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A. J. GALIS ETAL

3,288,536

MINING MACHINE

Filed Oct. 25, 1963

4 Sheets-Sheet 1

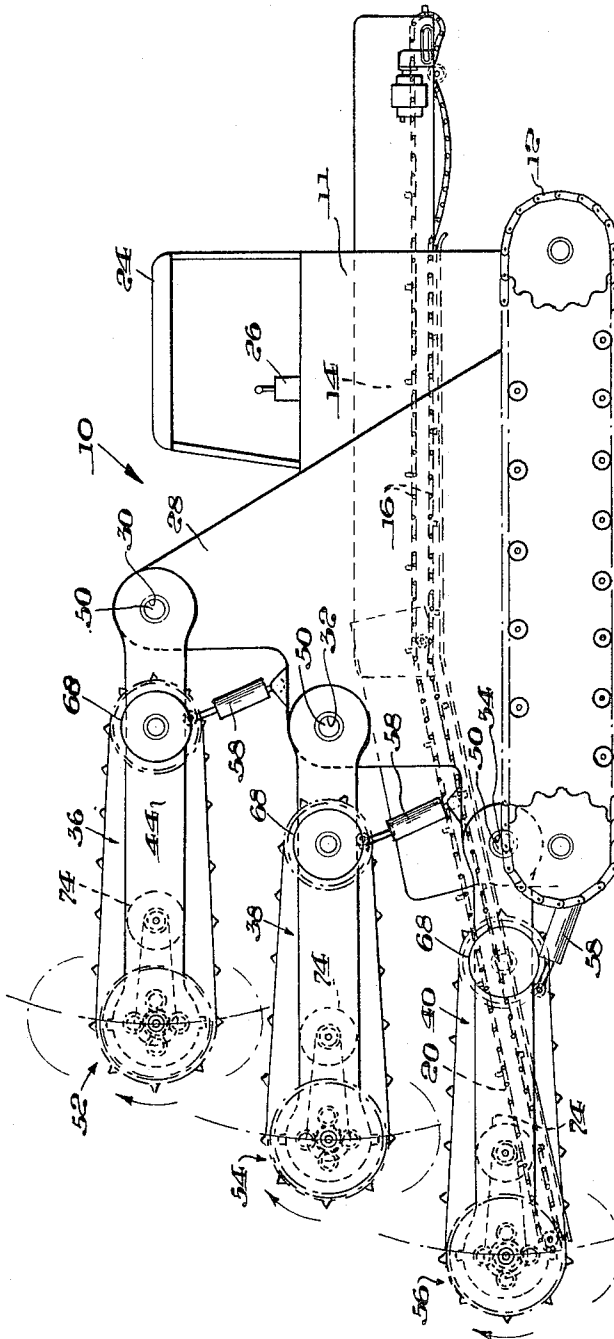


Fig. 1

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4 Sheets-Sheet 3

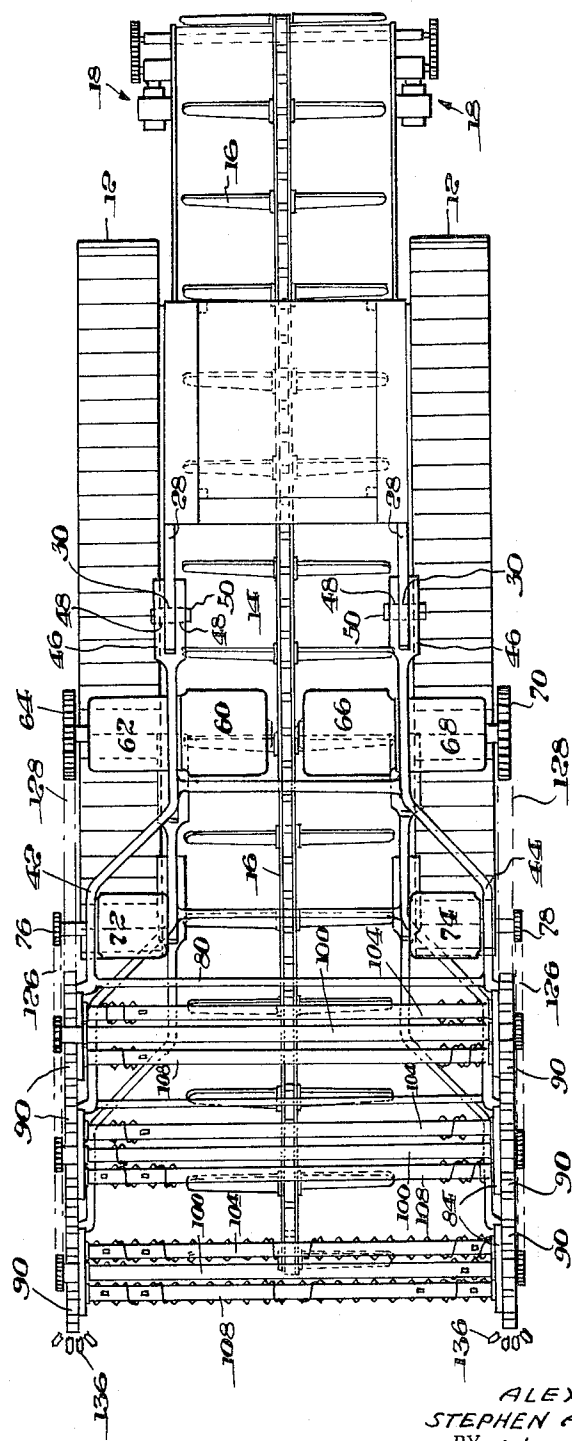


