

[54] **CONTINUOUS MINING MACHINE**

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[22] Filed: **Dec. 22, 1971**

[21] Appl. No.: **210,916**

[52] U.S. Cl. **299/76, 299/64, 299/89**

[51] Int. Cl. **E21c 27/24**

[58] Field of Search **299/64, 75, 76, 78, 299/89**

[56] **References Cited**

UNITED STATES PATENTS

2,758,826	8/1956	Paget	299/89 X
3,290,096	12/1966	Stalker	299/78
3,101,932	8/1963	Wright	299/89 X
3,307,880	3/1967	Newton et al.	299/89 X

Primary Examiner—Ernest R. Purser

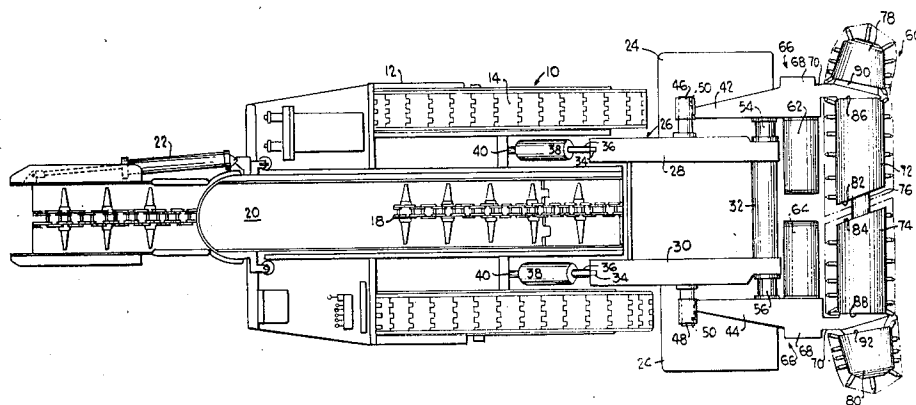
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[57] **ABSTRACT**

The continuous mining machine includes a body portion mounted on endless tracks with a boom member pivotally secured thereto and extending forwardly therefrom. A drum member is rotatably mounted on the front end of the boom member and has cutting el-

ements extending therefrom. The drum member has a pair of axially aligned intermediate sections and a pair of end sections arranged in non-parallel relation with the intermediate sections, and extending forwardly relative thereto. Along the front portion of the drum member the end section inner edge portions are positioned closely adjacent to the outer edge portions of the intermediate sections so that the cutting elements extending therefrom overlap to provide a continuous cutting pattern along the drum member front portion. The drum member end section inner edge portions are spaced from the intermediate section outer edge portions along the rear portion of the drum member to provide an opening between the end sections and the intermediate sections along the rear portion of the drum. The boom member has front end portions extending through the openings into the inner portion of the drum member to rotatably support the drum member. The drum member drive means includes an input shaft extending through the opening and drivingly connected through a planetary gear arrangement within the drum member intermediate sections to the drum member intermediate section and end section. A universal connection is provided between the planetary gear arrangement and the drum member end section.

