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ATTORNEYS
CONTINUOUS MINER HAVING VERTICALLY AND HORIZONTALLY SWINGABLE CUTTER DRUM AND CONVEYOR SECTIONS

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This invention relates to improvements in mining machines of the continuous mining and loading type and more particularly relates to an improved form of ripper type miner.

A principal object of the present invention is to provide an improved form of continuous mining machine of the ripper type arranged with a view towards utmost compactness in height and efficiency in gathering and conveying the cuttings for loading.

A further object of the invention is to provide an improved form of continuous mining machine of the ripper type having a laterally swingable boom in which the conveyor of the machine is arranged to follow the boom as it is swung laterally from side to side and has a laterally swingable discharge end portion spaced from the pivot boom to accommodate the discharge of the mined material to one side or the other of the machine.

A further object of the invention is to provide a conveyor structure particularly adapted for continuous mining machines of the ripper type in which the boom supporting the ripper head is transversely pivoted to a turntable and extends along the conveyor, and in which the conveyor has a rear end portion pivoted to the turntable for up and down tilting movement about a horizontal axis and articulated about a generally upright axis coincident with the axis of the turntable for at least one tilted position of the conveyor about its axis of transverse pivotal connection to the turntable, and has a forward end portion tiltable about the axis of connection of the rear end portion of the conveyor to the turntable and following the boom arm and having gathering mechanism thereon disposed beneath the ripper head, for transferring the cuttings onto the conveyor.

Another object of the invention is to provide a continuous mining machine of the ripper type in which a boom arm carrying a ripper head is transversely pivoted to a turntable adjacent the rear end portion of the turntable, a conveyor is transversely pivoted to the turntable beneath the boom arm adjacent the opposite end of the turntable and has forward and rear end portions vertically tiltable about a common transverse axis and is articulated for movement about an axis coincident with the axis of the turntable in at least one tilted position of the conveyor and also has a laterally swingable discharge end portion, in which the axes of articulation of the conveyor, move in an arc struck from the common transverse axis during vertical adjustable movement of the rear end portion of the conveyor.

These and other objects of the invention will appear from time to time as the following specification proceeds and with reference to the accompanying drawings wherein:

FIGURE 1 is a top plan view of a continuous mining machine constructed in accordance with the principles of the present invention;

FIGURE 2 is a view in side elevation of the machine shown in FIGURE 1;

FIGURE 3 is a fragmentary longitudinal sectional view taken through the axis of pivotal movement of the turntable and conveyor, substantially along line 3—3 of FIGURE 1, with certain parts broken away; and

FIGURE 4 is a fragmentary detail plan view of the central part of the machine, with a part of the conveyor broken away and certain other parts broken away and shown in generally horizontal section, in order to illustrate certain details of the invention not shown in FIGURE 3.

In FIGURES 1 and 2 of the drawings, I have shown a continuous mining machine 10 of the ripper type including a mobile main frame 11 mounted on laterally spaced continuous traction tread devices 12, for propelling the machine along the ground from working place to working place and angling a mining head in the form of a rotary cutting and dislodging element 13 into the working face of a mine, to thereafter be fed vertically along the working face and effect a mining operation of the working place.

The cutting and dislodging element 13 is in the form of a cutter drum 15 rotatably supported a suitable pivot 14 in advance of the main frame 11 on a boom 15 transversely pivoted to a turntable 16. The turntable 16 is pivoted to the main frame 11 for movement about the axis of a vertical bearing boss 17, welded to a bottom plate 18 of said main frame and extending upwardly therefrom.

As shown in FIGURE 3, the turntable 16 is in the form of a plate journalined on the boss 17 on an annular bearing 19, resting on a thrust bearing 20 partially recessed in the plate 18. The forward end portion of the turntable 16 rests on a semiannular bearing 21, partially recessed in the plate 18 and forming a bearing support for said turntable in the various positions of adjustment thereof about the axis of the boss 17. A thrust bearing 22 abuts the top surface of the bearing 19 and is partially recessed within the top surface of the turntable 16 and is abutted by a cap 23 secured to the top surface of the boss 17 and extending about the top surface of the thrust bearing 22.

Hydraulic jacks 24 are vertically pivoted to opposite sides of the main frame 11 on vertical pivot pins 25 and have extensible piston rods 26 vertically pivoted to opposite sides of the turntable 16 adjacent the rear end portion thereof on pivot pins 27. Fluid under pressure may be admitted to the head end of one hydraulic jack and the piston rod end of the other hydraulic jack to swing the turntable 16 from side to side at the selection of the operator of the machine, in a conventional manner.

The turntable 16 also has a pair of laterally spaced ears 29 mounted thereon rearwardly of the cap 23 and forward of the pivot pins 27 and hydraulic jacks 24 and forming mountings for pivot pins 30 extending outwardly therefrom and having arm members 31, 31 of the boom 15 mounted thereon and extending forwardly therefrom, mounting said boom on said turntable for lateral movement therewith and for vertical angular movement with respect thereto.

The cutter drum 13 may be a conventional form of ripper type rotary cutter drum like that shown and described in the Hinskey Patent No. 3,109,636, dated November 5, 1963, and extends across the forward end of the boom 15 and is rotatably journaled thereon in a manner similar to that shown and described in the Richard C. Lundquist application for patent Serial No. 277,540, filed on May 2, 1963, and entitled, "Ripper Type Continuous Mining Machine," now Patent No. 3,157,438.

FIGURE 13 is rotatably driven from motors 32 mounted on the outsides of the arm portions 33 of the boom 15 and extending therealong and having speed reducer housings 33 secured to and extending forwardly of the forward ends of the casings for said motors.

