May 27, 1958 A. L. BARRETT 2,836,408

ROTARY CUTTING, CORE BREAKING AND CONVEYING MEANS

Filed March 28, 1956

FIG. 1.

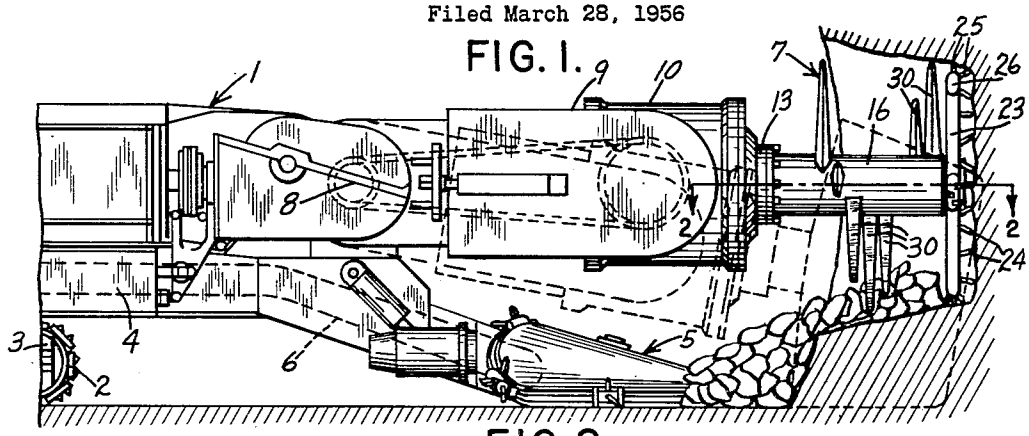


FIG. 2.

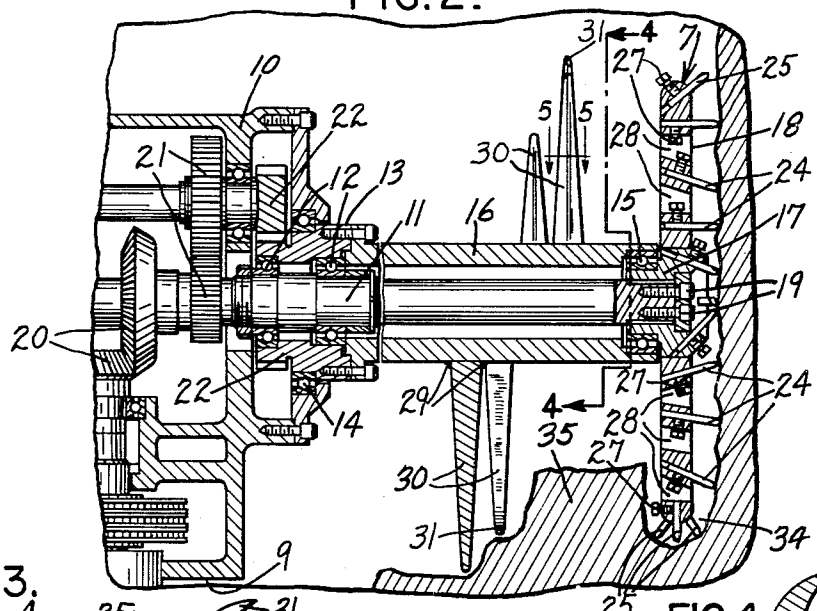


FIG. 3.

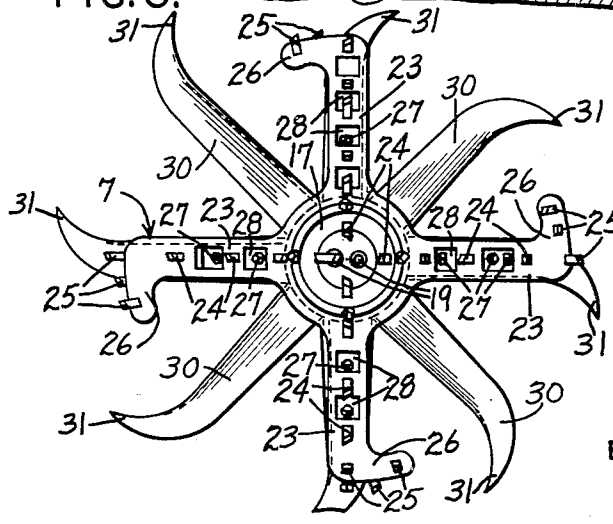


FIG. 4.