Fig. 2.

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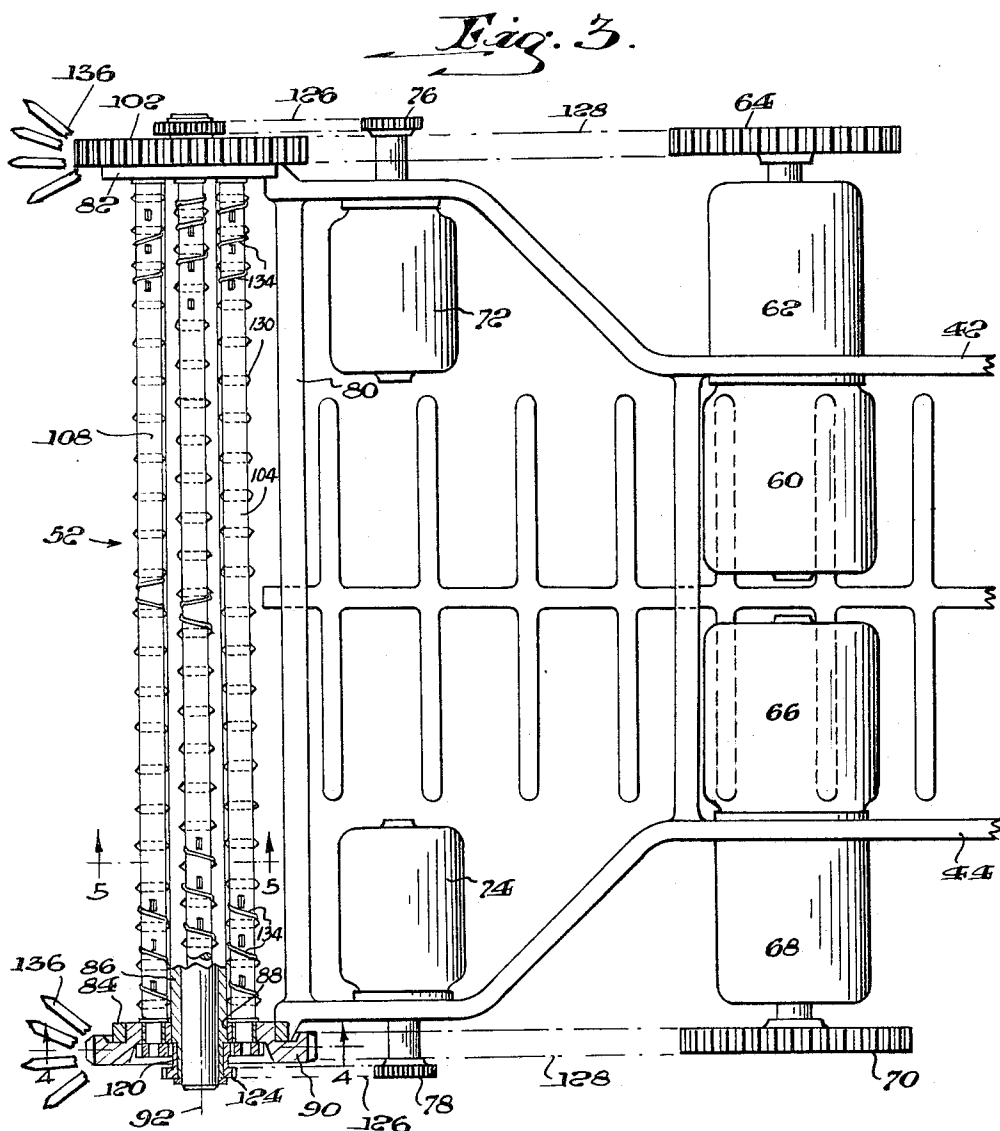
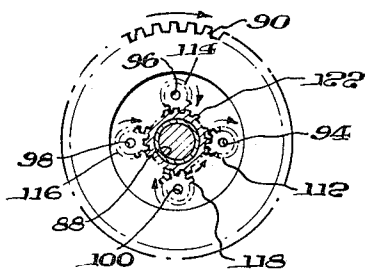
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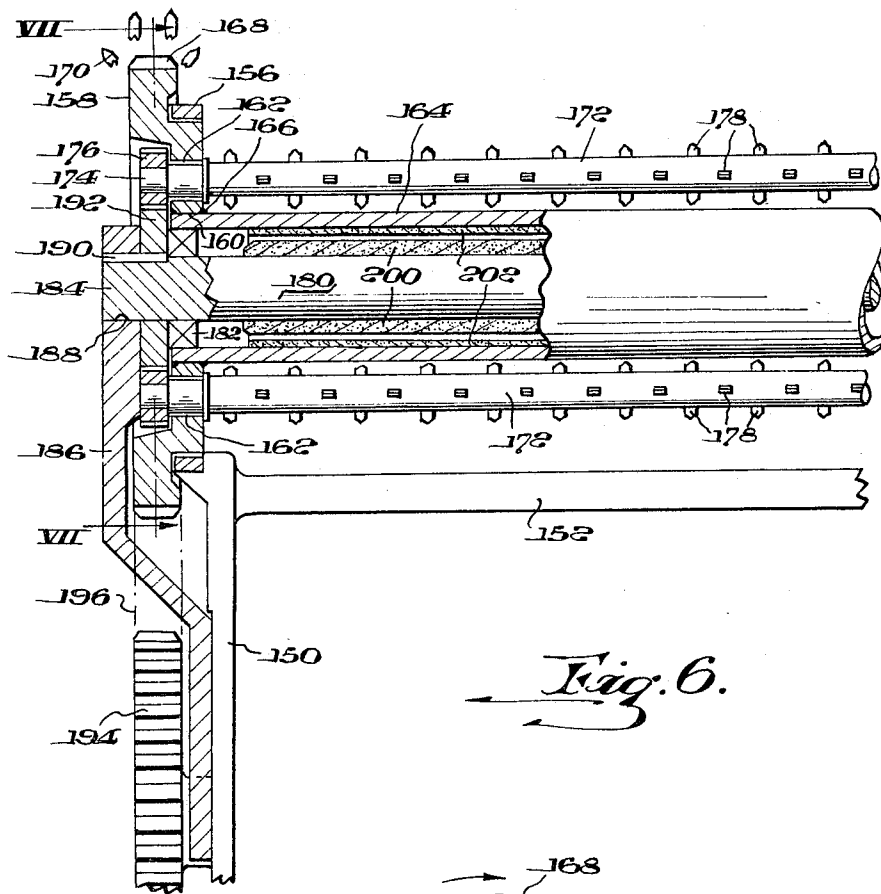
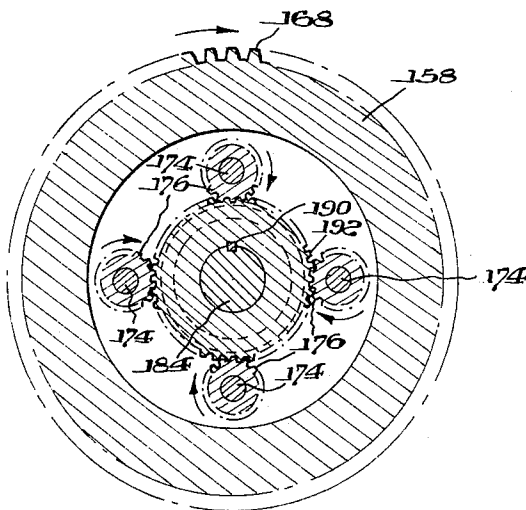


