June 7, 1955 F. CARTLIDGE 2,710,179

ROTARY DISC CUTTER HEADS WITH CORE BREAKING DEVICES FOR CONTINUOUS MINERS

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Fig. 1

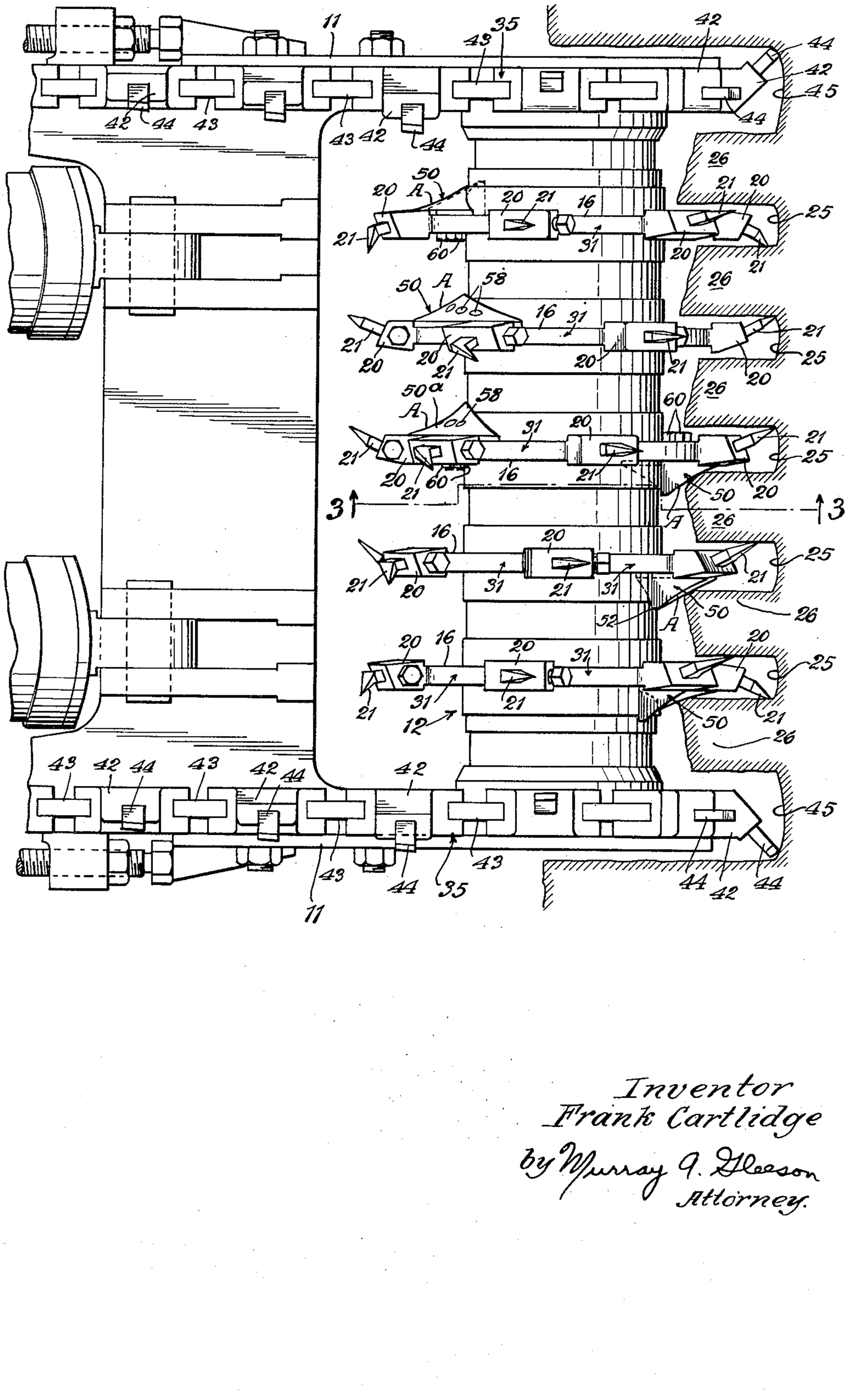

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Fig. 2

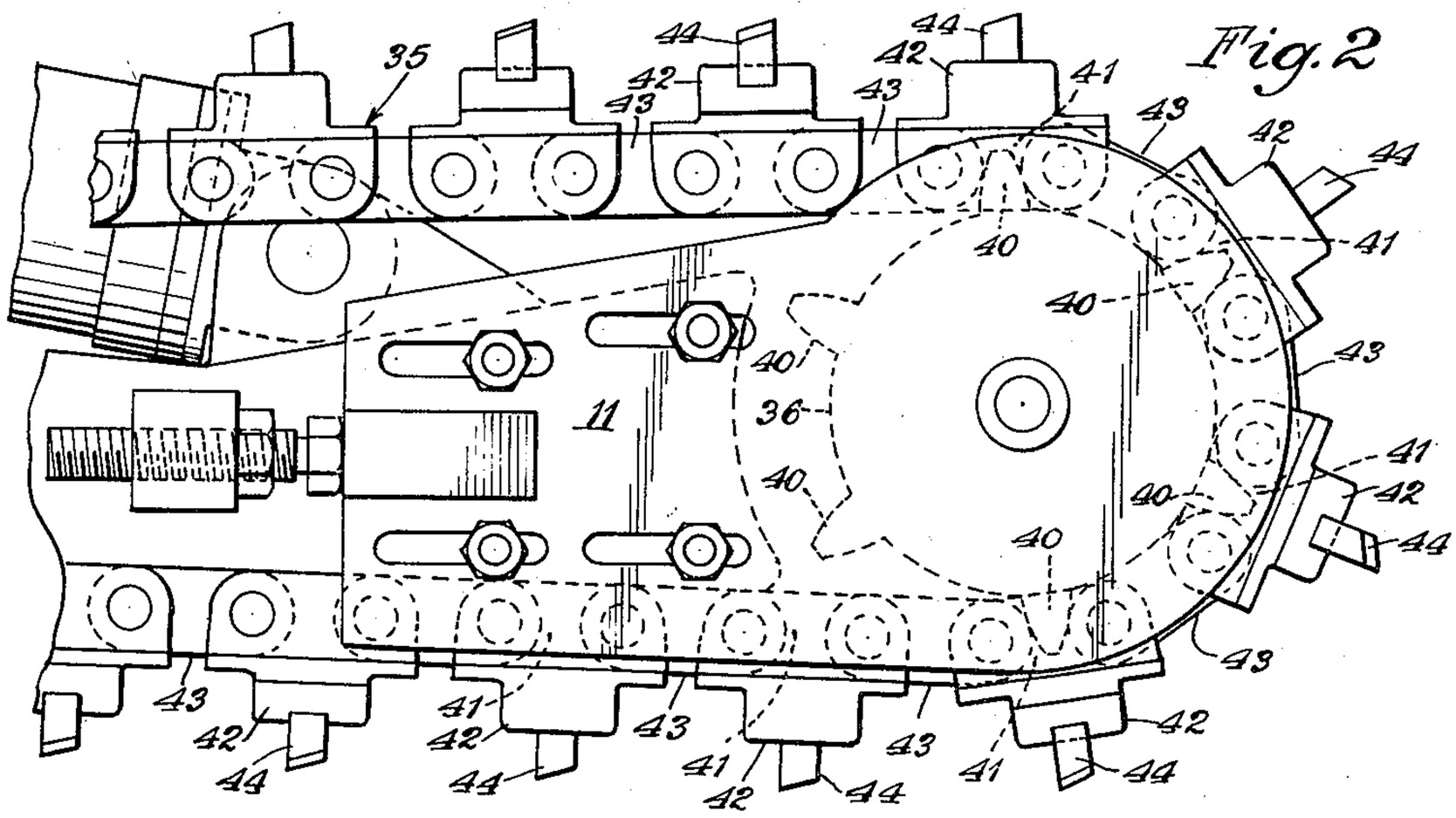

Fig. 3

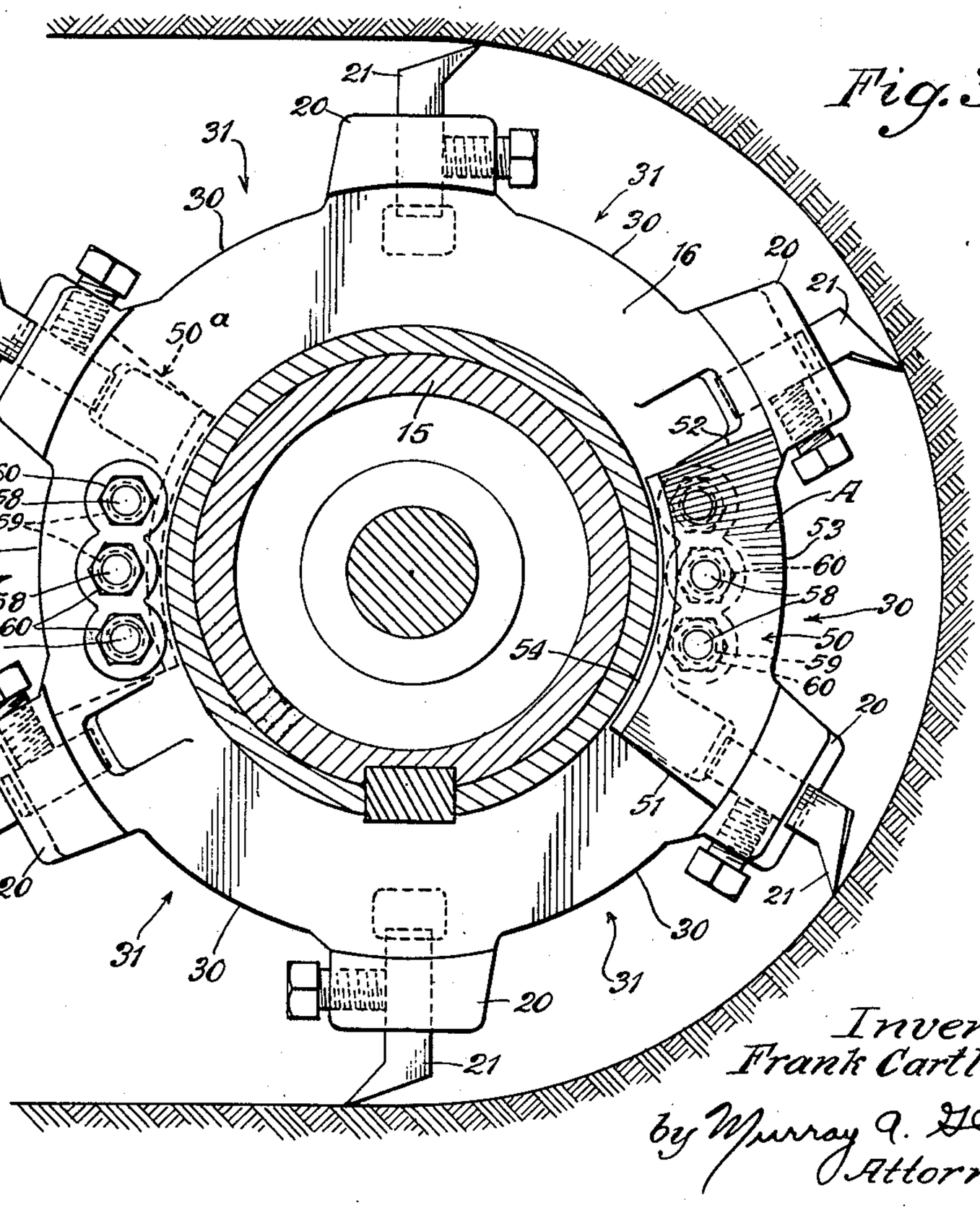

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Fig. 4

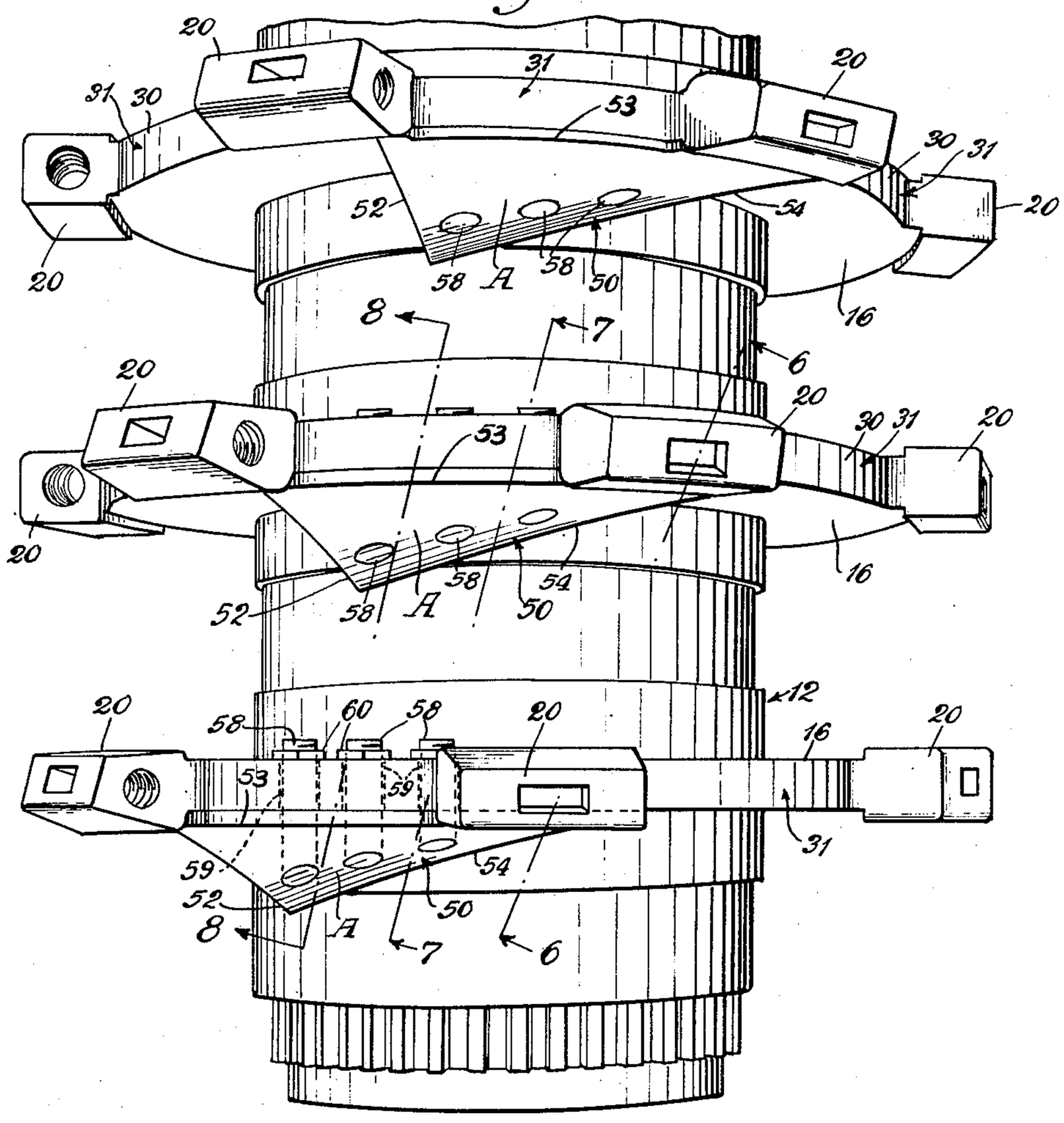

Fig. 5

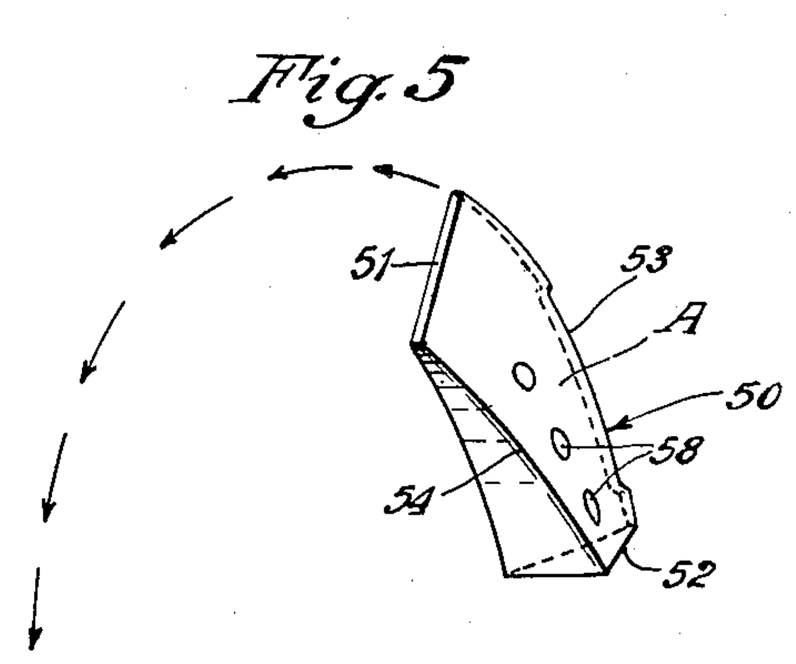

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Fig. 6

