Aug. 10, 1965 N. W. DENSMORE 3,199,611

TOOL MOUNTING

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FIG. 2.

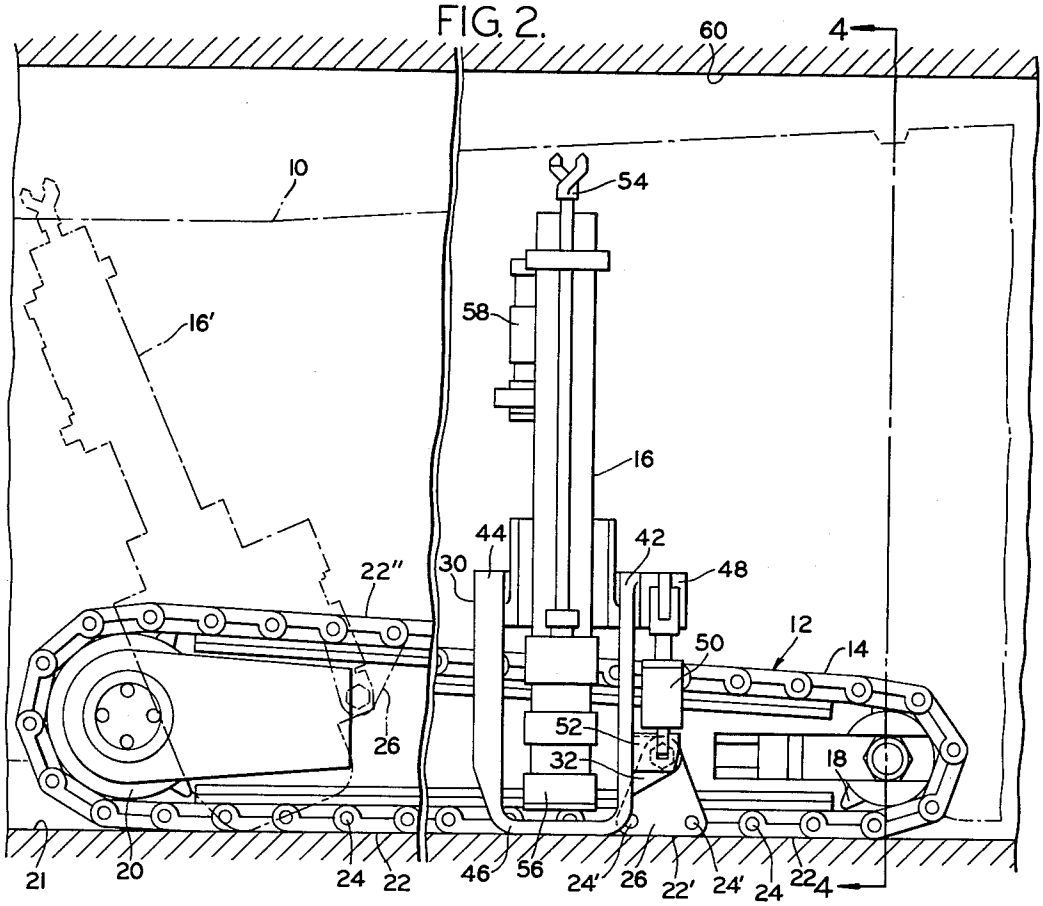
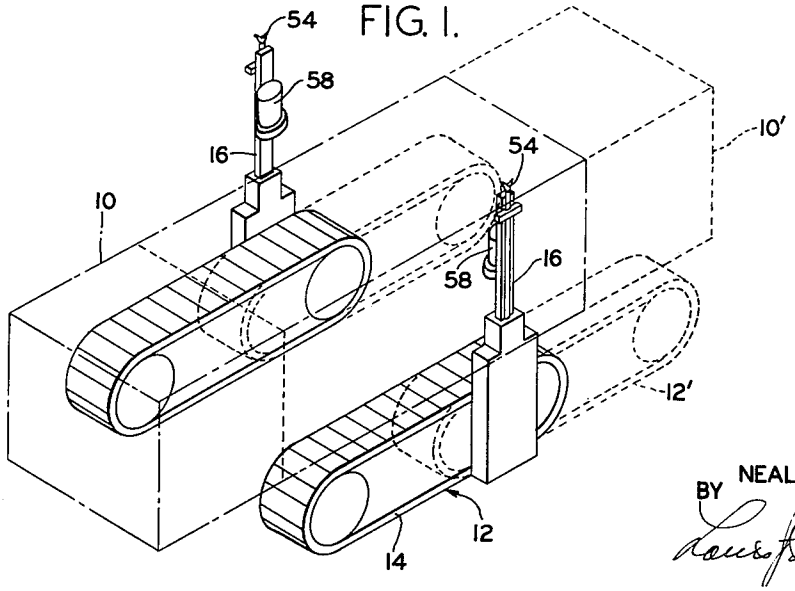


FIG. 1.



