

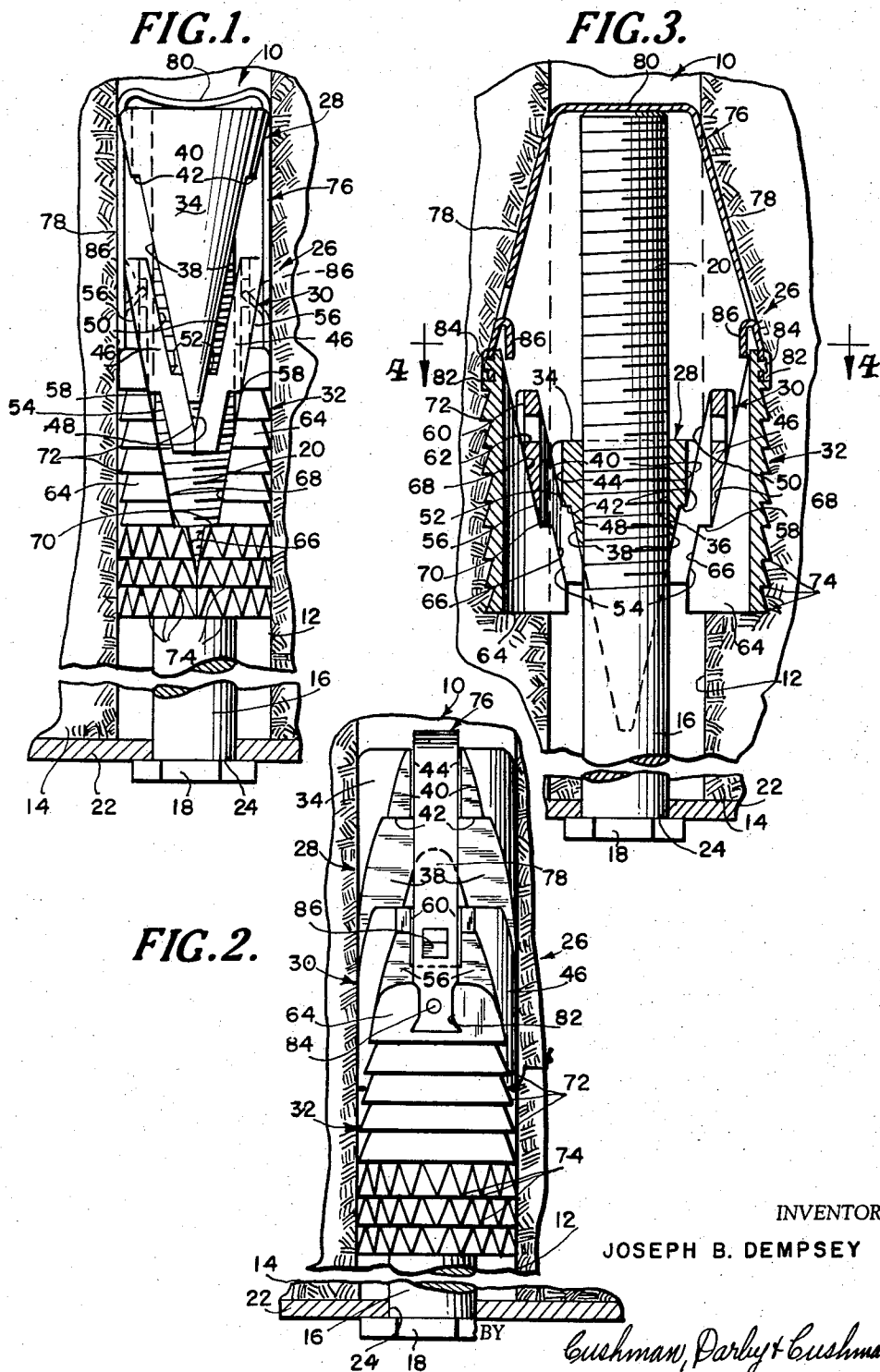
Feb. 27, 1962

J. B. DEMPSEY
MINE ROOF BOLT ASSEMBLY WITH SEQUENTIAL
MULTIPLE EXPANSION MEANS

3,022,700

Filed March 14, 1958

2 Sheets-Sheet 1



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FIG. 4.

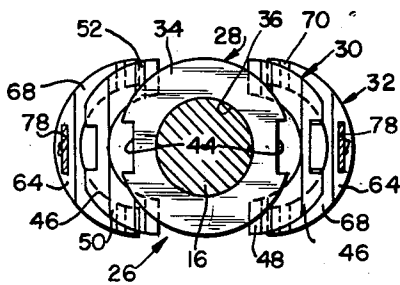


FIG. 5.