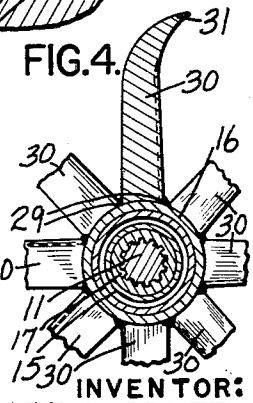
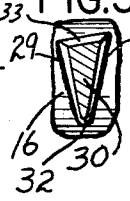


FIG. 5.



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ROTARY CUTTING, CORE BREAKING AND CONVEYING MEANS

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Application March 28, 1956, Serial No. 574,528

9 Claims. (Cl. 262—9)

This invention relates to mining machines and more particularly to a rotary cutting, core breaking and conveying device especially designed for use in a continuous mining machine for removing mineral such as coal from a solid mine vein.

This application is a continuation-in-part of my copending application Serial No. 430,175, filed May 17, 1954, owned by the same assignee as the present invention, now matured into Patent No. 2,776,823, dated January 8, 1957, and embodies an improved form of dislodging and disintegrating mechanism whereby the mineral of a solid mine vein is effectively dislodged and disintegrated. The present invention contemplates improvements over known earlier devices in that the mineral to be dislodged is not only effectively penetrated but also is dislodged and conveyed from the working face in a more efficient manner.

An object of the present invention is to provide an improved mining machine having improved means for dislodging the mineral from a solid mine vein. Another object is to provide an improved rotary disintegrator having improved means for dislodging the mineral from the solid and for conveying the dislodged mineral from the working face. Yet another object is to provide an improved rotary drilling head having improved dislodging means mounted to revolve about the axis of head rotation for dislodging mineral from the working face. A further object is to provide an improved dislodging means having a conveying function whereby the dislodged mineral is effectively moved rearwardly away from the rotary distintegrator and discharged outwardly from the working face. A still further object is to provide an improved rotary drilling head for forming a core of mineral and having improved means for breaking the core as cutting progresses and for moving the dislodged core fragments away from the working face. Yet another object is to provide an improved rotary drilling head for forming a core of mineral and having improved means for breaking the core as cutting progresses and for moving the dislodged core fragments away from the working face. Yet another object is to provide an improved rotary drilling head having improved core breaking and conveying means rotating about the axis of head rotation at a relatively slow speed. 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 is a side elevational view of the forward portion of a continuous mining machine in which a preferred illustrative form of the improved rotary cutting, core breaking and conveying device is embodied.

Fig. 2 is an enlarged horizontal sectional view taken on line 2—2 of Fig. 1, with the rotary cutting, core breaking and conveying device in operative relation to the mineral of a mine vein.

Fig. 3 is a front end view of the improved rotary cutting, core breaking and conveying device shown in Figs. 1 and 2.

Fig. 4 is a detail cross section taken on line 4—4 of Fig. 2, showing one of the breaking and conveying arms in section.

Fig. 5 is an enlarged detail section taken on line 5—5 of Fig. 2, showing one of the breaking and conveying arms in cross section.

The mining machine or so-called "continuous miner" in which the improved rotary cutting, core breaking and conveying device is embodied is generally designated 1 and herein may be generally similar in construction and in operation to that disclosed in my copending application Serial No. 355,975, filed May 19, 1953, likewise owned by the assignee of the present invention, and now matured into Patent No. 2,776,809, dated January 8, 1957. Evidently the improved rotary cutting, core breaking and conveying device may be embodied in mining machines of other types and constructions.

The continuous miner 1 shown herein generally comprises a mobile base 2 having a frame 3 on which is mounted a horizontal frame 4 swiveled to swing horizontally with respect to the base, as disclosed in the copending application above referred to. This swiveled frame carries a gathering or floor clean-up mechanism generally designated 5, an elevating and loading conveyor means shown in dotted lines at 6, and the rotary cutting, core breaking and conveying device generally designated 7. The gathering mechanism 5 and the rotary cutting, core breaking and conveying device 7 are swingable horizontally with the frame 4 relative to the base and the device 7 is pivotally mounted at 8 on the swiveled frame to swing in vertical planes relative to the swiveled frame and base.