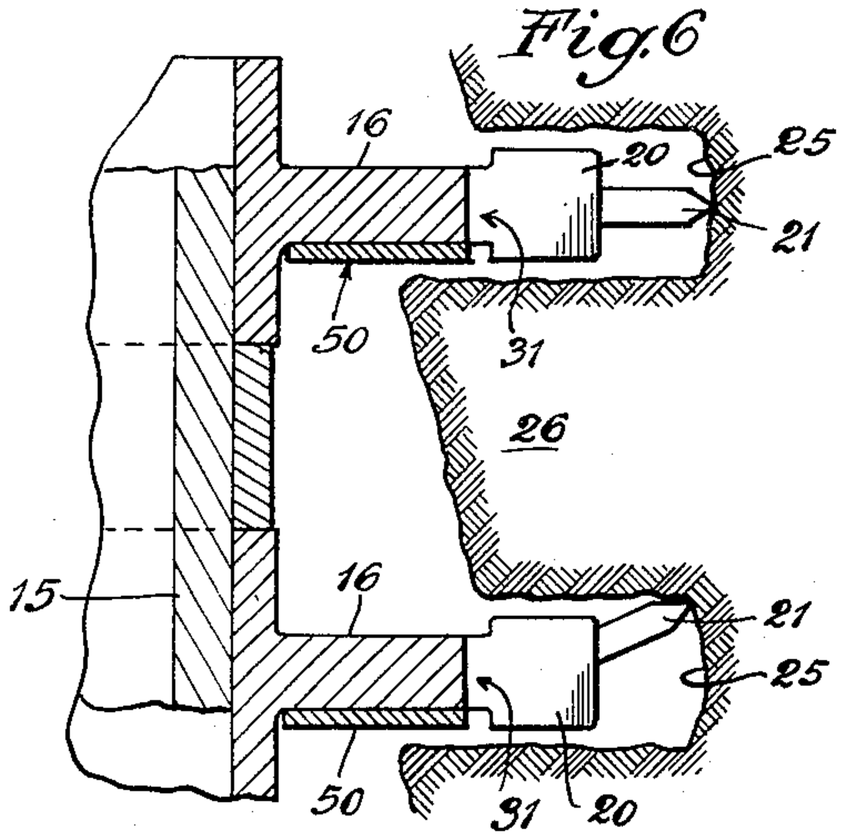


Fig. 7

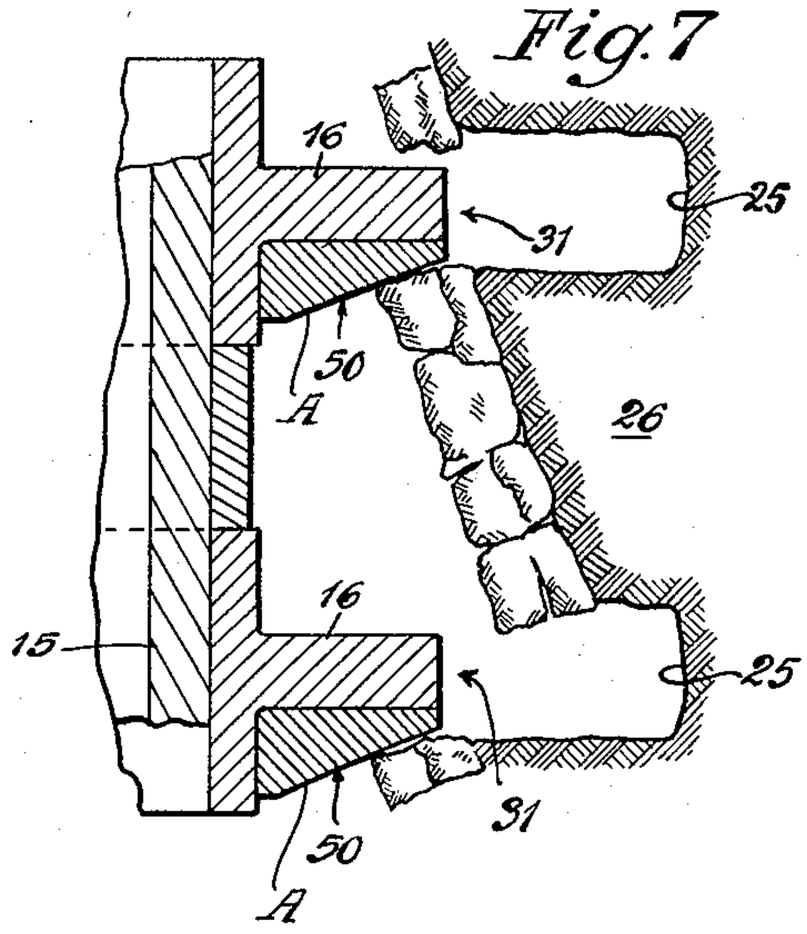


Fig. 8

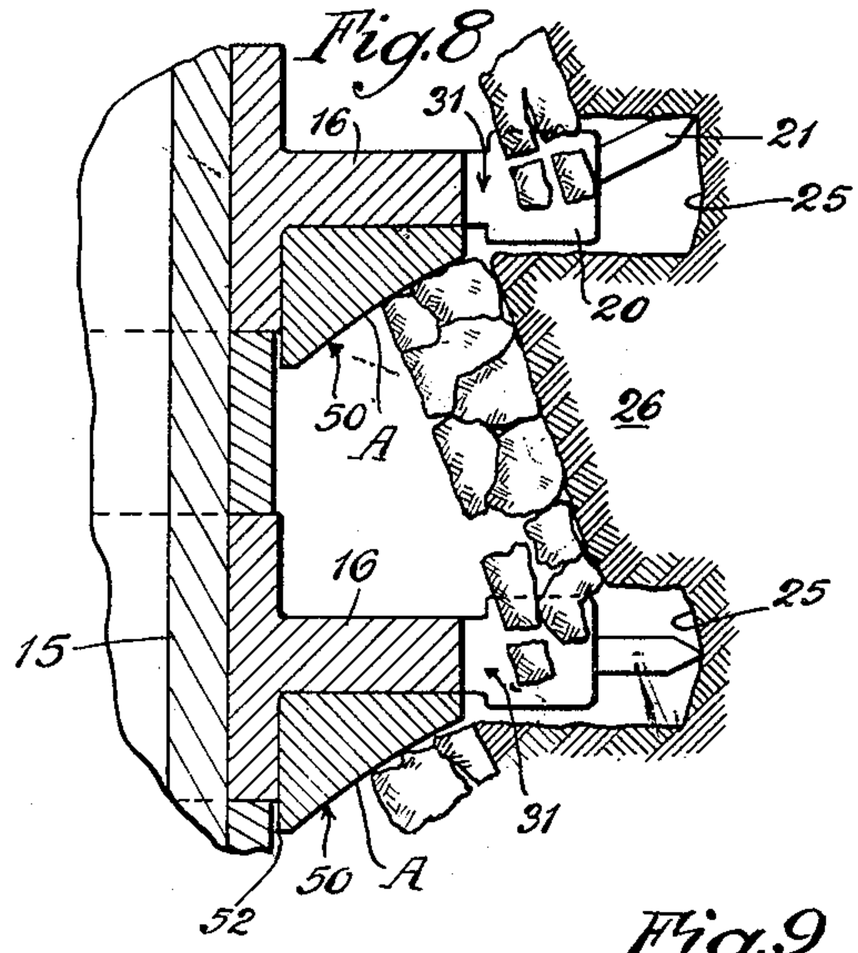
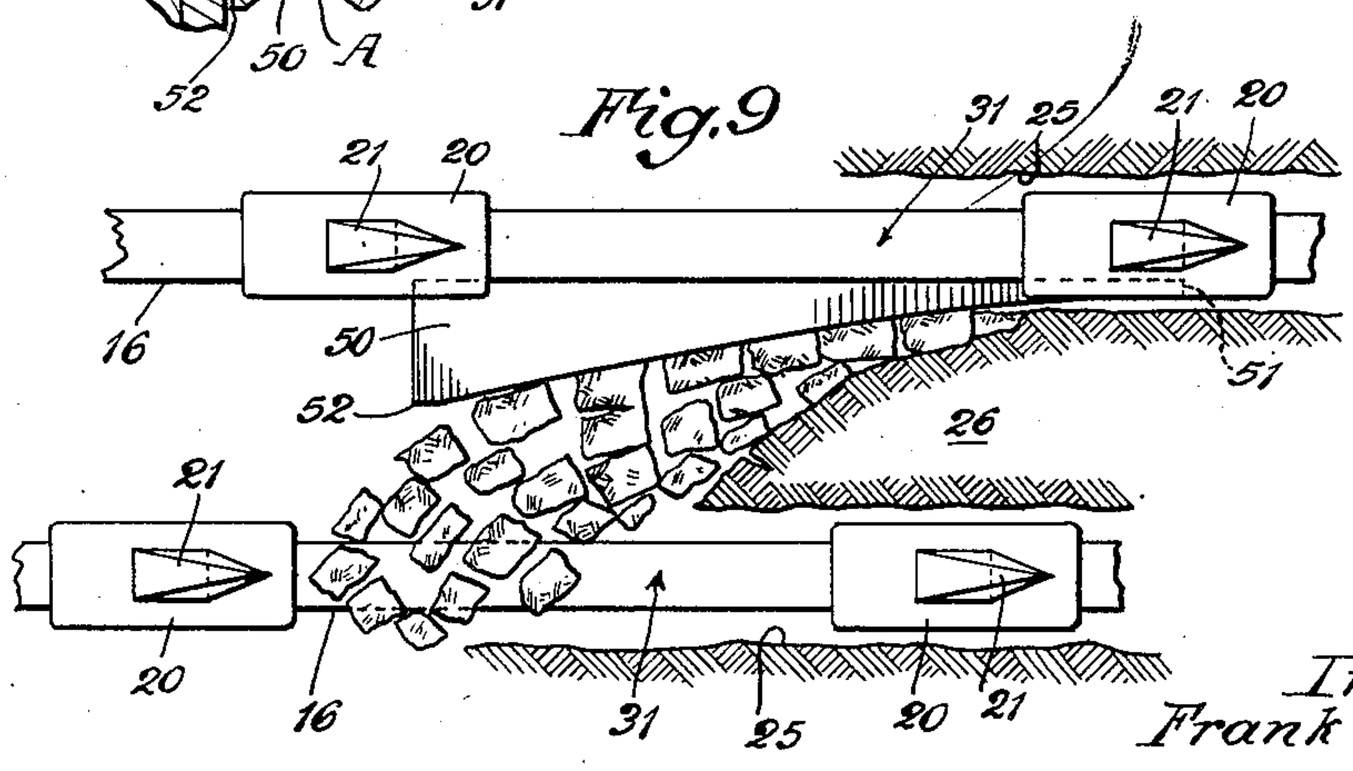


Fig. 9



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ROTARY DISC CUTTER HEADS WITH CORE BREAKING DEVICES FOR CONTINUOUS MINERS

Frank Cartlidge, Chicago, Ill., assignor to Goodman Manufacturing Company, Chicago, Ill., a corporation of Illinois

Application July 9, 1952, Serial No. 297,950

3 Claims. (Cl. 262—9)

