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2,988,950

WEDGE OPERATED ANCHORING MEANS FOR MINE ROOF BOLT

Filed July 31, 1957

2 Sheets-Sheet 1

FIG. 1.

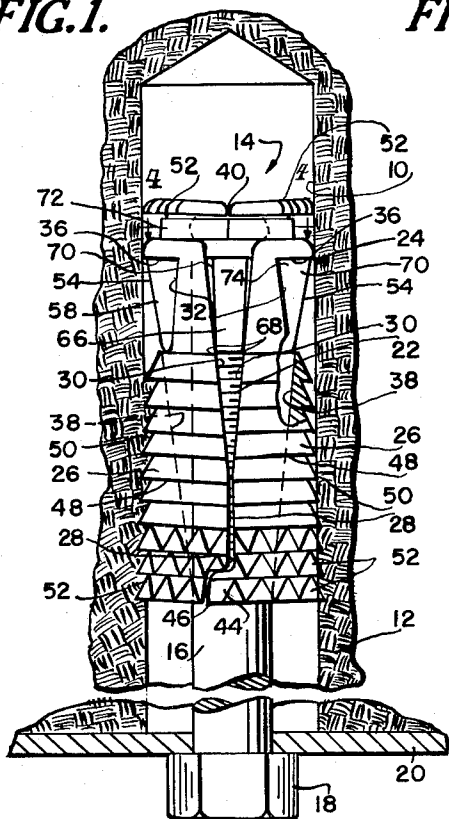


FIG. 2.

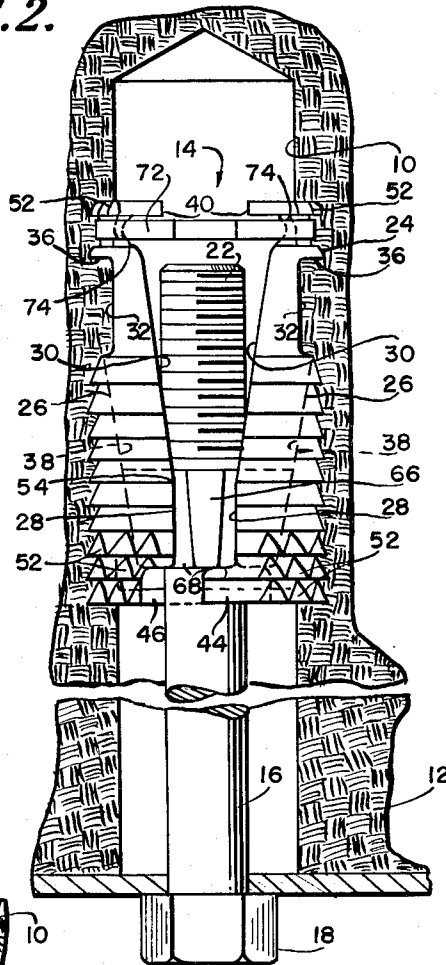
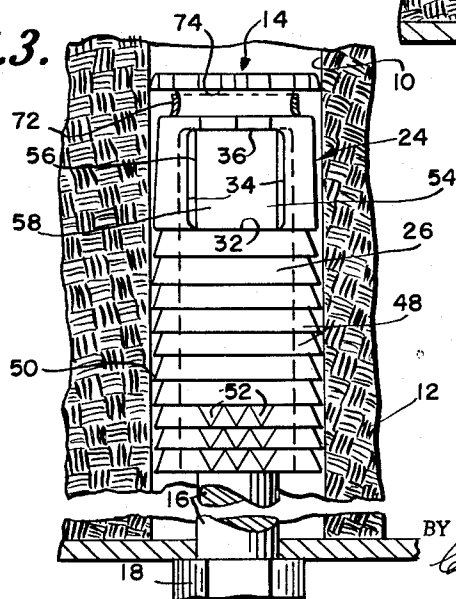


FIG. 3.



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FIG. 5.

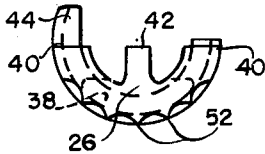


FIG. 6.

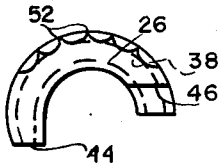


FIG. 7.

