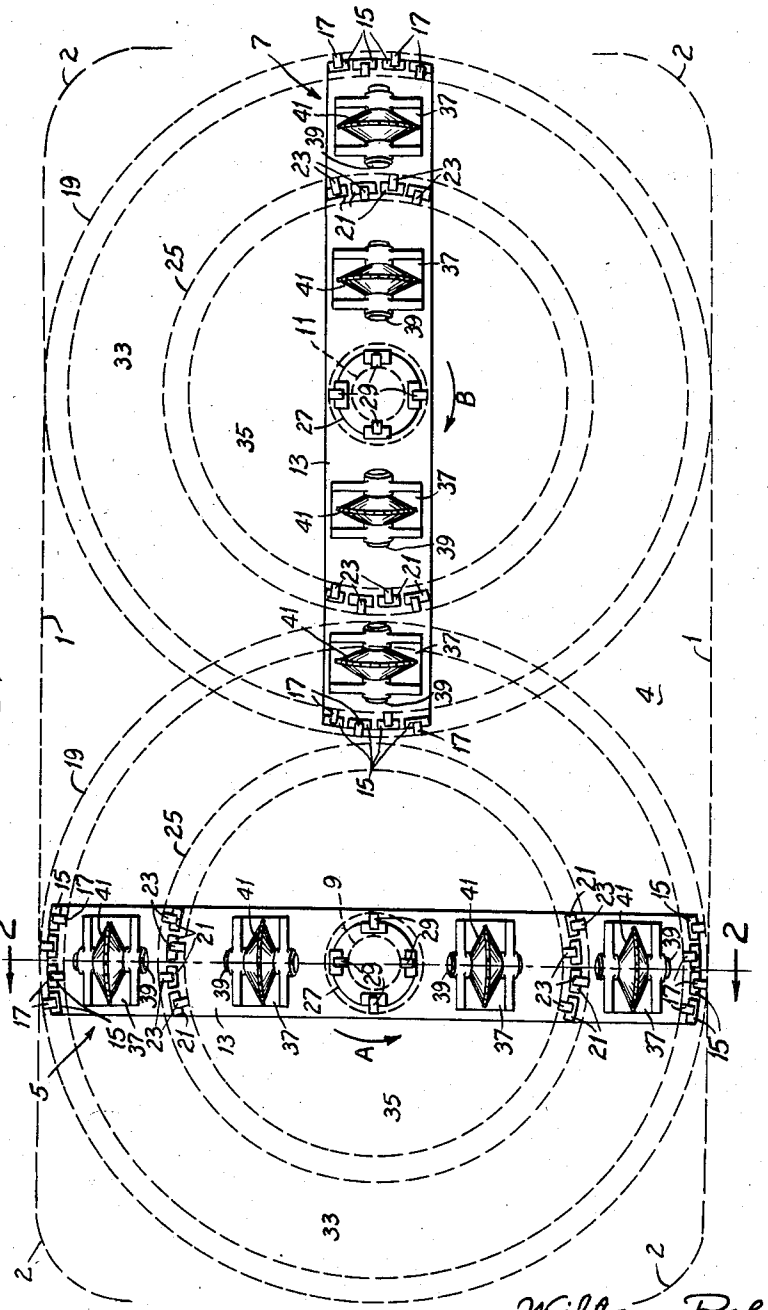
Feb. 3, 1959 W. ROBBINS ET AL 2,872,169

CONTINUOUS MINING BY CUTTING AND CRUSHING

Filed Nov. 1, 1957 2 Sheets-Sheet 1

FIG. 1.



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FIG. 2.

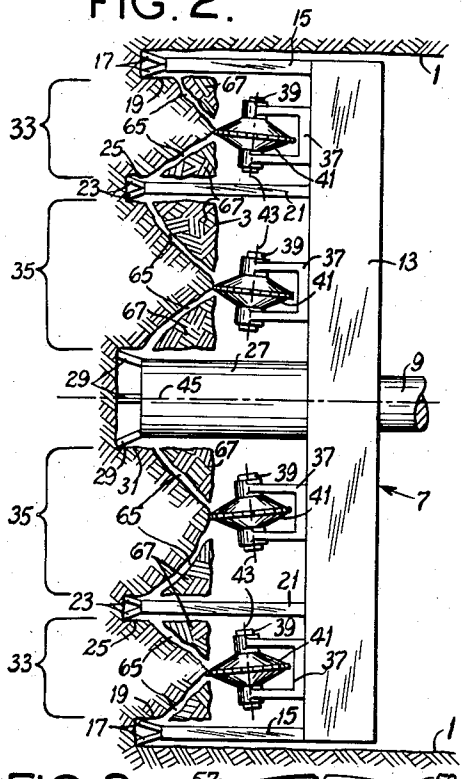


FIG. 5.

