

Nov. 16, 1971

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3,620,120

MINE ROOF BOLT ASSEMBLY

Filed May 1, 1969

2 Sheets-Sheet 1

Fig. 1

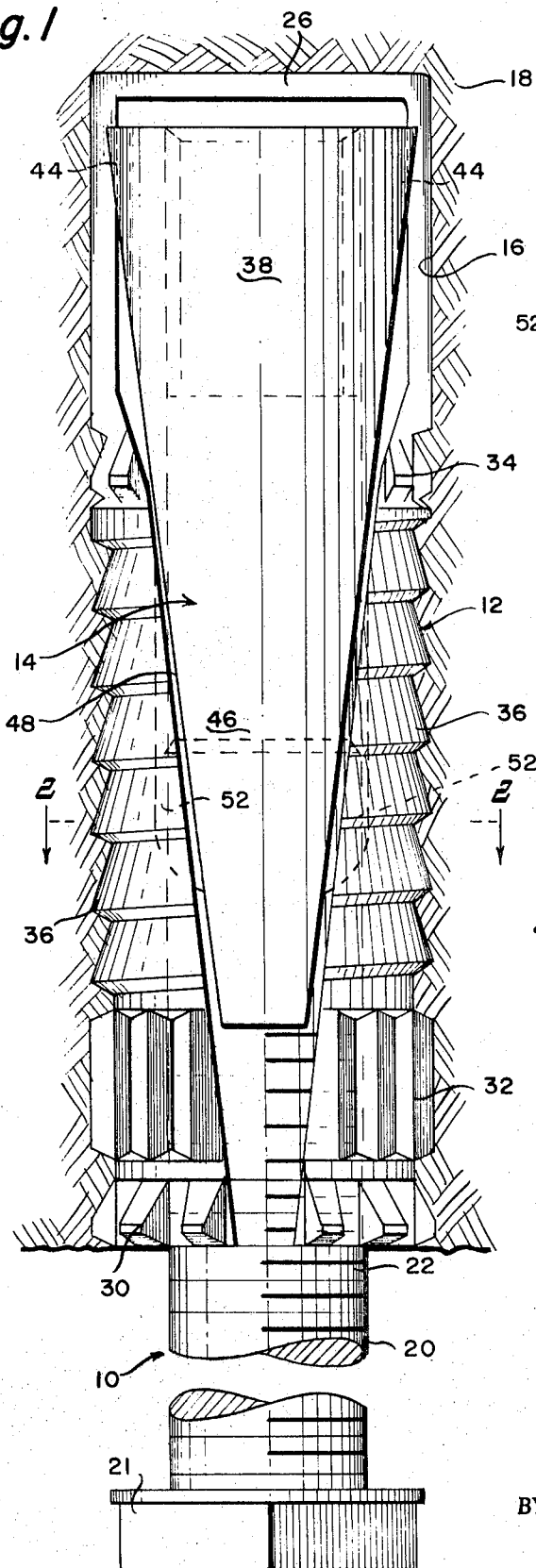


Fig. 2

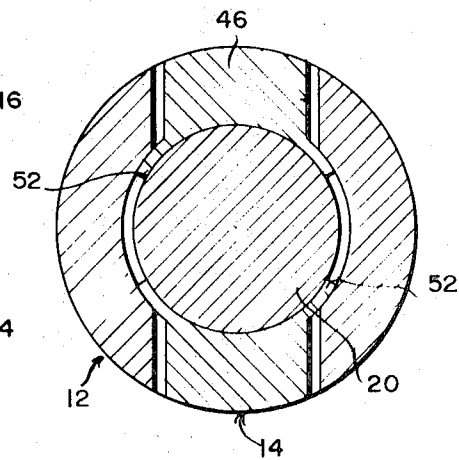
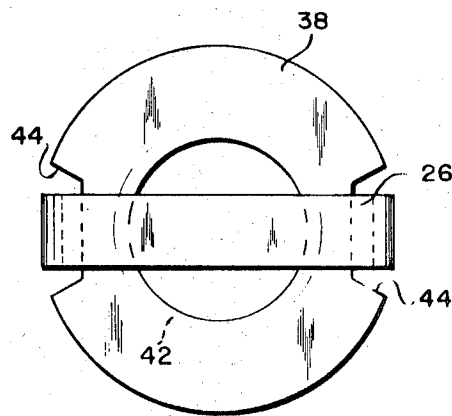