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FIG. 3.

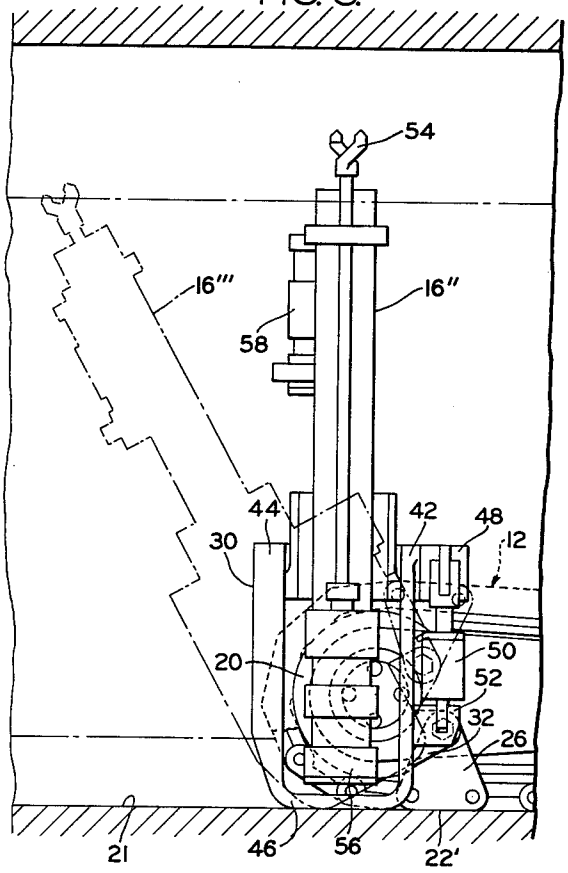


FIG. 4.

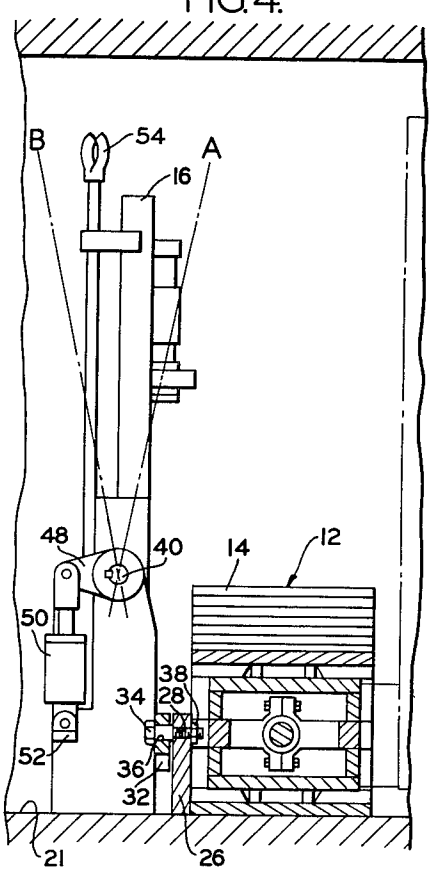
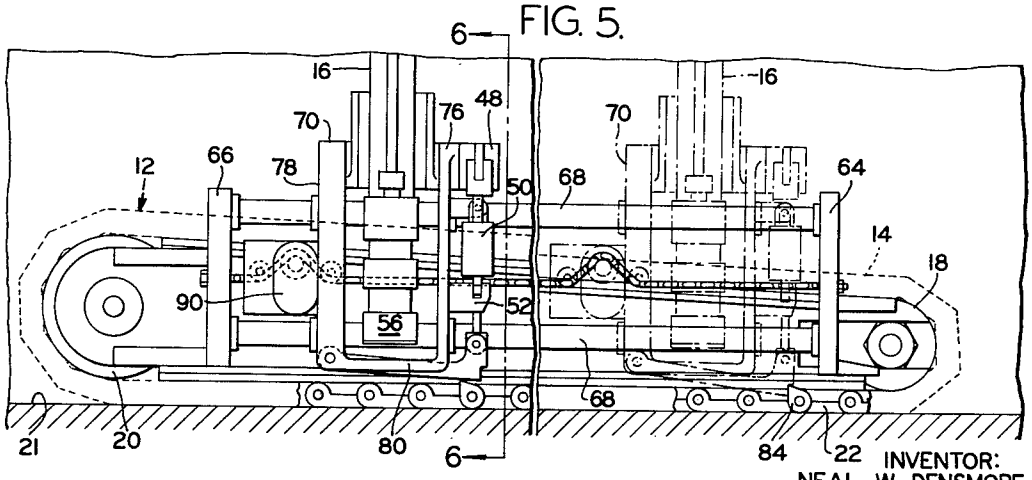


FIG. 5.



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FIG. 6.