Fig. 7.



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3,288,536

MINING MACHINE

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13 Claims. (Cl. 299—64)

This invention relates to a mining machine and more particularly to a mining machine having a plurality of cutter heads arranged substantially parallel to the face of the material being dislodged.

The mining machine of this invention is designed to continuously dislodge and remove material from the working face. The mining machine includes one or more cutter heads disclosed and claimed in U.S. patent application Serial No. 295,405, filed July 16, 1963. The mining machine herein disclosed is simpler and less expensive to manufacture than the known ripper or boring type mining machines and more efficiently dislodges and removes the material from the mine face.

Briefly, our invention includes a continuous mining machine having one or more cutter heads arranged substantially parallel to the face. The cutter heads have a plurality of cutter shafts arranged in parallel spaced relation to each other on a support means. Each of the cutter shafts has a plurality of radially extending cutter bits. Drive means are provided to revolve the cutter shafts about the axis of the cutter head and rotate the respective cutter shafts about their axes. Suitable drive means and support means are provided on our mining machine to advance the cutter head into the face and to move the cutter head in an arcuate path to dislodge the material from the face. One embodiment of our invention includes a plurality of cutter heads positioned in spaced vertical relation to each other. With our improved mining machine it is now possible to continuously and rapidly dislodge material from the mine face.

A principal object of this invention is to provide a continuous mining machine having one or more cutter heads substantially parallel to the face of the material being dislodged.