As the rotary cutting, core breaking and conveying device effects removal of the mineral from the mine vein the gathering mechanism 5 receives the dislodged mineral and moves it onto the elevating and loading conveyor means 6 and the latter moves the disintegrated mineral rearwardly of the mining machine to a convenient point of delivery.

The vertically swingable dislodging and disintegrating mechanism comprises an elongated boom frame 9 mounted centrally of the swiveled frame 4 and extending forwardly above the gathering mechanism 5, and this boom frame has a transmission housing 10 in which a longitudinally extending transmission shaft 11 is journaled within bearings 12 supported within the transmission housing. The bearings 12 are supported within a revolving frame or annular housing 13 which is in turn journaled within a bearing 14 supported within the transmission housing and by a bearing 15 supported by a tubular forward portion 16 secured to the revolving frame 13. Journaled within the bearing 15 is a hub 17 of a rotary cutting and disintegrating head 18. The hub 17 of the rotary head 18 is secured as by screws 19 to the forward end of the drive shaft 11.

In this illustrative construction, the drive shaft 11 is driven at a relatively high speed through bevel gearing 20 while the revolving frame 13 is driven in the same direction at a relatively low speed through spur reduction gearings 21 and 22, all in the manner fully disclosed in the copending application Serial No. 355,975, above referred to. The rotary cutting or boring head 7 has a plurality, herein desirably four, radially extending arms 23 carrying cutters 24 along their front faces and peripheral cutters 25 at their outer end portions 26. These cutters may be in the form of mining machine cutter bits held in position by usual set screws 27 and the arms are recessed at 28 to provide for access to certain of the set screws. Suitably secured as by welding at 29 at

spaced points along the length of the tubular forward portion **16** of the revolving frame are radially located core breaker arms **30** having their outer tooth portions **31** lying in the surface of a cone coaxial with the rotary head with the cone surface diverging rearwardly and outwardly from the cutting head. The core breaker arms are spirally arranged on the tubular portion **16** to provide a spiral conveyor which serves to convey the dislodged and disintegrated mineral rearwardly away from the rotary head and for discharging the same outwardly from the working face. The breaker arms are wedge-shaped in cross section (Fig. 5) with the apex portion of each providing a trailing edge **32**, and these arms have forward faces **33** which are inclined inwardly and rearwardly so that the dislodged mineral is directed rearwardly, and the spiral arrangement of the arms together with the surfaces **33** tend to move the dislodged mineral outwardly away from the face. The rotary cutting head may be rotated at a relatively high speed through the driving connections above described and as the cutter head is rapidly rotated the rotary core breakers are concurrently rotated about the axis of head rotation in the same direction as the cutting head but at a relatively slow speed.

The rotary cutting or boring head may be moved in the direction of its axis toward the working face of the mine vein with a rotary boring action to penetrate the mineral and when the head is disposed as shown in Fig. 1 it may be swung edgewise either in vertical or horizontal planes, in the manner disclosed in the copending applications above referred to, with the swiveled frame **4** to form an arcuate slot or kerf **34** which lies inside of the face, as shown in Fig. 2. This slot or kerf forms a core or projection **35** of mineral and as the core breaker arms revolve at a relatively slow speed about the axis of head rotation they periodically engage and break away fragments of the core of mineral, and the spiral arrangement of the breaker arms causes the dislodged mineral to be moved rearwardly away from the rotary head and discharged outwardly from the working face in the manner shown in Fig. 1. By arranging the tooth portions of the core breaker arms in the surface of a cone with the sides of the cone diverging outwardly and rearwardly from the rotary head the boom frame **9** may be swung upwardly or downwardly to locate the rotary head either at the roof or floor levels with the cut conforming substantially with the contour of the roof and floor. Due to the relatively slow motion of the core breaker arms a slot or kerf of substantial depth may be cut in the mine vein prior to the core breaking action of the breaker arms on the core thereby to facilitate dislodging of the mineral from the solid.

