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CONTINUOUS MINING MACHINE

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Fig. 2

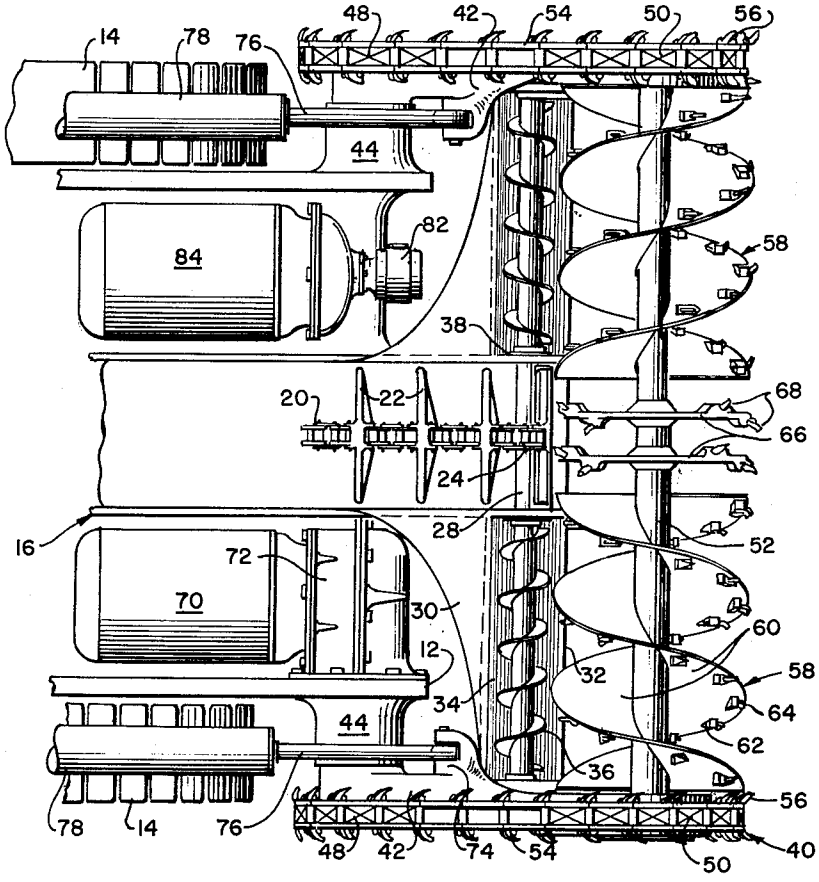
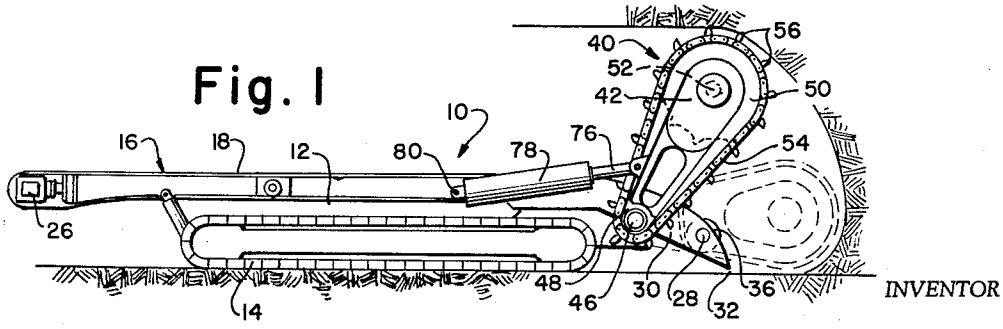


Fig. 1



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CONTINUOUS MINING MACHINE

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This invention relates to mining machines and more particularly to mining machines of the continuous type adapted to substantially continuously cut material, such as coal or the like, from a vein and convey the material away from the vein.

Continuous mining machines are well-known and, in general, they fall into two classifications. First, borer type machines which usually have a rotary cutting head or heads disposed forwardly of the machine movable about a longitudinal axis or axes, the cutting head or heads having a diameter of a size to cut material in the vein sufficient to permit forward movement of the machine frame therethrough. Borer type machines usually operate by substantially continuous forward movement of the machine through the vein. Heretofore, such machines in actual coal mining practice, have been utilized only in relatively high seams.

