July 10, 1956

B. F. TRACY

CUTTING AND DISLODGING HEAD FOR A CONTINUOUS MINING MACHINE

2,754,099

Filed April 27, 1955

2 Sheets-Sheet 1

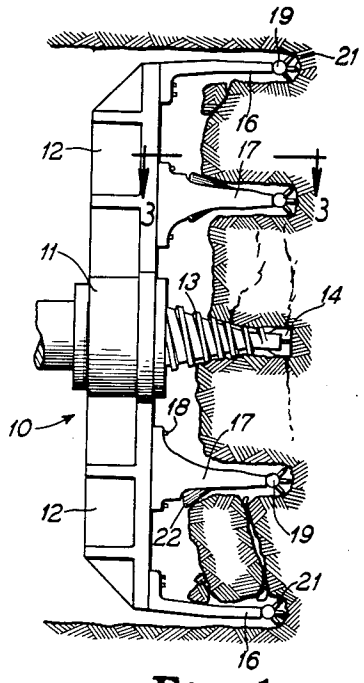


Fig. 1

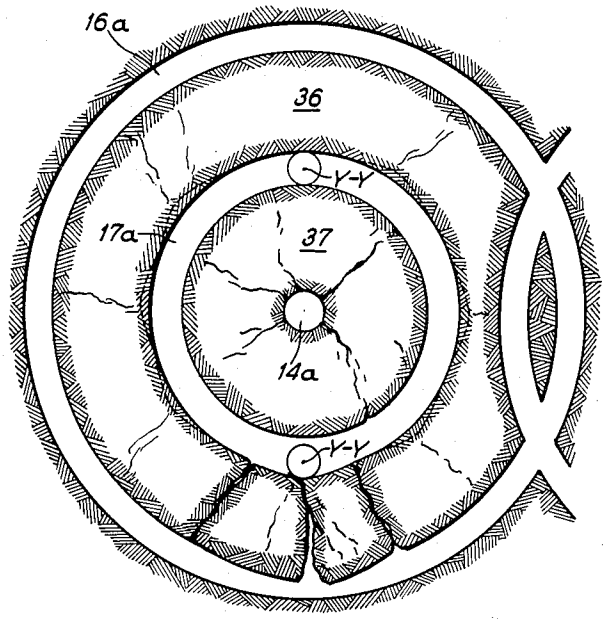


Fig. 2

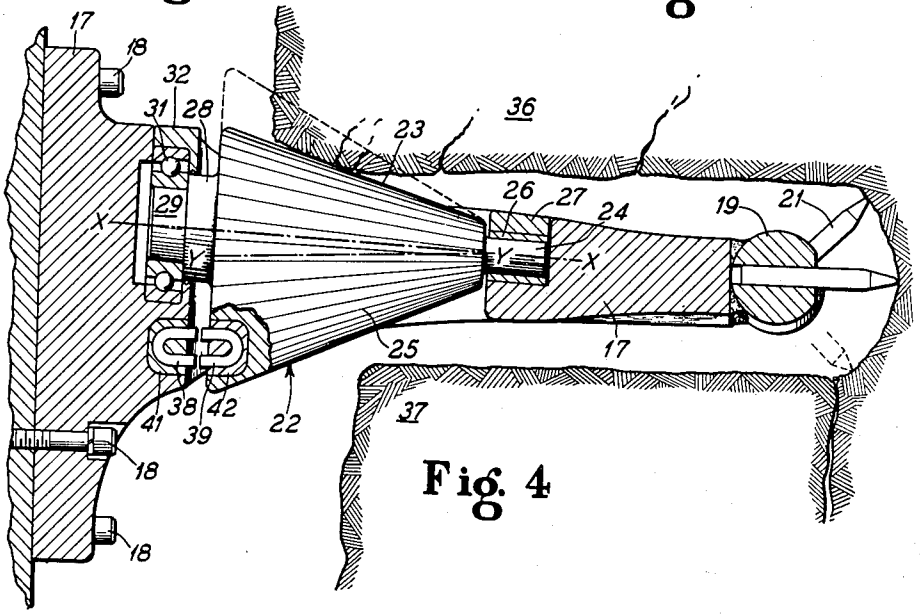


Fig. 4

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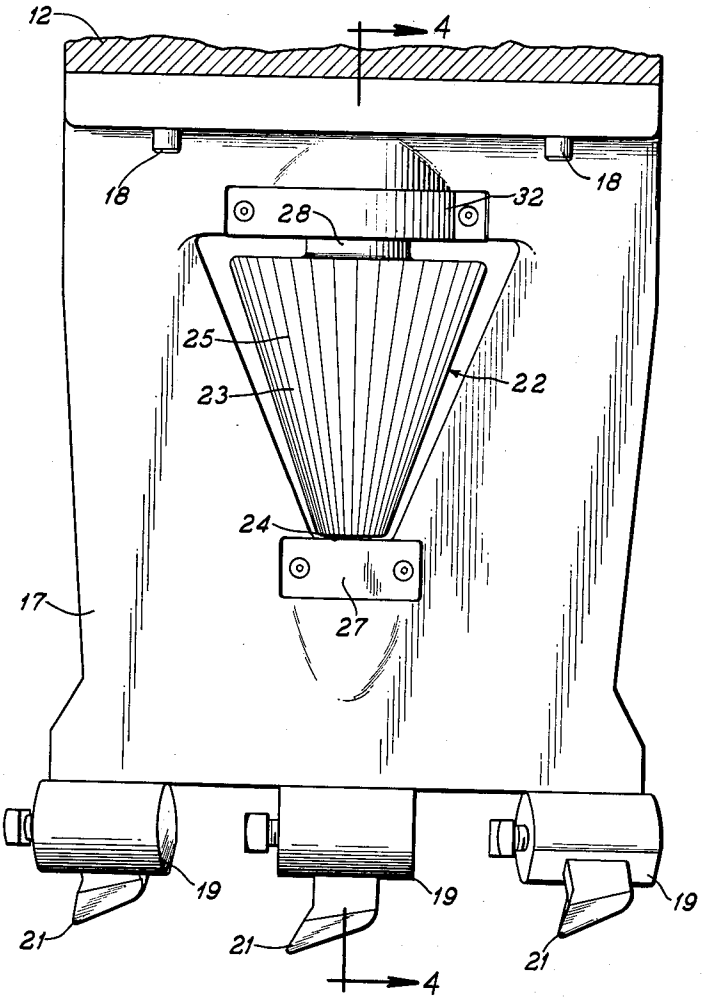


Fig. 3

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CUTTING AND DISLODGING HEAD FOR A CONTINUOUS MINING MACHINE

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9 Claims. (Cl. 262—7)

This invention relates to a core breaking device for use on the cutting head of a mining or tunneling machine particularly adapted for cutting and dislodging coal, rock, or other mineral from the solid working face of a mine or tunnel.

The invention is intended primarily for use on continuous mining machines and, by way of illustration, will be described specifically in connection with the mining of coal.

In the past, extensive use has been made of wedge-shaped core breakers such as the roller or cone type disclosed in my co-pending application Serial No. 391,789, filed November 13, 1953, on Cutting Head Construction for Mining Machines and in McKinley Patent 1,603,621. These breakers have heretofore been fixed to the cutting head in such manner that their rate of movement into a breaking position relative to a core was equal to and limited by the rate of penetration of the cutting head into the seam. As the progress of the cutting head into the seam is extremely slow even under the best of conditions, these core breakers sometimes do no more than merely wear away the edge of the core they are designed to break. Even the most advanced designs have proven to be very inefficient consuming large amounts of power, requiring high thrust forces and producing much dust by the wearing action above-mentioned.

It is the purpose of this invention, therefore, to obviate the many disadvantages which are inherent in core breakers heretofore used in machines of the described type. A primary object of this invention is the provision of a core breaking device which is intermittently operable and which, therefore, is more efficient in power consumption and in the production of lump with a minimum of fines.

Another object of this invention is to provide a core breaking device which will exert a suddenly applied force against the core rather than a gradually applied force, the effect of the sudden action being a large increase in efficiency of operation.

Another object is to provide a core breaking device which is operable only after a substantial size, outstanding core has been formed by the action of the cutter bits, thereby giving a maximum percentage of lump coal.

Still another object is to utilize the rotative movement of the cutter head for moving the core breaking elements into positions of frictional engagement with the cores to cause said cores to break into adjacent kerfs.

