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CUTTER BIT MOUNTING FOR RIPPER TYPE MINER

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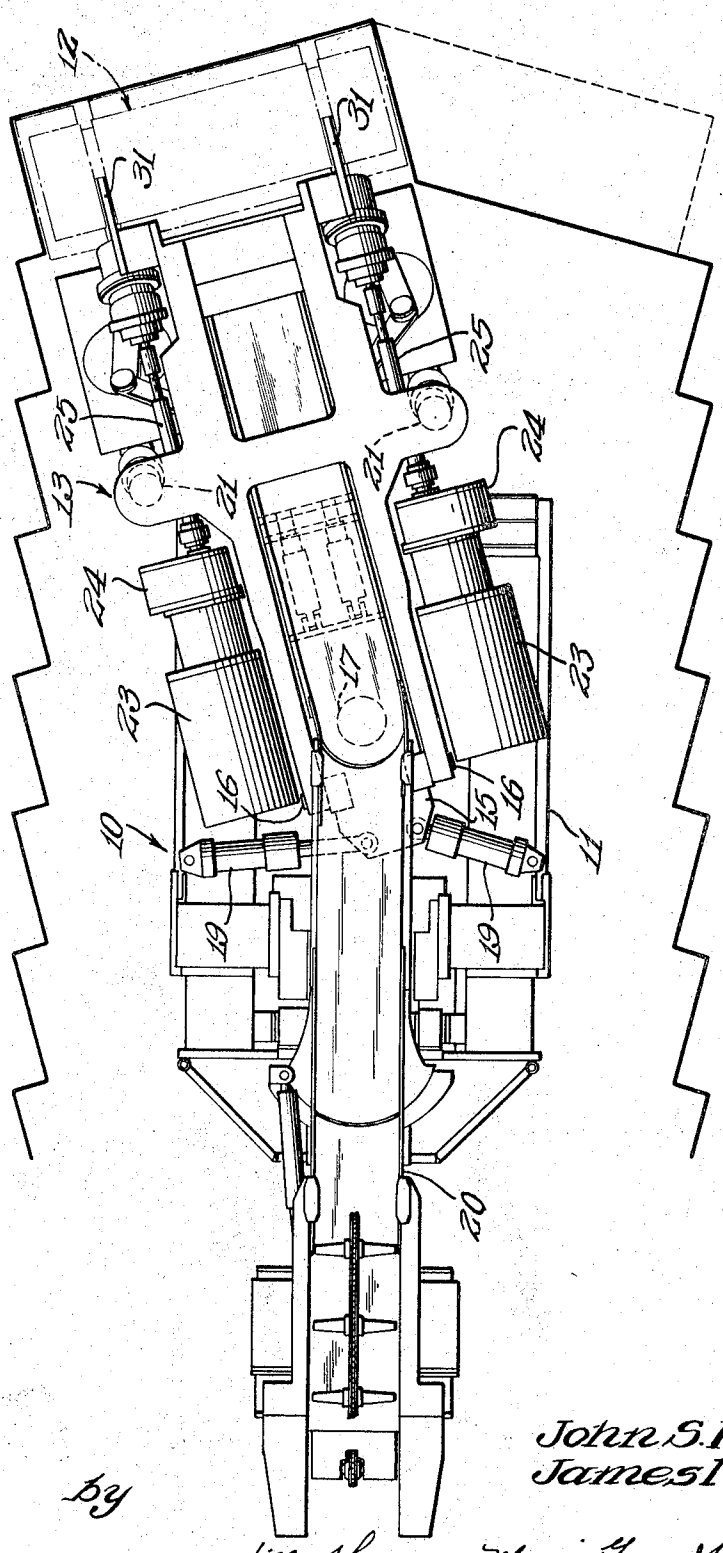