16 Claims, 4 Drawing Figures



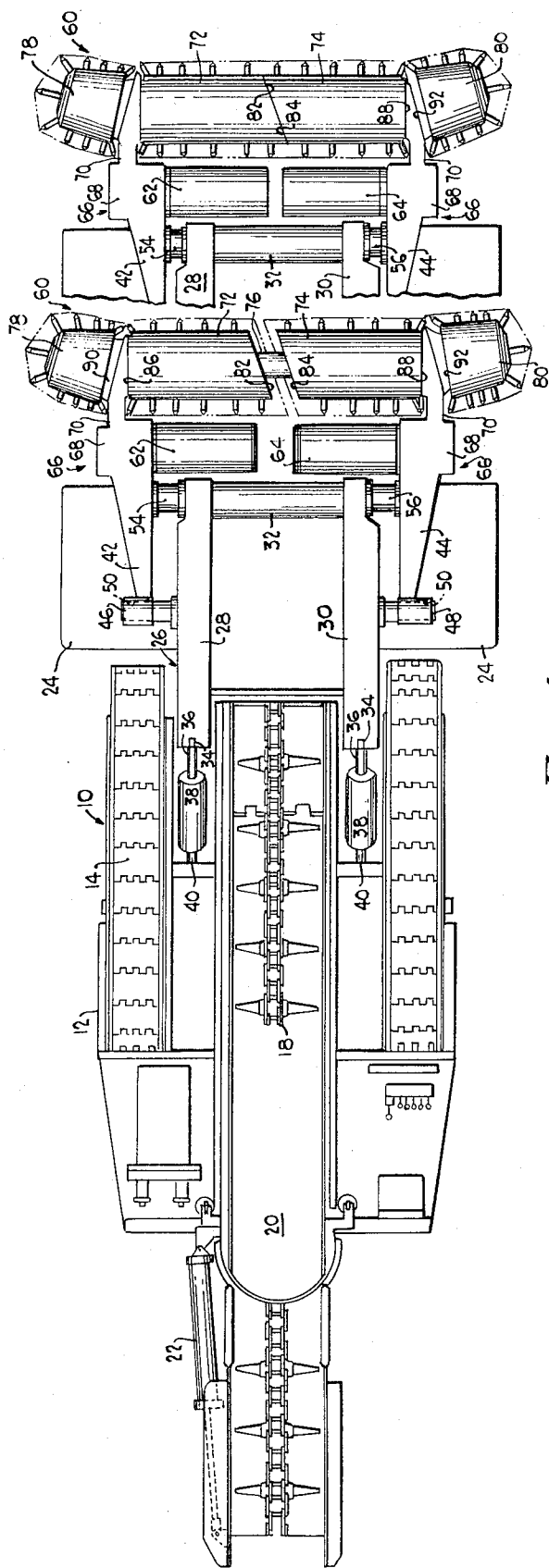


Fig. 1.

Fig. 2.

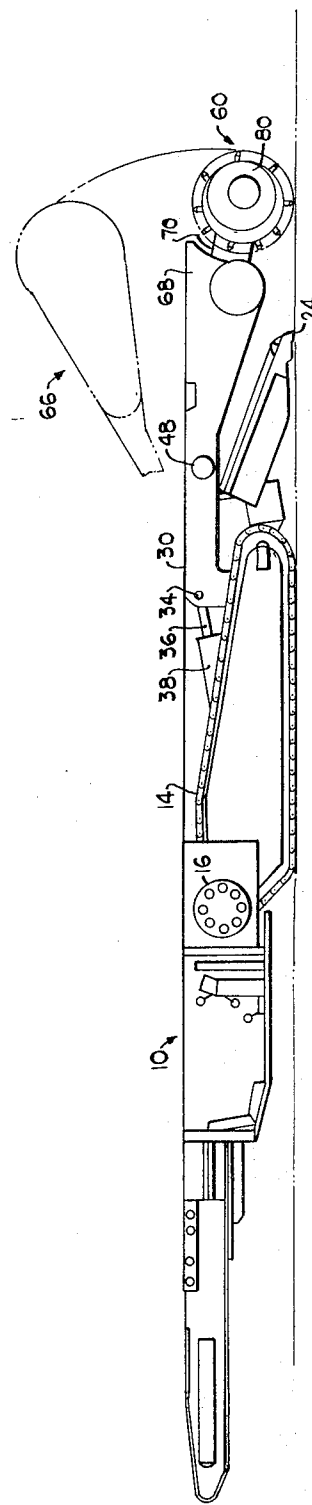


Fig. 3.