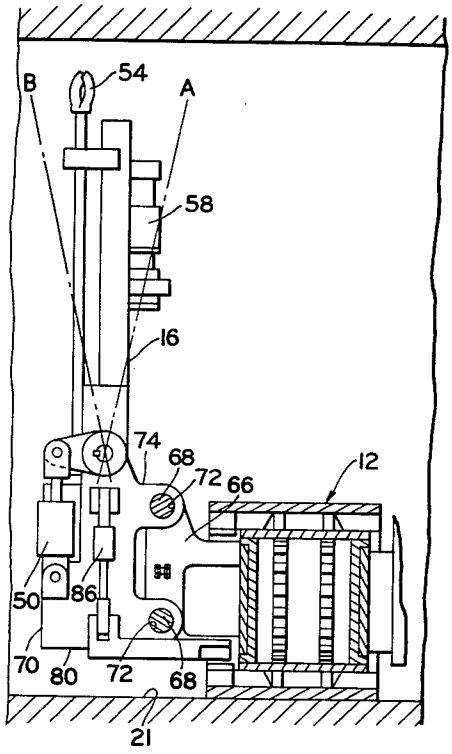


FIG. 7.

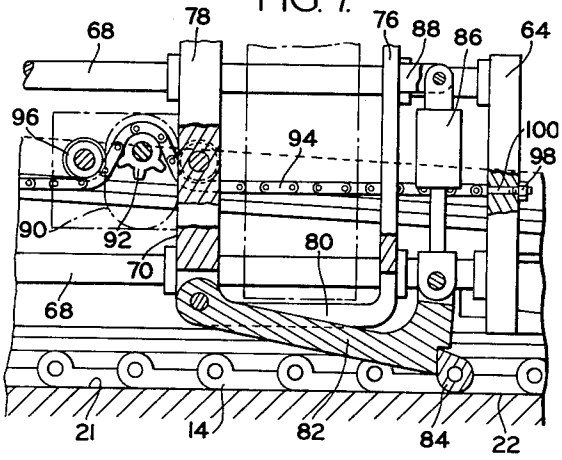
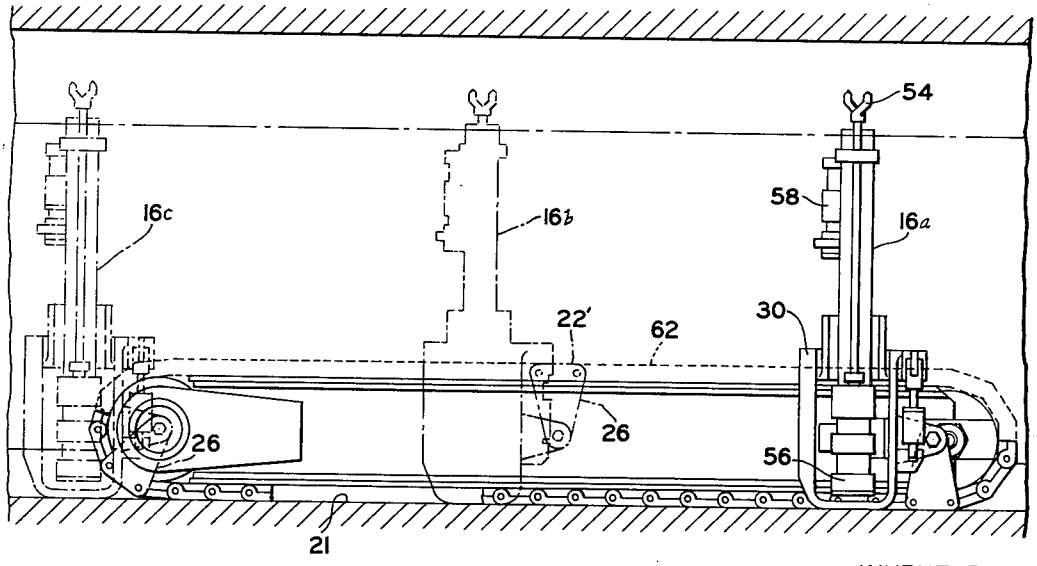


FIG. 8.



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3,199,611

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3,199,611

TOOL MOUNTING

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Continuation of application Ser. No. 727,808, Apr. 11, 1958. This application Aug. 28, 1961, Ser. No. 134,264

5 Claims. (Cl. 173—24)

This application is a continuation of application Serial No. 727,808, filed April 11, 1958, now abandoned.

This invention relates to a tool mounting apparatus and more particularly to a mounting means which permits the operation of a mine roof drilling tool, mounted on a self-propelled support, during such time when such support performs its function of removing mineral from a solid vein.

Roof conditions in some mines necessitate roof bolting because certain rock strata, forming the roof of the mine, are incompetent to support their own weight after the removal of the mineral thereunder. Incompetent roof strata can be supported by roof bolts securing the incompetent strata to overlying competent strata. Each roof bolt is provided with a bearing plate between the head of the bolt and the roof of the mine and is threadedly engaged with an expansible nut anchored in the competent strata.

