

[54] SELF-DRILLING EXPANSION ROOF BOLT

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[57] ABSTRACT

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[58] Field of Search 85/68, 67, 69, 73, 74,
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61/45 B

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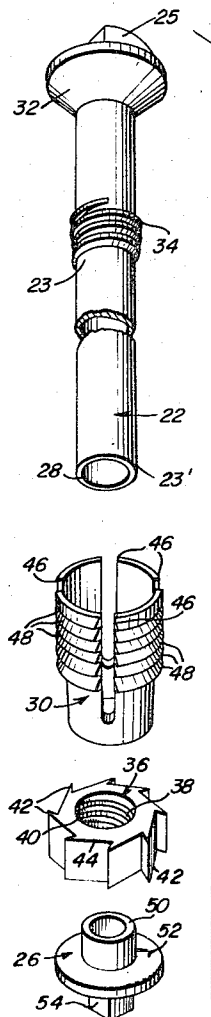
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A self-drilling expansion roof bolt having a drill rod with spaced ends. A cutting head provided with cutting edges is mounted on one end of the drill rod, and an end cap nut adapted for engaging in the drill head chuck of a roof bolting machine and the like is arranged at the other end. Rotation of the drill rod in a one direction will drill a hole in a mine roof and the like. The cutting head is circular in cross section and flared outwardly toward the cutting edges to form a wedge portion. An expansion shell in the form of a sleeve is arranged about the cutting head, and an arrangement including screw threads on the cutting head will cause engagement of the wedge portion with the expansion shell and expand the latter by a rotation of the drill rod in the reverse direction to that for drilling the hole. The expansion will anchor the cutting head and drill rod in the hole.