The second general classification of continuous mining machines is the so-called ripper machines, which have a vertically movable cutting head operable to remove material from the vein by vertical movement with respect thereto. Usually the cutting head of a ripper machine has a width less than the width of the machine frame so that it is necessary to make more than one vertical movement into the vein at different lateral or transverse positions before the machine proper can be advanced with respect to the vein. Here again, in actual coal mining practice, the ripper machines are utilized mainly in high seams, that is, seams above 40 inches.

An object of the present invention is the provision of a continuous mining machine having a full width cutting head operable to cut material in a vein in one pass of a width sufficient to permit forward movement of the machine frame therethrough, the cutting head being mounted for vertical movement in the vein with respect to the machine frame.

Another object of the present invention is the provision of a continuous mining machine of the type described having an improved cutting head, the cutting head having embodied therein a pair of left and right hand rotary auger sections operable in a position parallel to the mine face to dig or cut material from the mine face in a direction transverse to the axis of rotation and to simultaneously convey the cut material centrally into a position to be picked up by a continuous conveyor of the machine.

Another object of the present invention is the provision of a continuous miner cutting head of the rotary type adapted to cut material from a mine vein with its axis disposed parallel to the face of the vein, the cutting head embodying spaced left and right hand auger sections adapted to cut the material from the vein and simultaneously convey the same to a central position to be conveyed from the vein.

Still another object of the present invention is the provision of a continuous mining machine as described which is relatively simple in construction, having but a few movable parts which can be driven by a simple driving mechanism and which are operable to efficiently cut material from mine veins of varying height including relatively low seams having a height of less than 40 inches.

These and other objects of the present invention will become more apparent during the course of the following detailed description and appended claims.

The invention may best be understood with respect to

the accompanying drawings wherein an illustrative embodiment is shown.

In the drawings:

FIGURE 1 is a side elevational view of a continuous mining machine embodying the principles of the present invention; and

FIGURE 2 is an enlarged fragmentary top plan view showing the cutting head end of the machine.

Referring now more particularly to the drawings, there is shown therein a continuous mining machine, generally indicated at **10**, which embodies the principles of the present invention. The machine includes a main frame **12** which is supported for movement along a mine bottom by a pair of transversely spaced endless tread assemblies **14**. The frame **12** and tread assemblies **14** are preferably constructed in accordance with usual practice and embody structure conventionally utilized in prior art crawler type continuous mining machines. It will be understood that such conventional construction embodies a power source carried by the frame for driving the endless tread assemblies and suitable controls for selectively operating the driving mechanism so that either or both endless tread assemblies may be advanced or reversed to thereby effect a desired forward, turning or rearward movement of the machine.

The central portion of the frame throughout its longitudinal extent is provided with an endless scraper conveyor structure, generally indicated at **16**. Here again, the conveyor may be of conventional design of the type embodied in the prior art continuous mining machines. In brief, the conveyor structure provides an upwardly U-shaped pan construction, indicated at **18**, within the central portion of which the upper flight of an endless chain **20** engages. The chain **20** has a series of longitudinally spaced flight bars **22** mounted thereon and extending transversely from opposite sides thereof which are adapted to move with the upper flight of the chain within the conveyor pan **18** in a rearward direction, as shown in FIGURE 1, to thereby convey cut material deposited therein rearwardly of the frame **12**. It will be understood that the chain is trained about forward and rearward sprockets **24**, the rearward sprocket being driven, by any suitable means, such as a motor **26** schematically illustrated in FIGURE 1. It will also be understood that the conveyor structure **16** in the usual fashion provides for the support of the lower return flight of the endless chain **20** and the flight bars **22** carried thereby. As already indicated, the motor **26** is operable to effect movement of the endless chain in a direction such that the upper flight thereof moves rearwardly.

