United States Patent [19]

LeBegue

[11] **3,848,930**

[45] **Nov. 19, 1974**

[54] **CONTINUOUS MINING MACHINE WITH DRIVE TO ANGLED END SECTIONS**

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[73] Assignee: **National Mine Service Company,** Pittsburgh, Pa.

[22] Filed: **Oct. 17, 1973**

[21] Appl. No.: **407,171**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 210,916, Dec. 22, 1971, Pat. No. 3,774,969.

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

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

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

[56] **References Cited**

UNITED STATES PATENTS

2,758,826	8/1956	Paget	299/89 X
3,101,932	8/1963	Wright	299/89 X

Primary Examiner—Ernest R. Purser

Attorney, Agent, or Firm—Stanley J. Price, Jr.

[57] **ABSTRACT**

The continuous mining machine has 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 elements extending radially therefrom. The drum member has a cylindrical intermediate section and a pair of canted end sections having a configuration of a segment of a cone. The end sections have radially extending cutter bits with the inner rows of bits overlapping the end rows of bits on the intermediate section to provide a continuous cutting pattern along the entire length of the drum member. The canted end sections provide an opening between the intermediate section and the respective end sections for the boom member front end portions. The drive means for the drum member includes input shafts extending through the openings between the drum member intermediate section and the canted end sections. Pinion gears on the drive shafts mesh with bevel gears secured to the drum member intermediate section. The canted end sections are driven by gearing meshing with the bevel gears or directly from the bevel gears through a universal type joint.