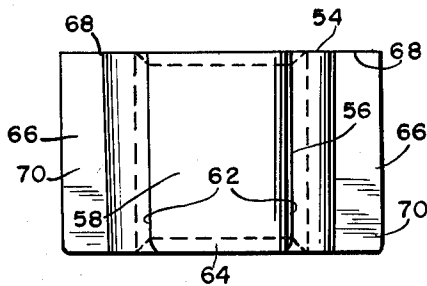


FIG. 8.

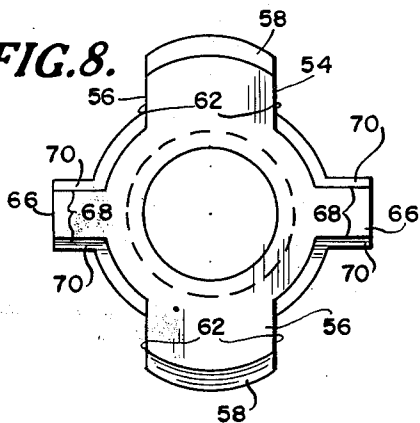


FIG. 4.

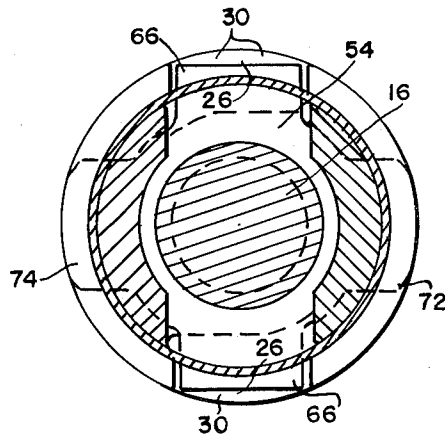
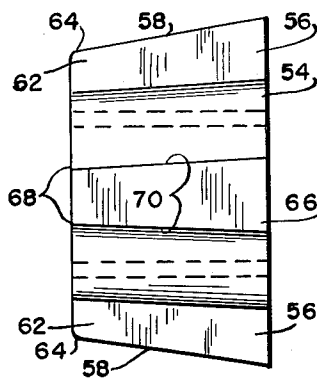


FIG. 9.



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WEDGE OPERATED ANCHORING MEANS FOR MINE ROOF BOLT

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Filed July 31, 1957, Ser. No. 675,485

3 Claims. (Cl. 85-2.4)

This invention relates to mine roof bolts and more particularly to an improved anchoring means for a mine roof bolt. This application constitutes a continuation-in-part of my copending application, Serial No. 629,820, filed December 21, 1956, now abandoned.

The use of mine roof bolts as supports for a mine roof is well known in the art, and such bolts usually comprise an elongated bolt that is inserted upwardly into a drilled hole in a mine roof and has means on the upper end thereof for firmly anchoring such end within the hole so that the bolt can be placed in tension. An example of such a mine roof bolt is illustrated in my Patent No. 2,753,750, issued July 10, 1956, and comprises a multi-part expandible shell enclosing a so-called "wedge nut" threaded on the upper end of the bolt. The shell disclosed in my patent comprises two shell segments or parts interconnected by a U-shaped strap member. The strap member has its ends rigidly connected to the shell segments and serves to retain the shell sections in assembled relation on the wedge nut prior to insertion of the mine roof bolt in the drilled hole. During installation, the U-shaped strap serves to resiliently urge the lower edges of the shell sections outwardly so that they will engage the walls of the drilled hole and prevent turning of the shell sections upon initial tightening of the bolt. After insertion is completed, the bolt is rotated to pull the nut downwardly and the latter effects an expansive wedging action on the shell parts to force such parts outwardly in firm engagement with the side walls of the hole. While the above arrangement has proven satisfactory in operation, considerable expense is involved in effecting the rigid securement of the strap ends to the shell sections.

Accordingly, it is an object of the present invention to provide a mine roof bolt assembly of the type described having improved anchoring means thereon which eliminates the necessity of rigidly securing the shell sections to a connecting piece, such as the U-shaped strap heretofore utilized and which achieves and performs all the advantages and functions heretofore accomplished by the U-shaped strap.

In many instances, an anchoring shell, in its completely collapsed or contracted condition, still has a rather tight fit within a drilled hole in a mine roof. Consequently, in such a case, power means, such as an air hammer, frequently are used to drive the bolt, together with the nut and shell, upwardly into the hole. Hence, it will be seen that the shell parts and the nut must have interengaging portions that are strong enough to carry the shell parts upwardly into the hole without danger of fracturing off any of the interengaging portions. Accordingly, it is another object of this invention to provide strong interengaging portions on the shell and nut so that the former can be carried upwardly into the hole with the latter without danger of fracturing.

