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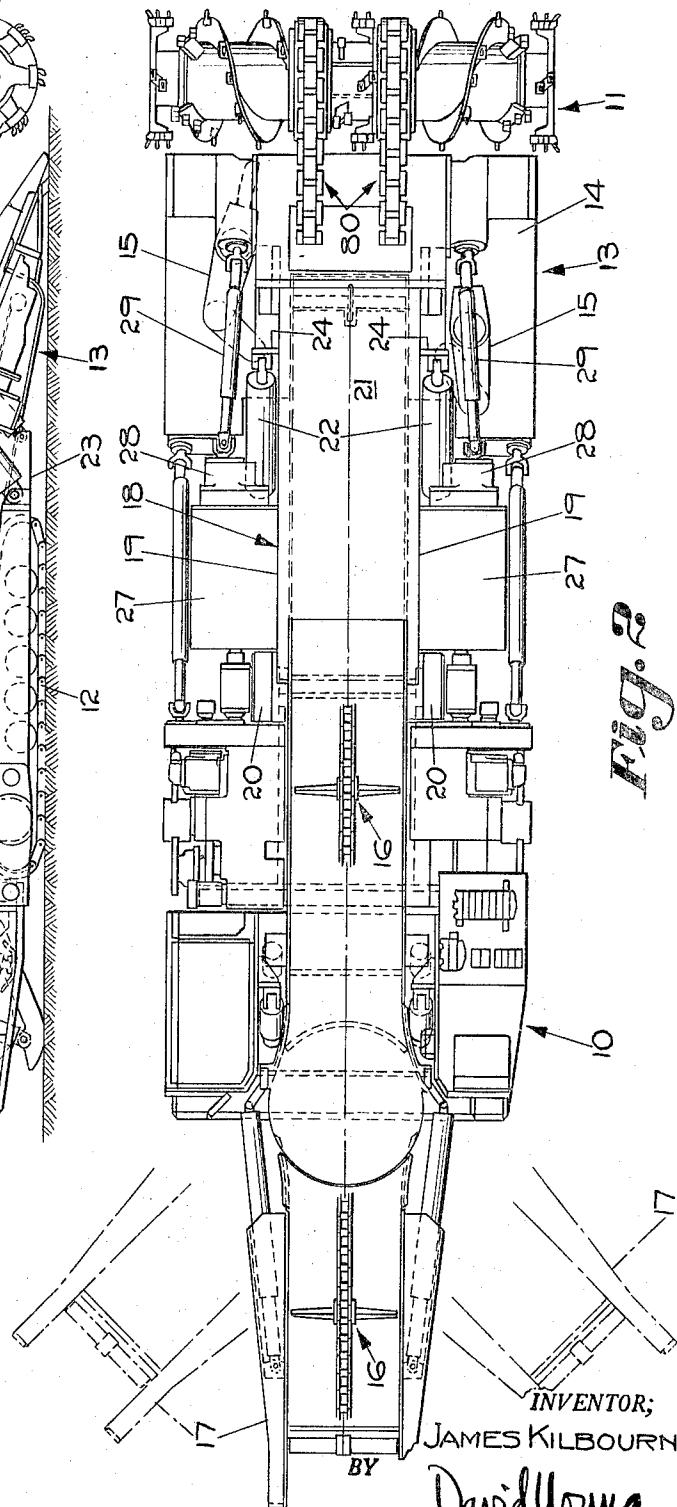
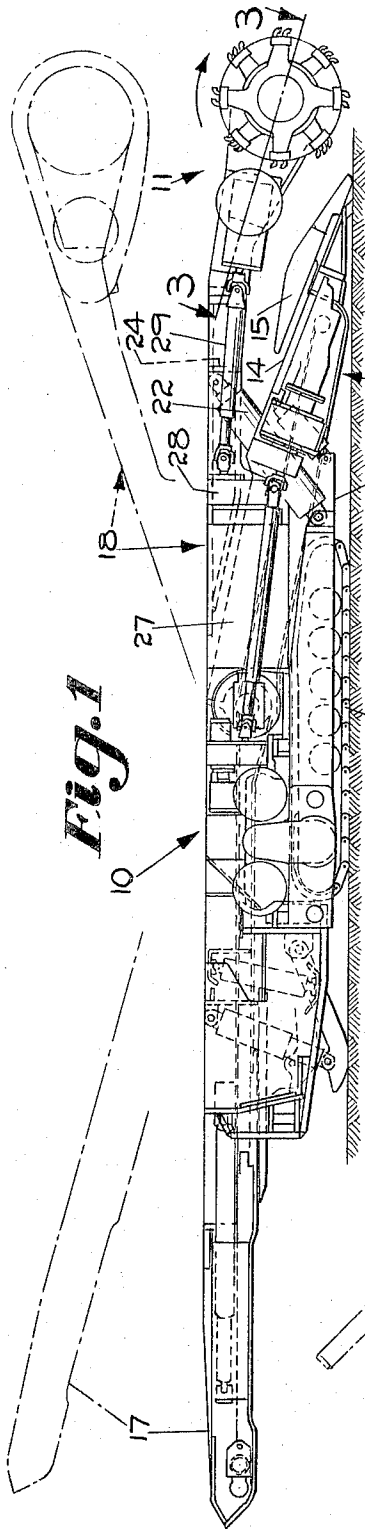
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3,305,273