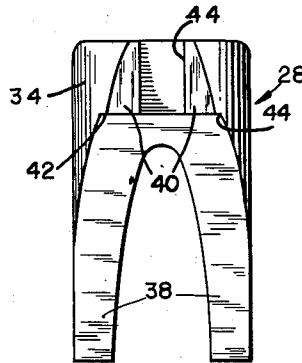


FIG. 6.

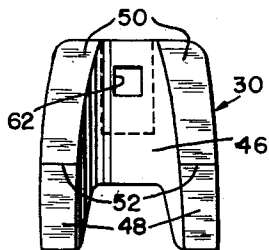
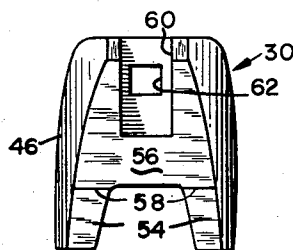


FIG. 7.



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MINE ROOF BOLT ASSEMBLY WITH SEQUENTIAL MULTIPLE EXPANSION MEANS

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5 Claims. (Cl. 85-2.4)

This invention relates to mine roof bolt installations and more particularly to an improved expansible anchoring assembly for such installations.

Mine roof bolts are well known and have been used successfully for many years in place of roof timbers to maintain mine roofs against collapse. An example of such a mine roof bolt is disclosed in Dempsey Patent No. 2,753,750 issued July 10, 1956. Briefly, the bolt assembly disclosed in the patent consists of a long bolt provided with anchoring means on one end thereof for retaining engagement with the side walls of the upper portion of a hole drilled in the mine roof. The anchoring means includes a wedge member arranged to spread apart a pair of interconnected, complementary shell parts. For most installations, the amount of spread or expansion of the shell parts within the limits provided by the wedge member is sufficient to provide a relatively safe securement of the bolt in position. However, for some installations where the roof formation is particularly loose, a greater expansion is required in order to prevent the hazards resulting from a loose bolt.

Accordingly, it is an object of the present invention to provide a mine roof bolt assembly of the type described having improved anchoring means arranged to multiply expand into the side wall formation of a drilled hole in a mine roof to thereby ensure a safe securement of the assembly.

Another object of the present invention is the provision of a multiple expansion anchoring means for a mine roof bolt having improved means for maintaining the parts in an assembled condition prior to installation.

Still another object of the present invention is the provision of a multi-stage expansion anchoring means for a mine roof bolt having improved means for limiting the expansion at each stage.

Still another object of the present invention is the provision of a multi-stage expansion anchoring means of the type described having improved means for insuring successive expansion of each stage separately.

A further object of the present invention is the provision of a mine roof bolt having improved expansible anchoring means of the type described which is simple in construction, efficient in operation and economical to manufacture.

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 of a mine roof bolt assembly embodying the principles of the present invention showing the same inserted in a drilled hole in a mine roof;

FIGURE 2 is a front elevational view of the assembly;

FIGURE 3 is a vertical sectional view showing the assembly in its fully expanded position;

FIGURE 4 is a cross-sectional view taken along the line 4-4 of FIGURE 3;

FIGURE 5 is a detailed elevational view of the wedge nut of the assembly;

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FIGURE 6 is a rear elevational view of one of the intermediate shell parts; and

FIGURE 7 is a front elevational view of the part shown in FIGURE 6.

Referring now more particularly to the drawings, there is shown in FIGURES 1-3 a mine roof bolt installation which includes a mine roof bolt assembly, generally indicated at 10, embodying the principles of the present invention. The assembly 10 is arranged to be inserted into a vertical hole 12 drilled in a mine roof 14 in an unexpanded assembled condition such as shown in FIGURES 1 and 2.

In general, the assembly 10 includes an elongated bolt 16 having an enlarged head 18 on its lower end and threads 20 formed on its upper end. The bolt head 18 is arranged to engage the lower surface of a washer plate 22 which is suitably apertured, as at 24, to receive the bolt. The upper surface of the washer plate is arranged to engage the ceiling of the mine roof 14 about the hole 12 and is retained in such position by means of a multi-stage expansion anchoring means or assembly generally indicated at 26, mounted on the upper end of the bolt 16. The anchoring means 26 preferably comprises a wedge nut 28, an intermediate or inner shell unit 30, and an outer shell unit 32.