The forward sprocket wheel **24** is fixed to a shaft **28** which extends transversely of the frame **12** substantially throughout the width of the latter including the endless tread assemblies **14**. The ends of the shaft **28** are journaled in the outer ends of a pair of laterally extending scoop sections **30** which are rigidly secured to the forward end of the conveyor pan **18** and each has a leading transverse edge **32** disposed forwardly of the shaft to engage the mine bottom. Each scoop section **30** includes an upwardly and rearwardly concavely arcuate wall **34** which cooperates with a gathering scroll **36** fixed on the shaft **28**. It will be understood that each gathering scroll **36** is pitched to convey material in a direction toward the central conveyor structure **16**. As shown, the shaft **28** is also supported adjacent the inner end of the scrolls by brackets **38** which extend above the shaft **28** and provide for passage of material conveyed by the gathering scrolls into the conveyor structure **16** therebelow.

The continuous mining machine **10** of the present invention also provides a cutting head, generally indicated at **40**, which is of the rotary type operable to cut material from a mine vein by vertical swinging movement

with respect to the vein and rotary movement of the cutting head about an axis parallel to the mine face. The cutting head **40** includes a pair of transversely spaced mounting arms **42** each of which is connected with the frame **12** at the forward end thereof adjacent one side of the frame. As shown, the frame includes a bearing member **44** fixed to the associated side of the frame having a shaft **46** extending laterally therefrom through the adjacent end of the associated arm **42**. The arms are thus connected to the frame for swinging movement about a common transverse horizontal axis disposed rearwardly and somewhat above the axis of rotation of the shaft **28**.

Mounted on each shaft **46** is a sprocket wheel **48** and a cooperating larger sprocket wheel **50** is journaled on the outer end of each mounting arm **42**, the sprocket wheels **50** being fixedly connected to a common shaft **52** extending between the outer ends of the arms **42** for rotation with the sprocket wheels **50** about a transverse horizontal axis parallel to the axis of the shaft **28** and shafts **46**. Trained about each pair of aligned sprocket wheels **48** and **50** is an endless chain **54** having a series of spaced cutting teeth **56** extending outwardly therefrom on opposite sides thereof. The cutting teeth **56** carried by the endless chains **54** serve as side cutters of the cutting head **40**.

Fixed to the shaft **52** is a pair of auger cutter sections **58**. Each auger section comprises a pair of helical blades **60** having their inner peripheries fixedly secured to the adjacent portion of the shaft **52** and their outer peripheries of a substantially constant radial extent. Preferably, the helical blades of each auger section are spaced longitudinally apart so that they are substantially 180° out of phase with respect to each other. The helical blades of each section have the same pitch with respect to each other and an opposite pitch with respect to the blades of the other section. Of course, the pitch of the blades of each section is such that when rotated they will serve to convey the material inwardly toward the forward end of the centrally disposed conveyor **16**.

The outer periphery of each helical blade of each auger section has fixedly secured thereto a plurality of spaced blade bit or tooth holders **62** arranged to receive blade bits or teeth **64** of conventional structure which extend outwardly of the outer periphery of the blades. The blades of each auger section are spaced so as to be disposed in planes, perpendicular to the axis of the shaft **52**, which are spaced apart equally in the longitudinal direction; the teeth in successive planes being disposed on alternate blades. Stated differently, the teeth or bits are so arranged that the bits on each blade are spaced apart equally in a longitudinal or axial direction and the teeth on one blade are positioned longitudinally midway of the spaces between adjacent teeth of the other blade.

The spacing of the teeth as described above is of considerable importance in obtaining a proper cutting action from the auger sections **58**. It will be noted that due to the central offsetting of the teeth on each blade from the adjacent pair of teeth on the associated other blade, the first set of teeth will progressively engage the mine face at spaced positions during rotation and before these same teeth again engage the face the teeth of the other blade will engage the face at positions intermediate the engagement of the teeth of the first blade. In this way, the material of the mine face is disintegrated in a highly satisfactory manner with a minimum of power application and without the possibility of coring. It will also be understood that the blades serve to convey the material simultaneously with the cutting action in a direction toward the forward end of the central conveyor structure **16**, as indicated above.

As can be clearly seen from FIGURE 2, the inner ends of the auger sections terminate in spaced relation with respect to each other at positions adjacent the outer ends of the conveyor flights **22**. Fixed on the shaft **52** between the auger sections is a pair of transversely spaced centrally located cutting disks **66**, each of which has a diameter substantially equal to the diameter of the helical blades **60** and has a plurality of blade bits or teeth **68** carried thereby in positions spaced circumferentially therearound so as to extend outwardly of the periphery thereof.