9 Claims, 5 Drawing Figures



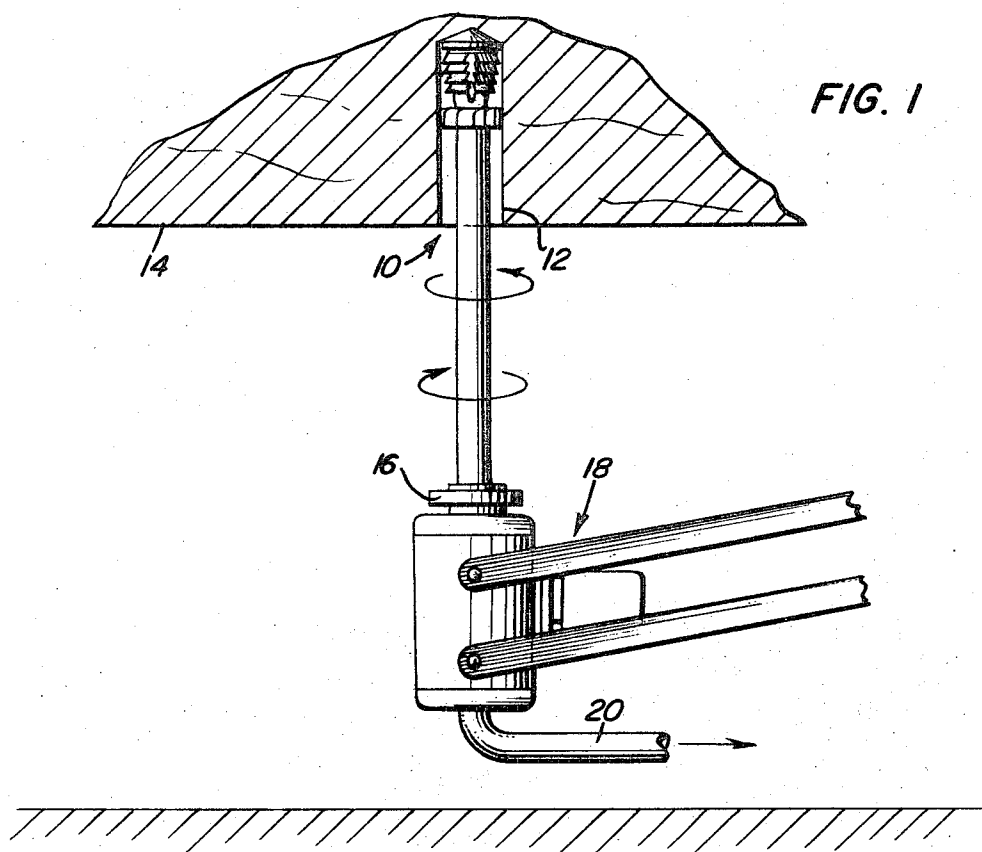
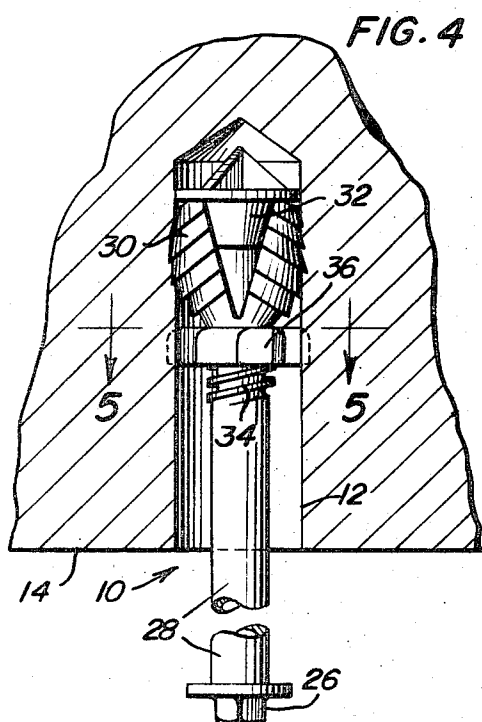
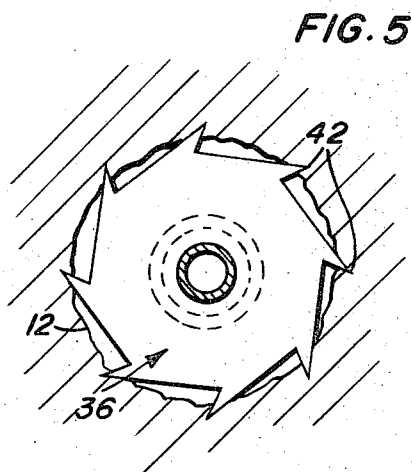