FIG. 1

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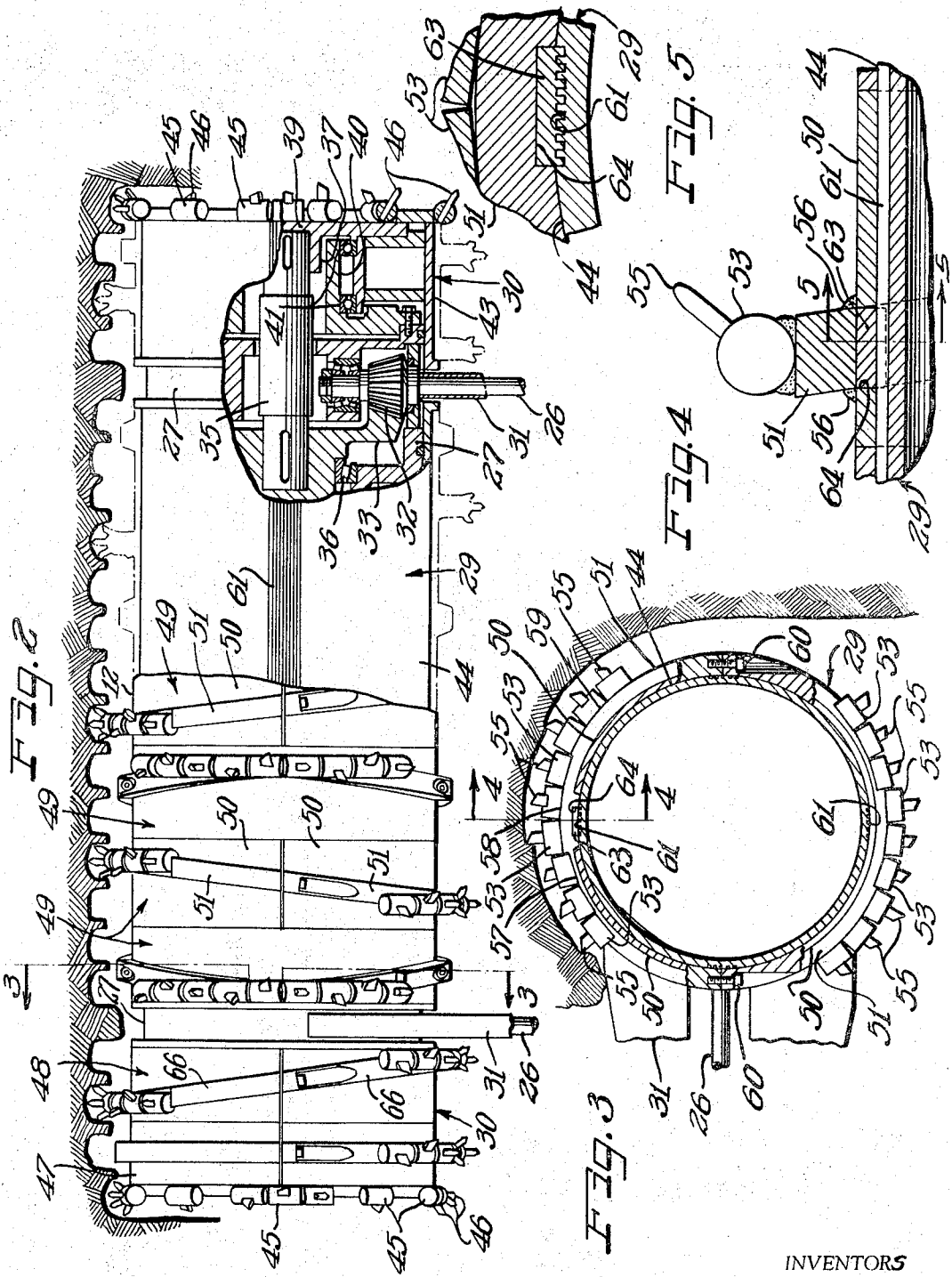


Fig. 2

Fig. 5

Fig. 4

Fig. 3

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CUTTER BIT MOUNTING FOR RIPPER TYPE MINER

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This invention relates to improvements in mining machines and more particularly relates to an improved form of continuous mining machine commonly known as a ripper miner.

In the mining of coal by continuous mining machines of the ripper type, a cut is usually made at one side of a room or entry by a rotating cutter drum rotating about an axis extending transversely of the working place. In order to retain the machine to a moderate cutting width to cut clearance for itself, without providing complicated retraction means for the cutter head for tramming clearances, the room or entry is usually cut in a double pass. That is, a cut is made at one side of a room or entry to advance the face and the boom arm supporting the cutter drum is then swung to the other side of the room or entry and a second cut is made, to mine the room or entry to its full width.

In order that the machine may cut efficiently with a minimum power consumption, it is advantageous to have as many bit positions as possible, to thereby reduce the cores left between the bits to a size where they will readily break down upon advance of the cutter drum. Sufficient space between the rows of bits must also be provided to accommodate the passage of the dislodged coal to its conveyor, which dislodged coal requires 60% more area when it is cut than when it is in the solid, to thereby reduce the building up of coal between the bits and avoid the impeding of the progress of the mining head by this built up coal.