Any suitable means may be provided for driving the cutting head **40**. As shown, there is provided on the frame **12** an electric motor **70** which is drivingly connected with one of the shafts **46**, as for example, the right hand shaft as shown in FIGURE 2, through a conventional power transmission assembly contained within a gear box **72**. It will be understood that the gear box **72** contains conventional reduction gears of any desired design, the specific embodiment of which need not be shown in the drawings.

Suitable means is also provided for effecting a vertical swinging movement of the cutting head **40** about the common transverse horizontal axis of the shafts **46**. To this end, each arm includes a rigid bifurcated lug **74** adapted to pivotally receive the outer end of a piston rod **76** forming a part of a conventional hydraulic ram assembly **78**. The cylinder of the ram assembly is suitably pivoted to the frame **12**, as indicated at **80** in FIGURE 1. It will be understood that an appropriate hydraulic circuit containing control valves (not shown) is provided for actuating the ram assemblies **78**. In FIGURE 2 there is shown a hydraulic pump **82** driven by a motor **84** which constitutes a part of the hydraulic system.

Operation

In operation, it will be understood that the motor **26** serves to effect movement of the conveyor **16** in a direction such that the flight bars **22** connected with the upper flight of the endless chain **20** will move through the conveyor pan **18** toward the rearward end of the frame. Thus, the shaft **28** which carries the gathering scrolls **36** will be rotated in a counterclockwise direction as viewed in FIGURE 1. The gathering scrolls **36** are oppositely pitched in a direction to convey material engaged thereby inwardly toward the centrally disposed conveyor **16**. The motor **70** and gear box **72** is operable to effect rotation of the cutting head in a clockwise direction as viewed in FIGURE 1. It will be noted that shaft **52** is rotated by the motor **70** and gear box **72** through the right hand shaft **46**, the sprocket wheel **48** fixed thereto, the right hand sprocket wheel **50** fixed to the shaft **52** and the right hand endless chain **54**. The left hand endless chain will be moved in its path about the left hand sprocket wheels **48** and **50** by the rotation of the shaft **52**.

As best shown in FIGURE 1, it is preferable to advance the cutting head into the mine face with the auger sections disposed in their uppermost position. During the advance of the cutting head into the upper portion of the mine face the auger sections serve to cut and disintegrate the material by the engagement of the teeth **64** therewith, in the manner indicated above, while at the same time the helical blade **60** of each auger section serve to convey the disintegrated material inwardly toward the cutting disks **66** adjacent the forward end of the conveyor **16**. Of course, the cut material is picked up by the conveyor **16** and moved to the rearward end thereof where other continuous conveyors (not shown) of conventional construction utilized with the mining machine serve to carry the disintegrated material out of the mine. Of course, any material engaged by the gathering scrolls will also be conveyed thereby to the centrally located conveyor **16**.

After the advancing movement of the machine has been completed the hydraulic rams **78** are actuated to swing the cutting head downwardly from the solid line position shown in FIGURE 1 to the dotted line position shown therein. Again, during this movement there is a simultaneous cutting of the material in the vein and

conveying of the same centrally to be picked up by the centrally located conveyor **16**.

It will be noted that the width of the cutting head **40** is greater than the width of the frame **12** including the endless tread assemblies **14**. Moreover, the upper periphery of the cutting head when disposed in its uppermost position as shown in solid lines in FIGURE 1 is of a height greater than the height of the frame. Thus, the cutting head **40** is capable of removing material from the vein from an area greater than the area of the frame so as to permit the latter to be advanced therein after each cutting action. It will be understood that the machine may be advanced in this way to form the main entries, lateral entries and rooms of the mine in accordance with conventional practice. In so doing, it may become necessary to make one advance movement and then to back up and make another at a position alongside the first to provide entries and rooms of sufficient width under certain conditions.