FIG. 2

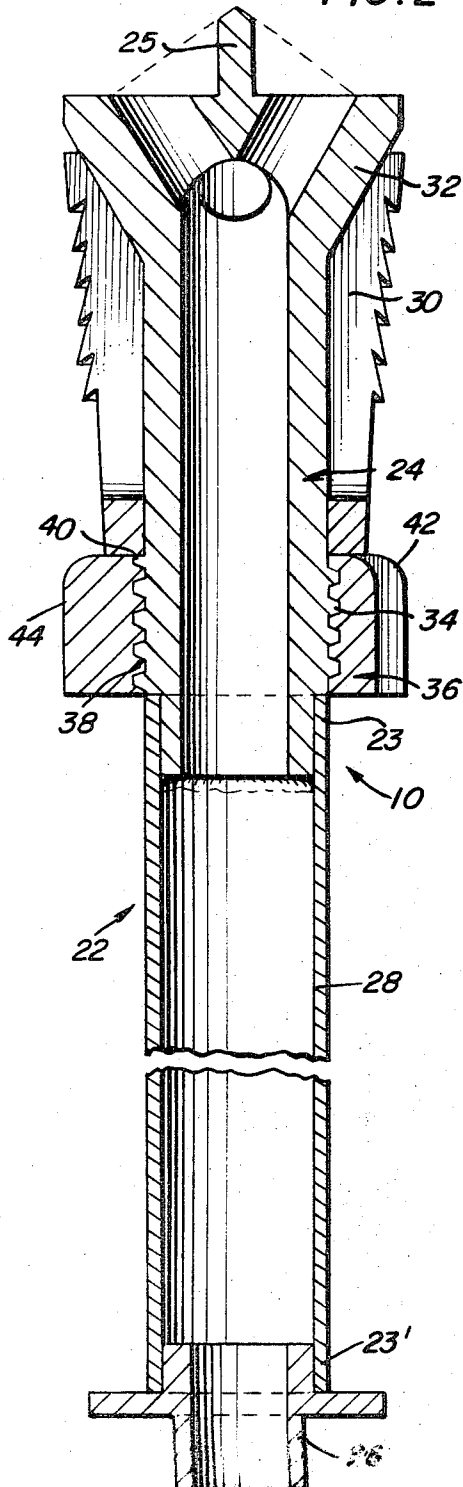
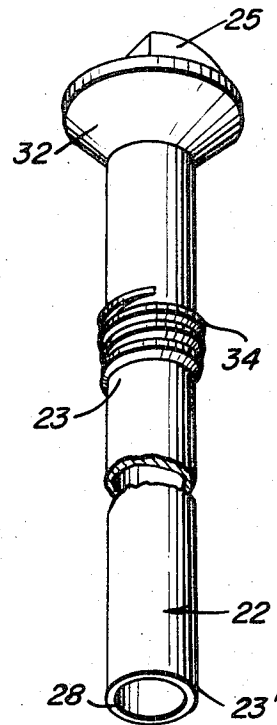
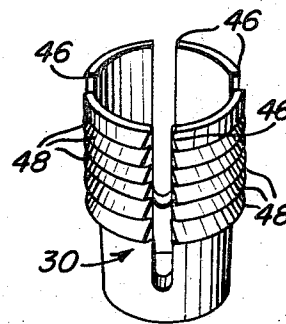
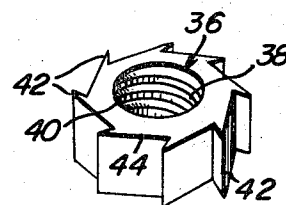
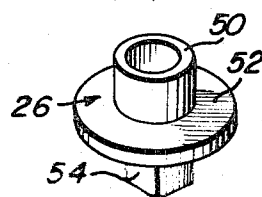


FIG. 3



SELF-DRILLING EXPANSION ROOF BOLT

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to expansion anchors, and in particular to a self-drilling expansion bolt for mine roofs and the like.

2. Description of the Prior Art

Mine roof bolting is one of the most dangerous and time-consuming operations performed in modern mining. A widely used system of installing roof bolts requires an operator of roof bolting equipment to drill a hole into the mine roof, withdraw the drill rod, install a roof bolt, and finally tighten the roof bolt.

Among the disadvantages of this known system is that the operator is required to be in a very hazardous position for long periods of time. This time factor also reduces the efficiency of the operation with a resulting increase in its cost.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a roof drill rod that drills when rotated in one direction and expands and locks in the drill hole when the rotation is reversed.

It is another object of the present invention to provide a roof bolt which allows drilling and anchoring to be performed in one operation, and reduces installation time and accidents from operator errors made when changing from drilling to bolting.

It is yet another object of the present invention to provide apparatus permitting automation of the roof bolting operation.

These and other objects are achieved according to a present invention by providing a self-drilling expansion roof bolt having a member forming a drill rod, a cutting head provided with cutting edges mounted on the member for making a hole, and an expansion shell arranged about the cutting head for being expanded by a wedge portion of the cutting head and anchoring the roof bolt in the hole.

Advantageously, the cutting head drills a hole when the member is rotated about an axis of rotation in a one direction, and the expansion sleeve is expanded when the member is rotated about the same axis of rotation in a reverse direction to the one direction.