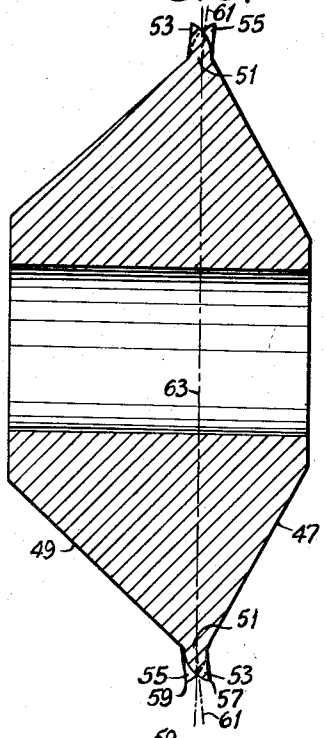


FIG. 3.

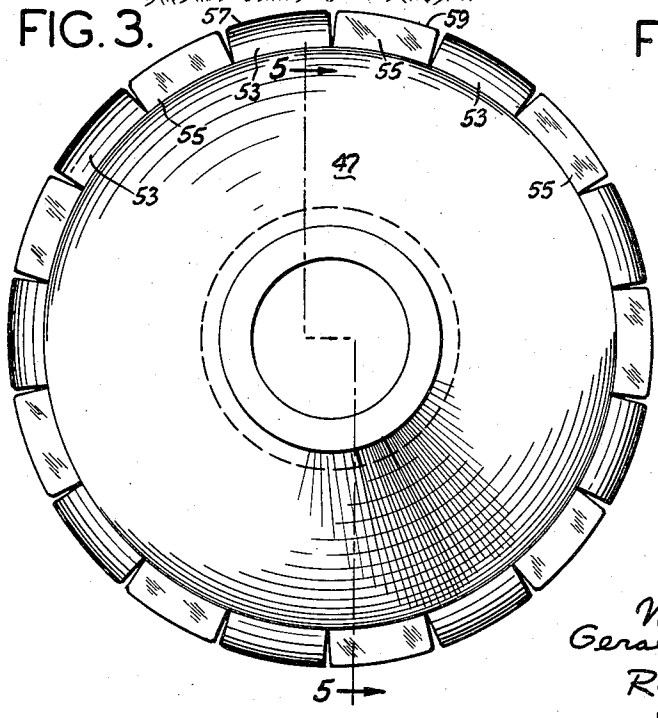
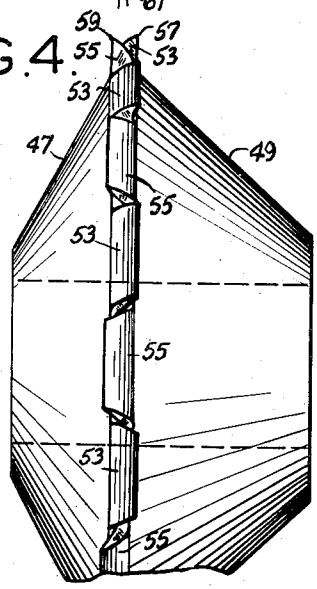


FIG. 4.



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CONTINUOUS MINING BY CUTTING AND CRUSHING

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Application November 1, 1957, Serial No. 693,880

5 Claims. (Cl. 262—7)

This invention relates to continuous mining by cutting and crushing, and with regard to certain more specific features, to improved cutting heads for continuous mining machines of the rotary boring type.

Among the several objects of the invention may be noted the provision of a cutting head for use on rotor shafts on boring type mining machines which will make such machines especially effective, among other things, in the mining of hard strata such as coal containing impurities and also in the mining of rock, hard shale and the like; the provision of a cutting head for use on such machines which is adapted, in addition to the usual cutting action, to exert an improved impact crushing action minimizing abrasive action upon the material being mined; the provision of a cutting and crushing head of the class described which results in an increase in the size of lumps of material produced and reduces the amount of undesirable small fines and dust; and the provision of apparatus of the class described adapted to reduce the amount of power consumed in crushing the mined material. Other objects and features will be in part apparent and in part pointed out hereinafter.