A roof bolting drill such as that described in U.S. Patent 2,741,461, adapted to the formation of substantially vertical bores in the roof of a mine and to the application of rotative forces (wrenching) to the roof bolt, is used in the roof bolting operation. Such operation comprises the following steps: a substantially vertical bore is formed in the roof of the mine by the aforementioned apparatus and extends through the roof strata of the mine into overlying competent strata; an elongated roof bolt, provided with an expansible nut on its threaded end and a roof bearing plate adjacent the head end is inserted in the bore in such manner that the expansible nut is positioned within the competent strata; wrenching action applied to the bolt by the drilling apparatus expands the nut in the competent strata, securing it therein, and brings the bearing plate into abutting contact with the roof surface of the mine in a manner well known in the art.

It has heretofore been found advantageous to mount a roof drilling apparatus on continuous miners of the ripper bar type. Such mounting was made possible by the fact that the main body of the machine remains stationary during that part of the mining cycle when the ripper bar is in operation. The mounting of the present invention makes the roof drilling operation possible with such roof drilling apparatus mounted on a continuous miner of the boring arm type which is characterized by continuous forward motion of the miner during the mining operation.

A feature common to all continuous miners is the mounting of such miners upon orbital tread means known as crawlers, actuated by a crawler mechanism having front and rear sprockets. The orbital tread means are composed of individual tread links which, as the machine moves forward at a constant rate, move in the following manner: Each individual link, by action of the front sprocket, is laid upon the ground or other supporting surface and remains stationary upon the ground while the machine moves forward resting a portion of its weight on such link; when the rearward portion of the crawler mechanism passes over the individual link it is raised by action of the rear sprocket from its position in contact with the ground and carried forward in the direction of motion of the machine at a rate twice as great as that of the machine; upon reaching the front sprocket of the crawler mechanism, the individual link is again laid upon the ground and the above described cycle is repeated. It is to be noted that the motion of the above described tread link is an intermittent one characterized by periods of relatively rapid forward motion alternating with periods of time during which the tread link is stationary with respect to the ground.

The present invention contemplates controlling the forward motion of a tool mounting apparatus by taking advantage of the above described action of crawler treads to impart a desired intermittent forward motion to such apparatus, i.e. periods of forward motion alternating with substantially equal periods of stationary positioning of the mounting apparatus. The roof drilling and bolting apparatus may be mounted directly upon the tool mounting which is carried forward by one of the aforementioned tread links or alternatively such apparatus may be slidably mounted upon the continuous miner but periodically held stationary by the action of one of the tread links and intermittently moved forward on the miner by motor means mounted thereon.

The advantages inherent in the device of this invention are:

(1) Supporting the roof bolting drill upon the tool mounting obviates any need for an independent self propelled mechanism, to transport, position and control the drill.

(2) The tool mounting as described permits the drilling and bolting operation to proceed without interrupting the mining operation.

(3) Positioning of the drill for correct spacing of the roof bolt is accurately and readily achieved when the drilling apparatus is operatively connected to the tool mounting of this invention.

(4) Such mounting permits the roof bolting operation to be applied very near to the mining face so that only a small portion of the mine roof is left unsupported at any time. This insures the safety of the mining operation and makes it possible to use a boring type miner in mineral veins where the overlying strata is of such nature that roof conditions would otherwise prevent the use of this type of miner.

(5) No mine personnel need be exposed to the risk of working under an unsupported roof.

It is therefore an object of this invention to provide a new and improved mounting for a roof bolting drill.

It is a further object of this invention to provide a new and improved tool mounting applicable to a crawler tread propelled support.

Another object of this invention is to provide a new and improved tool mounting capable of imparting intermittent motion to a roof bolting drill by operatively connecting such mounting to the crawler treads of a continuous miner.

It is a more specific object of this invention to provide a new and improved tool mounting, the forward motion of which is controlled by the motion of one tread link

of an articulated orbital tread means which supports and renders movable over a surface a continuously moving continuous miner.

It is a further specific object of this invention to provide a new and improved tool mounting for a continuously moving continuous miner mounted upon orbital articulated tread means, which mounting provides that the roof bolting drill will be alternately held stationary and carried forward by one link of the orbital tread means.

It is a further specific object of this invention to provide a new and improved tool mounting applicable to a continuously forward moving continuous miner, mounted upon orbital tread means so that intermittent stationary positioning of a roof bolting drill apparatus will be controlled by the stationary positioning of one link of the orbital tread means and the forward motion of the roof bolting drill apparatus will be accomplished by the application of hydraulic power through a sprocket and chain apparatus.