According to a preferred embodiment of the present invention, external screw threads are provided on the cutting head. A drive nut having internal screw threads provided in a hole thereof threadingly engage the external threads. Jaw elements are advantageously provided on an outer periphery of the drive nut for engaging walls defining the drilled hole only in the reverse direction of rotation of the member to hold the nut against rotation. This engagement will hold the nut stationary while the drill rod is being rotated in the reverse direction and move the nut toward the wedge portion of the cutting head. The expansion shell, which is arranged between the drive nut and the wedge portion, will be driven toward the wedge portion and expanded.

A bore is advantageously provided through the cutting head and drill rod for forming a removal passageway for particulate matter produced by the drilling of a hole by the self-drilling expansion roof bolt according to the present invention.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary, schematic, partially sectional, elevational view showing a self-drilling expansion roof bolt according to the present invention mounted on a roof bolting machine and arranged in a drill hole in a mine roof.

FIG. 2 is a longitudinal sectional view, partly broken away, of a self-drilling expansion roof bolt according to the present invention.

FIG. 3 is an exploded perspective view showing a self-drilling expansion roof bolt according to the present invention.

FIG. 4 is a fragmentary, partially sectional, elevational view, partly broken away, of a self-drilling expansion roof bolt according to the present invention in anchored arrangement in a drill hole.

FIG. 5 is a fragmentary, sectional view taken generally along the line 5—5 of FIG. 4.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 of the drawings shows a self-drilling expansion roof bolt 10 according to the present invention arranged in a drill hole 12 in a mine roof 14 and the like, and mounted in a drill head chuck 16 of a conventional roof bolting machine 18. A hose 20 is emanating from machine 18, and may be connected to a suction in a known manner to assist in removing particulate matter while a hole 12 is being drilled. The manner in which hose 20 may remove this matter will be explained below.

Referring now to FIGS. 3 and 4 of the drawings, a self-drilling expansion roof bolt 10 according to the present invention has a longitudinal drill rod 22 provided with spaced ends 23 and 23'. A cutting head 24 provided with cutting edges 25 arranged for drilling a hole 12 is mounted at one end 23 in a suitable, known manner, as by the interfitting joint best seen in FIG. 2. An end cap nut 26 may be mounted at the other end 23' and arranged for attachment to a chuck 16 for rotating rod 22. A bore 28 is provided through cutting head 24 and drill rod 22 for forming a removal passageway for particulate matter (not shown) produced by the drilling of a hole 12. This particulate matter, which may be dust and the like, produced by the drilling is advantageously sucked down bore 28 and passed through hose 20 into a dust collecting system (not shown). Such dust collecting systems are conventional and commonly used.

An arrangement for anchoring drill rod 22 and cutting head 24 in a hole 12 which has been previously drilled by the same structure includes an expansion shell 30 and a wedge portion 32 formed on cutting head 24 and arranged for selective engagement with shell 30. Also arranged on cutting head 24 are external screw threads 34. A drive nut 36 having internal screw threads 38 provided in a hole 40 of nut 36 threadingly engages with screw threads 34 so as to move longitudinally of cutting head 24. These screw threads 34, 38 are arranged so as to provide a movement of nut 36 toward

cutting edges 25 when drill rod 22 is rotated in a predetermined direction, to be referred to herein as the reverse direction. Jaw elements 24 are advantageously provided on outer periphery 44 of nut 36 for engaging with walls defining a hole 12 only in the reverse direction of rotation of drill rod 22.

As can best be seen from FIG. 3 of the drawings, cutting head 22 is circular in cross section and flared outwardly toward cutting edges 25 to form the wedge portion 32. Expansion shell 30 is in the form of a sleeve provided with slots 46 and projections 48. The generally circular cross section of cutting head 22 permits expansion shell 30 to be arranged thereabout as is illustrated.

FIG. 3 of the drawings also best shows end cap nut 26. This element has a sleeve portion 50 extending in one direction from a flange 52 provided with a centrally located opening, and a fitting 54 extending from flange 52 in the direction opposite the sleeve 50. Fitting 54 is any standard fitting suitable for being engaged by a chuck 16 and the like.