The invention accordingly comprises the elements and combinations of elements, features of construction, and arrangements of parts which will be exemplified in the structures hereinafter described, and the scope of which will be indicated in the following claims.

In the accompanying drawings, in which one of various possible embodiments of the invention is illustrated,

Fig. 1 is a front elevation showing the application of two cutting and crushing heads made according to the invention as applied to a double-boring type of continuous mining machine;

Fig. 2 is an ideal longitudinal section through a mine shaft at a cutting face, illustrating the operation of the left-hand cutting and crushing head shown in Fig. 1, being viewed on line 2—2 of said figure but showing in side elevation the head and the parts mounted thereon;

Fig. 3 is an end view of one of the crushing rollers illustrated in Figs. 1 and 2;

Fig. 4 is a right-side elevation of Fig. 3; and,

Fig. 5 is a cross section taken on line 5—5 of Fig. 3.

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

Referring now more particularly to Figs. 1 and 2, there is shown at numeral 1 a mine passage being formed by a cutting action into its face, ideally shown at 3. This cutting action in the example shown is being performed by two oppositely rotating cutting heads shown in general at numerals 5 and 7. The heads 5 and 7 are attached to the parallel cutter shafts 9 and 11, respectively, of any conventional or other suitable double-boring type of mining machine (not shown). As is known, such machines are usually mounted upon endless-track carriages including suitable rotary power drive means for rotating the shafts 9 and 11 in opposite directions. This

is illustrated by the darts A and B in Fig. 1. Such machines also usually include behind the heads 5 and 7 automatic take-off conveyor means for scooping up and transporting away from the face 3 the broken-down material. They also have the usual chain cutters which trim the top, bottom and corners of passage 1, indicated at numerals 1 and 2 in Fig. 1. The conveyor scoops up material from behind the central region 4 (Fig. 1).

Usually heads such as 5 and 7 are substantially identically constructed, which is also true of the cutting heads shown herein. Description of one will therefore suffice for description of the other. Thus each head 5 and 7 is constituted by a cutter bar 13 respectively attached to one of the drive shafts 9 or 11. At the outer ends of the bar 13 are located outer cutter supports 15, carrying bits 17 adapted to cut outer circular kerfs 19. In Fig. 1 the kerfs 19 are shown by dotted circles.

At a suitable distance inward from supports 15 there are also provided cutter supports 21. At the outer ends of these are located cutter bits 23 adapted to cut inner circular kerfs 25. The latter also are shown by dotted circles in Fig. 1.

At numeral 27 is shown a centrally located pilot member carrying pilot center bits 29, which remove material centrally as shown, to form a pocket 31. Thus as the machine advances, there are left in the face 3 rings 33 and 35 of material which must be broken away.

There are shown at numeral 37 brackets which are fastened to each cutter bar. Each member of the outer pair of brackets is located outward between cutter supports 15 and 21, and each member of the inner pair is located inward between a cutter support 21 and the central member 27. These brackets 37 carry fixed roll-supporting pins 39. Upon the pins 39 are mounted freely rotatable crusher rollers 41, details of which are shown in Figs. 3–5. The axes 43 of pins 39 are somewhat angled (approximately 5° or so) with respect to a plane normal to the axis of rotation 45 of the respective cutter bar 13. Each roller is, for example, unsymmetrically double-coned, as shown at 47, 49, the marginal section at 51 where the bases of the cones meet being provided with a ring of hardened teeth 53 and 55 which are shaped with oppositely directed staggered edges 57 and 59, respectively. A median line 61 between the teeth 53 and 55 is located at a small angle of approximately 5° with respect to a radial plane 63. This causes the median line 61 of the teeth to stand approximately normal to the face 3 when the teeth make contact therewith.

The mounting of the rollers 41 on the pins 39 is such that the edges 57, 59 of the teeth 53 and 55 bear alternately on the face 3 as the cutters 19, 23 and 29 advance to form the kerfs 19, 21 and the central pocket 31. The arrangement is such that the marginal bearing of each roller is at or near a mid region of the upstanding ring of material on which it bears between the cut recesses. That is to say, the outer rollers 41 bear on a mid portion of the upstanding ring of material 33 between the circular kerfs 19 and 25, and the inner rollers 41 bear on a mid portion of the upstanding ring of material 35 between the kerf 25 and the recess 31. By mid portion is meant that each roller bears at a substantial distance from a bit-cut kerf or recess.

