

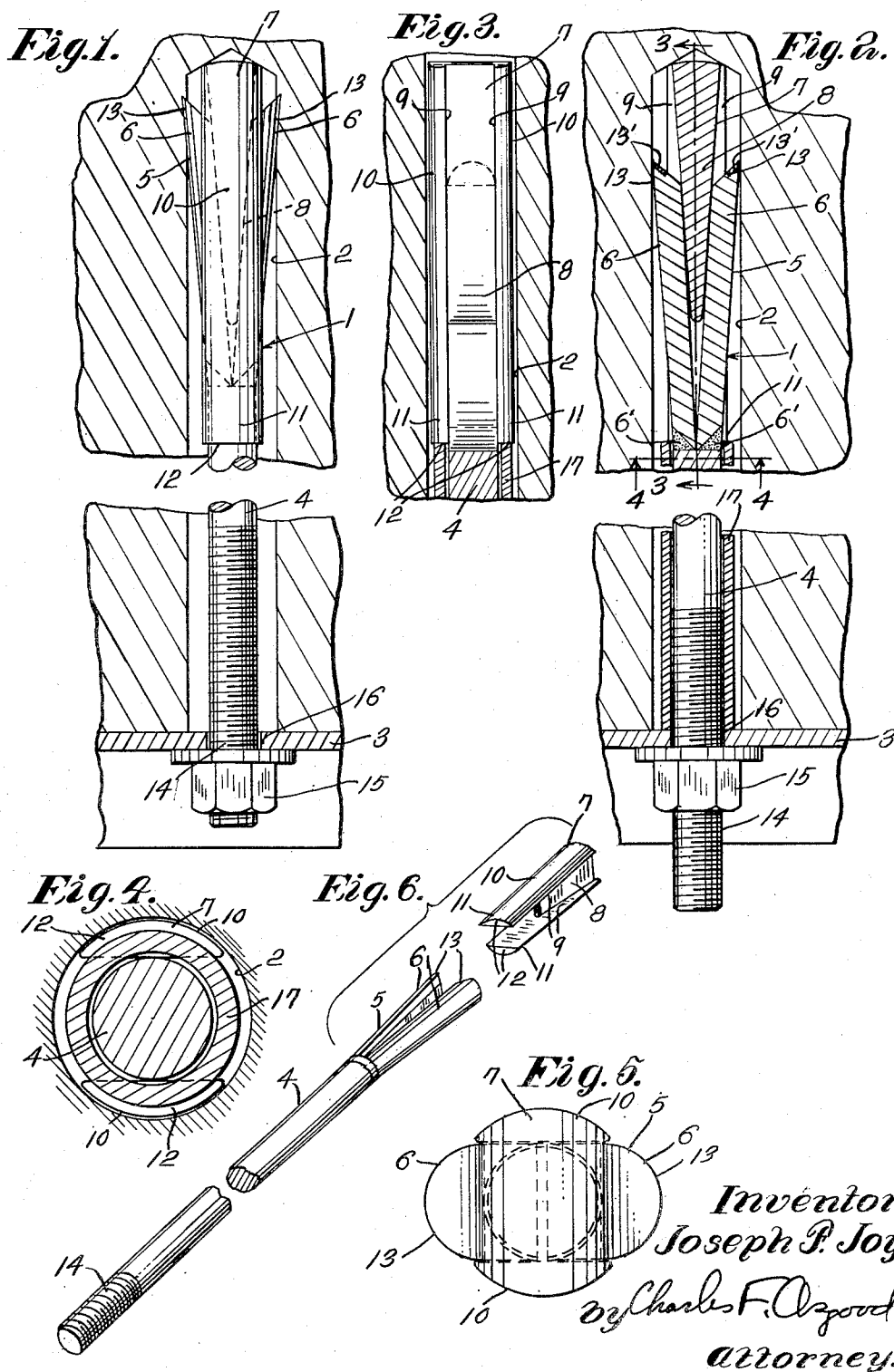
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RELEASABLE WEDGE TYPE ROOF BOLT

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RELEASABLE WEDGE TYPE ROOF BOLT

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5 Claims. (Cl. 61—45)

This invention relates to suspension type roof supports and more particularly to improved roof anchors insertable in holes drilled in the roof strata of an underground mine or tunnel for at least temporarily supporting the roof wholly without external supports such as timbering and which are releasable for recovery to permit reuse at other locations.