MINING APPARATUS SUPPORTING AND DRIVING CONSTRUCTION

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3 Sheets-Sheet 1



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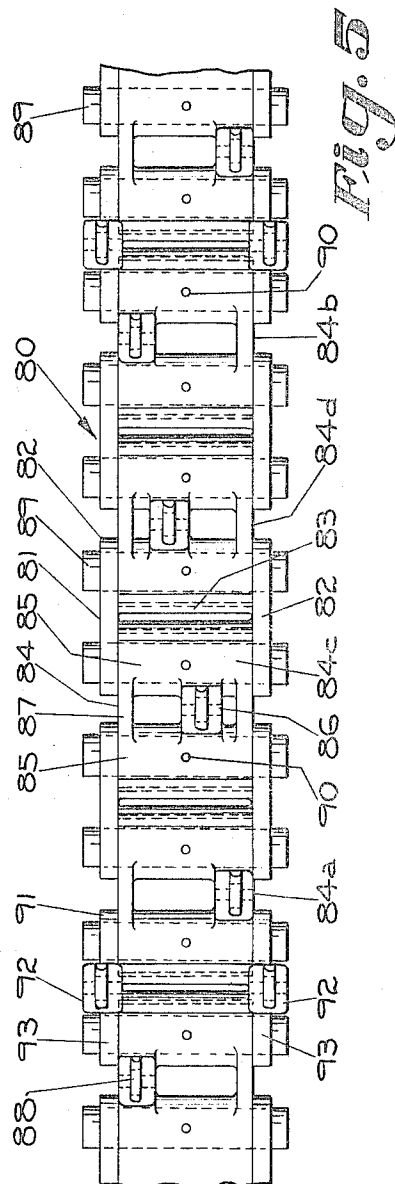
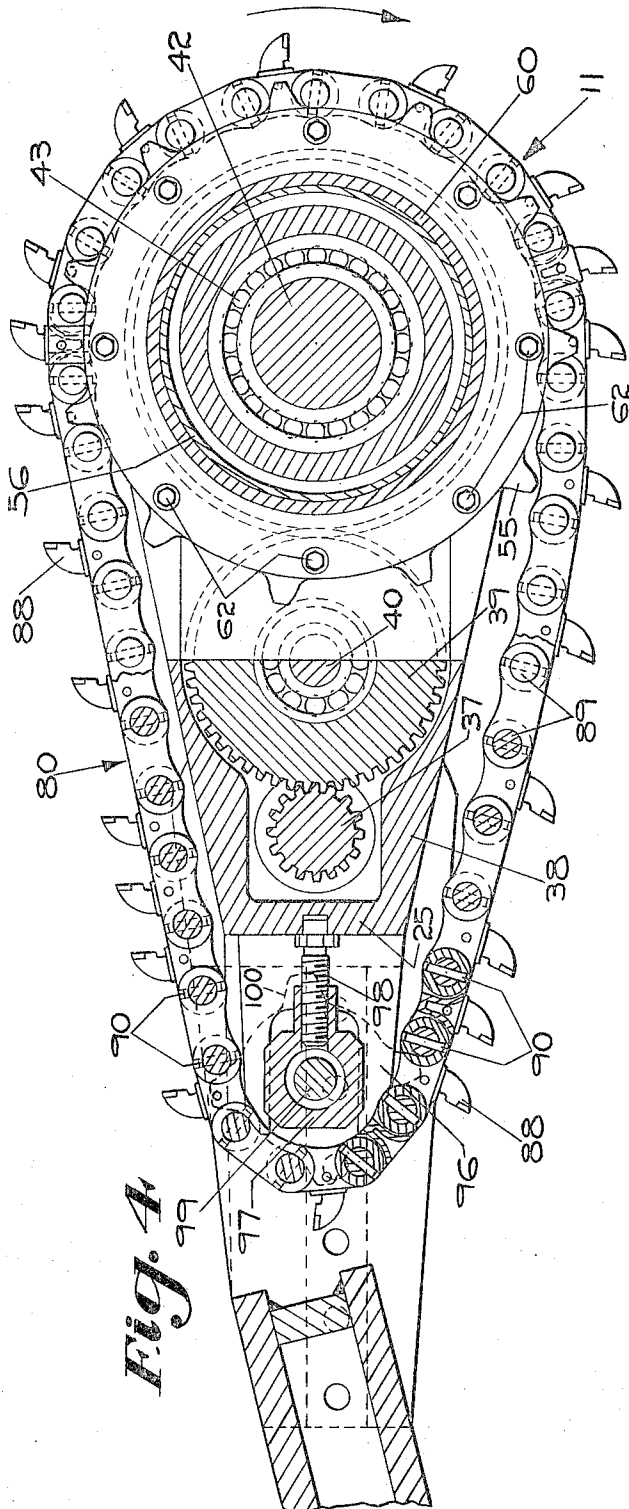
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3 Sheets-Sheet 3