In view of the above, it will be seen that the serrated edges on the rollers 41 apply staggered points of pressure by impact as the rollers are driven into the mine face. These points of impact alternate slightly along the general trajectory in an amount equal to the offsetting of the serrated edges and thus produce a radially changing impact and improved crushing action, without any substantial wedging and abrasive action as heretofore occurred in the case of rollers operative in the kerfs. The improved arrangement results in somewhat cone-

shaped fracture lines illustrated ideally at **65**, and in larger lumps illustrated ideally at **67**. More fractures such as shown at **65** continue to be formed as action continues. It is to be understood that while the practical operation is not ideal, since the cutting face **3** is not exactly as flat as illustrated, nevertheless the ideal is approached in practical operation of the invention. That is to say that, the rollers effect continuous crushing by fracture-producing impacts between cuts in the face. In this manner the number of smaller pieces, fines and dust is minimized, or conversely, a larger proportion of larger lumps is obtained.

As the machine advances and the circular kerfs **19**, **23** and recess **31** are cut, the angular rings of material are broken down and fall. In view of the opposite rotations of the bars **13**, the relatively large-lumped broken-down material is swept toward the center region indicated at C in Fig. 1, at which point it is readily picked up at the throat of the conveyor forming part of the machine. The material is then carried to the rear for transportation away from the machine in mine cars.

In some seams of coal or other material it also is possible to omit the intermediate bits **23** and their supports **21** and to employ a single set of crusher rollers such as **41** bearing upon the face **3** approximately midway between the outer kerf **19** and the central pilot cut **31**. Whether or not one or two kerfs are employed depends upon the properties of the material to be mined, and the cutting radii of an outer kerf such as **19** and the inner bore **31**.

While the two features of the invention constituted by the improved crusher rollers and the reduced number of kerfs operate in conjunction to produce the results stated, it will also be observed that each functions of itself to produce a substantial part of such results. Thus the new crusher roller arrangements at more or less midpoints between kerfs are useful in and of themselves on a cutter head having any number of bit-cut recesses or kerfs.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

We claim:

1. A cutting head for a boring type mining machine comprising rotatable means, at least one pair of outer and inner cutter supports thereon, cutter bits on said supports adapted to cut radially spaced circular recesses upon rotation of said means and leaving a projecting ring of material therebetween, and at least one crusher roller mounted for rotation and in a location in which it

contacts said ring of material and rolls thereon at substantial distances from any of said recesses as the machine advances said bits to produce said recesses, said roller having a shape forming a margin composed of tooth-forming projections having noncoplanar end portions for staggered impact with the material being crushed.

2. A cutting head according to claim 1, wherein the axis of said roller is located at a small angle on the order of 5° with respect to a plane normal to the axis of rotation of the rotatable means.

3. A cutter head according to claim 2, wherein median lines defining the extended directions of said staggered tooth-forming projections are located at a small angle on the order of 5° with respect to a radial plane normal to the axis of rotation of the crusher roller adapted to cause the staggered teeth to engage said surface substantially perpendicularly.

4. A cutting head for a boring type mining machine comprising a rotatable means, a central pilot cutter bit thereon for cutting a central pocket, an outer cutter bit support thereon for cutting an outer kerf and a single intermediate cutter bit thereon for cutting a single kerf intermediate the outer kerf and said central pocket, and crusher rollers mounted at locations relative to said bar such that said rollers contact material being cut at substantial distances from said pocket and said kerfs, said crusher rollers having double cone shapes providing margins including tooth-forming projections having noncoplanar end portions adapted to contact the material being crushed.

5. A cutting head for a rotary power shaft of a boring type mining machine comprising a rotatable means having radially extending arms, supports for cutter bits near the ends of said arms adapted to produce an outer circular kerf in material being bored, a central pilot bit support adapted to produce a central pocket in said material, cutter bit supports mounted relatively to the pilot bit support and the outer cutter bit supports to produce an intermediate circular kerf in said material, rollers supported for movements in paths between said outer and intermediate cutter bit supports, additional rollers supported for movements in paths between said intermediate cutter bit supports and said pilot bit support, said rollers having girthwise sets of teeth adapted for rolling impact contact with said material at substantial distances from said kerfs and said pocket, alternate teeth on each roller being staggered to produce staggered points of impact on said material.

References Cited in the file of this patent

UNITED STATES PATENTS

2,754,099	Tracy	July 10, 1956
2,766,977	Robbins	Oct. 16, 1956
2,823,025	Biedess	Feb. 11, 1958