9 Claims, 5 Drawing Figures

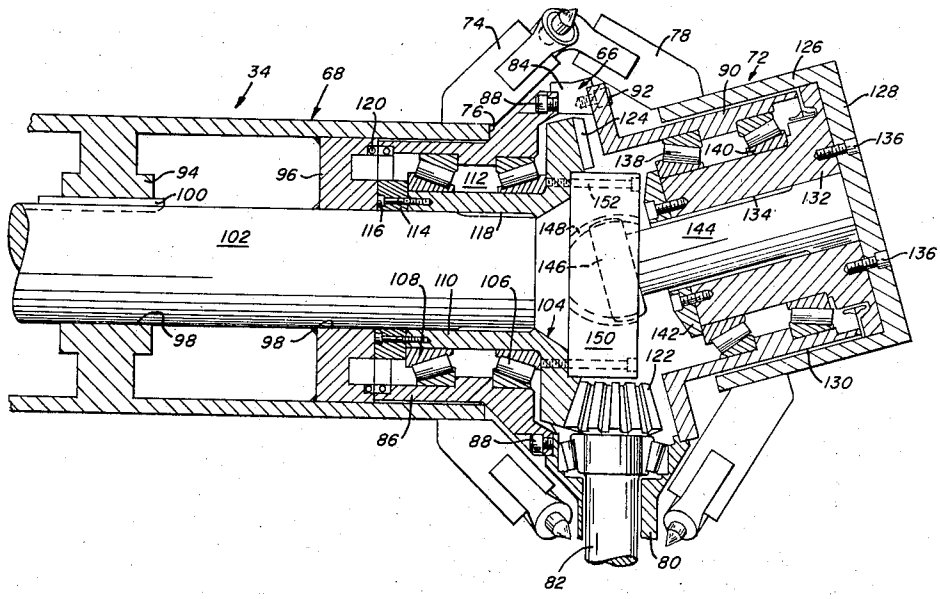


FIG. 1

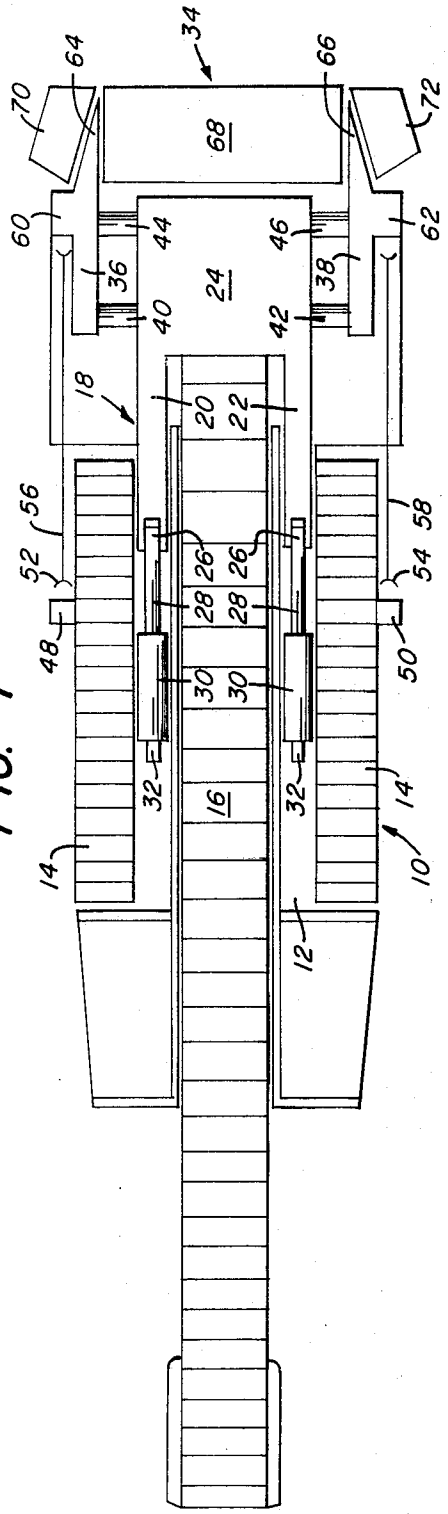


FIG. 5

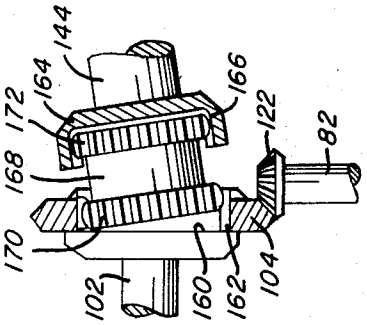


FIG. 4

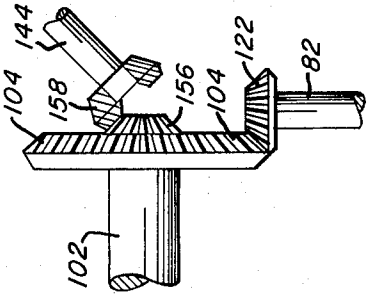
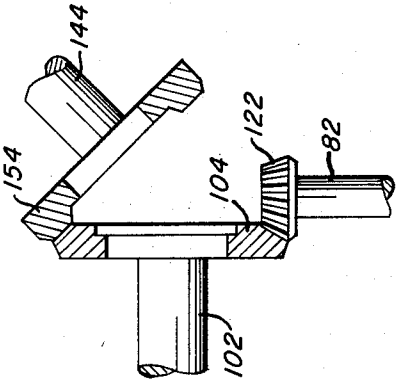