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MINING APPARATUS SUPPORTING AND DRIVING CONSTRUCTION

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The instant invention relates to mining apparatus, and to the mechanism by which such mining apparatus is driven.

It is an object of the instant invention to provide an improved mining apparatus which is advanced into a mine face to remove material therefrom, and in which the cutting and breaking means is operable about an axis that is transversely disposed with respect to the direction of advance of the mining apparatus. The drive means for the cutting and breaking means is connected to the latter on the transverse axis at a position intermediate the ends of the same. An auxiliary cutting and breaking means is provided, and is operative in the area of the driving connection to the cutting and breaking means, to span this area and to provide cutting and breaking means across the full width of the mining apparatus.

Other objects of the invention will appear hereinafter, the novel features and combinations being set forth in the appended claims.

In the drawings:

FIG. 1 is a side elevational view of a mining machine incorporating the mining apparatus of this invention;

FIG. 2 is a plan view of the mining machine illustrated in FIG. 1;

FIG. 3 is a plan view, in section, of the mining apparatus of this invention, taken on the line 3—3 in FIG. 1;

FIG. 4 is a sectional view of the mining apparatus, taken on the line 4—4 in FIG. 3; and

FIG. 5 is a plan view of the auxiliary cutting and breaking means.

Referring to the drawings, there is illustrated in FIGS. 1 and 2 a mining machine 10 which incorporates the mining apparatus 11 of this invention. The mining machine 10 may be of the continuous type in which the mining apparatus 11 is disposed at the forward end thereof to be advanced into a mine face for cutting and breaking material out of such face. The mining machine 10 is supported on endless traction treads 12, 12, which are disposed one at each side of the machine and are suitably driven for propelling the mining machine 10.

A gathering means 13 is also disposed at the forward end of the mining machine 10. The gathering means 13 comprises an apron or deck 14 which slopes downwardly to the mine floor. Two gathering arms 15, 15 are mounted on the apron or deck 14, one at each side thereof, and operate with a sweeping motion to gather the mined material from the mine floor onto the apron 14 and to crowd the same into the chain and flight conveyor 16 which extends from the forward end of the mining machine 10 to the rear end thereof, at which there is a discharge boom 17 from which the material is discharged.

The gathering means 13 may be adjusted upwardly and downwardly to follow an uneven mine floor and thereby to maintain the leading edge of the apron or deck 14 on the mine floor for maximum effectiveness in loading the mined material into the conveyor 16. The discharge boom 17 is adjustable upwardly and downwardly and from side to side for directing the discharge of mined material from the mining machine 10.