As a result of this invention an improved mining machine is povided whereby the mineral of a solid mine vein may be effectively mined and loaded out. By the provision of the improved rotary cutting, core breaking and conveying device the mineral may be readily penetrated and dislodged from the solid vein in relatively large lumps with a minimum of actual cutting and tearing away of the mineral. The rotary drilling, core breaking and conveying head after it has drilled itself axially into the face may be moved edgewise along an arcuate path relative to the face to form a core of mineral which is periodically dislodged from the face and conveyed outwardly from the face. By the provision of the improved breaker arms the mineral is not only effectively dislodged but the dislodged mineral is also effectively conveyed away from the face. Other 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. In combination, a rotary boring head having face and peripheral cutters for penetrating and cutting a kerf in the mineral of a solid mine vein to form a core, and a core breaker mounted to revolve about the axis of head rotation rearwardly of said head for engaging and dislodging fragments of the core, said core breaker embodying means for conveying the dislodged core-fragments rearwardly away from said rotary head and for discharging the same outwardly from the face.

2. A combination as set forth in claim 1 wherein said breaker is in the form of a spiral conveyor and has spirally arranged breaker arms for conveying the core-fragments as aforesaid.

3. A combination as set forth in claim 1 wherein said core breaker has its outer portions lying in a surface of a cone coaxial with said head with the sides of the cone diverging outwardly and rearwardly from the head axis.

4. A combination as set forth in claim 1 wherein means is provided for rotating said core breaker and conveying means about the axis of head rotation at a speed substantially slower than the speed of rotation of said rotary head.

5. In combination, a rotary boring head having face and peripheral cutters and movable axially toward the face of a mine vein to penetrate the mineral with a boring action and movable edgewise from its penetrating position to cut a kerf in the mineral to form a core, and a rotary conveyor mounted to revolve about the axis of rotation of said head rearwardly of the latter for conveying disintegrated mineral rearwardly away from said rotary head and for discharging the same outwardly from the face, said conveyor having core breaker portions for engaging and disintegrating the core as cutting progresses.

6. In combination, a rotary boring head having face and peripheral cutters for penetrating and cutting a kerf in the mineral of a solid mine vein to form a core, and a core, breaker revolving about the axis of head rotation rearwardly of said head for engaging and dislodging fragments of the core, said core breaker embodying radially extending breaker arms spaced apart in staggered relation longitudinally and circumferentially about the head-axis, the radial dimension of said arms being at least substantially equal to the radial dimension of said head, said breaker arms being spirally arranged and cooperating to provide a spiral conveyor, said arms conveying the core fragments rearwardly away from said rotary head.

7. A core cutting and dislodging mechanism comprising a rotary drilling and cutting head having face and peripheral cutters, said head mounted for axial movement to form a circular bore in the mineral of a solid mine vein and for edgewise movement to cut a slot inside of the face of the vein to form a core of mineral, means for rotating said head, a revoluble core breaker, means for mounting said core breaker to revolve about the axis of head rotation relative to said head rearwardly of the latter, and means for causing said core breaker to revolve about said head-axis for intermittently applying dislodging blows to the core to dislodge the latter, said core breaker embodying conveyor portions for moving the dislodged core-fragments axially outwardly from said head and for discharging the core-fragments outwardly from the face.

8. A mechanism as set forth in claim 7 wherein said rotating means for said core breaker and conveyor provides for revolution of the latter about the axis of head-rotation at a speed substantially slower than the speed of rotation of said head.

9. In combination, a rotary drilling and core cutting head having face and peripheral cutters for cutting a slot inside the face of the mineral of a solid mine vein to

form a core, means for rotating said head, said head mounted for axial movement to effect boring of a hole in the mineral and for edgewise swinging movement to effect cutting of a slot inside of the face to form the core, core breaker and conveying means, means for mounting said core breaker and conveying means for rotation about the axis of rotation of said head and with said breaker and conveying means spaced rearwardly of said head, and means for rotating said breaker and conveying means with elements thereof moving in an orbit about the axis of head-rotation forwardly in the direction of lateral movement of said head to engage and dislodge the core, said conveying means moving the dislodged core fragments rearwardly away from said head and discharging the core fragments outwardly from the face.

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