The wedge nut 28 is preferably constructed of a cylindrical member 34 having a central threaded aperture 36 engageable with the threads 20 on the upper end of bolt 16. The cylindrical member 34 is formed with lower wedging surfaces 38 which diverge upwardly from the lower end thereof and similarly inclined upper wedging surfaces 40 which converge downwardly from the upper end thereof. The upper and lower wedging surfaces 38 and 40 on each side of the member 34 are disposed in generally parallel transverse planes with respect to each other and are joined by a transversely extending shoulder 42. A vertical groove 44 is formed in each upper wedging surface for receiving a portion of the outer shell unit.

The inner shell unit 30 comprises a pair of separate inner shell parts 46 of substantially identical construction, each being formed as a segment of a hollow cylinder. Each part has its side edges disposed in a stepped upwardly and outwardly inclined transverse plane so as to form inner lower and upper wedging surfaces 48 and 50 interconnected by transverse shoulders 52 for engaging the lower and upper wedging surfaces 38 and 40 and shoulder 42 respectively on one side of the wedge member. The outer periphery of each shell part 46 is formed with outer lower and upper wedging surfaces 54 and 56 interconnected by a shoulder 58 in a manner similar to the wedging surfaces of the wedge member. As before, the outer upper wedging surface 56 of each part is formed with a vertical groove 60 and communicating with each groove is a horizontally disposed aperture 62 extending through the shell part.

The outer shell unit 32 comprises a pair of shell parts 64 of substantially identical construction, each being formed as a segment of a hollow cylinder in a manner somewhat similar to the inner shell parts 46. Each outer shell part has its side edges disposed in a stepped upwardly and outwardly inclined transverse plane so as to form lower and upper wedging surfaces 66 and 68 interconnected by transverse shoulders 70 for engagement with the outer lower and upper wedging surfaces 54 and 56 and shoulders 58 respectively of the associated inner shell part 46.

The outer peripheral surface of each outer shell part 64 is formed with a series of tapered horizontal grooves which provide a series of downwardly facing serrations 72 for engaging the wall of the hole 12 to grip the same and prevent any substantial downward movement of the outer shell parts in the hole. In addition, the lower three

serrations are formed with a series of vertical grooves which provide teeth 74 for preventing turning movement of the outer shell parts in the hole by engagement with the wall thereof.

The outer shell parts are secured together by an inverted U-shaped strap 76 preferably constructed of spring steel. The strap includes normally parallel legs 78 and a normally downwardly bowed bight portion 80 interconnecting the legs at their upper ends. The free ends of the legs are suitably secured to the upper outer ends of the shell parts 64 by any suitable means and, as shown, such means preferably embodies a vertical groove 82 formed in each shell part for receiving the free end of the associated leg. An integral horizontal lug 84 is formed in the central portion of each groove for engagement within a registering aperture formed in the free end of each leg. Each leg end is permanently secured in position by deforming the sides of the associated shell part forming the walls of the groove and the outer end of the lug over the outer surface of the associated leg.

In order to retain the separate inner shell parts in assembled position, the legs of the strap have normally upwardly and inwardly extending tabs 86 struck therefrom. Each tab is disposed in a position to enter the aperture 62 formed in the associated inner shell part 46 when the anchoring means 26 is initially assembled so as to prevent any substantial movement of the inner shell unit 30 with respect to the outer shell unit 32.

Operation

As noted above, the roof bolt assembly 10 of the present invention is maintained in its assembled condition by the outer shell unit 32. It will be noted that the strap 76 serves to maintain the outer shell parts 64 together about the separate inner shell parts 46. In addition, the engagement of the tabs 86 within the apertures 62 in the inner shell parts 46 serve to maintain the latter in position about the wedge nut 28. The latter is maintained on the upper extremity of the bolt by the engagement of threads 20 in the central aperture 36.

With the assembly 10 in this condition, it is inserted upwardly into the mine roof hole 12 as shown in FIGURES 1 and 2. When insertion has been completed, a power tool (not shown) connected with the head 18 is actuated to turn the bolt. Turning of the bolt causes the wedge nut to move downwardly with respect thereto. Downward movement of the inner and outer shell units with the edge nut is prevented by the engagement of serrations 72 and teeth 74 with the wall of the hole and by the engagement of the bight portion 80 of the strap 76 with the upper end of the bolt. In this regard, it will be noted that the downwardly bowed construction of the bight portion 80 provides a yielding resistance between the outer shell unit and the bolt. That is the bight portion will serve to absorb the shock of sudden engagement of the bolt therewith under the action of the power tool and thereby prevent breakage of the strap which would render the anchoring means incapable of properly expanding.