Another object of this invention is to provide a continuous mining machine with cutter heads that include a plurality of cutter shafts arranged substantially parallel to the face of the material being dislodged. The cutter shafts have a plurality of cutter bits extending radially therefrom that are arranged upon rotation of said cutter shafts to dislodge material from the mine face.

Other and further objects of this invention will become apparent from the following description and claims and may be understood by referring to the accompanying drawings which by way of illustration show a preferred embodiment of the invention and what we now consider to be the best mode of applying the principles thereof. Other embodiments of the invention may be used without departing from the scope of the present invention as set forth in the appended claims.

In the drawings:

FIGURE 1 is a view in side elevation of our improved mining machine.

FIGURE 2 is a top plan view of the mining machine illustrated in FIGURE 1 with the operator's compartment not shown.

FIGURE 3 is an enlarged detail view of one of the cutter heads on our improved mining machine.

FIGURE 4 is a view in section taken along the line 4—4 in FIGURE 3 illustrating a portion of the drive mechanism for the cutter shaft portions of the cutter head.

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FIGURE 5 is a view in section taken along the line 5—5 of FIGURE 3 illustrating the relative position of the cutter shafts and the direction of rotation of the cutter shafts during the mining operation.

FIGURE 6 is an enlarged detail view of one of the cutter heads of our improved mining machine illustrating another embodiment of the drive mechanism.

FIGURE 7 is a view in section taken along the line 7—7 in FIGURE 6 illustrating a portion of the drive mechanism for the cutter head and the cutter shafts secured to the cutter head.

Referring to the drawings and particularly to FIGURES 1 and 2, there is illustrated our improved mining machine generally designated by the numeral 10 that has a body portion 11 mounted on a pair of crawler treads 12. The crawler treads 12 are arranged to position the mining machine 10 in operative relation with the working face and to advance the mining machine 10 into the face as the material is being dislodged. The body 11 has a trough shaped compartment 14 extending longitudinally thereon between the crawler treads 12. An endless conveyor 16 extends throughout the compartment 14 and is driven through suitable drive means 18 to convey the dislodged material rearwardly through the compartment 14 to a suitable receiver positioned adjacent the drive means 18. The conveyor 16 has a portion 20 extending forwardly of the body portion 11 arranged to gather the material dislodged by the cutter heads and convey the material through the trough shaped compartment 14.

The body portion 11 has an operator's control compartment 24 positioned above the trough shaped compartment 14. Control devices schematically illustrated at 26 are utilized by the operator to control the various components of the mining machine. Extending upwardly from the sides of the body portion 12 are a pair of vertically extending supports 28 having pairs of aligned apertures 30, 32 and 34 therethrough. Cutter head supports generally designated by the numerals 36, 38 and 40 are similar in construction and only one of the cutter head supports will be described in detail. Similar numerical designations will be given to similar parts of the other cutter head supports.

The cutter head support 36 includes a pair of arms 42 and 44 arranged in parallel spaced relation to each other. Each of the cutter arms 42 and 44 has a rear yoke portion 46 with aligned apertures 48 therethrough. The apertures 48 are aligned with apertures 30 in the support members 28 and pins 50 pivotally secure the arms 42 and 44 to the support members 28. With this arrangement, the cutter head supports 36 are movable through an arcuate path about the pin 50.

Cutter heads generally designated by the numerals 52, 54 and 56 are rotatably secured to the front end of the cutter head supports 36, 38 and 40 respectively. Since the cutter head supports 36, 38 and 40 are all similarly connected to the support members 28, the three cutter heads 52, 54 and 56 are arranged to move in substantially parallel arcuate paths about the respective pins 50. Piston cylinder type servo mechanisms 58 are suitably connected to the cutter head supports 36, 38 and 40 and are arranged to move the cutter heads 52, 54 and 56 through the arcuate paths about the pins 50. Suitable controls are provided for the servo mechanisms 58.

Referring to FIGURES 2 and 3 there is illustrated in detail a portion of the drive mechanism for the cutter head 52. Similar drive mechanisms are provided for cutter heads 54 and 56 and are omitted in FIGURES 1 and 2 to permit illustration of the relative positions and arrangement of the cutter heads. The relative position of the drive mechanisms for cutter heads 54 and 56 is schematically illustrated in FIGURE 1 and it should be under-

stood that substantially the same type of drive mechanisms are used for all the cutter heads and suitable control means may be provided to operate the cutter heads at the same or at different speeds depending upon the mining conditions encountered.

As is illustrated in detail in FIGURE 3, a drive motor 60 and gear box 62 are secured to the arm 42 and a sprocket or gear 64 is driven thereby. A similar motor 66 and gear box 68 are secured to the arm 44 and a similar sprocket 70 is secured thereto. The motors 60 and 66 are arranged to rotate the sprockets 64 and 70 at substantially the same speed so that, as will be later explained, the cutter head 52 is driven by both motors 60 and 66. There are secured to the inner portion of arms 42 and 44 other motors 72 and 74 which drive sprockets 76 and 78 extending outwardly therefrom.