It is a further object of this invention to provide an improved, simplified and consequently inexpensive anchoring means for a mine roof bolt, wherein the parts can be maintained easily in assembled condition for ready threading of the bolt into the assembly prior to insertion of the bolt, together with the assembly, upwardly into a drilled hole in a mine roof.

In many instances, a mine roof will be formed of quite soft strata. In using anchoring means of the "shell and

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wedge nut" type in such a roof, there have been numerous instances wherein the shell will expand to an extent sufficient to permit the wedge nut to be pulled completely therethrough, thus resulting in the bolt and nut being free to fall out of the hole. This occurrence is more readily understood when it is realized that mine roof bolts usually are tightened by a power operated wrench.

Accordingly, it is still another object of this invention to provide anchoring means for a mine roof bolt of the shell and wedge nut type wherein stop means are provided on the shell and the nut for preventing the nut from being pulled out of the shell.

These and other objects of the present invention will become more apparent during the course of the following detailed description and appended claims.

The invention may best be understood with reference to the accompanying drawings wherein an illustrative embodiment is shown.

In the drawings:

FIGURE 1 is a side elevational view, partly broken away, of a mine roof bolt assembly embodying the principles of the present invention showing the same in an initial inserted position within the mine roof hole;

FIGURE 2 is a side elevational view of the assembly showing the anchoring means expanded in the hole;

FIGURE 3 is a front elevational view of the assembly;

FIGURE 4 is an enlarged cross-sectional view taken along the line 4-4 of FIGURE 1;

FIGURE 5 is a top plan view of a shell part of the assembly;

FIGURE 6 is a bottom view of the shell part;

FIGURE 7 is an enlarged front elevational view of the wedge nut of the assembly;

FIGURE 8 is a bottom view of the wedge nut; and

FIGURE 9 is a side view of the wedge nut.

Referring now more particularly to the drawings, there is shown in FIGURES 1-3 a drilled hole 10 in a mine roof 12 having a mine roof bolt assembly, generally indicated at 14, inserted therein. The assembly 14 includes a bolt 16 having a head 18, which, when the assembly is installed, seats against a large washer 20, bearing against the roof 12 at the mouth of the hole 10. The upper end of the bolt 16 is threaded, as indicated at 22, and has anchoring means, generally indicated at 24, embodying the principles of the present invention, mounted thereon.

In general, the anchoring means includes a pair of diametrically opposed shell parts 26, preferably of identical construction, each formed generally as a longitudinal segment of a hollow cylinder. In their assembled condition, the shell parts 26 are disposed adjacent each other along side edges 28 extending intermediate the ends thereof. Slightly below the upper end of the shell parts 26, however, both side edges of both parts are spaced apart and formed to provide a downwardly directed V-shaped slot therebetween having downwardly converging side edges 30.

Adjacent its upper end, each shell part 26 is provided with a medial, generally rectangular aperture 32 having two side walls or edges 34 formed with planar parallel surfaces. As best shown in FIGURE 3, the rectangular aperture 32 of each shell part also includes a top wall or edge 36 which is planar and disposed at right angles to the axis of the shell parts 26. Below the apertures 32, the two shell parts 26 are formed with opposed interior wedging surfaces 38 that converge downwardly to a location slightly above the lower end of the shell part 26. Preferably, each of the surfaces 38 constitutes a longitudinal segment of a cylinder. That is, these interior surfaces are not conical for reasons hereinafter to be more fully explained. The upper end of each shell part 26 above the associated aperture 32 includes side edges

40 which terminate short of the plane of the associated side edges 28 and a medial, inwardly extending projection 42 is disposed between the side edges 40.

The lower end of each shell part adjacent one side edge 28 is provided with a tongue-like extension 44 that fits into a complementary recess 46 formed in the opposed shell part adjacent the opposite side edge thereof. Preferably, the shell parts 26 are provided with exterior circumferential serrations 48 that define a plurality of generally downwardly directed sharp edges 50 which have strong anti-withdrawing engagement with the side walls when the anchoring means 24 is expanded. Above the aperture 32 and also at its lower end, each shell part 26 preferably is provided with a plurality of exterior longitudinal serrations 52 for anti-turning engagement with the side walls of the hole 10.