Fig. 3



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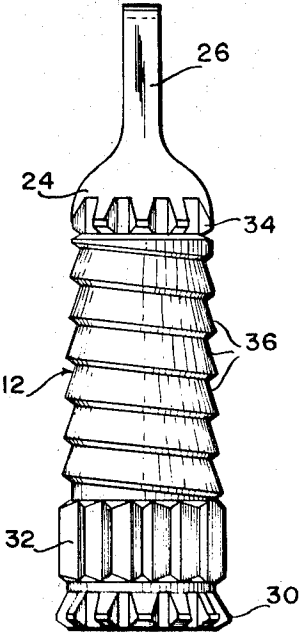


Fig. 4

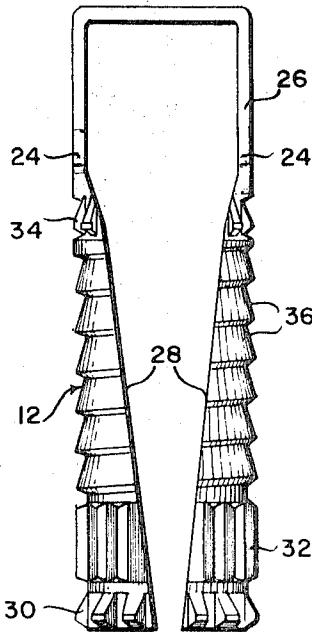


Fig. 5

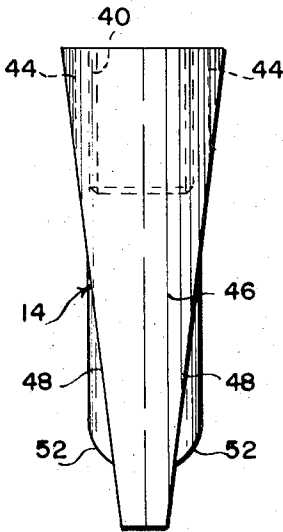


Fig. 6

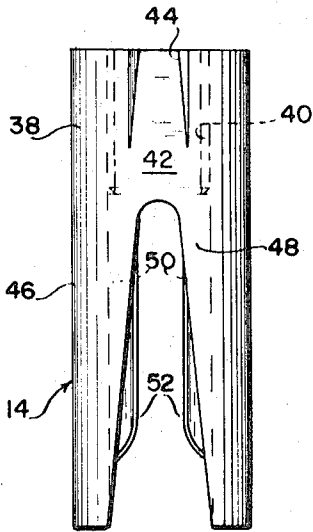


Fig. 7

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MINE ROOF BOLT ASSEMBLY

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Filed May 1, 1969, Ser. No. 820,770

Int. Cl. F16b 13/06

U.S. Cl. 85—76

6 Claims

ABSTRACT OF THE DISCLOSURE

A mine roof bolt assembly including a roof bolt having a head at one end and threaded at the other end, a wedge member having tapering walls threadedly engaged with the roof bolt, and an expansion shell positioned over the wedge member and actuated thereby, the expansion shell including a pair of ears connected by a bale, the inner surface of the ears being engageable with the wedge member and expanded thereby upon passage of the wedge member through the shell. The outer surface of the shell is provided with a series of ribs which are angularly disposed transversely of each ear, for effecting "threading" of the shell into rock surrounding the hole into which the assembly is placed. The wedge member is provided with an alignment notch near the upper limit thereof, for engagement with the bale of the shell, and the lower end is provided with alignment lugs engageable with the inner surface of the shell, the alignment notch and lugs preventing lateral misalignment of the ears and wedge.

