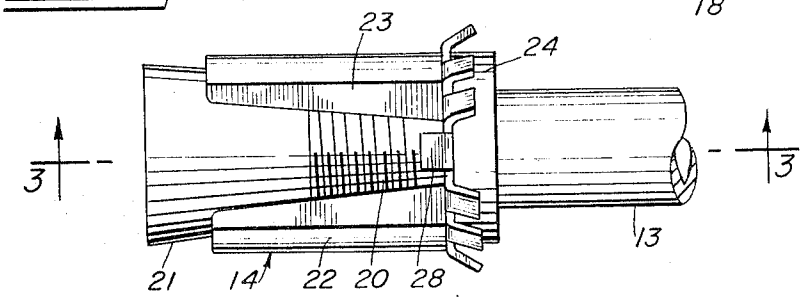
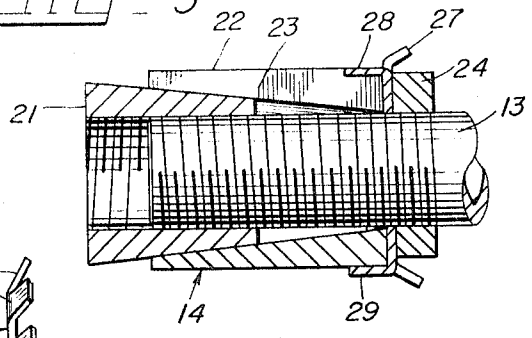


FIG. 3



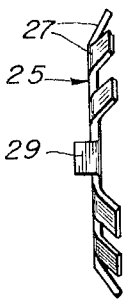
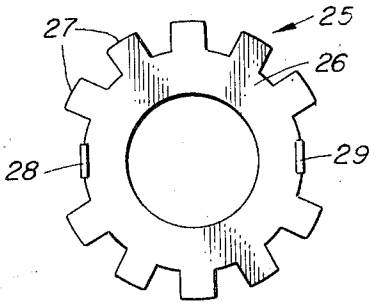


FIG. 4

FIG. 5



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RETAINING DEVICE FOR ROCK BOLTS

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This invention provides a device for retaining a rock bolt in a drilled overhead hole in a rock formation as the bolt is installed. The inserted portion of the rock bolt is a rod usually an inch or more in diameter, with an expandable anchor at the inner end. If the slope of the overhead hole is sufficient to create a tendency for the rod to slide back out as it is inserted, the workman has an obviously difficult problem to contend with. The rods are often over twenty feet long, and may be assembled in sections as they are installed. Holding the inserted portion while attaching another section represents an extra operation that can well be dispensed with. Once the entire rock bolt is in the installed position, it should stay there by itself until the anchor can be "set."

The most effective anchor units now in general use are those involving relative rotation between the rod and a cone, so that threaded engagement between these members produces axial movement of the cone to expand a surrounding shell against the wall of the hole in the rock. To set such an anchor, it is necessary to restrain the tendency of the cone and shell to rotate with the rod as a result of friction. The preferred form of this invention provides a very simple modification of a conventional rock bolt anchor that has the dual function of preventing slip-back of the installed rock bolt, and restraining rotation of the anchor shell. This is accomplished through the use of resilient fingers arranged to engage the wall of the hole, and slanted in a direction such that movement into the hole is relatively free, but movement back out of the hole is inhibited.

The several features of the invention will be analyzed in detail through a discussion of the particular embodiment illustrated in the accompanying drawing. In the drawing:

FIGURE 1 presents a sectional elevation of a rock bolt incorporating this invention in the fully installed position.

FIGURE 2 is a fragmentary view of the inner end of the rock bolt rod, and the attached anchor device.

FIGURE 3 is a section on the plane 3—3 of FIGURE 2.

FIGURE 4 is a side elevation of the resilient retaining ring incorporated in the assembly.

FIGURE 5 is an end elevation of the ring shown in FIGURE 4.