The arms 42 and 44 have laterally extending members 80 that maintain the arms in spaced relation to each other and annular ring-like end portions 82 and 84. The cutter head 52 is supported within the arm annular end portions 82 and 84 in a manner that the cutter head 52 rotates therewithin. The cutter head 52 includes a tubular support member 86 which is mounted in a central aperture 88 of a drive gear 90. The drive gear 90 is rotatably supported in the support arm annular end portion 84 and is arranged to rotate the entire cutter head 52 about its longitudinal axis indicated by the numeral 92 in FIGURE 3. The drive gear 90 has apertures 94, 96, 98 and 100 therethrough. On the opposite end of the cutter head a similar drive gear 102 is secured to arm 42 and has apertures therethrough aligned with the respective apertures 94, 96, 98 and 100. Cutter shafts 104, 106, 108, and 110 have portions extending through the respective apertures 94, 96, 98 and 100 to rotatably position the cutter shafts in spaced parallel relation to the support member 86. Each of the cutter shafts has a gear 112, 114, 116, and 118 nonrotatably secured to its end portion that extends through the respective apertures 94, 96, 98, and 100. The gears 112, 114, 116, and 118 are arranged to rotate the respective cutter shafts 104, 106, 108, and 110 about their respective axes. The cutter shafts 104, 106, 108, and 110 have similar gears secured to the other end portions adjacent gear 102.

A secondary drive gear 120 is rotatably mounted on the end of supporting shaft 86 and has a first set of gear teeth 122 meshing with gears 112, 114, 116, and 118, as is illustrated in FIGURE 4. The gear 120 has a second set of gear teeth 124 that are driven by a chain 126 operably connected to gear or sprocket 78. The externally toothed drive gear 90 is driven by a chain 128 operably connected to sprocket 70.

With this arrangement the motor 66 through gear box 68 and sprocket 70 drives the externally toothed drive gear 90 to rotate the entire cutter head 52 about the axis 92. The motor 74 through sprocket or gear 78 and chain 126 and secondary drive gear 120 and gears 112, 114, 116, and 118 rotate the respective cutter heads 104, 106, 108, and 110 about their respective axes. A similar drive arrangement provides a drive to the opposite end of cutter head 52 through motors 60 and 72 and gears 64 and 76. Thus the motors 60 and 66 rotate or drive the entire cutter head about the cutter head central axis 92. The motors 72 and 74 rotate the respective cutter shafts 104, 106, 108, and 110 about their axes. While the cutter shafts 104, 106, 108, and 110 rotate about their respective axes they also revolve about the cutter head axis 92.

FIGURE 5 is a section taken along the line 5—5 in FIGURE 3 and illustrates the direction of rotation of the respective cutter shafts 104, 106, 108, and 110. Each of the cutter shafts has spaced longitudinally thereon a plurality of cutter bits 130. Suitable bores are provided in the cutter shafts to receive the cutter bits 130. The cutter bits are preferably arranged in alternating perpendicular arrangement to each other and are secured to the

shafts by means of screws 132 as illustrated in FIGURE 5. Each end of the cutter bits 130 has cutter portions thereon to provide two cutting surfaces per bit. Each of the cutter shafts has a scroll 134 which directs the dislodged material toward the center of the cutter head where it is picked up by the conveying device 20 and transported to the rear of the mining machine 10.

The chains 128 are utilized as trimmer chains and have secured to their external surface a plurality of cutter bits 136 which extend angularly from the chain a sufficient distance to dislodge material and provide a clearance for the mining machine. The cutter bits 136 are shown schematically in the drawings. It should be understood that conventional chains with cutter bits secured thereto as utilized in presently known mining machines may be employed.

The cutter heads 54 and 56 have similar drive arrangements and the respective motors may be separately controlled or suitably connected to be driven at preselected speeds.