BACKGROUND AND OBJECTS

The largest users of mine roof bolts are those mines where the mineral to be mined occurs in layers, such as coal mines. This type mine conventionally utilizes bolting machines which drill holes and install several bolts at one time. In this type of operation, material, rather than labor, constitutes the major part of the bolting costs. Most mine roof bolt assemblies are designed for this type mining and consequently the bolting pattern is based upon three to five ton anchorage of the individual bolts.

However, where the mineral occurs in pockets, such as uranium, copper, lead, zinc, gold, etc., which is more common in the western part of the United States, underground tunnels drift out in the direction of the pockets and this type mining does not lend itself to the use of bolting machines. Accordingly, a Jackleg or Stoper is used to drill the hole, and the mine roof bolts are manually installed. In this form of mining, labor constitutes the major cost of bolting.

Since hand installation of bolts is considerably more costly than installation by use of bolting machines, higher strength roof bolt assemblies must be employed in this form of mine so that the same control of mine roofs may be achieved with considerably fewer bolt assemblies.

It is an object of this invention to provide a high strength mine roof bolt assembly which enables the same control of mine roofs to be effected with substantially fewer roof bolts than has heretofore been possible.

Another object is to provide a mine roof bolt assembly including interacting wedge and expansion shell units wherein positive means are provided for maintaining the wedge member and expansion shell relatively aligned during the installation operation.

A further object is to provide an expansion shell of unitary construction embodying a pair of ears connected

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by a bale, the outer surface of the ears being provided with a series of transverse ribs which are angularly disposed to the horizontal when installed, for effecting "threading" of the shell into rock surrounding the hole into which the assembly is placed.

A still further object is to provide a mine roof bolt assembly wherein the parts thereof are self-aligning and are non-spinning when the roof bolt is installed and tightened in the mine roof opening.

Other objects of the invention will be manifest from the following description of the presently preferred form of the present invention taken in conjunction with the appended drawings.

DESCRIPTION OF FIGURES OF THE DRAWINGS

FIG. 1 is a side elevational view of the mine roof bolt assembly of the present invention, illustrating its use;

FIG. 2 is a sectional view taken along the line 2—2 of FIG. 1, looking in the direction of the arrows;

FIG. 3 is a top plan view of the mine roof bolt assembly of the present invention;

FIG. 4 is a side elevational view of an expansion shell forming a part of the present invention;

FIG. 5 is an end elevational view of the expansion shell of FIG. 4;

FIG. 6 is a side elevational view of a wedge member forming a part of the present invention, and

FIG. 7 is an end elevational view of the wedge member of FIG. 6.

DESCRIPTION OF INVENTION

In FIG. 1 there is illustrated a mine roof bolt assembly constructed in accordance with the present invention including a roof bolt generally designated 10, an expansion shell 12, and a wedge member 14, installed in a complementary opening 16 of a mine roof 18.

Roof bolt 10 is of conventional construction and includes a shank 20 having a head 21 at one end; the opposite terminal of which shank is threaded at 22.

Expansion shell 12 is preferably of unitary construction to reduce the chances of breakage during installation. The shell includes a pair of like ears 24 connected at their upper limits by an inverted U-shaped bale 26. Ears 24 may be of any desired length, a length of two to three inches having been found to produce optimum results. As shown in FIG. 5, the longitudinal edges of expansion shell 12 are tapered as indicated at 28, in a manner to effect gradual convergence of the edges from the upper to the lower limits of the opposed ears.

The lower limits of the outer periphery of each ear is provided with a row of teeth 30, above which are a row of vertical ribs 32. At the upper limit of each ear 24 is another row of teeth 34. Teeth 30 and 34 and ribs 32 tend to prevent spinning of ears upon tightening of bolt 20.