It is a principal object of the present invention to provide an improved form of bit mounting for the cutter drum of a ripper type mining machine which enables the number of bit positions to be increased over conventional bit mounting means with less bit mountings and with more space between the mountings.

Another object of the invention is to provide an improved form of mounting means for the bits of the cutter drum of a ripper type mining machine, in which the bits are carried in mounting rings canted with respect to the axis of rotation of the cutter drum and are mounted in diametrically opposed relation with respect to each other, and positioned by each canted mounting ring to opposite sides of a plane extending through the cutter drum, perpendicular to its axis of rotation.

A still further object of the invention is to improve upon the cutter drums for ripper type continuous mining machines by mounting the cutter bits on the cutter drum on split rings in clusters and by canting the rings with respect to the axis of rotation of the drum to offset the clusters axially with respect to each other.

A still further object of the invention is to provide an improved form of bit holder for carrying the cutter bits for the cutter drum of a ripper type mining machine in which the bit holder is in the form of a split ring section, which may readily be removed and replaced without removing other parts of the cutter drum for sharpening dull bits and replacing damaged bit holders.

Still another object is to provide a bit holder for the cutter bits of the cutter drum of a continuous mining machine utilizing split ring sections bolted together and clamping the rings on the cutter drum, and so arranged with respect to the axis of rotation of the cutter drum as to provide a uniform number of bits cutting into the working face at all times and maintain a steady load on the cutter drum.

A still further object of the invention is to provide a split ring mounting means for the bit holders of the cutter bits of a cutter drum, mounting the bits in clusters arranged in groups, in which the trailing groups are successively spaced radially outwardly from the leading groups distances equal to the bit penetration.

These and other objects of the invention will appear from time to time as the following specification proceeds and with reference to the accompanying drawings wherein:

FIGURE 1 is a top plan view of a continuous mining machine constructed in accordance with the principles of the present invention, showing the cutter drum in phantom and illustrating the mining of a working place in two passes;

FIGURE 2 is a fragmentary top plan view of the cutter drum with certain parts removed and certain other parts broken away and in section, in order to show the drive to the cutter drum;

FIGURE 3 is a transverse sectional view taken substantially along line 3—3 of FIGURE 2;

FIGURE 4 is a sectional view taken substantially along line 4—4 of FIGURE 3; and

FIGURE 5 is a sectional view taken substantially along line 5—5 of FIGURE 4.

In the embodiment of the invention illustrated in the drawings, I have shown in FIGURE 1 a continuous mining machine **10** including a main frame **11** mounted on laterally spaced continuous traction tread devices (not shown) for propelling machine along the ground from working place to working place and feeding a transverse rotary cutter drum in advance of the forward end of the main frame into the working face of a mine. The cutter drum **12** is supported on the main frame **11** in advance thereof, on a boom structure **13**, positioning the cutter drum in advance of the main frame and holding the cutter drum in position to be fed into and along a mine face in a conventional manner.

The boom structure **13** is transversely pivoted to a laterally swingable frame structure **15** on pivot pins **16**. The frame structure **15** is pivoted to the main frame **11** on a vertical pivot pin **17**. A pair of oppositely disposed hydraulic jacks **19**, **19** are pivotally connected between opposite outer sides of the main frame **11** and the frame structure **15** for swinging the boom structure **13** and cutter drum **12** from side to side, and retaining said cutter drum in position.

The mining machine **10** also includes a conveyor **20** extending from a position adjacent the ground at the forward end of the machine in an upwardly inclined direction and over the top of the machine beyond the rear end thereof, for discharging the mined material into shuttle cars or other material transporting means. The conveyor **20** is a conventional form of laterally flexible chain and flight conveyor commonly used on continuous mining machines, and is no part of the present invention so need not be shown or described further.

The boom structure **13** also has motors **23** extending therealong, one motor extending along each side thereof. The motors **23** have speed reducer housings **24** mounted on the forward ends thereof and extending in advance thereof and containing conventional speed reducer gearing driving universal drive couplings **25**. Each drive coupling **25** drives a longitudinally extending shaft **26** extending within a cylindrical housing **27** forming a support for the adjacent ends of an inner cutter drum **29** and an outer cutter drum **30**. The cylindrical support in turn is mounted on an arm **31** of the boom structure

3. The arms 31 extend along opposite sides of the shaft 6 forwardly of the boom structure 13.

As shown in FIGURE 2 the shaft 26 has a bevel pinion 2 on the inner end thereof, driving a bevel gear 33 eyed or otherwise secured to a transverse shaft 35. The evel gear 33 is journalled within the cylindrical housing 7 on its hub, on a bearing 36 and also forms a support nd drive member for the inner cutter drum 29, in a nanner similar to that shown and described in applica- ion Serial No. 277,540, filed by Richard C. Lundquist on May 2, 1963 and entitled "Continuous Mining Machine" ow Patent No. 3,157,438 dated November 17, 1964.