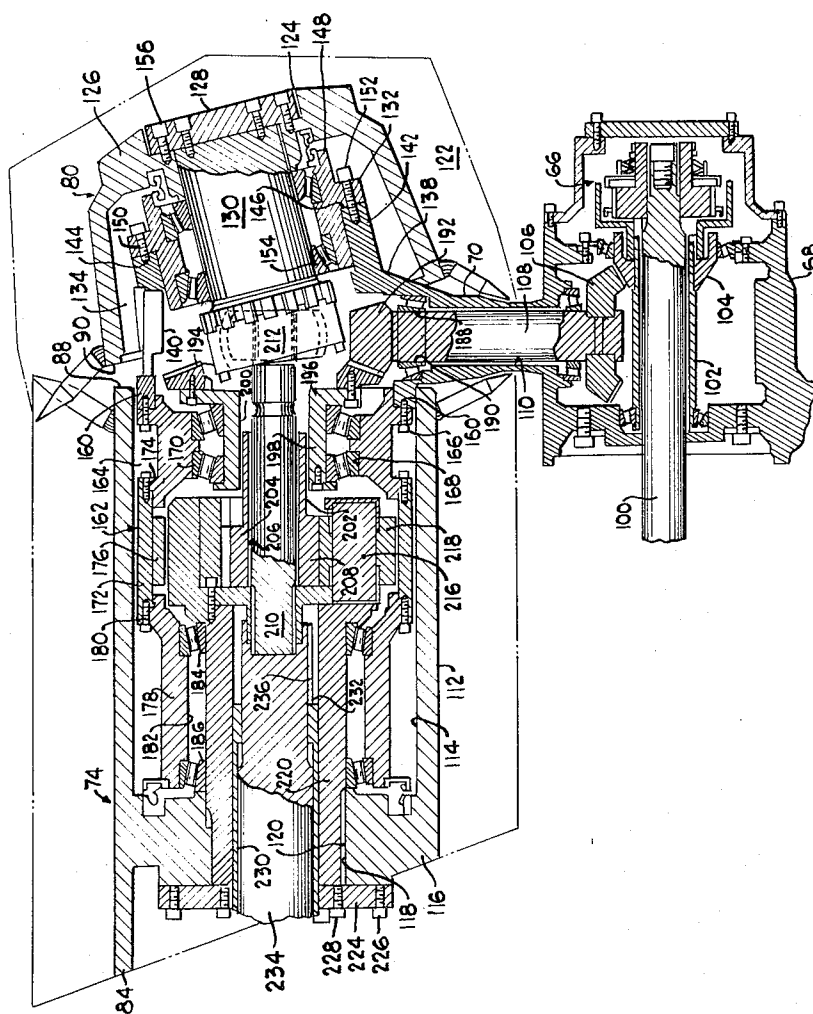


Fig. 4.

CONTINUOUS MINING MACHINE

CROSS-REFERENCE TO RELATED APPLICATIONS

A co-pending application, Ser. No. 155,177, entitled "Continuous Mining Machine," is directed to a continuous mining machine having overlapped intermediate sections to provide a continuous longitudinal cutting pattern along the length of the drum member. This co-pending application is assigned to the same assignee as the instant application.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a continuous mining machine and more particularly to a mining machine having a transversely extending drum-like dislodging device with openings therein for rotatably supporting and rotating the drum member.

2. Description of the Prior Art

Continuous mining machines with transverse cutting elements positioned in front of the mining machine are known. U.S. Pat. Nos. 2,695,164 and 3,310,347 disclose a pair of boom members extending forwardly from the mining machine frame with disc like rotatable dislodging elements mounted thereon. The dislodging elements are arranged to both rotate and move transversely while dislodging material from the face.

These mining machines are dependent upon the oscillating transverse movement of the dislodging elements to dislodge material across their entire face. U.S. Pat. Nos. 2,721,733; 3,109,636 and 3,305,273 disclose mining machines having a full face drum that is arranged to dislodge material from the face without transverse oscillating movement. The support means and drive means for the drum includes fixed portions of the boom member extending around the drum as is illustrated in U.S. Pat. No. 3,305,273. Endless chain elements are required to extend over the fixed housing to dislodge the material from the face within the width of the fixed housing.

In U.S. Pat. No. 3,109,636 the boom member has forwardly extending arm portions that form bearing supports for the drum member. Drive shafts extend along the drum member arm portions into the inner portion of the drum to rotate the drum. The bearing supports on the front end of the boom member do not rotate with the boom member and do not dislodge material from the face along the width of the bearing supports.

In U.S. Pat. No. 2,721,733 sprocket members are provided along the end of the drum. Endless drive chains are connected to the sprockets and rotate the drum. Cutter bits extend outwardly from the chains to dislodge the material along the width of the chains. There is a need for a full face drum type mining machine that has a continuous longitudinal cutting pattern along the length of the drum member without auxiliary cutting devices extending around fixed bearing supports of the boom member.