The mining machine 10 has a boom 18 comprising side arms 19, 19 which are disposed in laterally spaced positions, approximately in alignment with the opposite sides of the conveyor 16. The rear end of each side arm 19

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is connected to the main frame 23 of the mining machine 10 by pivot support means 20, on which the boom 18 may be raised and lowered, and which additionally provide for the load of the mining apparatus 11. A transverse reinforcing member 21 extends between the side arms 19, 19 and is secured thereto to provide the boom 18 with the requisite rigidity. Two cylinder and piston devices 22, 22 are disposed one at each side of the mining machine 10. These are secured to the mining machine main frame 23 and extend upwardly and forwardly therefrom to the boom 18, and are secured to the latter on suitable bifurcated brackets 24, 24, one at each side of the boom 18. The cylinder and piston devices 22, 22 are extensible and retractable to raise and lower the boom 18 and the mining apparatus 11.

Referring now to FIGS. 3 and 4, there is illustrated therein the mining apparatus 11 and the forward end of the boom 18 on which it is mounted. This structure is symmetrical about the longitudinal center line of the mining machine 10, and accordingly, FIG. 3 only illustrates the structure at one side of the mining machine 10, it being understood that the structure at the other side thereof is identical, except that it is oppositely arranged. Accordingly, the description will proceed in the singular with respect to the structure illustrated in FIG. 3, with the understanding that the description applies equally to the like structure at the other side of the longitudinal center line of the mining machine 10.

The mining apparatus 11 is secured to the boom 18 by engagement of rearwardly extending arms of a drive housing and main support 25 with the side arms 19, 19 of the boom 18, and is secured thereto by a plurality of bolts 26 or the like.

The mining apparatus 11 is driven from the motors 27, 27, which are disposed one at each side of the mining machine 10. The drive from the motors 27, 27 is delivered to transmissions 28, 28, and thence to universal shafts 29, 29. Each universal shaft 29 is connected to a drive shaft 30, which is rotatably mounted in the drive housing and main support 25, as seen in FIG. 3.

The end of the drive shaft 30 is formed with a bevel pinion 31 which engages a bevel gear 32 to drive the latter. The bevel gear 32 is rotatably mounted in the main support 25. The bevel gear 32 is secured to a hollow shaft 33, which extends laterally outwardly from the bevel gear 32 and is rotatably supported in the main support 25. The hollow shaft 33 is connected to a clutch 34, which is rotatably supported in the lateral housing extension 35 of the main support 25. The clutch 34 connects the shaft 33 to a shaft 36 which extends laterally inwardly from the clutch 34. The shaft 36 extends through the hollow shaft 33 and beyond the bevel gear 32, and is connected to a pinion 37 that is rotatably supported in the main support 25.

The main support 25 has a forward housing extension and support member 38. A reach gear 39 engages the pinion 37. The reach gear 39 is rotatably mounted in the forward housing extension 38 on a shaft 40. The reach gear 39 in turn engages a driven gear 41 to drive the latter. The driven gear 41 is fixedly secured to a rotatable shaft 42 that has its axis disposed transversely with respect to the longitudinal center line of the mining machine 10. The shaft 42 is supported by the forward housing extension and support member 38 and is rotatable with respect to the latter on a bearing 43, the member 38 being a fixed support for the transverse rotatable shaft 42. The driven gear 41 connects the drive means to the shaft 42.

The rotatable shaft 42 supports the cutting and breaking means of the mining apparatus 11. A split collar 45 is fixedly secured to the shaft 42 at the longitudinal center line of the mining machine 10. A sprocket 46 has a hub 47 by which it is fixedly secured to the shaft 42. The

sprocket 46 is placed adjacent to one side of the support member 38. A circular frame 48 is secured to the sprocket 46 by a plurality of bolts 49 or the like. The frame 48 is formed with a plurality of bit holders 50, in each of which there is secured a bit 51. The bits 51 are disposed in an imaginary cylindrical surface, and the transverse disposition thereof spans the distance between the sprocket 46 and the longitudinal center line of the mining machine 10. The bit holders 50 and their bits 51 are an intermediate cutting and breaking means which is operative between the two forward housing extensions and support members 38, 38, as seen in FIG. 2.

At the outer side of the support member 38 there is a sprocket 55 which is disposed closely adjacent to the support member 38. The sprocket 55 has a laterally extending web 56 by which it is connected to a hub 57. The hub 57 is fixedly secured to the shaft 42, whereby the sprocket 55 is rotatable with the shaft 42. A sleeve 58 is also fixedly secured to the shaft 42 to be rotatable therewith and is interposed between the bearing 43 and the hub 57. The sleeve 58 abuts the bearing 43, and the hub 57 abuts the sleeve 58. The several elements are maintained in assembly on the shaft 42 by a lock nut 59 which is threaded on the shaft 42 against the hub 57.