The opposite end of the shaft 35 from the bevel gear 3 is keyed or otherwise secured to an inwardly extend- ng cup portion 37 of an end plate 39, closing the outer nd of the outer drum 30 and also forming a support and lrive member therefor. The outer drum 30 is supported n a hub structure 40 of the cylindrical support 27, on nti-friction bearings 41.

Referring now in particular to the cutter drums 29 nd 30, 30 and the bit mounting means of the invention, ach outer cutter drum 30 has a generally smooth cylin- lrical outer wall 43. The center cutter drum 29 also has smooth cylindrical outer wall 44 extending between the rms 31. The end plate 39, closing the end of the outer lrum 30 has a plurality of bit blocks 45, 45 mounted hereon and extending outwardly therefrom. The bit locks 45 extend at varying angles with respect to the ace of the end plate 39 to position cutter bits 46 to cut t varying angular relations with respect to the outer ace of said end plate and perform a side cutting opera- ion during sumping of the cutter drum into the mine ace and vertical feeding movement thereof.

Each outer drum 30 also has two adjacent bit holders 7 and 48 mounted thereon as by clamping. The center utter drum 29 also has a series of adjacent bit holders 9, 49 mounted thereon and extending along said drum rom one end thereof to the other.

As shown in FIGURES 2, 3, 4 and 5, each bit holder 9 comprises a split sleeve in the form of two diametrical- y opposed semi-cylindrical sleeve parts 50 fitting about he cylindrical wall 44 of the center cutter drum 29. The leeve parts 50 extend from each side of a canted or angled ing 51, projecting from the periphery of the outer wall 4 and sleeve parts 50. Each ring 51 forms the mount- ng for a cluster of cutter bit supporting blocks 53 having cutter bit 55 projecting therefrom.

As shown in FIGURE 3 the clusters of bit blocks 53 nd cutter bits 55 are arranged in diametrically opposed elation with respect to each other, and each ring section 1 carries a cluster of bit blocks 53 having cutter bits 5 projecting radially therefrom. The clusters of bit locks 53 and bits 55 are shown as being arranged in iers of three blocks and bits and each group includes a eading center bit, a trailing bit inclined to one side of enter and another trailing bit inclined to the opposite ide of center. The first tier of bits 55 extends a prede- ermined radial distance from the axis of rotation of the enter cutter drum 29. The second tier of three bits is paced radially outwardly from the first tier an amount ubstantially equal to the bit penetration in the coal, which may be one-half inch. In a like manner the third ier is spaced radially outwardly from the second tier, a listance equal to the bit penetration of the second tier, which distance may also be one-half inch outwardly from he tips of the bits in the second tier. Thus when the ead rotates to the point where the first tier of bits is gain in contact with the coal, the feed advance of the ead will be such as to equal another half-inch bit pene- ration.

Each semi-cylindrical ring section 51 extends diagonally f the sleeve parts 50 and is shown in FIGURE 4 as being ecured to adjacent sleeve parts as by welding, as indi- ated by reference character 56. The outer surface of each ring section 51 has three steps 57, 58 and 59 each of which steps supports and has secured thereto by welding, a tier of three bit holders 53, with the trailing tiers spaced radially outwardly of the leading tiers, as previously described.

As shown in FIGURE 3 one semi-cylindrical ring section 51 has recessed portions at its opposite ends accommodating cap screws 60 to pass through opposite end portions thereof and be threaded in the adjacent end portions of the next adjacent semi-cylindrical ring section 51, to clamp said ring sections and the sleeve sections 50 to the cylindrical wall 44 of the center cutter drum 29.

A means is provided for properly locating the ring sections on the cutter drum, which is shown in FIGURE 3 as comprising a series of keyways 61 recessed in and extending along the surface of the center cutter drum 29. The keyways are shown in FIGURE 3 as being located at 90° intervals, to provide locating means for the semi-cylindrical ring sections 51 and to accommodate the positioning of said semi-cylindrical ring sections about the center cutter drum 29, to provide a uniform number of bits cutting into the working face at all times. If desired more keyways can be provided in the face of the drum 29, to increase the number of bit positions along and about the circumference of the drum.