SUMMARY OF THE INVENTION

The hereinafter described invention relates to a continuous mining machine that has an elongated body portion with a boom member pivotally secured thereto and extending therefrom. A drum member with cutting elements extending therefrom is rotatably mounted on the front of the boom member transversely to the body

portion. The drum member has an intermediate portion and at least one end section. The end section extends angularly to the intermediate portion so that certain of the cutting elements mounted on the drum member overlap along the front of the drum member to provide a continuous cutting pattern along the length of the drum member. A portion of at least one of the drum member end sections is spaced from the drum member intermediate portion and form an opening therebetween. Drive means are provided for rotating the drum member. The drive means extend through the opening into the drum member.

The boom member has a front end portion extending through the opening between the drum member end section and drum member intermediate portion and has laterally extending intermediate section support means and end section support means. A drive shaft extends through the opening and is connected through the planetary gearing in the intermediate section to both the intermediate section and the end section of the drum member to rotate the drum member sections.

Accordingly, the principal object of this invention is to provide a full face drum type mining machine without external fixed bearing supports for the drum member extending around the drum member.

Another object of this invention is to eliminate the auxiliary chain type dislodging device on a full face drum type mining machine.

These and other objects of this invention will be more completely disclosed and described in the following specification, the accompanying drawings and the appended claims.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top plan view of my improved mining machine, illustrating the drum member in an extended position and the bit pattern for the drum member in an extended position.

FIG. 2 is a fragmentary view of the mining machine, illustrating the drum member in a retracted position.

FIG. 3 is a view in side elevation of the mining machine illustrated in FIG. 1 with the path followed by the drum member shown in phantom lines.

FIG. 4 is a view in section of a portion of the drum member, illustrating the manner in which the elements of the drum are driven.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings and particularly FIGS. 1, 2 and 3, there is illustrated a continuous mining machine generally designated by the numeral 10 that has a body or frame portion 12 suitably mounted on endless crawler tracks 14. Hydraulic motors 16 are provided to propel the mining machine 10 on the endless crawler tracks 14 to advance the mining machine during mining operation. An endless conveyor mechanism 18 is positioned in a longitudinal trough member 20 and conveys dislodged material therein from the front of the mining machine to an articulated rear discharge section 22. As illustrated in FIG. 3, a gathering device 24 extends forwardly from the body portion 12 and is arranged to gather the dislodged material and feed the dislodged material onto the conveyor trough 20 so that the dislodged material can be conveyed rearwardly by the endless conveyor mechanism 18 to the discharge section 22.

A forwardly extending boom member generally designated by the numeral 26 has a pair of parallel rearwardly extending arm members 28 and 30 that are connected to each other adjacent the front end portion by a transverse housing 32. The arm members 28 and 30 are pivotally connected to the mining machine body portion 12 and are also pivotally connected at 34 to a piston rod 36 of the piston cylinder assembly 38. The pair of shear piston cylinder assemblies 38 are, in turn, pivotally connected to the mining machine body portion at 40. With this arrangement, extension and retraction of the piston rods 36 within the piston cylinder assemblies 38 pivot the boom member about the rear end portions of the respective arm members 28 and 30 and move the boom member 26 vertically to the position illustrated in phantom lines in FIG. 3 for the upward shear cut by the drum. It should be understood that the mining machine may be constructed to advance into the face with the boom member in its upper position as illustrated in phantom lines in FIG. 3 and the piston cylinder assemblies 38 are arranged to pivot the boom member 26 downwardly to the position illustrated in solid lines in FIG. 3 to thus dislodge material by a downward shear cut.

The boom member 26 has a second pair of parallel arm or support members 42 and 44. The arms 42 and 44 are supported adjacent a rear end portion on stabilizer rods 46 and 48 that are secured to and extend laterally from the respective arm members 28 and 30. The stabilizer rods 46 and 48 have a generally cylindrical configuration and extend through cylindrical passageway 50 in the respective arm members 42 and 44.

The housing 32 that supports the ends of the arm members 28 and 30 in spaced parallel relation to each other has a cylinder therein with piston rods 54 and 56 extending outwardly therefrom. The piston rods 54 and 56 are secured at one end to the respective arm members 42 and 44 and to pistons within the cylinder in the transverse housing 32. Suitable means are provided to supply hydraulic fluid under pressure to the cylinder within housing 32 to move the respective piston rods 54 and 56 laterally and thus move the arm members 42 and 44 laterally relative to the fixed arm members 28 and 30. The lateral movement of the arms 42 and 44 either extends or retracts the drum member generally designated by the numeral 60. The drum member 60 has a front portion 61 and a rear portion 63 and is illustrated in the extended position in FIG. 1 and in a retracted position in FIG. 2.