In underground mines or other subterranean excavations roof bolting has been found very advantageous and is coming into increasing use in supporting the roof strata against falls or cave-ins. Such anchor bolts usually are inserted in holes drilled in the roof strata and have expandable heads whereby the bolts may be firmly anchored in position, and nuts threaded on the bolts may engage cross beams or plates to hold the latter in supporting position against the roof to bind the immediate strata together thereby minimizing flexure and preventing rock failure. In areas which have been worked-out it is good economy to recover the anchor bolts and to allow the roof to subside. Further, in underground workings where roof timbering is still used as in mines where uninterrupted mining is effected by continuous mining apparatus it is important to firmly support the roof near the working face and above the continuous mining apparatus, prior to the installation of permanent timbering, and it has been found that roof bolting not only provides a reliable means of roof control for this purpose but also provides for increased roof and sidewall clearances and improved ventilation of the mine passageway. Where the roof is temporarily held up by the anchor bolts it is desirable to recover the bolts, for reuse at other locations, as the permanent timbering is advanced. In known types of roof anchor bolts recovery of the bolts is practically impossible and in any event is extremely dangerous since the bolts must be torn loose by fracturing the roof strata surrounding the walls of the holes or by breaking up the roof strata, due to lack of any means for releasing the expandable bolt heads.

The present invention contemplates improvements over known types of expandable anchor bolts in that the bolts are constructed so that they may be readily and quickly released from the rock strata when desired, for reuse at other locations. The anchor bolt of the present invention embodies an expandable bolt head so arranged and constructed that it may be quickly released by insertion in the hole, in the space surrounding the bolt, of a suitable releasing instrument such as a section of pipe, to engage and release the wedging means of the expandable bolt head. The wedging means in accordance with the present invention includes a novel wedge structure having side projections extending laterally beyond the sides of the bolt body so that the wedge releasing instrument or pipe section may be placed over the bolt body in the hole and moved into engagement with the wedge projections so that relative longitudinal movement between the wedge and the bolt may be effected by turning the nut on the bolt and thus collapse, so to speak, of the spread ends of the bolt may be brought about and the bolt then removed from the strata and recovered. In a preferred embodiment the wedge releasing instrument or pipe section may be engaged with the wedge and the bolt may be actuated to effect release of the bolt head or the wedge may be moved relative to the bolt body by the same means that is employed to hold the cross beams or plates against the roof.

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An object of the present invention is to provide an improved suspension type roof support especially designed for use in supporting the roof strata of an underground excavation such as a mine passageway or tunnel. Another object is to provide an improved expandable type anchor bolt so arranged and constructed that the expandable head of the bolt may be firmly secured in anchored position and may be readily released when desired. A further object is to provide an improved expandable anchor bolt having releasable wedging means for contracting the bolt head. A still further object is to provide an improved expandable anchor bolt insertable in a hole drilled in the roof strata of an underground excavation and which may be firmly anchored in position and may be quickly released when desired. Still another object is to provide an improved wedge structure for an expandable bolt head with the wedge structure so constructed that the bolt head may be readily released by a releasing instrument insertable in the hole and engageable with the wedge structure. Yet another object is to provide an improved releasing instrument which is held in position to effect wedge release to contract the bolt head by the same means as that employed to tighten the bolt. A further object is to provide an improved anchor bolt which by effecting by releasing means inserted in the hole relative movement of parts of its expanded head, may enable the anchor to be readily recovered from the hole. Still a further object is to provide an improved expandable anchor bolt having an expandable head provided with a novel wedge for effecting expansion of the head, with the wedge presenting lateral shoulders or abutments engageable by a tubular member placed over the bolt for holding the wedge in stationary position during contraction of the bolt head. Another object is to provide an improved expandable head for an anchor bolt. These and other objects and advantages of the invention will, however, hereinafter more fully appear.

In the accompanying drawing there is shown for purposes of illustration one form which the invention may assume in practice.

In this drawing:

Fig. 1 shows a fragmentary section of the roof strata with the improved anchor bolt secured in roof supporting position in the strata.

Fig. 2 is a view similar to Fig. 1 with the anchor bolt shown partially in central longitudinal section and with the wedge releasing instrument shown in wedge releasing position.

Fig. 3 is a vertical section taken on line 3—3 of Fig. 2, with a portion shown in elevation, showing the releasing instrument in engagement with the wedge-shoulders.

Fig. 4 is a cross sectional view taken on line 4—4 of Fig. 2.

Fig. 5 is an enlarged end view of the expandable head of the anchor bolt.

Fig. 6 is a perspective view showing the bolt body, the expandable split head and the expander wedge, with the wedge separated axially from the split head.

In this illustrative embodiment of the invention, as shown in the drawing, the anchor bolt is generally designated 1 and is insertable in a hole 2 drilled in the roof strata of a mine or other subterranean excavation, to hold a roof support such as a cross beam or plate 3 in supporting position against the roof.