FIG. 3



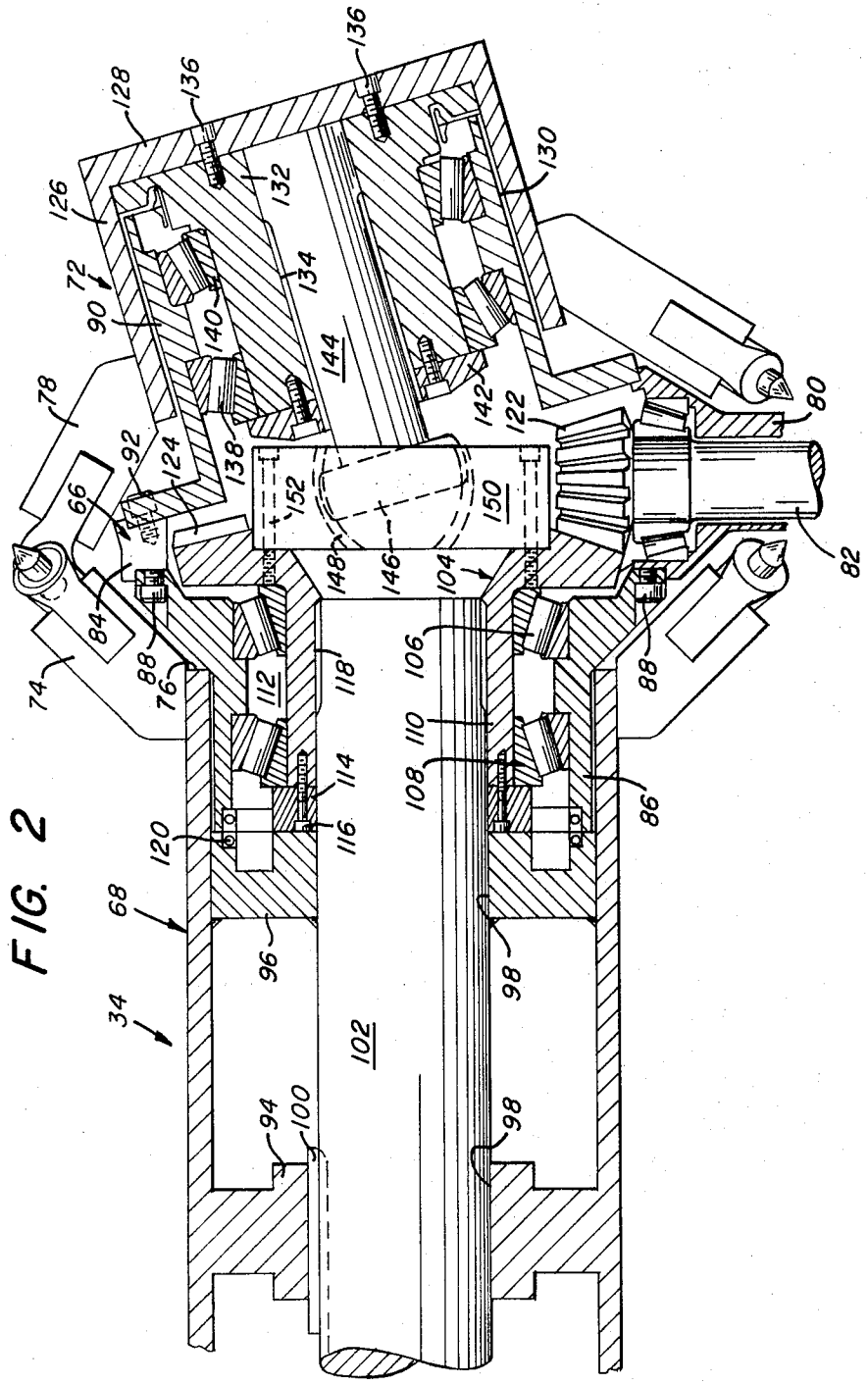

136
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FIG. 2

CONTINUOUS MINING MACHINE WITH DRIVE TO ANGLED END SECTIONS

CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of copending application Ser. No. 210,916 entitled, "A Continuous Mining Machine" filed on Dec. 22, 1971 now U.S. Pat. No. 3,774,969.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a drum-type, continuous mining machine and more particularly to a drum-type mining machine with a drum having a cylindrical intermediate section and canted end sections.

2. Description of the Prior Art

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 of the drum. The support means and drive means for the drum include fixed annular end portions of the boom member extending around the external surface of the drum, as is illustrated in U.S. Pat. No. 3,305,273. Endless chain elements with cutter bits mounted thereon extend around the support means to dislodge material from the face along the width of the annular end portions of the supporting boom.