These and other objects and advantages of this invention will hereinafter become more fully apparent from the following description of the annexed drawings, which illustrate a preferred embodiment, and wherein:

FIG. 1 is a schematic representation of a continuous mining machine provided with roof bolting drills supported by mountings constructed according to the principles of this invention.

FIG. 2 is an enlarged fragmentary elevational view of a crawler mechanism on which is mounted a roof bolting drill, which mounting is constructed according to the principles of this invention.

FIG. 3 is a fragmentary side elevational view of a portion of the crawler shown in FIG. 2 showing the roof bolting drill (in broken outline) in two different positions relative to the crawler.

FIG. 4 is a sectional view taken substantially on the line 4—4 of FIG. 2.

FIG. 5 is a fragmentary side elevational view of a second embodiment of a roof drill mounting constructed according to the principles of this invention.

FIG. 6 is a sectional view taken on line 6—6 of FIG. 5.

FIG. 7 is an enlarged fragmentary view partially in section of a portion of the apparatus shown in FIG. 5.

FIG. 8 is a side elevational view of the roof drill mounting of FIG. 2 as applied to a crawler mechanism of a different type.

Referring now to the drawings: in FIG. 1 there is shown in dot and dash outline a diagrammatic representation of a continuous miner 10 supported, and rendered movable over a surface, by a pair of crawler mechanisms generally indicated at 12 provided with endless circulating tread means 14 upon each of which crawlers 12 is mounted in a manner to be described, a roof bolting drill 16. The dotted outline 10' and 12' show the position of the continuous miner and crawler mechanism 12 with respect to the roof bolting drill 16 (shown in solid outline) after the crawler mechanism 12 has moved forward a distance approximately equal to one-half the length of the crawler mechanism from the position shown by the solid outline 12.

In FIG. 2 there is shown a crawler mechanism 12 provided with endless orbital tread means 14 trained about a front sprocket 18 and a larger diameter rear sprocket 20. The tread means 14 is driven by the rear sprocket 20 actuated by a power means (not shown) to render the continuous miner 10 self-propelled and movable over a surface 21 in a manner well known in the art. The tread means 14 are composed of a plurality of individual ground engaging tread links 22 pivotably connected together in an endless chain by elongated cylindrical link pins 24. A generally triangular bracket member 26 is mounted against an outer end surface of one tread link 22 by means of a pair of link pins 24'

somewhat longer than the link pins 24 used for the rest of the chain but serving the same purpose of linking two of the tread links 22 together. The special link pins 24' are rigidly secured in a pair of bores centered in two of the corners of the bracket member 26, these bores being laterally spaced by an amount equal to the spacing of the link pin 24 in the rest of the chain. The bracket member 26 is mounted so that when the tread link 22 on which it is mounted is resting upon the ground the bracket member 26 extends upwardly so that a threaded bore 28 (see FIG. 4) centered in the third corner of the triangular bracket member 26 will be at a distance from the supporting surface 21 equal to the distance of the center of the front sprocket 18 from the same surface 21. A generally U-shaped roof bolting drill mounting means 30 is pivotably secured to the bracket member 26 by a generally triangular mounting bracket member 32 overlappingly engaged with the bracket member 26 and pivotably engaged by a threaded retaining member 34 such as a shoulder cap screw, threadedly engaged in the threaded bore 28 and rigidly secured in such engagement by a threaded lock member 38 such as a nut.

The U-shaped roof bolting drill mounting means 30 has a flattened bight portion 46 resting upon the surface 21 and a pair of upwardly extending leg portions 42 and 44, being forward and rearward leg portions respectively, the upper ends of which are provided with a pair of axially aligned bores (not shown) which pivotably receive an elongated cylindrical shaft element 40 (see FIG. 4). The shaft element 40 is rigidly secured to an intermediate portion of the roof bolting drill 16. The mounting means 30 thus provides a pivotable support for the roof bolting drill 16 to allow angle drilling by the roof bolting drill 16 in a manner to be described. The shaft element 40 extends forwardly through the leg element 42 and has mounted on the shaft 40, in keyed relationship therewith, a lever element 48 suitably secured to the rod end of a double acting fluid actuated extensible cylinder 50 suitably secured at its head end to a bracket 52 rigidly mounted on a lower portion of the forward leg 42. Admission of pressure fluid to the head end of the cylinder 50 will cause the roof bolting drill 16 to swing into the position indicated by the line A in FIG. 4 while admission of pressure fluid to the rod end of the cylinder 50 will cause the roof bolting drill 16 to pivot about the shaft 40 and swing into the position indicated by the line B in FIG. 4.

The roof bolting drill 16 is a type well known in the art and is provided with a drilling tool 54 rotationally driven by a fluid operated motor 56 and is vertically advanced in a drilling operation by a drill feed motor 58, also fluid operated. Another operation accomplished by the roof bolting drill mechanism 16 is the operation of rotating and tightening the roof bolts (such operation being known as wrenching). For further description of the operation and construction of such a roof bolting drill reference is made to U.S. Patent 2,741,461.