Threaded on the upper end 22 of the bolt 16 and enclosed by the shell parts 26 is a wedge nut 54. The axial length of the nut 54 is substantially equal to the length of the shell apertures 32, as is best shown in FIGURES 1 and 3. The nut 54 is provided with diametrically opposite lateral projections 56 having outer wedging surfaces 58 that converge downwardly at the same angle as the inner opposed shell wedging surfaces 38 for engagement and expansive action therewith. These outer surfaces 58 on the projections 56 also define longitudinal segments of a cylinder complementary to the shell wedging surfaces 38. Each projection 56 is adapted to be received within a corresponding part aperture 32 so that the upper surface of each projection may abut against the planar top wall surface 36 of an aperture, as is shown in FIGURES 1 and 3. The width of each projection 56 is only slightly less than that of the apertures 32, and each projection has planar parallel opposite side surfaces 62 for guiding engagement with the side wall surfaces 34 of each aperture. Preferably, the bottom edge of the outer surface 58 of each projection 56 is rounded slightly, as at 64, best shown in FIGURE 9.

The wedge nut 54 also is provided with two additional opposite lateral projections 66 disposed at 90° to the projections 56. In their initial assembled condition, the projections 66 are received within the V-shaped slots between the edges 30 of the shell parts 26. Each projection 66 includes opposed lower side edges 68 which engage the associated side edge surfaces 30 of the associated shell part and form fulcrums, about which the shell parts are pivoted. Each projection 66 also includes inclined surfaces 70 diverging upwardly from the associated fulcrum edges 68. As best shown in FIGURES 1-3, the shell parts are retained in assembled relation on the wedge nut 54 by a spring metal split ring 72 disposed within a peripheral groove 74 formed on the exterior surface of each shell part at the upper end thereof above the aperture 32.

Since the split ring is positioned on the upper end of the shell parts above the fulcrum edges 68, the lower edges of the shell parts are urged outwardly by the split ring so that the serrations 52 thereon will dig into the wall of the hole 10. Of course, the upper ends of the shell parts are urged inwardly until opposed ends of the projections 42 and opposed side edges 40 engage each other to limit the pivotal movement of the shell parts. The bolt 14 is threaded into the wedge nut 54 from the lower end of the shell parts 26, as shown in FIGURE 1. In this connection, the end of the bolt 16 will engage the shell projections 42 and prevent the former from being threaded too far into the nut 54. The bolt 16 having the washer 20 thereon is then inserted in the drilled hole 10 in the mine roof into the position shown in FIGURE 1. During this insertion, it will be seen that the upper surfaces of the projections 56, together with the surfaces 36 of the apertures 32, provide broad areas of engagement between the nut 54 and the shell parts 26 for pulling the latter upwardly into the hole 10 with the nut. At the same time, it will be seen that since the lower edges of

the shell parts are resiliently urged outwardly, the sharp serrations 52 thereof will dig into the side wall of the hole as the shell is inserted upwardly therein to both restrain turning of the shell in the hole and downward movement of the shell out of the hole. Where considerable resistance to the upward movement of the anchoring means is encountered, the lower edges of the shell parts move inwardly against the action of the split ring. It will be understood that the latter is only exemplary and that other constructions, such as elastic bands and the like can be employed for this purpose.

When the washer 20 on the bolt 16 engages the mine roof 12, initial turning will effect a slight separation of the two shell parts 26 and thereby cause all of the sharp edges formed by the circumferential and the longitudinal serrations 48 and 52 on the shell to engage and dig into the side wall of the hole 10. Hence the shell parts 26 will be more firmly restrained against turning in and movement outwardly of the hole 10. Turning of the bolt 16 is then continued in a direction to cause the wedge nut 54 to travel downwardly on the bolt, and such downward movement of the nut will cause the mutually engaged wedging surfaces 58 and 38 on the nut and on the shell parts 26 to expand the latter forcefully into tight engagement with the side wall of the hole 10, as shown in FIGURE 2, such expansion being readily permitted by the split ring 72.