In copending application Ser. No. 210,916, there is disclosed a mining machine with a drum member rotatably supported by annular end portions of a boom member. The drum member has an intermediate section and canted end sections with rear openings between the inner ends of the end sections and the outer ends of the intermediate section. Input shafts extend through these openings and have drive pinions meshing with bevel gears rotatably supported within the drum member intermediate section. The bevel gears are splined to shafts with sun gears of planetary gear trains nonrotatably mounted thereon. The plant cages are secured to the intermediate drum and rotate as the planet gears revolve around the respective sun gears. The planet cages are also connected through universal joints to the adjacent drum canted end sections. The above planetary drive is suitable for drum-type mining machines in which the drum has a sufficient diameter to accommodate the above discussed planetary gearing and the gearing has sufficient size and strength to withstand the stresses encountered during the mining operation. In smaller mining machines suitable for mining thin seams of material, the diameter of the drum and the size of the drive gearing are severely limited by seam thickness.

U.S. Pat. Nos. 2,758,826; 3,290,096; 3,101,932 and 3,307,880 were cited in the above named copending application. U.S. Pat. No. 2,758,826 discloses a drum-type cutting head having two sections that extend forwardly at an angle to each other. The sections are driven by a complex gear drive that includes a pinion bevel gear main drive. The bevel gear, in turn, drives a spur gear train that has a pair of bevel gears connected to one of the spur gears. The pair of bevel gears, in turn, mesh with bevel gears connected to the drum sections. U.S. Pat. No. 3,101,932 discloses a digging machine with canted end sections and a universal between the canted end sections of the drum.

SUMMARY OF THE INVENTION

The hereinafter described invention relates to a drum-type mining machine having an elongated body portion mounted on propelling means. A boom member is pivotally secured to the body portion and extends forwardly therefrom. A drum member is rotatably mounted on the front end of the boom member and extends transversely to the body portion. The drum member has cutting elements extending therefrom and includes an intermediate section and a pair of end sections. The end sections extend angularly to the intermediate section 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. The pair of drum member end sections have rear portions spaced from the drum member intermediate section and form a pair of openings between the end sections and the intermediate section. Drive shafts for rotating the drum member extend through the pair of openings. Bevel gear drive means are positioned within the drum member and are nonrotatably secured to the intermediate section. Pinion gears secured to the drive shafts mesh with the respective bevel gears. Other means drivingly connect each of the bevel gears to the adjacent end sections so that the input shafts rotate the drum member intermediate section and end sections.

The means that drivingly connect the bevel gear to the adjacent end sections include a universal means connecting the respective bevel gears to the end sections. Another embodiment includes second bevel gears nonrotatably connected to the end sections and meshing with the bevel gears secured to the drum intermediate section. Another embodiment includes bevel gears of reduced diameter nonrotatably secured to the bevel gears meshing with the drive pinions. The bevel gears nonrotatably connected to the end sections mesh with the bevel gears of reduced diameter. Another embodiment includes inwardly extending annular gear portions on the bevel drive gears and annular gear members with inwardly extending gear teeth secured to both of the end sections. Compound gears each have one gear portion meshing with the inner gear portion of the respective bevel gears and a second gear portion meshing with the respective annular gear members secured to the end sections.

Accordingly, the principal object of this invention is to provide a drum-type mining machine suitable for use in relatively thin seams.

Another object of this invention is to provide a continuous mining machine having a drum member with an intermediate section and canted end sections that are rotated by a bevel gear type drive.

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

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic illustration of my improved mining machine illustrating the drum member with the intermediate section and canted end sections.

FIG. 2 is a fragmentary view in section of a portion of the drum member illustrating the manner in which

the intermediate section and one of the end sections are driven.