Downward movement of the wedge nut has the initial effect of spreading apart both the inner and outer shell units through sliding engagement between the lower and upper wedging surfaces 38 and 40 of the wedge nut and the inner lower and upper wedging surfaces 48 and 50 of the inner shell parts 46. It will be noted that relative vertical movement between the inner shell unit and the outer shell unit is effectively prevented by the engagement of the tabs 86 within the apertures 62 during the initial downward movement of the wedge nut.

Spreading of both shell units together continues with continued downward movement of the wedge nut until the shoulders 42 thereon contact the shoulders 52 on the inner shell parts. The shoulders 42 and 52 act as stops which prevent further relative vertical movement of the inner shell parts with respect to the wedge nut in

response to continued downward vertical movement of the latter. Thus, the inner shell unit will be carried downwardly by and with the wedge nut upon continued downward movement of the latter, such movement serving to continue to spread the outer shell unit apart this time by engagement of the outer upper and lower wedging surfaces 54 and 56 of the inner unit with the lower and upper wedging surfaces 66 and 68 of the outer unit. During this movement, the shoulders 58 and 70 serve as stops to limit the expansion of the entire assembly and prevent the wedge nut from being drawn completely through both shell units and thereby render the anchoring means ineffective.

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. In a mine roof bolt assembly, the combination comprising: an outer expansible anchoring shell unit having two diametrically-disposed parts, each shaped as a longitudinally-tapering segment of a hollow cylinder and having longitudinal side edges, each opposed to the corresponding side edge of the other part, each corresponding pair of opposed side edges being divergent toward one end of said outer shell unit to form a generally V-shaped slot between said parts; an inner expansible anchoring shell unit having two diametrically-disposed parts disposed between the opposed side edges of said outer shell unit parts and having planar surfaces complementary thereto and said planar surfaces contracting said opposed side edges adjacent the large end of said V-shaped slot in mutual wedging engagement therewith and extending beyond the large end of said V-shaped slot for effective expansion of said outer shell unit upon relative longitudinal movement between said units in one direction, each of said inner unit parts having longitudinal side edges, each opposed to the corresponding side edge of the other part, each corresponding pair of the opposed edges of said inner shell unit being divergent toward one end of said inner shell unit to form a generally V-shaped slot between said inner shell unit parts; and wedge means disposed between the opposed side edges of said inner shell unit parts and having planar surfaces complementary thereto and in mutual wedging engagement therewith and extending beyond the large end of said V-shaped slot of said inner shell parts for effecting expansion of said inner shell unit upon relative longitudinal movement between the latter and said wedge means in one direction, and yielding interlocking means releasably securing said inner shell to said outer shell whereby said relative movement and expansion of said inner shell can take place before said relative longitudinal movement between said inner and outer shells.

2. The combination as defined in claim 1 wherein the side edges of each outer shell unit part are stepped to provide aligned transversely extending shoulders intermediate the ends of the associated part and wherein the complementary planar surfaces of said inner shell unit parts are correspondingly stepped to provide transversely extending shoulders intermediate the ends of said inner shell unit parts for engagement with the shoulders of said outer shell unit parts to thereby limit the relative longitudinal movement between the parts of said units in one direction.

3. The combination as defined in claim 1 wherein the side edges of each inner shell unit part are stepped to provide aligned transversely extending shoulders intermediate the ends of the associated parts and wherein the complementary planar surfaces of said wedge means are

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correspondingly stepped to provide transversely extending shoulders intermediate the ends of said wedge means for engagement with the shoulders of said inner shell unit parts to thereby limit the relative longitudinal movement between the parts of said inner shell unit and said wedge means in one direction. 5

4. The combination as defined in claim 1 wherein said outer shell unit further includes an inverted U-shaped strap having a bight portion extending across one end of said wedge means and spaced legs extending from said bight portion on opposite sides of said wedge means and said inner shell unit, the free ends of each of said legs being secured to one end of one of said outer shell unit parts. 10

5. The combination as defined in claim 4 wherein said last-mentioned means includes yieldable tabs stuck from the legs of said strap and wherein each of said 15

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inner shell parts are provided with an aperture receiving a tab to thereby retain said inner shell unit in unexpanded assembled relation and yieldingly restrain longitudinal movement between the parts of said unit in one direction.

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