A cylindrical shell 60 is supported on the laterally extending web 56 of the sprocket 55. At the inner end of the cylindrical shell 60 there is a radial flange 61 which abuts the sprocket 55 and is secured thereto by a plurality of bolts 62 or the like. The cylindrical shell 60 extends outwardly from the sprocket 55 along the shaft 42 and supports a portion of the outer cutting and breaking means of the mining apparatus 11. Such cutting and breaking means comprises two spiral flights 63, 64 which are secured to the cylindrical shell 60 to provide a double pitch spiral conveying or feeding means, which is operative to feed the mined material in towards the longitudinal center line of the mining machine 10 to facilitate the gathering and the loading of the mined material into the conveyor 16. A plurality of bit holders 65 are secured to the peripheral edges of the spiral flights 63, 64 at spaced positions, and a bit 66 is secured in each bit holder 65. The bits 66 are also disposed in an imaginary cylindrical surface, which is coincident with the imaginary cylindrical surface in which the bits 51 are disposed.

At the outer end of the cylindrical shell 60 there are a plurality of bit holders 67 and bits 68, which extend somewhat beyond the end of the cylindrical shell 60. These bit holders 67 and bits 68 are disposed in groups at spaced circumferential positions, of which there may be four groups. The bits 68 are disposed in the same imaginary cylindrical surface as the bits 51, 66.

At the outer end of the shaft 42 there is a sleeve 70 that is slidably mounted on the shaft 42, and is rotatably fixed with respect to the latter. The sleeve 70 may have a splined or keyed connection to the end of the shaft 42 for sliding movement relatively to the latter. An end cutting and breaking means has a disc-like element 71 formed with a hub 72 which is received on the end of the sleeve 70. An end cap 73 is secured to the end of the sleeve 70 by a plurality of bolts 74 or the like, and engages the end disc element 71 to fixedly secure it on the sleeve 70. A plurality of bit holders 75 are secured to the end disc element 71 on the periphery thereof, and each bit holder 75 has a bit 76 secured therein and extending radially outwardly. The bit holders 75 are disposed in groups, of which there may be four in number, and these are disposed at equally spaced positions around the periphery of the end disc element 71. The bit holders 75 and the bits 76 in each group are disposed at laterally spaced positions so as to have a cutting and breaking effectiveness along a transverse distance. The several groups of bit holders 75 and bits 76 are alternated with the circumferential disposition of the several groups of bit holders 67 and bits 68.

The sleeve 70 is illustrated in FIG. 3 in its outermost

position on the shaft 42. The sleeve 70 and the end disc element 71 may be withdrawn with respect to the cylindrical shell 60 to contract the rotary cutting and breaking means, whereby the width thereof along the transverse axis is reduced. Movement of the sleeve 70 along the shaft 42 may be effected by a plurality of cylinder and piston devices 77, which are disposed within the cylindrical shell 60 and are secured to the web 56 of the sprocket 55, and to the sleeve 70. Retraction of the end disc element 71 places it adjacent to the end of the cylindrical shell 60, as seen in phantom lines in FIG. 3. The several groups of bit holders 75 and their bits 76 overlap the outer end of the cylindrical shell 60 and fit between the groups of bit holders 67 and bits 68 that are secured thereto. The cylinder and piston devices 77 may be hydraulically operated, and hydraulic connections, for applying hydraulic fluid under pressure to the cylinder and piston devices 77, may be effected through the support member 38 and the sleeve 58, with these elements forming a rotary hydraulic joint, and direct hydraulic connections may be made from the sleeve 58 to the cylinder and piston devices 77.

The cutting and breaking means which has been described thus far has its bits 51, 66, 76 disposed in a common imaginary cylindrical surface, with each bit traveling in a circular path upon rotation of the shaft 42. Such rotary cutting and breaking means is the main or prime cutting and breaking means of the mining apparatus 11. The portion thereof disposed between the support members 38, 38 is the intermediate portion of the main cutting and breaking means, and the portion thereof which is disposed laterally outwardly of the support member 38 is the outer portion of the main cutting and breaking means, there being two such outer portions, as seen in FIG. 2.