Drum rotating motors 62 and 64 are secured to the laterally movable arm members 42 and 44 and are preferably positioned therebetween. The motors 62 and 64 may be either electrical or hydraulic motors that are arranged as later described to rotate the drum member. The motors 62 and 64 are connected through clutch mechanisms generally designated by the numeral 66 to the drive gearing for the drum member 60. The drum member 60 is supported from a housing 68 which forms a portion of the arm members 42 and 44 which are, in turn, portions of the boom member 26. The clutch members 66 are positioned in the housings 68. The arms 42 and 44 have forwardly extending nonrotatable annular housing portions 70 on which the rotatable portions of the drum member 60 are mounted. As later described, drive means extend through the housing portions 70 and are connected to gearing within the

drum member 60 and are arranged to rotate the drum member 60 to dislodge material from the face.

The drum member 60 has an intermediate portion comprising a pair of intermediate sections 72 and 74 that are connected to each other by a shaft 76. The drum member 60 has a pair of canted end sections 78 and 80 that are rotatably supported by the housing portions 70 for rotation with the intermediate sections 72 and 74. The respective intermediate section 72 and end section 78 and intermediate section 74 and end section 80 are arranged to move as units toward and away from each other on the connecting shaft 76 to extend and retract the drum member 60. The intermediate sections 72 and 74 have inner annular wall members 82 and 84 and outer annular wall members 86 and 88 that extend in nonparallel relation to the longitudinal axis of the drum member intermediate portions 72 and 74.

In the extended position, as is illustrated in FIG. 1, the bit pattern for the intermediate section adjacent the inner walls 82 and 84 overlap in both an extended and retracted position so that in the extended position the drum member 60 dislodges material along the entire length of the face. The canted end sections 78 and 80 have inner annular edge portions 90 and 92 which are substantially perpendicular to the axis of the canted end sections 78 and 80. The outer walls 86 and 88 of the intermediate sections are substantially perpendicular to the longitudinal axis of the intermediate sections 72 and 74. The drum member end sections 78 and 80 are so positioned that the bit pattern of the row of bits along the annular inner edge portions 90 and 92 overlaps the bit pattern of the row of bits along the drum member intermediate portions outer edge portions 86 and 88 along the front 61 of the drum member 60 and the bit patterns divert rearwardly and are spaced along the rear 63 of drum member 60. This feature is clearly illustrated in FIGS. 1, 2 and 4 and provides clearance for the boom member front end portion 70. With this arrangement the front portion 61 of the drum member 60, as viewed in FIGS. 1 and 2, is arranged to dislodge a continuous kerf of material from the face without leaving unmined or dislodged portions in the face. As is illustrated in FIG. 3, the upper portion and lower portions of the drum member are arranged to form a relatively horizontal linear floor and roof in the material being dislodged from the face. It will thus be apparent with the above described drum member 60 that it is now possible to dislodge a full face with the drum member 60 without the use of chains or other auxiliary apparatus to dislodge the unmined material at the location where the boom member rotatably supports the drum member.

Now referring to FIG. 4, there is illustrated in detail the drive gearing for the drum member intermediate section 74 and the end section 80. It should be understood that the drive gearing for the other drum member intermediate section 72 and end section 78 is similar to that illustrated in FIG. 4 and the description will be confined to the drive means for drum member intermediate section 74 and end section 80.

The drive motor 64 illustrated in FIG. 1 has a drive shaft 100 extending therefrom into the housing 68. The drive shaft 100 extends through a tubular shaft 102 and is rotatable relative thereto. The tubular shaft 102 is drivingly connected to drive shaft 100 by a clutch mechanism generally designated by the numeral 66 within the clutch housing portion 68. A drive bevel

gear 104 is secured to the tubular shaft 102 for rotation therewith. A driven bevel gear 106 meshes with the bevel gear 104 and is connected to the input shaft 108. The input shaft 108 extends through a cylindrical passageway 110 in the boom member housing 70 into the inner portion of the drum member 60.