During the initial part of such downward movement of the nut 54, the projection side faces 62 engage the side wall surfaces 34 of the apertures 32 to prevent rotation of the nut, while throughout such downward movement at least one of the inclined surfaces 70 on each nut projection 66 engages a side edge 28 or 30 of shell parts 26 to prevent rotation of the nut. In this connection, the direction of the threads on the nut 54 and on the bolt 15 is such that as the latter is tightened, the projections 66 on the nut 54 are caused to bear against and move longitudinally along the side edges 30 or 28 of the shell parts 26 from which the tongues 44 project. Consequently, if the strata in which the hole 10 is located are relatively soft, so that the bolt 16 can continue to be tightened and the shell will continue to expand without undue effort, the underside of each of the projections 66 will eventually travel down and engage the top edge of the corresponding tongue 44, as shown in FIGURE 2. This interengagement will positively prevent the nut 54 from traveling down farther on the bolt 16, and possibly entirely out of engagement with the shell parts 26. In this connection, the threads on a mine roof bolt are usually rolled thereonto, so that when the nut reaches the end of such threads, the nut can continue to travel down on the bolt unless some stop means are provided for preventing such action.

As stated heretofore, the interengaging wedging surfaces on the shell parts 26 and on the nut 54 preferably are of cylindrical configuration rather than conical. This cylindrical configuration provides for interengagement of the entire opposed areas of both wedging surfaces 38 and 58 to provide an effective expansive wedging action. On the other hand, were these interengaging wedging surfaces conical, each nut projection 56 would have only two-point contact with its corresponding shell wedging surface 38. Two-point contact wedging action is highly unsatisfactory, because it results not only in the application of localized and, therefore, possible fracturing forces, but also in greatly increased pressures at the contact points which will inhibit sliding movement between two wedge elements. While it will be realized that planar wedging surfaces on the nut 54 and on the shell parts 26 would accomplish the aforementioned advantageous results of cylindrical wedging surfaces, cylindrical wedging surfaces are preferred here because of the cylindrical configuration of the shell. Were planar wedging surfaces employed, such surfaces would necessarily have to be of smaller overall interengaged areas than those illus-

trated, or else the walls of the shell parts 26 would be thinned unduly at the side edges of the wedgingly engaged surfaces, with a consequent weakening of the shell parts.

It thus will be seen that the objects of this invention have been fully and effectively accomplished. It will be realized, however, that the foregoing specific embodiment has been shown and described only for the purpose of illustrating the principles of this invention and is subject to extensive change without departure from such principles. Therefore, this invention includes all modifications encompassed within the spirit and scope of the following claims.

I claim:

1. Anchoring means for a mine roof bolt comprising: an expansible shell assembly having separate parts each generally shaped as a longitudinal segment of a hollow cylinder and provided with a medial aperture therein adjacent one end of said assembly, each of said apertures having parallel planar side wall surfaces and a planar end wall surface adjacent said one assembly end, said parts having inner inclined wedging surfaces which diverge toward said one assembly end at a constant fixed angle and are each of at least substantially the same width as and in longitudinal alignment with the aperture in the corresponding part; and wedge means disposed between said parts and provided with projections each receivable in a corresponding part aperture and engageable with the end wall surface thereof adjacent said one assembly end when said assembly is contracted, said projections having wedging surfaces complementary to and for mutual wedging engagement with said part inner surfaces to expand said assembly on movement of said wedge means toward the other end of said assembly, the inner wedging surfaces of said parts and the complementary wedging surfaces of said projections having a uniform profile throughout their longitudinal extent so as to provide said mutual wed-

ing engagement during said last-mentioned movement throughout the longitudinal extent of the wedging surfaces of said projections, and each of said projections being of substantially the same width as its corresponding aperture and having parallel planar side wall surfaces for guiding engagement with those of said aperture.

2. Anchoring means as defined in claim 1 wherein said wedge means includes second projections providing transversely extending fulcrum edges; and said shell parts include side edges abutting said fulcrum edges when the assembly is initially assembled; removable means engaging the shell parts in a position spaced from said fulcrum edges in a direction toward the one end of said wedge means for retaining the shell parts together on said wedge means with the respective side edges of said shell parts in engagement with the fulcrum edges of said wedge means and for resiliently biasing the shell parts about said fulcrum edges to move the ends thereof adjacent said one wedge means end together and the opposite ends apart; and abutment means for limiting the movement of said shell parts about said fulcrum edges by said removable means.

3. Anchoring means as defined in claim 1 wherein each of said wedging surfaces constitutes a longitudinal segment of a cylinder.

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