Operation

The mining machine 10 illustrated in FIGURES 1, 2, and 3 operates as follows. The mining machine 10 is advanced toward the mine face by means of the crawler treads 12. The servo mechanisms 58 are adjusted to move the cutter heads 52, 54, and 56 to their lowermost position. The motors 60, 66, 72, and 74 on each of the cutter head supports 36, 38 and 40 are energized to rotate the respective cutter shafts 104, 106, 108, and 110 about their respective axes and to revolve the cutter shafts 104, 106, 108, and 110 about the cutter head axis 92. The actuation of motors 60 and 66 on each of the supports 36, 38, and 40 further activates the chains 128 to orbit the cutter bits 136. The conveyor 16 is lowered to its lowermost position adjacent the floor through suitable control means and the conveyor drive 18 is energized to actuate the conveyor. The mining machine 10 is then moved into the vertical wall or face of the material to be dislodged. The cutter bits 136 secured to chains 128 associated with cutter head 56 cut a pair of vertical kerfs in the wall of material to be dislodged. As the mining machine advances into the kerfs cut by the bits 136, the face of the mineral between the kerfs is dislodged by the cutter bits 130 on the cutter shafts 104, 106, 108, and 110 of cutter head 56. The servo mechanism 58 associated with cutter head support 40 is actuated to move the cutter head 56 upwardly in an arcuate path about the pin 50. After the cutter head 56 has advanced to its uppermost position and dislodged an arcuate swath of material the cutter head 56 is again moved to its lowermost position and the mining machine is advanced into the face. As the mining machine 10 continues to advance, the cutter heads 54 and 52 contact the intermediate and upper portions of the face and dislodge the material therefrom in a manner similar to the cutter head 56. The cutter heads 52, 54, and 56 may be moved in arcuate paths in timed relation to each other as the mining machine 10 is continually advanced into the face and the dislodged material is gathered by the conveyor 16 and transferred through the compartment 14 to the rear portion of the machine 10 where it is deposited in a conventional manner in a suitable receiver such as a surge car or a conventional shuttle car.

Although the mining machine 10 has been described as having three cutter heads 52, 54, and 56, it should be understood, depending upon the thickness of the seam of material to be removed, the mining machine may be constructed with one or more cutter heads. For example, in extremely thin seams a mining machine having a single head may be sufficient to dislodge all the material in the seam.

It will be appreciated that with the herein described cutter head the bits perform a true cutting action to dislodge the coal and it is no longer necessary to exert excessive forces on the cutting tools to dislodge the material from

the face. The rapid arcuate movement of the cutter heads permits rapid penetration of the cutter head into the material to continually and rapidly dislodge material from the face.

In FIGURES 6 and 7 there is illustrated another embodiment of a drive mechanism for the cutter head. In this embodiment the drive to revolve the cutter head and rotate the cutter shafts is provided by means of an electric motor positioned within a tubular support member.

Referring to FIGURES 6 and 7 the cutter head support arm 150 is similar to the cutter head support arm 44 illustrated in FIGURE 3 and has a laterally extending member 152 that is connected to a cutter head support arm on the opposite end of a cutter head generally designated by the numeral 154. The cutter head support arm 150 terminates in a pair of annular ring like portions 156, one of which is illustrated in FIGURE 6. Rotatably supported within the annular ring like portion 156 is a drive gear 158 that has a central aperture 160 and a plurality of apertures 162 radially spaced from the central aperture 160. A tubular member 164 is positioned in the central aperture 160 and fixedly secured to the drive gear 158 by means of welds 166. With this arrangement the drive gear 158 and tubular support member 164 rotate as a unit in the cutter support arm annular ring like end portions 156. The drive gear 158 has an externally toothed portion 168 which drives a cutter chain (not illustrated) with cutter bits 170 extending laterally beyond the periphery of drive gear 158.

A plurality of cutter shafts 172, in this instance four, extend through the respective apertures 162 and are freely rotatable therein. Suitable bearing means are provided in apertures 162 to provide relatively friction free rotation of cutter shafts 172 in the respective apertures 162. The cutter shafts 172 have end portions 174 extending beyond the apertures 162. Gears 176 are nonrotatably secured to the ends of cutter shafts 172 and are rotatable therewith. Similar to cutter shafts 108 illustrated in FIGURE 3, the cutter shafts 172 have a plurality of cutter bits 178 extending radially therefrom. Upon rotation of the cutter shafts 172 the cutter bits 178 are arranged to dislodge material from the working face in substantially the same manner as the cutter bits 130 in the embodiment illustrated in FIGURE 3.

The tubular support member 164 has coaxially positioned therein a shaft 180. Bearings 182 permit the tubular support member 164 to rotate relative to shaft 180 and maintain shaft 180 substantially coaxial with the tubular support member 164. The shaft 180 extends outwardly beyond the tubular support member 164 and has an end portion 184. The cutter head support arm 150 has secured thereto a member 186 which has an aperture 188 therethrough adjacent the front end portion. The shaft end portion 184 extends through aperture 188 and is nonrotatably secured thereto by means of pin 190 extending through mating grooves in apertures 188 and shaft end portion 184.

A gear 192 is secured to the shaft 180 between the tubular support member 164 and member 186 and is nonrotatably positioned thereon. The pin 190 nonrotatably secures gear 192 to shaft 180 so that shaft 180 and gear 192 remain fixed relative to member 186 while tubular support member 164 and gear 158 are rotatable relative to member 186 and the cutter head support arm annular ring like end portion 156. The gears 176 secured to the ends of cutter shafts 172 mesh with gear 192 fixed to shaft 180. With this arrangement when drive gear 158 rotates in the cutter head support arm annular ring like portion 156 the gears 176 are driven by the fixed gear 192 so that the cutter shafts 172 rotate in the apertures 162 at a higher rate of speed than the rotation of drive gear 158, as is clearly illustrated in FIGURE 7.