The anchor bolt comprises an elongated rodlike body 4 having formed at its upper end an expandable head 5 which, for illustrative purposes, comprises split fingers or anchoring portions 6, 6 which are yieldable laterally. The portions 6, 6 are of semi-circular cross section and are desirably secured by welding at 6' to the bolt body, thereby to provide a rugged construction (Fig. 2). Thus the loss of cross sectional strength due to slotting of a solid cylindrical piece of metal, is avoided. A wedge 7 of novel design has a central wedge portion 8 tapering downwardly and insertable between the yieldable fingers 6 as shown in Fig. 2. The wedge has parallel side portions 9, 9 formed with curved outer surfaces 10 which lie in the surface of a cylinder and are shaped substantially to fit the hole. The parallel side portions 9 of the wedge project downwardly at 11 a substantial distance below the

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narrow edge or apex of the wedge and extend along the sides of the split portions 6 of the bolt and provide shoulders or abutment surfaces 12 at their bottoms which project laterally from the sides of the bolt body as shown in Fig. 3. The yieldable fingers or anchoring portions 6 of the expandible head lie in the space between the side portions of the wedge and have prong-like upper portions 13 which are hard faced at 13' to resist wear and which are adapted to be embedded into the walls of the hole. The lower portion of the bolt body is externally threaded at 14 for engagement with a nut 15.

In use the wedge 7 is first placed in position on the split head of the anchor bolt and is then inserted by the bolt in the hole and the bolt is moved upwardly to bring the upper end of the wedge against the bottom of the hole, and then the bolt is suitably driven upwardly, desirably with a hammering action, to cause the wedge to deflect the split fingers laterally into firm anchoring relation with the walls of the hole as shown in Fig. 1. The cross beam or plate 3 is then placed against the roof with the lower end of the bolt extending downwardly through an opening 16 in the beam or plate. The nut 15 is then threaded on the lower end of the bolt and is tightened against the beam or plate to secure the latter firmly in supporting position against the roof. When it is desired to effect release of the anchor bolt the nut and beam or plate may be removed from the bolt and a tubular releasing instrument 17 desirably in the form of a pipe section may be inserted in the hole outside of the bolt body and the beam or plate 3 and nut 15 may then be replaced so that the lower end of the pipe section rests on the beam or plate as shown in Fig. 2 and with the upper end of the pipe section engaging the shoulders 12 at the bottom of the wedge as shown in Fig. 3. The nut may then be again tightened to effect drawing of the bolt body and bolt head downwardly while the wedge is held up in stationary position against the hole bottom by the pipe section or, if there is initial separation between the anchor and the bottom of the hole, and if the length of the instrument 17 is such that it is placed under compression before the plate 3 engages the roof, to move the wedge a slight distance upwardly into engagement with the hole bottom prior to drawing down of the bolt body, and as the wedge is moved upwardly or as the bolt is drawn downwardly the spring fingers 6 are contracted to the position shown in Fig. 2, out of contact with the hole walls. The anchor and roof support may then be removed from the roof strata for reuse at another location. With reference to the release of the roof bolt from the hole it will be apparent that by the provision of the pipe section between the nut 15 on the bolt and the shoulders 12 on the wedge, the pipe section 17, upon screwing of the nut towards the split end of the bolt, will effect relative longitudinal movement between the wedge and the split end of the bolt, so it is immaterial whether the bolt initially moves outwardly relative to the stationary wedge or whether the wedge, as might be possible if it were not in engagement with the hole bottom in the expanded position of the roof bolt, moves inwardly relative to the momentarily stationary bolt. Rather certainly most of the collapsing of the bolt head will be accomplished by movement of the bolt downwardly with respect to the wedge. What is necessary in such contraction of the bolt head is to effect relative longitudinal displacement between the wedge and the laterally bent ends of the split bolt head so that there may be space for these bent ends to approach each other sufficiently to allow their withdrawal from the hole. If there is sufficient space for the wedge to move inwardly slightly toward the hole bottom while the bolt remains stationary with its bent end portions embedded in the hole walls, the establishment of a clearance between the bent bolt ends 6 and the wedge can be very readily initiated. Whether or not, however, this is possible is immaterial because the recesses in the wall of the hole engaged by the ends 6 of the bolt can never have their walls spaced from the adjacent points of the wedge surface of the wedge element by lesser distances than the thicknesses of the spaced ends. Thus, if the wedge be held stationary and there be an outward movement of the bolt relative to the stationary wedge, there will be no such interlock with the wall of the hole so as to prevent concurrent outward movement of the bolt and mutual approach of its split ends. Whether the element 3 is employed or not during withdrawal of the bolt is also immaterial. If it is, after the spaced ends of the bolt have been brought partially together within the bore of the pipe section 17 and thus

