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BOLT WITH DRIVING HEAD SHEARABLE AT PRE-DETERMINED TORQUE

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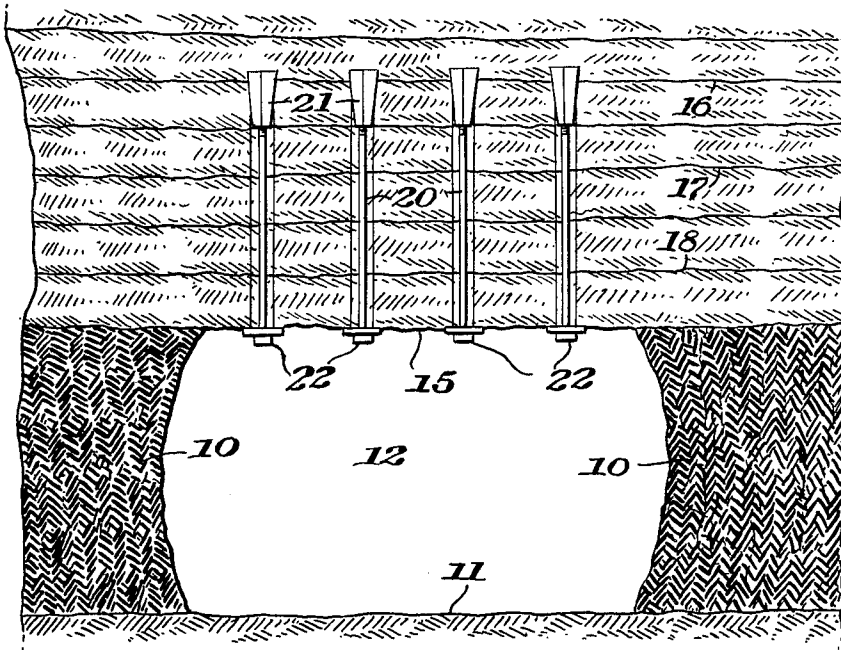


Fig. 1.

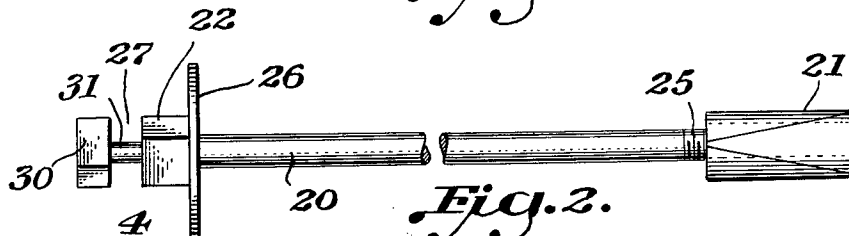


Fig. 2.

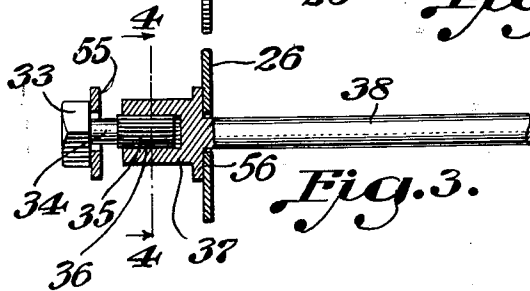


Fig. 3.

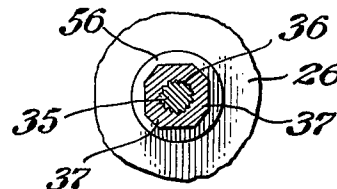


Fig. 4.

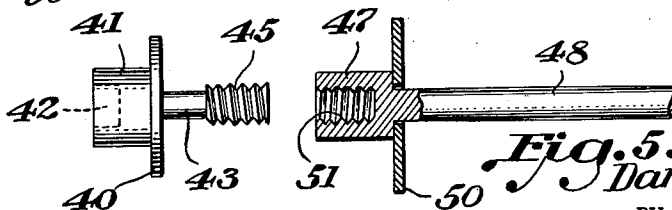


Fig. 5.

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BOLT WITH DRIVING HEAD SHEARABLE AT PRE-DETERMINED TORQUE

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2 Claims. (Cl. 85-61)

This invention relates to bolts generally but particularly those used in a mine to hold the various strata together and has for its principal object the provision of a bolt of any type in which the shank, generally of uniform diameter, is threaded at one end and at the other end carries two heads separated by a valley which may be a mere kerf but is preferably of an axial length which is about half of the space between the two bolts, so that when the bolt is tightened to a chosen degree the outer head will shear off at the valley.