The drum member intermediate portion 74 has a cylindrical body portion 112 with an outer bit supporting wall. The body portion 112 has an outer annular edge or wall 88 and an inner annular edge or wall 84 and an internal cavity 114.

The body portion 112 has an inwardly extending cylindrical supporting portion 116 with an axial passageway 118 therein. The passageway 118 has an inner cylindrical wall with a splined portion 120.

The drum member end section 80 has a body portion 122 with an outer bit support wall and a generally cup shaped configuration with an inner annular edge portion 90 and an opening 124 in the end portion 126. A circular cap member 128 is arranged to be positioned in the opening 124 and secure the body portion 122 to an output shaft 130 positioned within cavity 134 of drum member end section 80. The output shaft 130 is suitably mounted on bearings within an annular fixed support member 132 within cavity 134 of body portion 122.

The housing 70 has an annular front end portion 138 with an axial opening 140 therein. The end portion 138 has an angularly extending annular support flange 142 that extends into the cavity 134 of body portion 122 and has a plurality of bolt holes 144 in the outer edge 146. A cylindrical support member 148 has bolt holes 150 therein that are in overlying relation with the bolt holes 144 in flange 142. Bolts 152 secure the cylindrical support member 148 to the outwardly extending annular flange 142 and have a tapered roller bearing assembly 154 mounted thereon. Thus, the drum member end section output shaft 130 is rotatably supported on the roller bearing assembly 154 within the annular support member 148 that is, in turn, secured to the flange 142 of housing 70. The drum member end section body portion 122 is secured to the output shaft 130 by means of bolts 156 through cap member 128. The cap member 128 is, in turn, secured to the drum member end section body portion 122 by bolts 158.

The boom member annular front end portion 138 has an oppositely extending annular flange 160 to which there is connected an inner support member having a generally cylindrical configuration and generally designated by the numeral 162 for the intermediate drum member 74. The support member 162 includes an annular end portion 164 bolted to the flange 160 of housing front wall 138 by bolts 166. The annular end portion 164 has an inner cylindrical wall 168 that supports a tapered roller bearing 170. The inner support member 162 has an intermediate annular portion 172 that is bolted to the end portion 164 along one edge by bolts 174. The intermediate portion 172 has internal gear teeth that form the ring gear 176 of a planetary gear arrangement, later described. The inner support member 162 has another annular end portion 178 that is bolted at one edge to the intermediate portion 172 by bolts 180 and has an inner cylindrical wall 182 that supports a pair of spaced tapered roller bearings 184 and 186.

With the described elements the boom member housing 70 has an annular front edge portion 138 that non-rotatably supports the outer drum support portion 148

and also non-rotatably supports the intermediate drum support portion 162 with the drum intermediate section body portion 122 and drum outer section body portion 112 rotatably mounted thereon and is driven by the drive train hereinafter described. The input shaft 108 is rotatably supported on bearings 188 and 190 within the passageway 110 of housing 70 and has a bevel pinion 192 connected to the end portion extending into the opening between outer drum section body portion 122 and intermediate drum section body portion 112. A bevel gear 194 meshes with the bevel pinion 192 and is secured to a radial flange 196 on a tubular shaft 198. The tubular shaft 198 is rotatably supported by bearing 170 in the fixed inner support member 162 annular end portion 164. The tubular shaft 198 has an inner wall 200 with a splined portion 202. A sun gear 204 has an axial bore 206 therethrough and a tubular shaft portion 208 extending laterally therefrom. The tubular shaft portion 208 is splined to tubular shaft 198 at portion 202 to drivingly connect the sun gear 204 to the bevel gear 194. With this arrangement rotation of bevel pinion 192 on input shaft 108 rotates the meshing bevel gear 194 which, in turn, through the splined connection 202 rotates the sun gear 204 of the planetary gear train.