By reason of the support member 38, on which the shaft 42 and the rotary cutting and breaking means is supported, and in which the drive connection is effected to the shaft 42 on its transverse axis, there is a gap between the intermediate cutting and breaking means and each outer cutting and breaking means, in which the main cutting and breaking means is not operative. Such gap is filled by an auxiliary or secondary cutting and breaking means comprising an endless, flexible chain type of cutting and breaking means 80, which is adapted to operate over and about a support member 38, and is of such lateral width as to fill the gap between the intermediate cutting and breaking means and an outer cutting and breaking means.

The endless chain cutting and breaking means comprises a plurality of connecting links 81 having an H-form comprising opposite side bars 82, 82, which are laterally spaced from each other, and are joined by a laterally extending web 83. Between the connecting links 81 there are block links 84, each of which is formed with a barrel 85 at each end thereof and which are spaced from each other. A bit holder 86 is interposed between the barrels 85, 85 and is integrally formed therewith. In addition, a block link 84 includes one or more webs 87 extending between the barrels 85, 85 and reinforcing the link 84.

As seen in FIG. 5, the bit holders 86 of the successive block links 84 are disposed at laterally spaced positions so that the bits 88 that are secured thereto are effective across the full width of the block links 84. There are four laterally spaced positions for the bit holders 86 and bits 88 of the block links 84. However, only two different block links 84 are required to achieve this disposition of the bit holders 86 and bits 88, by reason of the symmetrical construction of the block links 84. Thus, the block links 84a and 84b may be the same, except that they are reversed in the assembly. Similarly, the block links 84c and 84d may be the same, except these are also reversed.

The connecting links 81 are connected to the block links 84 by a plurality of laterally extending pins 89, by which there is effected an articulated connection of the

several links 81, 84. Each pin 89 extends through the side bars 82 of a connecting link 81 and through a barrel 85 of a block link 84. A pin 89 is fixedly secured to a block link 84 by a roll pin 90, or like means, which extends through a barrel 85 and a pin 89. Thus, a pin 89 is freely pivotable in the side bars 82, 82, but is fixed in a barrel 85.

In order to achieve the lateral distribution of bits 88 across the full width of the chain cutting and breaking means 80, there is provided a special connecting link 91, which includes two bit holders 92 disposed at the opposite sides of the link 91 on the side bars 93, 93. In effect then, there are six cutting bits 88 spaced across the width of the chain cutting and breaking means 80, which is sufficient to effectively fill the gap over the support member and between the intermediate cutting and breaking means and the outer cutting and breaking means. Other than as stated, the connecting link 91 is identical to the other connecting links 81.

In the chain cutting and breaking means 80, each of the pins 89 extends laterally beyond the side bars 82, 93 of the connecting links 81, 91, respectively. The projecting ends of the pins 89 are engaged by the sprocket wheels 46, 55, as seen in FIGS. 3 and 4. The sprocket wheels 46, 55 are rotatable with the shaft 42, whereby they drive the chain cutting and breaking means 80, in at least a portion of the path thereof, around the transverse axis of the main rotary cutting and breaking means. The rotation of the main cutting and breaking means is in a clockwise direction, as viewed in FIGS. 2 and 4, and thus the chain cutting and breaking means 80 moves from top around to bottom in its movement about the transverse axis. For maximum cutting and breaking effectiveness of the chain cutting and breaking means 80, the teeth of the sprockets 46, 55 have a pitch distance which is slightly greater than the pitch of the chain cutting and breaking means 80, whereby the lowermost teeth of the sprockets 46, 55 are fully engaged with the chain cutting and breaking means 80 to effectively pull the chain cutting and breaking means 80 around the axis of the shaft 42, with the effect of maintaining the chain cutting and breaking means 80 in firm engagement with the sprockets 46, 55.

The main support 25 is formed with a cavity 95 behind the support members 38, 38. Each chain cutting and breaking means 80, 80 has a path that extends around a support member 38 and through the cavity 95. Referring to FIGS. 3 and 4, within the cavity 95 there are two bifurcated supports 96, 96, which are laterally spaced from each other and extend rearwardly behind each support member 38. A bearing block 97 is slidably supported in the bifurcated ends of the supports 96, 96. A screw 98 is threadably engaged with the bearing block 97 and abuts the main support 25. The position of the bearing block 97 on the supports 96 may be adjusted by rotation of the screw 98. A shaft 99 is rotatably supported in the bearing block 97 and extends laterally beyond the latter at each side thereof. An idler sprocket 100 is fixedly secured to each projecting end of the shaft 99 in position to engage the projecting ends of the pins 89 of the chain cutting and breaking means 80 to support and guide the latter at the rear end of its path behind the support member 38.