A selected series of keyways 61 is engaged by a key member 63. One key member 63 is provided for each semi-cylindrical ring section. The key member 63 is shown as being recessed within a radially inwardly opening slot 64 of a semi-cylindrical ring section 51. This positions the key member 63 to mesh with the keyways 61 and properly locate the ring section 51 about the periphery of the center cutter drum 29, and to retain said ring section from movement about said drum during the mining operation.

It will be noted from FIGURE 2 that the clusters of cutter bit carrying blocks 53 are arranged in circumferential alignment with respect to each other to position their bits to cut along circumferential center lines and to each side of these center lines, and that the ring sections 51 extend across the face of the center cutter drum 29 in opposite angular relation with respect to each other to position the clusters of bits to cut a series of kerfs in the mine face closely adjacent each other to leave relatively narrow cores which will readily break during mining. One semi-cylindrical ring section thus positions its cutter bits to cut one kerf in the mine face while the opposite semi-cylindrical ring section positions its cutter bits to cut an adjacent kerf in the mine face. The distance between the kerfs may thus readily be varied by varying the angular relation of the ring sections with respect to their sleeve sections and the periphery of the center cutter drum 29. This mounting means for the cutter bits thus provides more bit positions with less mounting rings for the bits than is conventional, and also provides far more space between the clusters of cutter bits than could be attained by the use of conventional bit mounting means, which space readily accommodates the dislodged coal and reduces the possibility of a build-up of coal between the bit mounting rings to a point where it will impede the mining progress. Moreover, where the coal is of such texture that the cutter bits will not readily break the cores, the angular side surfaces of the ring sections perform a wedging core breaking operation before the cores retard advance of the cutter drums.

The bit mounting means 47 for each outer cutter drum 30 is shown as extending circumferentially about the drum with the cutter blocks and bits supported thereon in aligned relation with respect to each other. The next adjacent mounting means 48 is shown as having angular or skewed cutter block mounting rings 66 mounted thereon, to position each diametrically opposed cluster of bits in rows to opposite sides of the transverse center line of the repective bit mounting means. The bit mounting means 47 and 48 are constructed in the same manner as

the bit mounting means 49 and are located on their respective cutter drums 30 in the same manner as the bit mounting means 49 are located upon the cutter drum 29, and are also clamped to the outer cutter drums in the same manner the bit mounting means 49 are clamped to the cutter drum 29. A detailed description of these mounting means, therefore, need not be repeated herein.

It may be seen from the foregoing that we have provided a novel form of mounting for the cutter bits of a ripper type continuous mining machine increasing the lateral space between the cutter bits to prevent impeding the mining operation by the build-up of coal between the cutter bit supports, and also increasing the bit positions with less mounting rings than has heretofore been possible.

It may further be seen that the mounting rings may be located in various circumferential relationships with respect to each other about the drum, to vary the spacing between the cutter bits and that the angle of skew of the mounting rings may also be varied to vary the spacing of the cutter bits.

It may further be seen that with the cutter bit mountings of the present invention, the split ring sections may readily be removed and replaced without removal of any other parts of the cutter drum and that when the bits become dull, the split ring sections may be removed and replaced with other ring sections containing sharpened bits and thereby greatly speeding up the replacing of dull bits and holding the unproductive time of the machine to a minimum.

While we have herein shown and described one form in which the invention may be embodied, it may readily be understood that various modifications and variations in the invention may be attained without departing from the spirit and scope of a novel concept thereof as defined by the claims appended hereto.

We claim as our invention:

1. In a continuous mining machine,
a rotary cutter drum supported for rotation about a horizontal axis extending parallel to a face to be mined and moved vertically along the face, to mine out a working place,
a series of cutter support rings stacked along the exterior of said drum and secured thereto for rotation therewith and having clusters of cutter bits extending outwardly therefrom, certain of which bits are pitched at angles to cut clearance for said rings,
said clusters of cutter bits on each ring being circumferentially misaligned with respect to a plane extending perpendicular to the axis of rotation of the drum and intersecting the periphery of the ring and the clusters of cutter bits on adjacent rings being out of axial alignment with respect to each other.