An idler sprocket 194 is rotatably secured to the cutter head support arm 150 and an endless cutter chain 196

diagrammatically illustrated by the dash dot lines in FIGURE 6 extends around idler sprocket 194 and drive gear 158. Cutter bits 170 are secured to the chain 196 and are arranged to cut a kerf in the material having a lateral dimension greater than the lateral dimension of the drive gear 158. The endless chain 196 is driven by drive gear 158, previously described.

The shaft 180 and the tubular support member 164 have secured thereto suitable windings 200 and 202 respectively so that when the windings are supplied with electrical energy in a well-known manner the tubular support member 164 rotates relative to the shaft 180. Thus the shaft 180 and tubular support member 164 are similar to an alternating current type electric motor where the rotor, which in this instance is shaft 180, is maintained stationary and the motor housing, which in this instance is tubular support member 164, rotates relative to the shaft 180 when current is supplied to the windings in a well-known manner. The commutators and the like are not illustrated in FIGURE 7 since these are diagrammatic representations of the drive system. It should be understood that any suitable commutator may be used. Although not illustrated, the electrical energy for the windings 200 or 202 may be supplied through conductors which could extend through an axial bore in fixed shaft 184.

In FIGURE 6 the windings 200 and 202 are of such a dimension to provide the necessary torque to rotate the cutter head 154. For certain applications a single motor with windings 200 and 202 on one side of the cutter head will suffice. For higher torque requirements a pair of motors or drive mechanisms can be provided on opposite sides of the cutter head.

According to the provisions of the patent statutes, we have explained the principle, preferred construction, and mode of operation of our invention and have illustrated and described what we now consider to represent its best embodiment. However, we 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.

We claim:

1. A continuous mining machine comprising,
 - a body portion having a front end portion,
 - cutter head support means extending forwardly from said body front end portion,
 - a cutter head having a body portion and opposite end portions, said cutter head secured adjacent said opposite end portions to said cutter head support means,
 - said cutter head including cutter shaft support means,
 - a plurality of cutter shafts carried by said cutter shaft support means in parallel spaced relation to each other, said cutter shafts arranged in substantially parallel relation to said body front end portion,
 - said cutter shafts having a plurality of cutter bits extending radially therefrom,
 - drive means to rotate said cutter head in said cutter head support means and to rotate said cutter shafts in said cutter shaft support means, and
 - other cutter means positioned adjacent both ends of said cutter head and adjacent said cutter head support means, said other cutter means arranged to cut a pair of vertical kerfs in the mine face, the distance between said vertical kerfs being greater than the lateral dimension of said body portion.
2. A continuous mining machine as set forth in claim 1 which includes,
 - drive means arranged to rotate said cutter head in said cutter head support means and to revolve said other cutter means about said cutter head support means.
3. A continuous mining machine comprising
 - a body having a front end portion and a pair of spaced vertical supports,
 - a cutter head support pivotally secured at one end to said vertical supports,

means to move said cutter head support other end portion in an arcuate path relative to said vertical supports,
 a cutter head secured to said cutter head support other end portion and movable therewith relative to said vertical supports,
 said cutter head including cutter shaft support means having a longitudinal axis arranged substantially parallel to said body front end portion,
 a plurality of cutter shafts carried by said cutter shaft support means in spaced parallel relation to each other and substantially parallel relation to said body front end portion,
 said cutter shafts having a plurality of cutter bits extending radially therefrom, and
 drive means to rotate said cutter shaft support means and thereby revolve said cutter shafts therewith and to rotate said cutter shafts,
 said cutter bits on said cutter shafts arranged to dislodge material as said mining machine advances into the mine face and said cutter shafts revolve about said cutter shaft support means longitudinal axis.

4. A continuous mining machine as set forth in claim 3 in which said cutter head includes first drive means to rotate said cutter head in said cutter head supports, and
 a second drive means to rotate said cutter shafts in said cutter shaft supports.

5. A continuous mining machine as set forth in claim 3 in which said cutter shaft supports include a drive gear rotatably secured in an annular end portion of said cutter head support,
 said drive gear having a plurality of radially spaced apertures therein, and
 said cutter shafts rotatably supported in said spaced apertures.

6. A continuous mining machine as set forth in claim 3 in which said cutter shafts include a plurality of scrolls arranged upon rotation of said cutter shafts to direct dislodged material toward the center of said cutter head.