The anchoring operation of a roof bolt 10 according to the present invention will now be explained in conjunction with FIGS. 4 and 5 of the drawings. After drill rod 22 is rotated in a one predetermined direction, either clockwise or counterclockwise as viewed in FIG. 5, to drill a hole 12 in a mine roof 14 and the like, the drill rod 22 is rotated in the reverse direction to the drilling direction as by a reversal of machine 18. This reverse rotation will cause drive nut 36 to grab the wall of drill hole 12 with jaw elements 42. Nut 36 will now be held stationary while cutting head 22 continues to rotate in the reverse direction. Since drive nut 36 is threaded onto cutting head 24, and is being held stationary while cutting head 24 continues to turn, drive nut 36 will thread its way up cutting head 24 toward wedge portion 32. As drive nut 36 moves up cutting head 24, it will push expansion shell 30 upwards and force it to be wedged into a larger diameter by wedge portion 32. The expanded shell 30 soon reaches a diameter that wedges it against the sides of the drilled hole 12. Roof bolt 10 is now permanently anchored in drilled hole 12 as by projections 48 and is used to support the roof burden (not shown). This roof bolt 10 is intended to be used only to drill the one hole 12 where it is to be permanently anchored and left.

Alternatively, in unusual situations, a roof bolt 10 according to the present invention could, of course, be anchored in a hole previously drilled by a separate drill rod and bit.

An advantageous feature of the present invention is that continued reversed drill rod 22 rotation will take the slack out of the system and preload roof bolt 10. That is, the reverse rotation should be continued for several turns after expansion of shell 30 to pull the slack out of the system and apply a pre-load to roof bolt 10.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.

What is claimed as new is as follows:

1. A self-drilling expansion roof bolt, comprising, in combination:

a. a member;

b. means mounted on the member for making a hole; and

c. means for anchoring the member in a hole, the hole making means making a hole when the member is rotated about an axis of rotation in a one direction, and the anchoring means anchoring the member in a hole when the member is rotated about the axis of rotation in a reverse direction to the one direction, the anchoring means including an expansion shell, a wedge portion arranged for selective engagement with the expansion shell, and means for engaging the wedge portion with the expansion shell and expanding the latter by a rotation of the member in the reverse direction, the engaging means including external screw threads, and a drive nut having internal screw threads threadably engaged with the external screw threads and jaw elements provided on an outer periphery of the nut for engaging only in the reverse direction of rotation of the member with walls defining the hole.

2. A structure as defined in claim 1, wherein the hole making means includes a cutting head provided with cutting edges arranged for drilling a hole.

3. A structure as defined in claim 2, wherein the wedge portion and external screw threads are arranged on the cutting head.

4. A structure as defined in claim 3, wherein the cutting head is circular in cross section and flared outwardly toward the cutting edges to form the wedge portion, and the expansion shell is a sleeve provided with slots and projections and arranged about the cutting head.

5. A structure as defined in claim 4, wherein the member further includes means for attaching the member to a chuck.

6. A structure as defined in claim 5, wherein the member is a longitudinal drill rod and has spaced ends, with the cutting head arranged at one end and the attaching means at the other end, and a bore provided through the cutting head and drill rod for forming a removal passageway for particulate matter produced by the making of a hole.

7. A structure as defined in claim 2, wherein the member further includes means for attaching the member to a chuck.

8. A structure as defined in claim 7, wherein the member is a longitudinal drill rod and has spaced ends, with the cutting head arranged at one end and the attaching means at the other end, and a bore provided through the cutting head and drill rod for forming a removal passageway for particulate matter produced by the making of a hole.

9. A structure as defined in claim 2, wherein the cutting head is circular in cross section and flared outwardly toward the cutting edges to form a wedge portion, and the anchoring means includes an expansion shell in the form of a sleeve provided with projections and arranged about the cutting head for being expanded by the wedge portion.

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