It is a salient feature of the present invention to provide ears 24 with a series of transverse ribs 36, which ribs are disposed at an angle to the horizontal, the angle of the ribs being substantially equal to, but opposite hand with respect to threads 22 of bolt 10.

The angularly disposed ribs 36 "thread" into the sides of the mine opening 16 in the event of rotation of ears 24, to effect torquing of the expansion shell and consequent expansion more rapidly with less enlargement of opening 16.

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Wedge member 14 is of bifurcated construction and includes an upper portion 38 of basically cylindrical construction, which portion is provided with a central bore which is threaded as indicated at 40. Threads 40 are adapted for engagement by threaded portion 22 of roof bolt 10 for moving wedge member 14 longitudinally through shell 12.

Opposite sides of portion 38 are flattened and tapered inwardly as indicated at 42 and the upper limit of opposed, flattened sides of portions 38 are notched as indicated at 44 for the reception of bale 26 of expansion shell 12, in order to maintain alignment of the upper portion of the shell with respect to the wedge member during installation.

The lower extremity of cylindrical portion 38 issues into a pair of opposed legs 46, the outer surface of which is arcuate. The lateral extremities of legs 46 are flattened and taper inwardly of the leg, as indicated at 48, which tapered portion is adapted for engagement with the complementally tapered portions 28 of expansion shell ears 24 for expanding the latter into anchoring engagement with the mine roof. The inner surface of legs 46 is arcuate as indicated at 50.

It is another salient feature of the present invention to provide, in conjunction with aligning notch 44, a second alignment means located near the lower terminal of wedge member 14. These alignment means include pairs of arcuate lugs or plates 52 extending outwardly and inwardly from the lateral extremities of legs 48, the arcuate conformation of lugs 52 corresponding to the arcuate conformation 50 of the inner periphery of legs 46. Referring to FIGS. 6 and 7 it will be seen that lugs 52 extend through a substantial portion of the length of legs 48.

As shown to advantage in FIGS. 1 and 2, arcuate legs 52 serve to align the lower portion of legs 46 with respect to expansion shell 12 so that tapering portion 48 of each leg is maintained in constant opposed relation to tapering portions 28 of expansion shell 12 and there is no lateral misalignment of expansion shell 12 and wedge member 14. Lugs which are approximately three-sixteenth inches long have been found to give optimum results.

OPERATION

In use of the mine roof bolt assembly of the present invention, after complementary opening 16 is made in mine roof 18 by a Jack-leg or Stoper, the assembly is inserted into the opening, following which roof bolt 10 is tightened. By virtue of bale 26, a spring-like force is applied to the ears 24 in a direction to urge the same against the side walls of the hole and cause teeth 30 and 34 and ribs 32 to bite into the walls and restrain the expansion shell from turning as the bolt is tightened. The bale further holds the ears in place so that the wedge member, as it is threaded further down the bolt, advances an equal distance down both ears simultaneously. The teeth and ribs restrain the tendency of the expansion shell to turn with the bolt. Transverse ribs 36, being at the same angle, but in opposite hand to the threads on the bolt, have a tendency to "thread" into the side walls of the hole, pulling the shell assembly in a downward direction. This causes wedge member 14 to thread down on the bolt, expanding the shell rapidly and effecting anchorage in a shorter time with less spinning effect. Simultaneously, tapering walls 48 of wedge member 14 move downwardly along tapering walls 28 of expansion shell 12, to effect outward movement of ears 24 in a well known manner.

During the tightening process, alignment notch 44 and curved lugs 52 maintain wedge member 14 and expansion shell 12 in alignment with each other to prevent lateral movement of these two parts.

With the mine roof bolt assembly of the present invention, a minimum yield point of 8.5 to 10 tons is effected, thereby providing maximum efficiency with minimum costs, and enabling mine roofs to be supported with substantially fewer mine roof bolt assemblies. This in turn

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enables the use of mine roof bolts in mines wherein the minerals occur in pockets.