7. A continuous mining machine comprising
 a body portion having a front end portion and a pair of spaced vertical supports,
 said body portion having a longitudinally extending trough shaped compartment,
 endless conveyor means positioned in said trough shaped compartment,
 drive means to move said endless conveyor means in said trough shaped compartment to convey dislodged material away from said body front end portion,
 a cutter head support having a pair of arms pivotally secured at one end to said vertical supports positioned on opposite sides of said trough shaped compartment,
 power operated means to move said cutter head support other end portion in an arcuate path relative to said vertical supports,
 said cutter head support having a pair of axially aligned annular other end portions,
 a cutter head rotatably secured in said cutter head support annular other end portions and movable therewith relative to said vertical supports,
 said cutter head including a cutter shaft support means having a longitudinal axis arranged substantially parallel to said body front end portion,
 said cutter shaft support means including a pair of drive gears rotatably secured in said cutter head support annular other end portion,
 said drive gears having a plurality of radially spaced apertures therein,
 a plurality of cutter shafts extending through and rotatably supported in said radially spaced apertures in substantially parallel relation to said body front end portion,
 said cutter shafts having a plurality of cutter bits extending radially therefrom,

gear means secured to end portions of said cutter shafts, drive means associated with said gear means to rotate all of said cutter shafts in a preselected direction, and
 other drive means meshing with said drive gear and arranged to rotate said cutter head in said cutter head support member end portions.

8. A continuous mining machine as set forth in claim 7 in which said drive means meshing with said drive gear includes an endless chain,
 cutter bits secured to said chain and arranged upon actuation of said drive means to revolve about said drive gear.

9. A continuous mining machine as set forth in claim 7 in which said cutter shaft support means includes a second drive gear axially positioned in said first drive gear in rotatable relation thereto,
 said second drive gear positioned in meshing relation with said gears secured to the end portions of said cutter shafts,
 said drive means including motor means secured to said cutter head support and drivingly connected to said second drive gear to rotate said cutter shafts.

10. A continuous mining machine as set forth in claim 7 which includes a plurality of cutter head supports secured to said vertical supports in overlying spaced relation to each other, each of said cutter head supports having a cutter head secured thereto and movable therewith, power operated means to move said cutter head support free end portions in arcuate paths, and
 means to actuate all of said cutter heads simultaneously and advance said mining machine.

11. A continuous mining machine comprising a body portion having a front end portion,
 cutter head support means extending forwardly from said body front end portion,
 a cutter head secured to said cutter head support means, said cutter head including a cutter shaft support means having a laterally extending tubular support member fixed thereto,
 a shaft positioned axially in said tubular support member,
 means fixedly securing said shaft to said cutter head support means,
 means rotatably securing said cutter shaft support means to said cutter head support means,
 a plurality of cutter shafts carried by said cutter shaft support means in spaced parallel relation to each other and radially spaced from said tubular support member,
 said cutter shafts having a plurality of cutter bits extending radially therefrom,
 gear means associated with said cutter shafts and said shaft positioned axially in said tubular support member, said gear means arranged upon rotation of said tubular support member to rotate said cutter shafts in said cutter shaft support means, and
 power operated means to rotate said tubular support member relative to said shaft extending axially therethrough.

12. A continuous mining machine comprising a body portion having a front end portion,
 cutter head support means extending forwardly from said body front end portion,
 a cutter head secured to said cutter head support means, said cutter head including a cutter shaft support means having a laterally extending tubular support member fixed thereto,
 a shaft positioned axially in said tubular support member,
 means fixedly securing said shaft to said cutter head support means,
 means rotatably securing said cutter shaft support means to said cutter head support means,

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a plurality of cutter shafts carried by said cutter shaft support means in spaced parallel relation to each other and radially spaced from said tubular support member,

said cutter shafts having a plurality of cutter bits extending radially therefrom, 5

gear means associated with said cutter shafts and said shaft positioned axially in said tubular support member, said gear means arranged upon rotation of said tubular support member to rotate said cutter shafts in said cutter shaft support means, and 10

circuit means associated with said tubular support member and said shaft positioned axially therein, said circuit means arranged upon energization by electrical current to rotate said tubular support member about said shaft extending axially therethrough. 15

13. A continuous mining machine comprising a body portion having a front end portion,

cutter head support means extending forwardly from said body front end portion, 20

a cutter head secured to said cutter head support means, said cutter head including a cutter shaft support means having a laterally extending tubular support member fixed thereto,

a shaft positioned axially in said tubular support member, 25

means fixedly securing said shaft to said cutter head support means,

10

means rotatably securing said cutter shaft support means to said cutter head support means,

a plurality of cutter shafts carried by said cutter shaft support means in spaced parallel relation to each other and radially spaced from said tubular support member,

said cutter shafts having a plurality of cutter bits extending radially therefrom,

said shaft having a gear secured thereto in nonrotatable relation with said cutter head,

said cutter shafts each having gears secured thereto and rotatable therewith, said gears secured to said cutter shafts meshing with said gear secured to said shaft, said gears secured to said cutter shafts arranged upon rotation of said tubular support to rotate said cutter shafts, and

power operated means to rotate said tubular support member relative to said shaft extending axially therethrough.

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