FIGS. 3, 4 and 5 are schematic illustrations of other types of drive arrangements for the drum member intermediate section and canted end sections.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings, and particularly FIG. 1, 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. Suitable drive means are provided to propel the mining machine 10 on the endless crawler tracks 14 to advance the mining machine during the mining operation. An endless conveyor mechanism 16 is positioned in a longitudinal trough member and is arranged to convey dislodged material from the front of the mining machine to a receiver positioned rearwardly of the mining machine. A suitable gathering device is provided for gathering the dislodged material and feeding the dislodged material onto the conveyor 16 so that the material can be conveyed rearwardly thereon.

A forwardly extending boom member generally designated by the numeral 18 has a pair of parallel rearwardly extending arm members 20 and 22 that are connected to each other adjacent the front end portion by a transverse housing 24. The arm members 20 and 22 are pivotally connected to the mining machine frame member 12 and are also pivotally connected at 26 to piston rods 28 of piston cylinder assemblies 30. The piston cylinder assemblies 30 are, in turn, pivotally connected to the mining machine frame portion 12 at 32 so that the piston cylinder assemblies 30 are arranged to pivot the boom member 18 about the respective end portions of the arm members 20 and 22 to move the boom member 18 vertically for an upward or downward shear cut of the mine face by the drum member generally designated by the numeral 34.

The boom member 18 has a second pair of parallel arm or support members 36 and 38 that are supported adjacent their rear end portions by stabilizer rods 40 and 42. The stabilizer rods 40 and 42 have a generally cylindrical configuration and extend through suitable cylindrical passageways in the respective arm members 36 and 38.

The transverse housing 24 that supports the ends of the boom arm members 20 and 22 in spaced parallel relation to each other has a cylinder therein with piston rods 44 and 46 extending outwardly therefrom. The piston rods 44 and 46 are secured at one end to the respective boom arm members 36 and 38 and to the pistons within the cylinder in the transverse housing 24. Suitable means may be provided, as is described in copending Application Ser. No. 210,916, to move the piston rods 44 and 46 outwardly to extend the intermediate section of the drum during the mining operation. Where the intermediate section of the drum is unitary so that the drum has a fixed longitudinal dimension, the rods 44 and 46 may be similar to the rods 40 and 42 to support the boom arms 36 and 38 from the tranverse housing 24. Drum rotating motors diagrammatically illustrated at 48 and 50 are connected through universal joints 52 and 54 to input drive shafts 56 and 58. The drum rotating motors 48 and 50 may be either electric or hydraulic motors that are arranged to rotate the input drive shafts 56 and 58 to rotate the drum member 34, as later described.

The drum member 34 is supported from housings 60 and 62 which form a part of the boom arm members 36 and 38. Suitable clutch mechanisms are included within the housings 60 and 62 to connect the respective input drive shafts 56 and 58 to the drum member. The boom arm members 36 and 38 have forwardly extending annular portions 64 and 66 that extend through openings in the drum member 34 to rotatably support the drum member 34. The annular end portion 66 is illustrated in detail in FIG. 2.

The drum member 34 has an intermediate portion 68 and a pair of canted or angularly arranged end sections 70 and 72. The intermediate section 68 has a generally cylindrical configuration and has cutter bits (not shown) extending radially therefrom. As is illustrated in FIG. 2, the intermediate section 68 has a row of cutter bits 74 adjacent the intermediate section end portion 76 that extend over the boom member annular end portion 66. Similarly, the canted end sections 70 and 72 have cutter bits 78 that extend inwardly in overlapping relation with the bits 74 adjacent the front of the drum member 34. The drum member end sections 70 and 72 have a configuration of a segment of a cone, as is illustrated in FIG. 1, or may have a generally cylindrical configuration, as illustrated in FIG. 2.

The end sections 70 and 72 are angularly positioned relative to the intermediate section 68 and the adjacent ends of the end sections 70 and 72. The boom member front end portions 64 and 66 extend through the openings to rotatably support the boom member 34.