This invention relates to improvements in cutter heads for coal mining machines, and more particularly to core breakers used with such devices. The invention is especially advantageous with cutter heads of the rotary disc type used in continuous mining machines but is not limited to such use.

One of the principal problems involved in the development of rotary disc cutter heads for continuous miners is that of obtaining a greater proportion of relatively large coal lumps as compared to fines usually obtained by such machines. One of the principal methods heretofore employed for this purpose is that of attacking the coal face with a plurality of rotating cutters carried by cutter discs or cutter chains, or a combination of both, which cutters are spaced apart a substantial distance to cut kerfs leaving relatively wide "cores" therebetween, to be broken out by core breakers also carried by the rotating cutters. The cuttings resulting from cutting the several kerfs must necessarily produce a substantial proportion of "fines," but it has been contemplated that the cores can be broken out and removed in larger lumps so as to raise the average size of lump coal loaded out by the machine. Many forms and arrangements of breaker devices have heretofore been employed which should, in theory, produce a large proportion of lump coal from the cores, but, in practice, much of such lump coal is reduced to fines while it is being removed from the working face.

I have ascertained that most of the difficulty above referred to is due to the fact that fragmented coal requires approximately two times the volumetric space that it occupies in the solid state, and that breaker devices of the kind heretofore employed do not allow for adequate expansion of the fragmented coal. As a result, the larger lumps tend to become crushed by and between moving parts of the cutter head and the solid face before they are discharged from adjacent the face.

The principal object of the present invention is to provide an improved form of wedge-like core breakers fixed on the rotating cutter discs to break out intervening cores, but disposed with respect to said cutter discs so as to transfer the broken lumps directly into relatively large open spaces in an adjacent kerf or channel in position to be removed from the face with a minimum of crushing.