A further object of the invention and a specific one is to provide an elongated bolt threaded at one end to carry the usual expansion shell and having at the other end two spaced bolt heads preferably square or hexagonal and each angularly turned with respect to the other to prevent a careless workman from tightening a wrench on both of the heads. In this case the heads are separated by a portion of the shank of the bolt which is reduced in diameter so that when the outer head is turned it will shear as soon as a chosen predetermined maximum torque is placed on the elongated smooth portion to the bolt.

An object of the invention which may be considered as a substitute for the angular displacement of the heads is to provide a circular inner flange on the outer head (which head is to be twisted off) with the purpose of preventing a careless workman with a well-worn octagonal chuck power wrench from gripping the inner head which is integral with the body or shank of the bolt.

A further object of the invention is to fasten together the various rock strata over a passage in a mine with a plurality of parallel expansion bolts which have been applied by turning the bolt head until it shears off at a chosen torque but which bolts may readily be retightened as is frequently advisable but rarely done, but which bolts also may be salvaged in part, which again is very rarely done.

At the present time the roof of a mine opening is unified by drilling a plurality of holes up through the ceiling, pushing an expansion bolt up through the hole, and then turning the bolt head to a chosen torque by a torque wrench, usually air or electrically operated. If the workmen were forced to supply their own tools, there would be far less difficulty with damage to these wrenches but unfortunately the wrenches are abused and when repaired it is quite common to set the damaged wrench to apply a considerably greater torque than is necessary or advisable.

As the amount of tension to be applied to a roof bolt varies considerably with the different areas of a mine and sometimes in fact even in areas quite close together, the practice has been to test the hardness of the rock formation by a test installation made by placing an excessive tension on the bolt to ascertain the precise number of pounds required to pull the expansion shell out of the hole. From this experimental data the correct torque may be ascertained and all of the bolts in that particular area are set by a wrench which has been adjusted to produce the torque desired. Under actual mining conditions, however, it is nearly impossible to maintain the proper torque settings on these wrenches.

All of the various objections to the present method of unifying a mine roof or ceiling are avoided by the use of an expansion bolt which will tighten correctly when applied in any manner, manually or with an incorrectly set

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wrench or one which previously has been damaged. One method of accomplishing this would be to furnish all of the expansion bolts at a maximum strength and to reduce the strength of each group of bolts for a given area of mine roof as by cutting a kerf in the head of the bolt, varying the depth of kerf and consequently the diameter of the shank at such kerf in accordance with the torque desired and stamping each of the bolts adjacent the head with a number corresponding to the so-determined maximum torque. A still better manner of reducing the minimum diameter would be to turn the bolt as in a lathe so as to increase the depth of the valley between two spaced heads, this giving a more accurate shear point. A still further method would be to have the outer head slip in the inner head, this being particularly useful for service other than in mines and where the desired tension is relatively light.

In the drawings:

FIGURE 1 is a vertical section through a coal seam in a mine showing the bolts as extending parallel to each other and at right angles to the strata surface;

FIGURE 2 is a view of my preferred form of bolt;

FIGURE 3 is a fragmentary central section partly in elevation through a modified form of head end;

FIGURE 4 is a transverse section through the modified form; and

FIGURE 5 illustrates a further modification.

In FIGURE 1 the coal seam is numbered 10, the bottom rock formation 11, the opening 12 and the roof or ceiling of the opening 12 is numbered 15. Above the roof there are a plurality of strata 16, 17, 18, etc., which are in contact with each other but any one of which might slip laterally if the roof strata are not secured firmly together. This fastening is accomplished by applying elongated bolts each having a shank 20, an expansion shell 21, and a head 22. The direction, spacing and such details will follow standard practice. As previously stated, the expansion bolts are given a chosen torque depending entirely upon the hardness of the rock formations and other factors which must be determined experimentally, as has always been the case.

The present invention is concerned solely with the specific form of bolt itself and the advantages that after a period of time the bolts may readily be retightened if that is found to be necessary and they can be removed should that ever be desired.

In FIGURE 2 the shank 20 is quite elongated and is threaded as at 25 at one end to receive the usual expansion shell 21 which may be of any of the various types now used in mines and elsewhere. Obviously the threads 25, under conditions different from mine use, could accommodate an ordinary nut in which case the shank 20 could be of any length, usually short. The head 22 is integral with the shank 20 and may or may not be integral with the washer 26 or bearing plate which is of a diameter at least twice the distance between parallel flats of the inner head 22 which preferably is either square or hexagonal, but may be of any suitable configuration.