Now referring to FIG. 2, there is illustrated in section the drive arrangement for the drum intermediate section 68 and one of the end sections 72. The boom member 18 has a tubular intermediate portion 80 through which the drive shaft 82 extends into the drum member 34. The front end of the boom member front end portion 66 has an annular ring member 84 to which a cylindrically shaped support member 86 is secured by means of bolts 88. A second cylindrical support member 90 is fixedly secured to the boom annular end portion 84 by means of bolts 92 and extends angularly to the cylindrically shaped support member 86.

The drum member intermediate portion 68 has a generally cylindrical configuration with internal rib members 94 and 96. The rib members have axial passageways 98 with internal splined recesses 100. A shaft 102 is nonrotatably positioned in the rib passageways 98 and has a bevel gear generally designated by the numeral 104 nonrotatably secured thereto.

The drum member intermediate section 68 is positioned over the cylindrical end portion of support member 86 and is rotatable relative thereto. Pairs of roller bearings 106 and 108 rotatably support the cylindrical end portion 110 of bevel gear 104 within the axial bore 112 of the support member 86. An annular bearing retainer 114 is secured to the cylindrical end portion 110 of bevel gear 104 by means of bolts 116. The bevel gear 104 is secured to the shaft 102 by the splined end portion 118 of shaft 102 secured in receiving key portions of the bevel gear cylindrical end portion 110. Suitable lubricant seals 120 are provided between the annular end portion of support member 86 and the adjacent drum intermediate section rib member 96.

The input drive shaft **82** has a bevel pinion **122** secured thereto and in meshing relation with the gear teeth **124** of the bevel gear **104.** With this arrangement, rotation of shaft **82** is transmitted through bevel pinion **122** to the bevel gear **104** and from the bevel gear **104** through shaft **102** to the drum member intermediate section **68.**

The drum member end section **72** has a generally cupshaped configuration with cylindrical side wall **126** and an end wall **128.** The cylindrical side wall **126** is rotatably positioned on the cylindrical wall **130** of support member **90.** A generally cylindrical end section internal support member **132** has an axial bore **134** therethrough and is secured to the drum end section wall **128** by means of bolts **136.** Roller bearings **138** and **140** are positioned between the internal support member **132** and the support member **90** secured to the boom end portion **66** to permit rotation between the fixed support member **90** and the drum member end section **72.** An annular bearing retainer member **142** is secured to the end of the internal cylindrical support member **132.** A shaft member **144** is nonrotatably secured by means of a splined connection within the bore **134** of internal support member **132** so that rotation of shaft **144** rotates the internal support member **132** and the drum member end section **72.** The shaft **144** has an externally geared portion **146** that meshes with an arcuate geared portion **148.** A ring member **150** is secured to the bevel gear **104** by means of screws **152.** The ring member **150** with the arcuate geared portion **148** and the gear **146** on shaft **144** provide a universal drive connection between the bevel gear **104** and the shaft **144.** With this arrangement, rotation of bevel gear **104** is transmitted through ring member **150,** meshing gear portions **148** and **146** to shaft **144** and drum member end section **72.**

Referring to FIGS. **3, 4** and **5,** other drive arrangements for the drum member intermediate section **68** and end section **72** are illustrated. Similar numerals will indicate previously described components of the drive arrangement for the drum **34.** Referring to FIG. **3,** in lieu of the universal connection between the shafts **102** and **144,** a bevel gear **154** is secured to the shaft **144** and meshes with the bevel gear **104** so that rotation of input shaft **82** is transmitted through bevel pinion **122** to bevel gear **104** which, in turn, through **154** rotates the shaft **144** connected to the drum member end section **72.** In FIG. **4** a bevel gear **156** of reduced diameter is secured to the main bevel gear **104** and meshes with a bevel gear **158** which is connected to shaft **144** so that rotation of shaft **82** is transmitted through bevel pinion **122** to bevel gear **104** and through bevel gear **104** to bevel gears **156** and **158** to thereby rotate shaft **144.** In FIG. **5** the bevel gear **104** has an annular bore **160** with inwardly extending gear teeth **162.** The shaft member **144** has an end portion **164** with an annular geared portion **166** with inwardly extending gear teeth. A compound gear **168** has a first gear portion **170** meshing with the internal gear portion **162** of bevel gear **104** and a second, external gear portion **172** meshing with the gear portion **166** of member **164.** With this arrangement, rotation of shaft **82** is transmitted through bevel pinion **122** to bevel gear **104.** Rotation of bevel gear **104** is transmitted through the compound gear **168** to the shaft **144.**