Other objects and advantages of the invention will appear from time to time as the following description proceeds.

The invention may best be understood by reference to the accompanying drawings, in which:

Figure 1 is a fragmentary top plan view of a cutter head constructed in accordance with my invention;

Figure 2 is a side view of the parts shown in Figure 1;

Figure 3 is a detailed section taken on line 3—3 of Figure 1.

Figure 4 is an enlarged fragmentary detail view in perspective of the cutter head drum, showing three of the cutter discs with their respective breaker wedges mounted thereon, but with the cutter bits removed from the discs;

Figure 5 is a detail perspective view of one of the breaker wedges;

Figure 6 is a detail section taken generally along planes

indicated by line 6—6 of Figure 4, to illustrate how each of the wedges progressively breaks off its adjacent core and directs the lumps through an opening in the periphery of the proximate cutter disc into the kerf which has been cut by said disc;

Figure 7 is a detail section taken on line 7—7 of Figure 4, showing the wedges still farther advanced than in Figure 6;

Figure 8 is a detail section taken on line 8—8 of Figure 4, showing the wedges still farther advanced than in Figure 7;

Figure 9 is a schematic diagram illustrating the transfer action of the wedge as viewed generally toward the periphery of the cutter discs.

Referring now to the embodiment of my invention illustrated in the drawings, Figure 1 shows the front part of a cutter head for a continuous mining machine of the kind broadly disclosed in my copending application bearing Serial Number 116,684, filed September 20, 1949, wherein a cutter frame is pivotally connected at its rear end for vertical pivotal swinging movement relative to the main frame of the mining machine, with a rotary disc type cutter head rotatable on a transverse axis at the front end of said cutter frame.

The cutter frame shown herein includes side frame members 11, 11 with the cutter head 12 rotatably supported on suitable bearings therebetween. The cutter frame is raised or lowered by any suitable power means (not shown) during the cutting operation.

The rotary head 12 has a hollow drum 15 extending the length thereof, with a plurality of generally similar radially extending kerf-cutting discs 16, 16 fixed in axially spaced relation therealong. Each of said kerf-cutting discs is provided with a plurality of radially projecting bit holding blocks 20, 20 at widely spaced equal angles around its periphery. Said bit holding blocks are wider than their respective discs and, as usual, are arranged to receive cutter bits 21, 21 disposed at varying angles to the plane of said disc, so that the discs cut several horizontally spaced kerfs in the coal, as indicated at 25, 25 in Figure 1, in advance of the machine, when the cutter head is swung vertically, and the cutter discs are rotated. A standing core 26 is left between each adjacent pair of cutter discs. The bit blocks 20, 20 project radially beyond the concentric edges 30, 30 of the cutting discs 16 to leave open spaces 31, 31 between each adjacent pair of said bit blocks.

The cutter head may be driven as usual through a pair of cutter chains 35, 35 guided for orbital movement along the side frame members 11, and trained about sprockets 36, 36 fixed to the outer ends of the rotary head. The sprocket teeth 40 engage recesses 41 in the under faces of the cutter blocks 42 of the cutter chain. The cutter blocks are pivotally connected together as usual by links 43, and cutter bits 44 are mounted in said cutter blocks at several angles to the orbital plane of the cutter chains, to cut vertical kerfs 45 at opposite ends of the cutter head substantially similar to the intermediate kerfs 25 cut by the cutter discs, as indicated in Figure 1, excepting that the end kerfs 45 may be formed somewhat wider than the intermediate kerfs.

In the illustrative form shown herein, each of the cutter discs has six bit blocks 20, spaced circumferentially thereabout at equal distances, with said bit holders arranged to support their bits in three successive angular positions; that is to say, one in the center, the next toward one side, and the next toward the other side of the disc. The cutter chains 35 are longer than the circumference of the discs, so may each have a larger number of cutter blocks 42 with cutter bits 44 having more than three angular bit positions, if desired.

The novel core breaking means of my present invention consists of a plurality of generally wedge-shaped plates

50, which for convenience herein may be referred to as "wedges." The shape of the wedges is best shown in Figures 3 to 7, wherein it will be noted that in flatwise view each wedge is similar to a sector of an annulus, with its inclined core breaking surface A defined by a leading edge **51**, a lagging edge **52**, a radially outer arcuate edge **53**, and a radially inner arcuate edge **54**. The leading edge **51** and the radially outer edge **53** are of substantially uniform thickness the radially inner edge **54** increases gradually from the leading edge **51** to the lagging edge **52**. Since the plate is longest in a direction circumferential of the disc **16** on which it is carried, the lagging edge **52** increases in thickness from the radially outer edge **53** to the radially inner edge **54** at a relatively sharp angle. The core breaking face A is also slightly concave both lengthwise and radially thereof, to present a substantially plowlike surface in a generally helical outwardly inclined angle with respect to the axis of the drum, as indicated in the several figures.