Other objects and important features of the invention will be apparent from a study of the following description taken together with the drawings which illustrate the preferred embodiments of the invention, and what is now considered to be the best mode of applying the principles thereof. The scope of the invention, however, is not intended to be limited by the embodiments shown, nor otherwise than by the scope and spirit of the appended claims.

In the drawings:

Figure 1 is a partial side view of a continuous mining machine, herein illustrated as a boring type miner, showing a preferred form of head incorporating the present invention in working position in a seam of mineral such as coal;

Figure 2 is a partial view of the face cut by a continuous mining machine having a pair of heads like that illustrated in Figure 1 arranged to cut contiguous overlapping bores;

Figure 3 is an enlarged view of one of the bit holders on the boring head shown in Figure 1, taken generally along the line 3—3, and showing a core breaker constructed in accordance with the present invention mounted within a recess or opening in the center of said holder; and

Figure 4 is a detailed sectional view taken along the line 4—4 of Figure 3 showing the core breaker in its inactive position, that is in its position of maximum spacing relative to the core.

Referring now to the drawings, Figure 1 shows a rotatable boring head **10** having a central hub portion **11** and a pair of diametrically opposed cutter arms or supports **12, 12** extending radially therefrom. Hub **11** also carries a forwardly projecting bursting screw **13** provided with a center bit **14** to bore an initial lead hole to be penetrated by said screw. Each support **12** carries a forwardly projecting outer cutter bit holder **16** and a forwardly projecting intermediate holder **17**, both of which are adjustably fastened to the support **12** by cap screws **18** so that their radial spacing may be changed to suit varied conditions of mining. Each of the bit holders **16** and **17** has welded to its forward extremity a plurality of bit blocks **19** in which are fitted cutter bits **21**. Referring now to Figure 2, it will be seen that the bits **21** on the outer holder **16** will, as the head **10** is rotated and advanced into the seam, cut a circular kerf **16***a* which defines the diameter of the bore cut by the rotating head. The center bit **14** bores a central lead hole **14***a* coaxial with the axis of rotation of the head, and the bits **21** on the intermediate holder **17** cut a kerf **17***a* intermediate the hole **14***a* and the outer kerf **16***a*. The bursting screw **13** is designed to enter the lead hole **14***a* as the head is advanced into the face, presenting a gradually increasing diameter to the hole, and resulting in a bursting of the doughnut-shaped core within the kerf **17***a*. It has been determined in actual operation of similar boring heads that a practical limit exists on the size of core which can be efficiently broken by such a central bursting screw and that this limit is usually somewhat less than the desired outer diameter of the bore, which in many cases ranges between five and seven feet. For this reason, the intermediate kerf **17***a* is cut in the face within the bursting range of the screw **13**, leaving a ring-shaped core between the outer kerf **16***a* and said intermediate kerf. By the present invention, this ring-shaped core is allowed to build up to a sizeable depth and is then broken off by an eccentrically mounted, substantially cone-shaped core breaker **22** which is shown in detail in Figures 3 and 4.

The core breaker **22** is comprised of a central body portion **23** shaped like a frustrum of a cone, the conical surface of which is roughened (in this case longitudinally grooved as at **25**) to increase the frictional engagement with the core for reasons soon to be made apparent. Extending from and formed integrally with the forward or apex end of the body portion **23** is a stub shaft **24** fitted with a bushing **26**, the lower half of which is designed to seat in a machined recess in the cutter holder **17**. A retaining cap **27** bolts over the top half of the bushing and locks the forward end of the core breaker securely to the cutter holder. Extending from the rear or base end of the body portion **23** is a second stub shaft **28** formed with a decreased diameter portion **29** at the extreme end thereof. A combined radial and thrust type roller bearing **31** is fitted to the smaller diameter **29** of the stub shaft

28. The lower half of bearing 31 fits within a machined recess in the holder 17, and a retaining cap 32 is bolted over the top half of the bearing, thereby securing the rear end of the core breaker to the holder 17.

The stub shafts 24 and 28 are formed coaxially with each other on an axis indicated as X—X, while the central body portion 23 is formed eccentrically thereof, on an axis indicated as Y—Y. As shown in Figure 4, this eccentricity may increase progressively from the front to the back portion of the body 23. The core breaker is designed to fit into the holder 17 with the axis Y—Y substantially coincident with the center of the kerf 17*a* and the axis X—X of the bearings displaced in a direction toward the core to be broken. This position is illustrated in Figure 4 and will henceforth be referred to as the inactive position or position of maximum spacing relative to the core.