With the above drive connections between the input shafts and the drum member intermediate section and end sections, it is now possible to provide a drive means for drum members having a reduced diameter that can be utilized in dislodging material in relatively thin seams. The drum member end sections **72** are arranged to dislodge material along the entire length of the drum member **34** and provide access openings for the drum member with drive means within the drum member that requires a minimum space.

According to the provisions of the patent statues, 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, I desire to have it 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 section and a pair of end sections, said end sections extending angularly to said intermediate section 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,

said pair of said drum member end sections having rear portions spaced from said drum member intermediate section and forming a pair of openings between said end sections and said intermediate section,

input drive shafts for rotating said drum member, said input drive shafts extending through said respective openings,

bevel gear drive means positioned within said drum member and nonrotatably secured to said intermediate section,

pinion gears secured to said input drive shafts and meshing with said respective bevel gear drive means, and

means drivingly connecting each of said bevel gear drive means to said adjacent end sections so that said input shafts rotate said drum member intermediate section and said end sections.

2. A continuous mining machine as set forth in claim **1** in which said means drivingly connecting each of said bevel gear means to said sections includes,

universal means connecting said bevel gear drive means to each of said end sections.

3. A continuous mining machine as set forth in claim **1** in which said means drivingly connecting each of said bevel gear means to said end sections includes,

a first pair of shafts nonrotatably secured within said end sections and extending toward said bevel gear drive means,

a second pair of shafts positioned within said intermediate section and nonrotatably connected to said respective bevel gear drive means, and

universal means connecting said bevel gear means to said first pair of shafts.

4. A continuous mining machine as set forth in claim 1 in which said means drivingly connecting each of said bevel gear means to said end sections includes,

second bevel gear means nonrotatably connected to each of said respective end sections, said second bevel gear means meshing with said bevel gear drive means.

5. A continuous mining machine as set forth in claim 1 in which said means drivingly connecting each of said bevel gear means to said end sections includes,

a pair of shaft nonrotatably secured within said end sections and extending toward said bevel gear means,

second bevel gear means nonrotatably connected to each of said shafts, said bevel gear means meshing with said bevel gear drive means.

6. A continuous mining machine as set forth in claim 1 in which said means drivingly connecting each of said bevel gear means to said end sections includes,

second bevel gear means nonrotatably connected to each of said end sections,

third bevel gear means nonrotatably connected to said first bevel gear drive means, said second bevel gear means meshing with said third bevel gear means.

7. A continuous mining machine as set forth in claim 6 in which said means drivingly connecting each of said bevel gear means to said end sections includes,

a pair of shafts nonrotatably secured within said end sections and extending toward said bevel gear drive means, said second bevel gear means nonrotatably connected to each of said shafts.

8. A continuous mining machine as set forth in claim 1 in which said means drivingly connecting each of said bevel gear means to said end sections includes,

annular inwardly extending gear means,

said end sections having second inwardly extending annular gear means,

a compound gear having a first gear portion meshing with said inwardly extending annular gear means and a second gear portion meshing with said second inwardly extending annular gear means.

9. A continuous mining machine as set forth in claim 8 in which said means drivingly connecting each of said bevel gear means to said end sections includes,

a pair of shafts nonrotatably secured within said end sections and extending toward said bevel gear means,

said second inwardly extending annular gear means secured to said shafts.

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