In the operation of the mining machine 10 the boom 18 is raised to dispose the mining apparatus 11 at the level of the top of the mine face. This mining machine 10 is then propelled forwardly to advance the cutting and breaking means of the mining apparatus 11 into the mine face. During such advance, the cutting and breaking means is operative about its transverse axis, whereby the cutting bits thereof cut and break the material of the mine face. Such mined material is fed inwardly towards the longitudinal center line of the mining machine and rearwardly by the spiral flights 63, 64, and the material is discharged out of the mine face onto the mine floor, to be

gathered by the gathering means 13 and loaded into the conveyor 16.

When the cutting and breaking means of the mining apparatus 11 has been advanced the desired distance into the mine face, the forward movement of the mining machine 10 is stopped, and thereafter, the boom 18 is moved downwardly, whereby the mining apparatus operates to further remove material from the mine face down to the bottom thereof at the mine floor.

The end cutting and breaking means, comprising the bit holders 75 and their bits 76 are normally placed in fully extended position so that the cutting and breaking means of the mining apparatus 11 forms an opening in the mine seam that is wider than the maximum width of the mining machine 10 behind the mining apparatus 11. This permits the mining machine 10 to be propelled forwardly without interference with the rib at either side thereof. The end cutting and breaking means may be retracted when the mining machine 10 is trammed, so that this cutting and breaking means does not contact the rib at either side of the mining machine 10.

The mining apparatus of this invention provides a highly effective cutting and breaking means for removing material from a mine face, in which cutting and breaking bits are disposed at positions across the full width of the mining apparatus. The drive means for the cutting and breaking means is connected to the latter on its transverse axis to provide a highly effective power transmission for driving the cutting and breaking means. The support members for the cutting and breaking means also form housings for the drive connections to the cutting and breaking means. By the construction of this invention, the cutting and breaking means is driven in such manner as to satisfy the power requirements for achieving a mining operation with a full width mining apparatus.

Obviously those skilled in the art may make various changes in the details and arrangement of parts without departing from the spirit and scope of the invention as defined by the claims hereto appended, and applicant therefore wishes not to be restricted to the precise construction herein disclosed.

Having thus described and shown an embodiment of the invention, what it is desired to secure by Letters Patent of the United States is:

1. Mining apparatus including a rotary cutting and breaking means adapted to be advanced into the material of a mine face to remove said material therefrom, said rotary cutting and breaking means being disposed on a transverse axis relatively to the direction of advance thereof into said material, a housing for supporting said rotary cutting and breaking means for rotation around said transverse axis, said support housing extending forwardly to said transverse axis, means for driving said rotary cutting and breaking means, gear means connecting said driving means to said rotary cutting and breaking means, said gear means being disposed within said housing and comprising a first gear disposed on said transverse axis and a second gear disposed on an axis that is parallel to said transverse axis and drivingly connected to said first gear to drive the latter, portions of said rotary cutting and breaking means being spaced from each other along said transverse axis, said housing and said first gear being disposed between said spaced portions of said rotary cutting and breaking means and said second gear being disposed in said housing in longitudinal alignment with said first gear, auxiliary cutting and breaking means disposed between said spaced portions of said rotary cutting and breaking means and extending around said housing to operate over said housing, and driving connections of said rotary cutting and breaking means to said auxiliary cutting and breaking means to drive the latter about said transverse axis.

2. Mining apparatus as recited in claim 1 in which said auxiliary cutting and breaking means includes an endless

flexible cutting and breaking means that extends around said housing.

3. Mining apparatus as recited in claim 2 further including means disposed beyond said housing and engaged with said endless flexible cutting and breaking means to support and guide the latter at the rear portion of its path of movement beyond said housing.