In operation, the boring head is rotated and advanced into the working face, and the bits 21 on holder 17 cut the kerf 17*a* until the grooved surface of the core breaker body portion contacts the edge of the outstanding core 36 between kerfs 17*a* and 16*a* as indicated in Figure 4. The longitudinal grooves 25 on the central body portion 23 frictionally engage and bite into the coal, and, since the core breaker is being revolved in an orbital path with relative motion between itself and the stationary core, it will be caused to rotate about the axis X—X of the stub shafts 24 and 28. This rotation about the axis X—X causes the eccentric body portion 23 to be moved outwardly from the center of the kerf 17*a* and against the core with sufficient force to break off or cam said core from the face, into the clearance provided by kerf 16*a*. The maximum position of eccentricity of the core breaker body, indicating maximum penetration into the core 35, is indicated by a broken line in Figure 4. This position will henceforth be referred to as the active position.

In Figure 2 both the active and the inactive positions of the core breaker are diagrammatically illustrated. At the top of the kerf 17*a* a core breaker is shown in the inactive position with the axis Y—Y of the body portion 23 coincident with the center of the kerf 17*a*. At the bottom of the same kerf another core breaker is shown in the active position with the axis Y—Y of the body portion 23 offset from the center of the kerf.

Over the normal range of bit speeds used in present day continuous miners, the time required for one of my core breakers to be rotated from its inactive position into its active position will vary from about 0.005 to 0.001 minute. An ordinary wedge fixed to the arm 17 would move into the kerf only as fast as the kerf could be advanced, or about 6 inches per minute under average conditions. Thus, with a wedge 6 inches long it would take one minute to move the wedge from its initial inactive position into its full active position. Such slow action permits the wedge to wear off the edge of the core, creating dust and friction and wasting power. The rapid action of my eccentric core breaker eliminates these disadvantages. Furthermore, the rapid action creates conditions of impact loading on the core, causing it to break more readily with less power consumption.

In order to allow the core to build up to a maximum depth so that it will be easier to break and so that larger lumps of coal will be obtained, it is desirable to bias the core breaker in the inactive position while the forward end of the body portion 23 enters the kerf. To this end, and for illustrative purposes only, I have shown a pair of permanent magnets 38 and 39 (Figure 4) embedded in non-permeable holders 41 and 42, respectively. The magnet 38 and its holder 41 are secured within a recess in the bit holder 17 and the magnet 39 and its holder 42 are secured within a recess in the base of the central body portion 23 of the core breaker. The magnets are so placed that they will attract each other and hold the body portion 23 properly located with respect to the kerf 17*a*, in maximum spacing relative to the core 36, until the core is contacted by the grooved surface 25 of the body

portion with enough pressure to cause rotation of the core breaker about the axis X—X. It is not necessary to the successful operation of my core breaker that a positive means to restrain rotation be employed, as good results may be obtained by statically balancing the core breaker 22 about the axis X—X. Nor, as will be apparent to one skilled in the art, is it necessary that any specific contour or configuration be attributed to the body portion 23 of my core breaker as long as the core-engaging surface 25 is eccentric to the axis of rotation X—X.

Therefore, I do not intend that my invention be limited by the precise embodiments shown nor otherwise than by the terms of the appended claims.

I claim:

1. In a cutting and dislodging head for a continuous mining machine having a movable support; kerf-cutting means on said support for cutting at least a pair of kerfs defining an outstanding core therebetween; the improvement comprising: a core breaking member carried by said support in alignment with one of said kerf cutting means to enter one of said kerfs and engage said core when the head is fed into the face; said core breaking member comprising a body which is eccentrically rotatably mounted on said support and having a cam surface which is frictionally engageable with said core to break the latter into the clearance provided by the other kerf.

2. In a cutting and dislodging head for a continuous mining machine having a rotatable support; kerf-cutting means on said support for cutting at least a pair of kerfs defining an outstanding core therebetween; the improvement comprising: a core breaking member carried by said support in alignment with one of said kerf cutting means to enter one of said kerfs and engage said core when the head is fed into the face; said core breaking member being rotatably mounted on said support and having a core engaging surface which is eccentric with respect to the rotational axis of said core breaking member and effective to break said core by cam-like action into the clearance provided by the other kerf.