A shaft 210 extends through the axial bore 206 of sun gear 204 and is rotatable relative thereto. One end of the shaft 210 is connected through a universal joint generally designated by the numeral 212 to the output shaft 130 in the drum end section 80. The universal joint 212 may be a ball type Rezeppa joint or any other suitable universal joint. A planet gear cage generally designated by the numeral 214 has a plurality of planet gear support shafts 216 mounted therein with planet gears 218 positioned thereon. The planet gears 218 mesh with the sun gear 204 and the ring gear 176. With this arrangement rotation of the sun gear 204 revolves the planet gears 218 on the fixed ring gear 176. The planet cage 214 rotates about the axis of the sun gear 204 which is concentric with the axis of the intermediate drum section 74.

An intermediate drum output shaft 220 has a flanged end portion 222 splined to the planet cage 214 for rotation therewith. The other end of the intermediate drum output shaft 220 is connected by a splined connection to the inner support portion 116 and annular cap member 224 secures the drum intermediate section body portion 112 to the intermediate section output shaft 220 by means of bolts 226 and 228. The output shaft 220 is supported by bearings 184 and 186 for rotation relative to the annular end portion 178 of inner support member 162. A tubular shaft 230 is positioned within the axial bore of intermediate drum output shaft 220 and has an inwardly extending annular shoulder portion 232 adjacent the inner end. An axial connecting shaft 234 extends through the axial bore of shaft 230 and has an outwardly splined end portion 236 that mates with the splines 232 of shaft 230. With this arrangement the drum member sections 74 and 80 are movable laterally on the connecting shaft 234 to an extended position where the tubular shaft end portion 230 abuts the snap ring 238 on the end of connecting shaft 234. The drum member sections 74 and 80 are illustrated in FIG. 4 in a retracted position. It should be noted that the drum member 60 may be extended or retracted without interfering with the drive train for the sections of the drum member.

It will thus be apparent from the above description that the input shaft 108 is arranged to drive both the intermediate section 74 and outer section 80 of drum member 60. The intermediate section 74 is driven through the bevel gear 194 with its tubular shaft end portion 198 nonrotatably connected to the tubular shaft end portion 208 of sun gear 204. The sun gear 204 driven by bevel gear 194 will, upon rotation, revolve the planet gears 218 about the fixed ring gear 176 to thus rotate the planet cage 214 about the ring gear 176 at a lower angular velocity than the sun gear 204. This provides a speed reduction between the input shaft 108 and output shafts 130 and 220. The planet cage 214 is connected to the drum member intermediate section output shaft 220 so that rotation of the planet cage 214 is transmitted to the output shaft 220 and to the drum member intermediate section outer bit support wall 112. To drive the outer drum section 80 the planet cage 214 is nonrotatably secured to the axial shaft 210 by a splined connection so that the shaft 210 rotates with the planet cage 214 at the same angular velocity as planet cage 214. The shaft 210 extends through the sun gear 204 and axial bore 206 and is connected by means of the universal joint 212 to the output shaft 130 of drum end section 80.

According to the provisions of the patent statutes, I have explained the principle, preferred construction and mode of operation of my invention and have illustrated and described what I now consider to represent its best embodiments. However, it should be understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. A continuous mining machine comprising, an elongated body portion mounted on propelling means, a boom member pivotally secured to said body portion and extending forwardly therefrom, a drum member rotatably mounted on the front of said boom member transversely to said body portion, said drum member having cutting elements extending therefrom, said drum member having an intermediate portion and a pair of end sections, said end sections extending angularly to said intermediate portion so that certain of said cutting elements mounted on said drum member overlap along the front of said drum member to provide a continuous cutting pattern along the length of said drum member, a portion of said pair of said drum member end sections spaced from said drum member intermediate portion and forming a pair of openings therebetween, and drive means for rotating said drum member extending through said openings into said drum member.
2. A continuous mining machine as set forth in claim 1 in which, said drum member intermediate portion includes an intermediate section having a generally cylindrical configuration with a longitudinal axis, said intermediate section longitudinal axis arranged substantially perpendicular to the longitudinal axis of said elongated body portion, said drum member end section having a longitudinal axis, and

said drum member end section longitudinal axis arranged in nonparallel relation with said drum member intermediate section longitudinal axis with said drum member end section longitudinal axis intersecting said drum member intermediate section longitudinal axis and extending forwardly therefrom.