2. The structure of claim 1,
wherein the cutter support rings are canted at angles with respect to the axis of rotation of said drum,
and wherein means are provided for locating said cutter support rings and the clusters of cutter bits carried thereby in axially misaligned relation with respect to each other.

3. In a continuous mining machine, a rotary cutter drum supported for rotation about a horizontal axis and for vertical movement along a mine face to mine out a working place, cutter means carried by said drum comprising a plurality of detachable bit holders extending about said drum and secured thereto and having clusters of cutter bits mounted thereon, each bit holder comprising two abutting semi-circular rings secured together at their opposite ends and thereby clamped to said drum, and said clusters of cutter bits being mounted on said rings in tiers in diametrically opposed relation with respect to each other, the succeeding tiers being spaced radially outwardly of the advance tiers a distance equal to cutter bit penetration.

4. In a continuous mining machine, a rotary cutter drum supported for rotation about a horizontal axis and for vertical movement along a mine face to mine out a working place, cutter means carried by said drum comprising a plurality of abutting canted semi-circular rings extending about said drum and secured together at their opposite ends, each semi-circular ring having clusters of bits extending therealong and arranged to cut in planes perpendicular to the axis of said drum, and said abutting semi-circular rings positioning said bits in axially offset relation with respect to each other to effect the cutting of two adjacent kerfs by the clusters of bits carried by the abutting semi-circular rings.

5. A continuous mining machine in accordance with claim 4 wherein key means locate said rings with respect to said drum and are positionable to position said bit clusters in selected relation about said drum.

6. A continuous mining machine in accordance with claim 4 wherein the drum has a plurality of diametrically opposed keying recesses therein and wherein a key is mounted in each semi-circular ring portion for locating said rings in selected of said keying recesses.

7. In a continuous mining machine, a rotary cutter drum supported for rotation about a horizontal axis and vertically moved along a mine face to mine out a working place, cutter means carried by said drum comprising a plurality of detachable bit holders extending about and spaced along said drum, said bit holders including semi-cylindrical mating sleeve sections having semi-cylindrical rings carried thereby and extending radially outwardly therefrom, means clamping said ring sections and sleeve sections to said drum with each pair of semi-cylindrical ring sections in abutting engagement with each other, each ring section having a cluster of bits extending radially outwardly therefrom and arranged to cut in planes perpendicular to the axis of rotation of said drum.

8. A continuous mining machine in accordance with claim 7 wherein each semi-cylindrical ring has a key carried thereby and extending through the associated sleeve section, and wherein said drum has a plurality of circumferentially spaced key slots recessed in the surface thereof and selectively engaged by said keys, to determine the positions of said bits with respect to said drum and with respect to the next adjacent axially spaced ring section.

9. In a continuous mining machine, a main frame, a cutting means spaced in advance of said main frame and mounted thereon for angular movement about a horizontal axis and lateral movement about a vertical axis, said cutter means comprising a center cutter drum extending across the front of said main frame and side cutter drums spaced laterally from each end of said center cutter drum, and forming axial continuations thereof, a pair of common supports, one for each of said side drums and one end of said center drum, said supports extending into the spaces between adjacent ends of said drums and forming a bearing support means therefor, drive means carried by each of said supports and having driving connection with each of said drums, said drums having a plurality of detachable bit holders secured thereto and spaced axially from one another along the face of the drums, means for locating said bit holders on said drums and providing a wide choice of axial and circumferential positions of the bit holders on said drums, each of said bit holders comprising a split ring canted with respect to the axis of rotation of said drums and having clusters of cutter bits mounted thereon at diametrically and axially remote locations.

10. A continuous mining machine in accordance with claim 9 wherein each split ring is mounted on a semi-cylindrical sleeve, and wherein means are provided to clamp said rings and sleeves to said cutter drum, with the clusters of cutter bits on the split rings located in diametrically opposed relation with respect to each other.

11. A continuous mining machine in accordance with claim 9 wherein each split ring is mounted on a semi-cir-

cular sleeve, wherein clamping means are provided to clamp said sleeves and rings to said drums in end to end relation with respect to each other, wherein said means locating said rings on said drums comprises a plurality of key slots extending longitudinally of said drums and spaced circumferentially of said drums, and wherein key members are mounted in said rings and have selective engagement with said key slots.

12. A continuous mining machine in accordance with claim 9 wherein the rings canted with respect to the center of rotation of the drums have angular side surfaces serving as core breakers wedging the cores between the

kerfs cut by bit clusters on opposite sides of each canted ring, from the mine face.

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