The installed rock bolt assembly generally indicated at **10** in FIGURE 1 is shown inserted in the hole **11** in the rock formation **12**. The inserted portion of the rock bolt includes the rod **13** and the anchor device **14**. It is conventional practice to insert the rock bolt into the hole, set the anchor against the wall of the hole, and then fill the space around the rod with grout to protect the rod and increase the bond between the rock bolt and the surrounding rock. At the surface of the rock, a bearing plate **15** and a beveled washer **16** are normally provided to transfer the stresses from the nut **17**, and a vent tube **18** is arranged to traverse a suitable hole in the bearing plate **15** to provide a passage for the egress of air from the hole in the rock as grout is supplied through the hollow interior of the rod **13**. A handful of plastic filler material **19** may be incorporated at the entrance of the hole **11** as a seal to permit the development of adequate grout pressure.

The preferred form of the anchoring device **14** is best shown in FIGURES 2 and 3. A threaded portion **20** at

the inner end of the rod **13** is engaged by the cone **21**, and relative rotation between these members will produce a movement of the cone to the right, as shown in the drawing. This movement brings the conical periphery of the cone **21** axially along the similarly-shaped conical interior of the expansible shell **22** to induce expansion of the shell into solid engagement with the wall of the hole. The periphery of the shell **22** is provided with the discontinuity shown at **23**, which produces a C-shaped configuration in cross section. The thrust provided by the axial movement of the cone **21** as the anchor is set is resisted by the ring **24**, which is usually positioned at the extremity of the threaded portion **20** of the rod **13**. The ring **24** is therefore normally fixed with respect to the rod **13**, both axially and rotatably. In addition to the thrust ring **24**, there may be other components to the thrust-transfer system such as one or more friction-reducing slip rings.

The retaining ring **25** has a central portion **26** preferably interposed between the thrust ring **24** and the end of the shell **22**. The ring **25** has a group of resilient fingers **27** arranged around the periphery of the central portion **26**, and slanted with respect to a plane perpendicular to the axis of the rod **13** in a direction from the central portion **26** away from the shell **22**. This slant may be considered as backward with respect to the direction of insertion of the anchor into the hole **11**, which is to the left as shown in the drawing. The circumscribed diameter around the outer extremity of the fingers **27** is selected to be in excess of that of the hole in the rock formation, resulting in a resilient engagement of the fingers in such a manner that the insertion of the rock bolt is readily accomplished, but withdrawal movement to the right is prevented in a manner similar to the action of the barb of a fish hook.

In addition to the antiwithdrawal function of the ring **25**, rotation of the shell **22** with respect to the rod **13** is prevented by the presence of the forwardly-bent fingers **28** and **29**, which are disposed as shown in FIGURE 3. One of these latter two fingers (such as the finger **28**) is preferably disposed within the discontinuity **23** of the shell **22**, and functions in the manner of a key disposed in a keyway. The finger **29** may be initially disposed as shown in FIGURE 3, but expansion of the shell **22** will ultimately bend the finger **29** into the plane of the central portion **26**. In the initial position, the finger **29** prevents lateral displacement of the shell **22** (prior to the development of large forces in the anchor) which might disengage the finger **28** from the discontinuity **23**. The engagement of the fingers **27** with the rock formation will restrain the rotation of the ring itself, and the presence of the finger **28** in the discontinuity **23** will correspondingly inhibit rotation of the shell **22**.

The particular embodiments of the present invention which have been illustrated and discussed herein are for illustrative purposes only and are not to be considered as a limitation upon the scope of the appended claim. In the claim, it is my intent to claim the entire invention disclosed herein, except as I am limited by the prior art.

I claim:

In combination with a rock bolt having a bolt rod and an anchoring device including an expansible shell with a C-shaped cross sectional configuration having an axial discontinuity, a cone member at least partially within said shell for expanding the same, said cone member having threaded engagement with said rod, said shell being a one-piece member having a slot extending from end to end, with the walls of said slot providing abutment shoulders, and wherein said shell has a conical bore complementary to said cone member, said rock bolt also having

a thrust member normally fixed with respect to said rod, a retaining ring axially fixed with respect to said rod, said ring having a central portion interposed between said thrust member and the end of said shell, said ring also having a plurality of resilient fingers extending to a radial distance beyond the periphery of said shell, certain of said fingers being inclined with respect to a plane normal to the axis of said rod in a direction from said central portion away from the end of said shell, said ring further having a pair of diametrically opposed fingers extending in the opposite direction from the inclined fingers, one finger of said pair being disposed within the said slot, and the other engaging the external surface of said shell.

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