3. A continuous mining machine as set forth in claim 1 in which,

said drum member intermediate portion includes a pair of longitudinally aligned intermediate sections, means nonrotatably connecting said intermediate sections to each other,

said intermediate sections have adjacent overlapped inner edge portions operable to maintain a continuous cutting pattern between said intermediate sections, and

means to move said inner edge portions of said intermediate sections toward and away from each other while in overlapped relation to thereby extend and retract said drum member.

4. A continuous mining machine as set forth in claim 1 in which,

said drum member intermediate portion includes an intermediate section having a generally cylindrical configuration with an outer annular edge portion, at least one of said drum member end sections having an inner annular edge portion, and

said drum member intermediate section and said end section rotatably mounted with said end section inner annular edge portion positioned in spaced nonparallel relation to said intermediate section outer annular edge portion, a portion of said end section inner annular edge portion positioned adjacent to a portion of said intermediate section outer annular edge portion so that cutting elements extending from said intermediate section and said end section adjacent to said respective edge portions overlap along the front portion of said drum member to dislodge material in front of said end section inner annular edge portion and said intermediate section outer annular edge portion.

5. A continuous mining machine as set forth in claim 4 in which,

said drum member rear portion having said end section inner annular edge portion spaced from said intermediate section outer annular edge portion to thereby provide an opening therebetween, and said boom member having a portion extending through said opening and rotatably supporting said drum member thereon.

6. A continuous mining machine as set forth in claim 5 in which,

said boom member includes an annular front end portion extending through said opening into said drum member, end section support means extending laterally from said boom member annular front end portion, and said end section rotatably supported on said end section support means.

7. A continuous mining machine as set forth in claim 5 in which,

said boom member includes an annular front end portion extending through said opening into said drum member, annular end section support means extending laterally from said boom member annular front end por-

tion into said drum member end section, said end section rotatably supported on said annular end section support means,

intermediate support means having a generally cylindrical configuration with a longitudinal passageway therethrough, said intermediate support means extending laterally from said boom member annular front end portion into said drum member intermediate section, said intermediate section rotatably supported on said intermediate support means.

8. A continuous mining machine as set forth in claim 5 which includes, drive means to rotate said drum member, said drive means extending through said opening.

9. A continuous mining machine as set forth in claim 5 in which, said boom member includes an annular front end portion extending through said opening into said drum member,

intermediate section support means extending laterally from said boom member annular front end portion, said intermediate section rotatably supported on said intermediate section support means.

10. A continuous mining machine as set forth in claim 9 which includes,

an input shaft rotatably supported by said boom member and extending into said drum member through said opening,

planetary gear means positioned in said drum member intermediate section, said planetary gear means including a sun gear, a plurality of planet gears meshing with said sun gear and mounted in a planet cage and a ring gear meshing with said planet gears, said intermediate support means for said ring gear nonrotatably mounted thereon,

means drivingly connecting said sun gear to said input shaft to transmit rotation from said input shaft to said sun gear, and

said drum member intermediate portion connected to said planet cage so that upon rotation of said sun gear said planet gears and planet cage revolve on said ring gear about said sun gear and rotate said drum member intermediate section.

11. A continuous mining machine as set forth in

claim 10 in which,

said intermediate section support means has a generally cylindrical configuration with a longitudinal passageway therethrough, and

said planetary gear means positioned in said intermediate support means longitudinal passageway.

12. A continuous mining machine as set forth in claim 10 in which,

said drum member includes an end section supporting means extending laterally from said boom member annular front end portion,

said end section rotatably supported on said end section support means,

connecting means drivingly connecting said input shaft to said drum member end section to rotate said drum member end section.

13. A continuous mining machine as set forth in claim 12 in which said connecting means includes means connecting said planet cage to said drum member end section to transmit rotation of said planet cage to said drum member end section.

14. A continuous mining machine as set forth in claim 12 which includes,

a first shaft member connected at one end to said planet cage,

an end section output shaft connected to said drum member end section, and

universal means connecting the other end portion of said first shaft member to said end section output shaft.

15. A continuous mining machine as set forth in claim 14 in which,

said universal means positioned within said annular boom member front end portion.

16. A continuous mining machine as set forth in claim 14 in which,

said drum member end section support means includes an axial passageway therethrough, said drum member end section output shaft extending through said axial passageway and connected at one end to said drum member end section, and said drum member end section output shaft rotatably supported in said drum member end section support means axial passageway.

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