4. Mining apparatus including a rotary cutting and breaking means adapted to be advanced into the material of a mine face to remove said material therefrom, said rotary cutting and breaking means being disposed on a transverse axis relatively to the direction of advance thereof into said material, laterally spaced support members for said rotary cutting and breaking means, an intermediate portion of said rotary cutting and breaking means being disposed between said support members, first and second outer portions of said rotary cutting and breaking means one of which is disposed outwardly of one support member and the other of which is disposed outwardly of another of said support members for rotation thereof around said transverse axis, each of said laterally spaced support members comprising a housing that extends forwardly in the longitudinal direction to said transverse axis, means for driving said rotary cutting and breaking means, means connecting said driving means to said rotary cutting and breaking means, said connecting means comprising a first gear disposed on said transverse axis and a second gear disposed on an axis that is parallel to said transverse axis, said first gear and said second gear being disposed within said housing in longitudinal alignment and the second gear being drivingly connected to said first gear to drive the latter, said housing and said connecting means including said first gear being disposed between said intermediate portion of said rotary cutting and breaking means and each of said first and second outer portions of said rotary cutting and breaking means, auxiliary cutting and breaking means disposed between said intermediate portion of said rotary cutting and breaking means and each of said first and second outer portions of said rotary cutting and breaking means and extending around said housing, and driving connections of said rotary cutting and breaking means to said auxiliary cutting and breaking means to drive the latter about said transverse axis.

5. Mining apparatus as recited in claim 4 in which said first and second outer portions of said rotary cutting and breaking means each includes a spiral flight for feeding the material inwardly towards said first and second support members, and bits secured to the peripheries of said spiral flights.

6. Mining apparatus as recited in claim 4 in which said auxiliary cutting and breaking means comprise endless chains operating over and about said support members, and said driving connections of said auxiliary and rotary cutting and breaking means comprising interengaging elements disposed in an arc about said transverse axis, and wheel means disposed behind said support members in guiding and supporting engagement with said endless chains.

7. Mining apparatus as recited in claim 4 in which said first and second outer portions of said rotary cutting and breaking means each includes an extensible and retractable cutting and breaking element, and means for extending and retracting said cutting and breaking element to

lengthen and shorten said rotary cutting and breaking means, respectively.

8. Mining apparatus as recited in claim 4 in which said auxiliary cutting and breaking means comprises endless chains each having a plurality of links and pins connecting said links to each other for articulation thereof, and said driving connections of said auxiliary and rotary cutting and breaking means comprise lateral extensions of said pins, and driving teeth of said rotary cutting and breaking means engaging the lateral extensions of said pins.

9. Mining apparatus including a rotary cutting and breaking means adapted to be advanced into the material of a mine face to remove said material therefrom, said rotary cutting and breaking means being disposed on a transverse axis relatively to the direction of advance thereof into said material, first and second laterally spaced support members for said rotary cutting and breaking means each comprising a housing which extends forwardly in the longitudinal direction to said transverse axis, an intermediate portion of said rotary cutting and breaking means being disposed between said first and second support members, first and second outer portions of said rotary cutting and breaking means disposed outwardly of said first and second support members, respectively, for rotation of the rotary cutting and breaking means around said transverse axis, means for driving said rotary cutting and breaking means, first and second means connecting said driving means to said rotary cutting and breaking means and disposed in the housings of said first and second support members, respectively, said first and second connecting means each comprising a first gear disposed on said transverse axis and a second gear disposed on an axis that is parallel to said transverse axis, said first gear and said second gear being disposed within said housing in longitudinal alignment and the second gear being drivingly connected to said first gear to drive the latter, each of said housings and said connecting means including said first gear being disposed between said intermediate portion of said rotary cutting and breaking means and said first and second outer portions of said rotary cutting and breaking means, respectively, first and second auxiliary cutting and breaking means extending around each housing and disposed between said intermediate portion of said rotary cutting and breaking means and said first and second outer portions of said rotary cutting and breaking means, respectively, and driving connections of said intermediate portion and said first outer portion of the rotary cutting and breaking means to said first auxiliary cutting and breaking means, and driving connections of said intermediate portion and said second outer portion of the rotary cutting and breaking means to said second auxiliary cutting and breaking means, to drive the first and second auxiliary cutting and breaking means about said transverse axis.

References Cited by the Examiner

UNITED STATES PATENTS

624,400	5/1899	Surgi	299—82 X
3,062,518	11/1962	Osgood	299—89 X
3,088,718	5/1963	Lilly	299—87 X
3,141,703	7/1964	Gonski	299—89 X
3,157,438	11/1964	Lundquist	299—89 X

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