In describing the operation of the device of this invention reference will be made to the supporting surface 21 (the floor of a mine) and an upper surface 60 (the roof of the mine) both of which surfaces are produced by the action of the continuous miner 10 in disintegrating and removing a portion of a mineral vein in a manner well known in the art. The continuous miner 10 associated with this invention is one which is charactreized by continuous forward motion during the cutting, disintegrating and removal operations performed upon the mineral vein. The roof bolting drill 16 is shown in various positions identified in FIGS. 2, 3 and 4 as 16, 16', 16'' and 16'''.

As the mining machine 10 moves forward at a constant rate of speed each individual link 22 of the tread means 14 is deposited upon the supporting surface 21 by the forward sprocket 18 and remains in the position in which it was deposited upon the surface 21 until the

rear sprocket 20 passes over it and raises it from contact with the surface 21. The individual link 22 is then raised to the upper side of the rear sprocket 20 and moves forward with a speed approximately twice that of the forward motion of the miner 10. When the individual link 22 reaches the forward sprocket 18 it is again lowered to the ground and the cycle of motion is repeated. When such motion is applied to the bracket member 26 pivotably supporting the roof bolting drill 16 through the roof bolting drill mounting means 30 the action of the roof bolting drill 16 is as follows: a particular tread link 22' is associated with the bracket member 26 by rigidly receiving therein the two link pins 24' upon which the bracket member 26 is rigidly mounted; when the link 22' is in the position shown and identified as such in FIG. 2 the roof bolting drill will be stationary with respect to the supporting surface 21 while the mining machine 10 and the crawler mechanism 12 move forwardly past it; the roof bolting drill will remain stationary and upright supported by surface 21 until the link 22' reaches the position shown in FIG. 3; while the link 22' is traveling around the rearward half of the rear sprocket 20 the retaining element 34 will be traveling in a small semicircle concentric with the sprockets 20; this motion of the retaining member 34 will slightly raise the mounting bracket member 32 and in so doing will change the position of the drilling device 16 from upright shown as 16" to backwardly tilted shown as 16"' in FIG. 3; as the link 22' travels forwardly along the upper side of the crawler mechanism 12 it takes successive positions such as 22" shown in FIG. 2 with a concomitant positioning of the roof bolting drill 16 shown as 16' in FIG. 2; when the link 22' reaches the front sprocket 18 the center of the retaining element 34 will have been brought to a position coaxial with the front sprocket 18; at this time the roof bolting drill 16 will be standing upright on the floor 21; as the mining machine 10 and the crawler mechanism 12 continue their forward motion the link 22' will be deposited on the floor 21 and remain stationary as before. It is to be noted that during the time the link 22' is resting on the supporting surface 21 the roof bolting drill 16 is standing in a stationary upright position suitable for the accomplishment of the drilling operation desired.

It is to be noted that while the roof bolting drill 16 remains upright and stationary supported by the mounting means 30 resting on the surface 21 suitable actuation of the rotative motor 56 and the feed motor 58 is used and applied to drilling tool 54 to produce a substantially vertical bore in the roof surface 60 extending from incompetent strata which forms the roof surface into competent strata thereabove. When the bore has been completed the drilling tool 54 is withdrawn downwardly therefrom. Insertion of a roof bolt into the bore and tightening of the bolt by the use of the rotative ability of the roof bolting drill 16 can be accomplished as described in the introduction. The tightening of the bolt or wrenching is made possible by the use of the socket (not shown) added to, or substituted for, the drilling tool 54. Such activity is feasible because the roof bolting drill mechanism 16 is stationary with respect to the surface 21 and the roof surface 60 during the whole time required for the roof drilling and bolting operation.

After the drilling operation has been completed continued forward motion of the crawler mechanism 12 carries it past the drill 16 into the relative position shown as 16" in FIG. 3. Continued forward motion of the crawler mechanism 12 will first tilt the roof bolting drill 16 into the position shown as 16"' in FIG. 3 and then drag the roof bolting mechanism forward along the surface 21 at a rate substantially twice that of the forward progress of the crawler mechanism 12. During the forward progress of the roof bolting mechanism 16 the mechanism passes through various positions similar to that illustrated at 16' in FIG. 2. It will be noted that as the roof bolting drill 16 approaches the forward end of the crawler mechanism 12 roof bolting drill 16 will gradually straighten up (that is become more nearly vertical). Further forward motion of the crawler mechanism 12 is without effect upon the roof bolting drill 16 until the rear sprocket again reaches the point relative to the stationary roof bolting drill 16 and the surface 21 shown as 16" in FIG. 3. This cycle, consisting of a stationary positioning alternating with relatively rapid forward motion of the drill mechanism 16, will be repeated indefinitely as long as the crawler mechanism 12 continues to move forward as necessitated by the mining operation.