It thus will be seen that the objects of this invention have been fully and effectively accomplished. It will be realized, however, that the foregoing specific embodiment has been shown and described only for the purpose of illustrating the principles of this invention and is subject to extensive change without departure from such principles. Therefore, this invention includes all modifications encompassed with in the spirit and scope of the following claims.

I claim:

1. A continuous mining machine comprising a frame having a pair of endless tread assemblies supporting the same for movement along a mine bottom, an endless scraper conveyor carried by said frame between said assemblies, said conveyor including an upper flight extending from the central forward end of said frame longitudinally rearwardly, a pair of rotary gathering scrolls extending transversely outwardly from the forward end of said conveyor, a pair of arms mounted on opposite sides of said frame adjacent the forward end thereof for pivotal movement about a transverse horizontal axis, said arms extending forwardly beyond said scrolls, a shaft carried by the outer ends of said arms for rotation about a transverse horizontal axis, a first sprocket wheel fixed to each end of said shaft, said first sprocket wheels being spaced apart a distance greater than the width of said frame and disposed outwardly of the associated endless tread assembly, a second sprocket wheel disposed in substantial longitudinal alignment with each of said first sprocket wheels and mounted for rotation about the pivotal axis of said arms, an endless chain trained about each pair of aligned sprocket wheels, each of said chains having a series of spaced digging teeth mounted thereon, means for rotating one of said second sprocket wheels, a pair of auger sections carried by said shaft at positions substantially coextensive with said scrolls, each of said auger sections including a pair of helical blades fixed to said shaft in spaced relation, each of said blades having a series of teeth fixed adjacent the outer periphery thereof and extending outwardly thereof, the teeth of said blades being disposed in planes perpendicular to the axis of said shaft spaced equally from each other, the teeth in successive planes being disposed on alternate blades, the helical blades of each section being of the same pitch with respect to each other and of an opposite pitch with respect to the blades of the other section and related to the direction of rotation of said shaft to move material engaged thereby inwardly, rotary cutting means separate from said auger sections carried by the central portion of said shaft intermediate said auger sections, and means for pivoting said arms about their pivot axis.

2. A continuous mining machine as defined in claim 1 wherein said centrally located rotary cutting means comprises a pair of spaced disks fixed to said shaft, said disks having a plurality of circumferentially spaced cutting teeth fixed thereto and extending outwardly of the periphery thereof.

3. A continuous mining machine as defined in claim 2 wherein said helical blades have a constant radius and said disks have a radius equal thereto.

4. In a continuous mining machine, a cutting head mounted for up and down swinging movement about a horizontal axis, said head including a pair of horizontally spaced arms, a first sprocket wheel mounted adjacent one end of each of said arms for rotation about said horizontal axis, a second sprocket wheel mounted on the other end of each of said arms in substantial alignment with the associated first sprocket wheel, a toothed endless chain trained about each associated pair of first and second sprocket wheels, a shaft extending between said arms and fixed to said second sprocket wheels for rotation therewith about a horizontal axis, an auger section carried by said shaft adjacent each of said second sprocket wheels, each of said auger sections including a pair of helical blades fixed to said shaft in spaced relation, each of said blades having a series of teeth fixed adjacent the outer periphery thereof and extending outwardly thereof, the teeth of said blades being disposed in planes perpendicular to the axis of said shaft spaced equally from each other, the teeth in successive planes being disposed on alternate blades, the helical blades of each section being of the same pitch with respect to each other and of opposite pitch with respect to the blades of the other section, and rotary cutting means separate from said auger sections carried by the central portion of said shaft intermediate said auger sections.

5. A cutting head as defined in claim 4 wherein said helical blades are of constant radial extent.

6. A cutting head as defined in claim 5 wherein said rotary cutting means comprises a pair of disks fixed to said shaft, said disks being of a radial extent substantially equal to the radial extent of said helical blades and having a plurality of fixed spaced teeth extending outwardly therefrom,

References Cited in the file of this patent

UNITED STATES PATENTS

1,143,897	Flexner et al.	June 22, 1915
1,336,440	O'Toole	Apr. 13, 1920
1,811,927	Halleck	June 30, 1931
2,689,720	Cartlidge	Sept. 21, 1954
2,696,375	Huff	Dec. 7, 1954
2,841,379	Driehaus	July 1, 1958