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have had their bodily removal made very easy, the removal of the nut 15, and removal of the member 3, freeing the mouth of the hole for outward movement of the bolt and wedge, will permit ready bolt withdrawal. On the other hand, if the element 3 be not used, and if the nut, with perhaps an intervening washer, engaging directly the end of the pipe section 17, then just as soon as the ends 6, 6 approach each other sufficiently the whole structure within the hole may be readily withdrawn. It is accordingly evident that by the provision of the shoulders on the wedge designed for engagement with the releasing instrument the anchor bolt may be readily and quickly released.

As a result of this invention an improved suspension type roof support for mines or other subterranean excavations is provided which may not only be firmly anchored in place in a hole drilled in the roof strata but which may also be readily and quickly released when desired. The expandible anchor bolt, by the provision of the improved wedge structure, may be readily released simply by placing a suitable releasing instrument against shoulders provided by the wedge so that the wedge may be held stationary in the hole while the bolt is drawn downwardly or the wedge may be moved upwardly while the bolt is momentarily stationary, to effect release of its expandible head. Thus by relatively moving the split head and wedge, the anchor may be readily released. By the provision of the novel structure disclosed a roof anchor of the type which normally remains permanently in the rock strata with but small modification may be made readily releasable, thereby enabling reuse of the anchor as desired. By forming the expandible head of the bolt by welding a pair of semi-circular parts to the bolt body and by providing the points of the expandible portions with hard facing not only is the cross sectional strength of the bolt head materially increased but also resistance to wear is improved. These and other manners of use and advantages of the invention will be clearly apparent to those skilled in the art.

While there is in this application specifically described one form which the invention may assume in practice, it will be understood that this form of the same is shown for purposes of illustration, and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. A releasing device for releasing a releasable anchor bolt of the kind insertable in a hole of substantial depth formed in strata to be supported comprising an elongated bolt body of smaller cross sectional area than the hole thereby leaving a space between the exterior of the bolt body and the hole walls, said bolt body carrying an expandible head at its inner end, and a wedge engageable with the hole bottom, said wedge and said bolt head being relatively movable to effect expansion of said head into engagement with the hole walls to anchor said bolt in the strata, said wedge having a lateral projection extending outwardly beyond one side of said bolt body into said space and providing an abutment shoulder adapted for engagement by a releasing instrument, said releasing device comprising a releasing instrument insertable in said space within the hole exteriorly of the bolt body into engagement with said wedge projection and cooperating with said bolt to effect relative movement of said wedge and head for effecting contraction of said head whereby said bolt may be readily removed from the hole.

2. A releasing device as set forth in claim 1 wherein the wedge of said anchor bolt has at its outer end opposed lateral projections extending into said space within the hole and providing outwardly facing abutment shoulders and said releasing instrument is in the form of a tube insertable in the hole over said bolt in the space surrounding the bolt body and at its inner end engaging said abutment shoulders for effecting such relative movement of said wedge and head.

3. A releasing device for a releasable anchor bolt as set forth in claim 2 wherein the wedge of said anchor bolt comprises a central wedge-shaped portion and parallel side arms projecting from said wedge-shaped portion a substantial distance outwardly of the apex of said wedge, said side arms have curved exterior surfaces lying within a circle and substantially fitting the hole walls, and said

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projecting side arms also have abutment surfaces at their outer ends with which the inner end of said tube engages.

4. A releasing device for releasing an expansible type anchor bolt of the kind comprising a bolt body insertable in a hole in strata to be supported and of smaller cross sectional area than the hole to leave a space between the exterior of said bolt body and the hole-walls, said bolt-body carrying an expansible head at its inner end, a wedge engageable with the hole bottom and co-operating with said head to effect expansion thereof, and tensioning means for said bolt acting on the outer surface of the strata to effect binding of the strata together in supported relation, said wedge having a lateral projection extending outwardly beyond one side of said bolt-body into said space within the hole and providing an abutment surface, and a releasing instrument insertable in the hole in said space exteriorly of the bolt body and engaging said abutment surface on said wedge and co-operating with said bolt tensioning means to effect contraction of said head whereby said bolt may be readily removed from the hole.

5. A releasing device as set forth in claim 4 wherein said bolt tensioning means engages a plate placed against the outer surface of the strata and said releasing instru-

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ment is disposed between said plate and said abutment surface on said wedge whereby when said tensioning means is adjusted to draw the bolt axially outwardly within the hole, said releasing instrument holds said wedge against movement so that said head may be contracted.

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