Each of the cutter discs **16** has a wedge **50** fixed at one side thereof with its radially inner edge **54** closely adjacent the periphery of the drum and its radially outer edge **53** substantially coincident with the adjacent arcuate edge **30** of the disc. Each of said wedges preferably extends through an arc slightly greater than that of the open space **31** between adjacent bit blocks **20**, **20** so that the radial outer edge **53** of the wedge is nested at both its front and rear ends beneath the laterally overhanging bit blocks.

Each wedge is fixed to its disc by suitable means, such as by a plurality of positioning studs **58**, herein three in number, screwed into the rear face of the wedge, with their inner ends fitting in apertures **59** in the disc. The studs have nuts **60** on their opposite ends, holding said wedges to the disc.

Referring to Figure 9, it will be observed that each wedge **50** is mounted on its respective disc so that the lagging edge **52** of its core breaking surface is positioned directly opposite and substantially in alignment radially and axially with an open space **31** between two bit blocks **20**, **20** on the periphery of the next adjacent cutter disc, and approximately midway between said bit blocks.

In the illustrative form shown, the bit blocks on one disc are offset circumferentially from the bit blocks of the next adjacent disc as is common practice, so that all the cutter bits of the several discs do not impinge upon the coal face at the same time. Accordingly the wedges **50**, **50** are offset correspondingly on their respective discs to maintain the desired axial relationship between the wedge and the circumferential opening **31** of the opposite disc, as described in the foregoing paragraph, to produce the novel transfer effect as will now be described in connection with Figures 6 to 9.

Figure 6 is a section taken diametrically through the edge of two adjacent cutter discs, showing the kerfs **25**, **25** cut thereby, and with a standing core of coal **26** therebetween, before said core is engaged by the breaking wedges.

Figure 7 is a section showing the position in which the discs have been rotated so that the wedge begins to engage one corner of the core **26** to break off the top portion thereof. It will be observed that the wedge face is disposed at such an outwardly inclined angle to the next adjacent disc that, as the coal is broken from the outer end of the core, it tends to be directed at an angle normal to the wedge, and toward the open space **31** between the bit blocks of the next adjacent disc, and thence into the kerf **25** already cut by the bits of the latter disc. For convenience in description, this open space **31** formed in the kerf **25** between each adjacent pair of bit blocks **20** may be termed the "material access way."

Figure 8 shows the manner in which, upon further rotation, the wedge **50** breaks off more coal from the standing core, and simultaneously directs the lumps into the material access way of the next adjacent cutter disc, so that the resulting lumps are transferred into the relatively large area formed by said material access way of the adjacent or second disc, together with the kerf **25** already cut by the latter. From this position, the lumps are removed from the kerf by the paddle-like front faces of the cutter blocks **20** of the second cutter disc.

Figure 9 also indicates graphically how the plowlike face of a wedge **50** serves to transfer the coal lumps laterally in a positively directed stream into the material access way of the adjacent cutter disc, so as to permit clearance of the lumps from the coal face with a minimum of crushing.

Clearance of the larger lumps from each material access way, and the kerf in which the disc is operating, is aided by the fact that much of the coal cut by the cutter bits **21** and **44** from intermediate kerfs **25** and end kerfs, respectively, are in the form of relatively fine cuttings, which tend to fall by gravity out of said kerfs, thus leaving more space for the lump coal.

The wedge principle above described can be applied to a wide variety of cutter head structures and is not necessarily limited to a cutter head rotating on a horizontal axis. The illustrative embodiment shown in Figure 1 shows the invention as applied to a 5-disc cutter head. In this form of cutter head, the center disc is provided with two similar wedges **50**, **50***a*, one on each side thereof, and fixed diametrically opposite to each other. The two discs on each side of the center disc are each provided with one outwardly facing wedge. The wedges on the next two discs direct the fragmented lumps into the material access way formed by the adjacent cutter chains **35**. This arrangement of two opposed sets of wedges serves to balance the reaction of the several wedges axially of the cutter head while breaking the cores in opposed directions.

Although I have shown and described certain embodiments of my invention, it will be understood that I do not wish to be limited to the exact construction shown and described, but that various changes and modifications may be made without departing from the spirit and scope of the invention as defined in the appended claims.

I claim.

1. In a cutting and dislodging head for a continuous mining machine, a rotatable drum having a plurality of axially spaced discs, each disc having a plurality of circumferentially spaced bit carrying cutter blocks extending radially outwardly from the periphery thereof for cutting spaced parallel kerfs with outstanding cores therebetween, the open spaces between the blocks forming material access ways, core breaking wedges supported at the sides of certain of said discs, the outer surface of each of said wedges being disposed in a generally helical outwardly inclined angle with respect to the drum access, and the lagging edge portion of each of said wedges being substantially in alignment radially and axially with a material access way in the adjacent disc to break and move portions of the intermediate core into said material access way for removal by the cutter blocks on said adjacent disc.

2. The combination of claim 1 wherein each wedge extends radially from the drum substantially to the edge of a material access way on its respective disc, and is longer circumferentially than said material access way.

3. The combination of claim 1, wherein the cutter blocks, wedges and their respective aligned material access ways on the adjacent discs are disposed in staggered relation along the drum.

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