Referring to FIG. 8 it is to be noted that the roof bolting drill mechanism 16 is here shown as it is applied to a crawler mechanism 62 having forward and rear sprockets of equal diameters. The positions of the drill mechanism 16 indicated as 16*a* and 16*c* in FIG. 8 are actually a single position with reference to the surface 21 and represent the stationary positioning of the roof bolting drill 16 as the crawler mechanism 62 moves forward relatively thereto. The position shown as 16*b* for the roof bolting drill 16 represents a position taken by the roof bolting drill 16 as it is carried forward by the action of the link 22' as it travels toward the front portion of the crawler mechanism 62. It is to be noted that the only difference in the action of the roof blting drill as shown in FIG. 8 from the action of the roof bolting drill as shown in FIGS. 2 and 3 reside in the fact that the roof bolting drill 16 is not rearwardly tilted during part of the cycle, as shown in FIGS. 2 and 3, but remains upright throughout the whole cycle of activity. It is to be further noted that the same mounting means 30 and bracket members 26 together with the associated parts hereinbefore described can be used for the mounting of this roof bolting drill 16 on either the crawler mechanism 12 or the crawler mechanism 62.

In FIGS. 5 and 6 there is shown a second embodiment of this invention in which the crawler mechanism 12 is provided with a pair of formed outwardly extended vertically disposed brackts 64 and 66, front and rear brackets respectively, parallel to each other and longitudinally spaced with respect to the crawler mechanism 12 so that the front bracket 64 is rigidly secured to the crawler 12 rearwardly adjacent to the front sprocket 18 while the rear bracket 66 is rigidly secured to the crawler 12 forwardly adjacent the rear sprocket 20. The brackets 64 and 66 rigidly engage and support a pair of parallel, horizontally disposed, vertically spaced, cylindrical rail members 68. The rail members 68 slidably support a U-shaped roof bolting drill mounting means 70 similar to the mounting means 30 described in the case of the first embodiment which similariy pivotably support the roof bolting drill 16 as described with reference to FIGS. 2 and 3. The U-shaped mounting means 70 has a front leg element 76 and a rear leg element 78 connected by a substantially flat bight portion 80. The leg elements 76 and 78 are provided with pairs of extended portions 74 having horizontal, axially aligned bores 72 (see FIG. 6) therein which slidably recive the rails 68 to support the roof bolting drill 16 in longitudinally slidable relationship with the crawler 12.

An elongated forwardly extending latch member 82 is pivotably mounted at the lower end of the rear leg 78 and extends forwardly and downwardly to abuttingly engage a cooperable latch element 84 rigidly mounted on the outer surface of at least one of the tread links 22 of the orbital tread means 14 so that motion of the mounting means 78 and the roof bolting drill 16 in relation to the crawler mechanism 12 may be controlled by the cooperation of the latch member 82 and the latch element 84 in a manner to be described. Pivoting motion of the latch member 82 about its attachment to the rearward leg 78 is controlled by a vertically disposed double acting fluid operated extensible cylinder 86 pivotably mounted

at its head end by a suitable bracket 88 forwardly extending from an upper portion of the forward leg 76 and connected at its rod end to the forward end of the latch member 82 so that admission of pressure fluid to the rod end of the cylinder 86 will cause the forward portion of the latch member 82 to be raised out of engagement with the latch element 84. Similarly the admission of pressure fluid to the head end of the cylinder 86 will cause the front portion of the latch member 82 to be lowered into a position suitable for engagement with the latch element 84 (see FIG. 7).

In FIG. 7 there is also shown a fluid actuated rotary driving means 90 provided with a suitable drive sprocket element 92 having teeth suitably engaged with a chain element 94 trained about a considerable portion of the periphery of the drive sprocket element 92 by the action of a pair of laterally spaced roller elements 96 located on either side of the sprocket element 92. The chain element 94 extends from the forward bracket member 64 to the rearward bracket member 66 being rigidly anchored in the bracket 66 and adjustably anchored to the bracket 64 by threaded members 98 and 100 so that suitable tension may be maintained in the chain element 94. The chain element 94 is located between and substantially equidistant from the rail members 68 and is parallel to the rail members 68 except for that portion of the chain which at any particular moment is passing over the sprocket elements 92. Activation of the rotary driving means 90 by the admission of pressure fluid thereto rotates the drive sprocket element 92 and causes the mounting means 70 and the roof bolting drill 16 to move longitudinally with respect to the crawler mechanism 12. It is to be noted that numbers starting at 12 and continuing up through 69 as applied in FIGS. 5, 6 and 7 identify parts which are the same as those described in reference to FIGS. 1, 2, 3 and 4 will not here be further described.