3. In a cutting and dislodging head for a continuous mining machine having a rotatable support; kerf-cutting means on said support for cutting at least a pair of kerfs defining an outstanding core therebetween; the improvement comprising: a core breaking member carried by said support in alignment with one of said kerf-cutting means to enter one of said kerfs and engage said core when the head is fed into the face; said core breaking member being rotatably mounted on said support and having a core engaging surface which is eccentric with respect to the rotational axis of said core breaking member; and biasing means acting between said core-breaking member and said support effective to restrain rotation of said core breaking member from a position of maximum spacing relative to said core except when frictionally engaged with the core at which time the latter will be broken into the clearance provided by the other of said pair of kerfs by eccentric rolling engagement of the core breaking member.

4. In a cutting and dislodging head for a continuous mining machine; a rotatable hub; cutter support means carried by said hub; cutter bearing holders projecting forwardly from said support means and having kerf cutter means at the forward ends thereof effective to cut at least two kerfs defining an outstanding core therebetween; the improvement comprising: a core breaking member comprising a body which is eccentrically and rotatably mounted on one of said holders, aligned with one of said kerf cutter means to enter the kerf cut thereby, and having a cam surface which is frictionally engageable with said core to break and dislodge the latter responsive to cam action of the core breaking member against the core.

5. In a cutting and dislodging head for a continuous mining machine; a rotatable hub; cutter support means carried by said hub; cutter bearing holders projecting forwardly from said support means and having kerf cutter

means at the forward ends thereof effective to cut at least two kerfs defining an outstanding core therebetween; the improvement comprising: a core breaking member rotatably mounted on one of said holders, aligned with one of said kerf cutter means to enter the kerf cut thereby, and having a cam surface which is frictionally engageable with the core and which is eccentric with respect to the rotational axis of the member to break and dislodge the core responsive to cam action of the core breaking member against the core.

6. In a cutting and dislodging head for a continuous mining machine; a rotatable hub; cutter support means carried by said hub; cutter bearing holders projecting forwardly from said support means and having kerf cutter means at the forward ends thereof effective to cut at least two kerfs defining an outstanding core therebetween; the improvement comprising: a core breaking member rotatably mounted on one of said holders, aligned with one of said kerf cutter means to enter the kerf cut thereby, and having a core engaging surface which is eccentric with respect to the rotational axis of the member; and biasing means acting between said core-breaking member and said support means effective to restrain rotation of said core breaking member from a position of maximum spacing relative to said core except when frictionally engaged with said core.

7. In a cutting and dislodging head for a continuous mining machine; a rotatable hub; cutter support means carried by said hub; cutter bearing holders projecting forwardly from said support means effective to cut at least two kerfs defining an outstanding core therebetween; the improvement comprising: at least one of said holders having a recess therein; a core breaking roller positioned in said recess being frictionally engageable with an edge of said core and being eccentrically rotatably journaled

on said holder on opposite sides of said recess to break and dislodge the core responsive to rolling cam-like action of the core-breaking roller against the core.

8. In a cutting and dislodging head for a continuous mining machine; a rotatable hub; cutter support means carried by said hub; cutter bearing holders projecting forwardly from said support means effective to cut at least two kerfs defining an outstanding core therebetween; the improvement comprising: at least one of said holders having a recess therein; a core breaking roller positioned in said recess, rotatably journaled in said holder, and having a surface which is frictionally engageable with an edge of the core and which is eccentric with respect to the rotational axis of the roller being effective to break and dislodge the core responsive to eccentric rolling action of the core breaking roller against the core.

9. In a cutting and dislodging head for a continuous mining machine; a rotatable hub; cutter support means carried by said hub; cutter bearing holders projecting forwardly from said support means effective to cut at least two kerfs defining an outstanding core therebetween; the improvement comprising: at least one of said holders having a recess therein; a core breaking roller positioned in said recess, rotatably journaled in said holder, and having a core engaging surface which is eccentric with respect to the rotational axis of the roller; and biasing means acting between said core breaking roller and the recessed holder effective to restrain rotation of said roller from a position of maximum spacing relative to the core except when frictionally engaged with the core, whereby the core is broken up in relatively large pieces, intermittently, whenever the kerfs are cut sufficiently deeply to cause said core to be engaged by the roller.

No references cited.