In the preferred form of the invention as shown in this figure, the valley 27 between the inner head 22 and the outer head 30 is of a depth to reduce that portion 31 of the shank to a smaller diameter than the remainder of the shank. The distance apart of the heads 22 and 30 may be of any distance varying from that of a thin kerf made by sawing apart the two heads 22 and 30 originally made as one, in which case the advantage of having the heads 22 and 30 angularly displaced with each other will be lost. The distance between the heads should be not greater than the axial length of either head and preferably is less than that shown in FIGURE 2 which illustrates the heads 22 and 30 as being square and displaced 45° with each other to prevent a careless

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workman from gripping a portion of the head 22 as might be the case if the heads were originally integral and separated merely by a saw kerf. I would prefer the heads be displaced 45° when using square head and when applied with a square socket in the wrench but when the heads are so arranged an octagonal socket would grip both heads; consequently, the angle had best be varied by an appreciable different angle, say 30° and 60°.

It is my preference that the bolts be completely made, tested, and then stamped by the manufacturer so that the torques necessary to shear the heads are clearly visible either on the outer head, 33 or 41, or on the shank of the bolt.

In FIGURES 3 and 4 the outer head 33 is joined by a neck 34 to a larger ribbed portion 35 fitting in a corresponding grooved portion 36 in the inner head 37 integral with a shaft or shank 38 corresponding exactly to shank 20. The force at which the outer head 33 would turn with respect to shank 20 would normally be governed by the size and number of the ribs 35 and grooves 36, but as shown the neck 34 is smaller in diameter than either the shank 38 or the ribbed portion 35. This particular modification would be useful where a great number of the bolts would be used, all outer heads shearing at the same tension.

In FIGURE 5 I have shown a feature that is intended to be added to any of the various modifications, namely a flange 40 carried by the outer head 41 which in this case is illustrated as a cylindrical head having a recess 42 of any form such as the Phillips head, Allen head, etc. It is my intention to have this flange 40 integral with the head 41 but it need not be as it could be a light element, such for instance as a split washer. The outer head and its flange carry a neck 43 which is a precision machined shear zone carrying an integral threaded portion 45 of materially larger diameter. The inner head 47, corresponding to the head 22, is integral with the shank here numbered 48 and corresponding to shank 20. The bearing plate 50 in this case is shown not integral with the head 47 and shank 48. The head 47 is tapped as at 51 to receive the screw threaded portion 45 of the outer head which, while illustrated with an Allen head, may have any of the other types, square, hexagonal, octagonal, etc. In this modification only the outer head would have to be varied for different torques as the other portion of the bolt would be uniform and all provision for shear torque is taken care of by changes in the diameter of the neck 43. The flange 40 is to insure absolutely against any turning of the inner head 22, 37 or 47 by a quite dilapidated octagonal chuck. These chucks do get terribly worn, in fact so badly worn that it is possible for a chuck to engage the inner head at almost any angle no matter how the two heads are shaped or are related to each other. The flange 40 is preferably circular and integral with the head 41 and is of such size as absolutely to prevent any possible engagement of a chuck or wrench with the inner head until after the weaker portion has been sheared freeing the outer head. A somewhat similar element 55 is shown in FIGURE 3, this being a loose washer readily fitting over the ribbed portion 35 and of a diameter appreciably greater than that of the inner head 37 which is of greater

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axial length than the other inner heads. The flange 56 on the inside of the inner head 37 is an optional feature which can be added to any of the inner heads to aid in distributing the load to the bearing plate 26 or 50.

What I claim is:

1. An elongated expansion bolt for pinning together layers of rock in a mine comprising a shank threaded to receive an expansion shell, said shank having two connected heads of the same size and with the same even number of flat sides but displaced angularly and a circular washer of a diameter at least twice that of the distance between parallel flats of the inner head, the connection between the two bolt heads including an internally threaded portion, an externally threaded portion snugly fitting therein and a neck joining one of the threaded portions to the outer head, the neck being of chosen smaller diameter than the uniform diameter of the shank adjacent its threaded portion, whereby the tension on the bolt by turning the outer bolt head may be held to a chosen maximum as the outer head will shear at such tension because of the reduced diameter of the neck between the two heads, and when the outer head has been removed the bolt may again be tightened by application of a wrench to the inner head.

2. A device for use in securing together layers of rock in a mine roof, comprising a bolt having a shank of uniform diameter threaded at one of its ends and having at the other end an inner integral head and a removable outer head, the inner head having an axially positioned recess therein with grooves parallel to the axis of the bolt while the outer head has an integral neck integrally joining a shank portion which fits the axial recess with ribs engaging said grooves so the two heads will normally turn together, said ribs being of a size to shear upon the tension reaching a chosen maximum and an expansion shell on the threaded end of the shank, whereby said outer head is connected to the integral head to turn with respect to the inner head but is sheared off when the tension on the ribs reaches said chosen maximum, leaving the inner head available to release or to tighten the bolt.

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