Operation of the second embodiment of this invention shown in FIGS. 5, 6 and 7 is very similar to that of the first embodiment with the following differences to be noted. Desired stationary positioning of the roof bolting drill 16 is accomplished as in the case of the first embodiment by connecting the mounting means 70 to a particular tread link 22 positioned on the supporting surface 21 thereby securing the roof bolting drill 16 in a stationary position with respect to the supporting surface 21 and the roof surface 60 while the miner 10 and the crawler mechanism 12 move forward at a constant rate. The connecting of the mounting means 70 with the tread links 22 is accomplished by action of the cylinder 86 in a manner hereinbefore described. Such latching will normally be accomplished when the link 22 upon which latch element 84 is secured, is very near the forward end of the crawler mechanism 12 having just been deposited on the ground by action of the forward sprocket 18. As the roof bolting activity progresses, the crawler mechanism 12 will be moving past the mounting means 70 until the drill 16 approaches the position with respect to the crawler mechanism 12 which is shown solid in FIG. 5. At this time, the roof bolting operating having been completed, the forward end of the latch member 82, lifted by the cylinder 86 in a manner hereinbefore described, will be raised out of engagement with the latch element 84. The sprocket element 92 activated by the driving means 90 and rotating in a counterclockwise direction as viewed in FIG. 7 will travel forwardly along the chain element 94 carrying the mounting means 70 and the drill 16 forward along the crawler mechanism 12 until the mounting means 70 reaches a position near the forward end of the crawler mechanism 12 such as that shown in dotted outline in FIG. 5. Upon reaching that position suitable activation of the cylinder 86 will renew the abutting engagement between the latch member 82 and the latch element 84 at which time the cycle of operation begins to repeat. It is to be noted that a plurality of the tread links 22 will be provided with latch elements 84. The number and spacing of the latch elements 84 will be determined in a particular instance by the desired spacing of the roof bolts to be installed by this device.

Having described a preferred embodiment of this invention in accordance with the Patent Statutes it is to be realized that modifications thereof may be made without departing from the broad spirit and scope of the invention. Accordingly it is respectfully requested that this invention be interpreted as broadly as possible and be limited only by the prior art.

What is claimed is:

1. A tool mounting for a mine roof drilling apparatus comprising, a crawler propelled support movable over a surface, means secured to said propelled support for slidably supporting and orbitally guiding endless flexible crawler treads for propelling said support, tool support means connected to said treads, drilling means secured to said tool support means wherein said tool support means positions said drilling means in constant engagement with said surface for forming holes in such mine roof, and means cooperable at least when one of the tread plates is surface engaged for maintaining said drilling means stationary when said propelled support is moving relative to such surface.

2. A mobile support movable in a passageway comprising, laterally spaced crawler treads secured to said support for moving said support in such passageway in response to the orbital movement of said crawler treads in a closed path, connecting means secured to a link of said crawler treads, a U-shaped cradle pivotally connected to said connecting means and having a portion thereof in constant engagement with the floor of such passageway as said treads are orbited in such path, and a drilling tool supported by said cradle and being positionable to form holes in the roof of such passageway when said link to which said connecting means is secured and engaged with the floor of such passageway.

3. In combination, crawler treads engageable with a surface, means for moving said crawler treads in a closed predetermined orbit, a tool support, means for cooperably connecting said tool support to said crawler treads so that said tool support is advanced along the line of movement of said crawler treads with such advance consisting of alternate periods of repose and movement, said means includes a link member secured to a tread of said crawlers with a portion of said link extending within such closed orbit and to which said tool support is pivotally connected, and said tool support being of a length to constantly engage said surface.

4. A mobile support movable in a passageway comprising, laterally spaced crawler treads secured to said support for moving said support in such passageway in response to the orbital movement of said crawler treads in a closed path, generally triangularly shaped, connecting means being secured to a link of said crawler treads and having a portion thereof extending interiorly of such path, a U-shaped cradle pivotally connected to said portion of said connecting means and having a portion thereof in constant engagement with the floor of such passageway as said treads are orbited in such path, and a drilling tool connected to said cradle and being positionable to form holes in the roof of such passageway when said link to which said connecting means is secured and engaged with the floor of such passageway.

5. A drilling apparatus bodily movable over a surface comprising, an elongated movable support having transversely spaced crawler tread frames secured thereto, said tread frames having a continuous orbit defining guide surface comprising coextensive rectilinear portions connected by arcuate portions, a plurality of pivotally connected tread means for forming an endless flexible crawler tread chain which is movably disposed on said tread

frames respectively, connecting means secured to one of said tread means and having a portion extending intermediate said rectilinear and said arcuate portions, a drilling apparatus pivotally connected to said portion of said connecting means with a portion thereof in constant engagement with the surface over which said tread means engages, means for circulating said crawler tread chains about their respective guide surfaces of said tread frames respectively for moving said support over a surface, whereby said drilling apparatus remains stationary when said one of said tread means is engaged with such surface.

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