With the assembly of the present invention, more uniform anchorage is effected then as heretofore been possible since the wedge member is always in full contact with legs 48.

What I claim is:

1. A mine roof bolt assembly including:

- (a) a roof bolt, one terminal of which is threaded,
- (b) a wedge member having a tapering outer surface threadedly engaged with said roof bolt,
- (c) an expansion shell mounted over said wedge member and actuated thereby,
- (d) said expansion shell comprising spaced, opposed ears,
- (e) a bale joining the upper limits of said ears,
- (f) a plurality of ribs extending along the outer surface of said ears,
- (g) said ribs being disposed at an angle to the horizontal,
- (h) the angle of said ribs being substantially equal to, but opposite hand with respect to, the angle of the bolt threads,
- (i) whereby, upon rotation of said roof bolt, said expansion shell tends to rotate with the bolt, and said ribs of the expansion shell threadedly engage the surrounding mine roof causing a slight threading down of the expansion shell on the roof bolt and frictional engagement of the expansion shell with the mine roof, continued rotation of the bolt effecting a threading down of said wedge member on the bolt to expand the ears of the expansion shell and effect maximum anchorage.

2. The mine roof bolt assembly of claim 1, with the addition of

- (a) a plurality of teeth on the outer periphery of said ears adjacent said ribs to prevent spinning of said ears upon tightening of said roof bolt.

3. The mine roof bolt assembly of claim 2, with the addition of

- (a) a plurality of vertical ribs on the outer periphery of said ears adjacent said ribs to further prevent spinning of said ears upon tightening of said roof bolt.

4. A mine roof bolt assembly including:

- (a) a roof bolt, one terminal of which is threaded,
- (b) a wedge member having a tapering outer surface threadedly engaged with said roof bolt, said wedge member comprising,
- (c) a generally cylindrical portion,
- (d) opposed tapering legs pending from said cylindrical portion,
- (e) the outer periphery of said cylindrical portion being notched on opposite sides of, and proximate the upper limit of, said wedge member,
- (f) arcuate lugs extending outwardly from said legs, and
- (g) an expansion shell positioned over said wedge member and actuated thereby, said expansion shell embodying,
- (h) a pair of ears,
- (i) a bale joining the upper limits of said ears,
- (j) portions of said bale being seated in the notches of said member to align the upper portions of the wedge member and shell,
- (k) the arcuate lugs of said wedge member being engageable with the inner periphery of the lower portion of said ears.
- (l) a plurality of transverse ribs along the outer surface of said ears,
- (m) said ribs being disposed at an angle to the horizontal,
- (n) the angle of said ribs being approximately equal to, but opposite hand with respect to, the angle of the roof bolt threads,

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(o) whereby, upon rotation of said roof bolt, said expansion shell tends to rotate with the bolt, and said ribs of the expansion shell threadedly engage the surrounding mine roof causing a slight threading down of the expansion shell on the roof bolt and frictional engagement of the expansion shell with the mine roof, continued rotation of the bolt effecting a threading down of said wedge member on the bolt to expand the ears of the expansion shell and effect maximum anchorage.

5. The mine roof bolt assembly of claim 4, with the addition of

(a) a plurality of teeth on the outer periphery of said ears adjacent said ribs to prevent spinning of said ears upon tightening of said roof bolt.

6. The mine roof bolt assembly of claim 5, with the addition of

(a) a plurality of vertical ribs on the outer periphery of said ears adjacent said ribs to further prevent

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spinning of said ears upon tightening of said roof bolt.

References Cited

UNITED STATES PATENTS

1,050,345	1/1913	Conrad	85—74
1,793,739	2/1931	Johnston	85—75
2,753,750	7/1956	Dempsey	85—76
3,115,056	12/1963	Teeple	85—76
3,134,289	5/1964	Dickow	85—76

FOREIGN PATENTS

30,022	12/1911	Great Britain	85—73
486,004	5/1938	Great Britain	85—83

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U.S. Cl. X.R.

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