The speed reducer housings 33 contain suitable reduction gearing (not shown), driving the drive shafts 35. The drive shafts 35 have driving connections with the cutter drum 13 through an angle drive (not shown) contained within a housing indicated generally by reference character 36,
and a shaft 37 driven by the angle drive from within said housing. The shaft 37 extends forwardly of the housing 36 and has drive connection with the cutter drum 13, to drive said drum in a direction to mine upwardly from the floor to the roof of the mine in a manner like that shown and described in the aforementioned Lundquist Patent No. 3,157,438.

The plate 35 extends along the main frame 10 and turntable 16 between the arm portions 31 of the boom 15 from a position disposed forwardly of the forward end of said main frame beneath the boom 15 and adjacent the ground, rearwardly along said main frame beyond the rear end thereof.

The conveyor 39 is shown in FIGURES 1 and 3 as being a laterally flexible single strand endless chain and flight type of conveyor including strands of chain 40 connected to parallel spaced flights 41 extending laterally from said strands of chain and connected to said strands of chain for pivotal movement about horizontal and vertical axes in a conventional manner.

As shown in FIGURES 2 and 3 the conveyor 39 has an inclined forward gathering or pick-up portion 43 including an inclined material conveying plate 44 and a downwardly spaced bottom plate 45. Side walls 46 extend along opposite sides of said plates and upwardly therefrom.

The forward inclined gathering section 43 of the conveyor is transversely pivoted to the upper end portions of parallel spaced side walls 47, extending along opposite sides of the turntable 16 and vertically therefrom. The side walls 47 have upwardly projecting ears 48 at their forward ends extending along the outer sides of the conveyor. Trunnion pins 49 extend laterally of the ears 48 and form trunnion supports for the forward inclined gathering section of the conveyor 43 and for an intermediate section 50 of the conveyor.

As shown in FIGURE 4, connectors 51 extend along opposite sides of the rear end portions of the side plates 46 and are welded or otherwise secured to said side plates. The connectors 51 extend angularly outwardly and rearwardly of the side walls 47 and are mounted on the pivot pins 49 at their ends for movement about the axes of said pivot pins. Connectors 53 are mounted on the pivot pins 49 on the outside of the connectors 51 and extend rearwardly of said pivot pins along side walls 55 of the intermediate section 50 of the conveyor and are welded or otherwise secured thereto. The entire rear and forward end portions of the conveyor may thus be independently vertically pivoted about the axes of the pivot pins 49.

The intermediate section 55 of the conveyor 39 includes a bottom plate 56 extending between the side walls 55 and supporting the return run of the conveyor and a vertically spaced material carrying plate 57 spaced above said bottom plate and forming the material carrying plate of the conveyor.

As shown in FIGURE 3, the bottom plate 56 has an annular boss 59 depending therefrom and forming a bearing support for a support plate 60 for an intermediate section 59 of the conveyor. The support plate 60 extends about the boss 59 and is journaled thereon on a bearing 62 and is abutted at its opposite sides by annular thrust bearings 63. The plate 60 and thrust bearings 63 are retained in position by a retainer cap 65 secured to the bottom of the annular boss 59 by machine screws 66, and extending outwardly of said annular boss along the thrust plate 60. The plate 60 is retained from lateral movement with respect to the main frame 11 and forms a support for a bottom plate 69 of the intermediate portion of the conveyor 59 along which the return run of the chain travels. A bearing member 70 is interposed between the bottom of the bottom plate 69 and the top surface of the plate 60. The intermediate portion of the conveyor has parallel spaced side walls 71 extending along and upwardly of the bottom plate 69 and along a vertically spaced material carrying plate 73 of the conveyor.

Flexible side walls 74 are suitably secured to the side walls 55 and extend therealong and along the insides of the side walls 71 and are suitably guided for movement along said side walls by guides 72 secured to the side plates 71 and extending over and along the insides of the flexible side walls 74. The flexible connection between the two sections of the conveyor is a conventional connection so need not herein be shown or described in further detail.

The forward inclined gathering section 43 of the conveyor 39 has an apron 75 extending across the forward end thereof and forwardly therefrom to the ground. The plate 75 also extends upwardly along the sides of the plate sides 46 for a portion of the length thereof. The apron 75 forms a support for conventional gathering devices 76 at opposite sides of the conveyor 39, for picking up the mined material and loading the mined material onto said conveyor. The gathering devices 76 include orbitally traveling gathering arms 77 moving to positions along the ground in advance of the forward end of the apron 75 and inwardly and backwardly toward the conveyor, for gathering the mined material onto the conveyor in a conventional manner. A ground engaging shoe 79 extends beneath the apron 75 for the width thereof and is connected with the lower forward end portion of the apron at its forward end, as by welding, or in any other suitable manner.

A pair of hydraulic jacks 80 is provided to raise and lower the shoe 79 and apron 75 with respect to the ground to accommodate trampling of the machine from working place to working place and to position said shoe and apron in a loading position.

As shown in FIGURES 3 and 4, the hydraulic jacks 80 have ears 81 extending rearwardly therefrom and pivotally connected to the turntable 16 on transverse pivot pins 83. Said hydraulic jacks also include extensible piston rods 85 pivotally connected at their outer ends between spaced connectors 86 on pivot pins 87.

The side walls 71 of the intermediate section 50 of the conveyor terminate at their rear ends into a flaring fan-like plate 88 of a frame structure 89, supporting a laterally swinging discharge section 90 of the conveyor for swinging movement from side to side. The discharge section 90 is supported on the frame structure 89 for laterally swingable movement with respect thereto about the axis of a vertical pivot pin 91 in a conventional manner, so the support therefor need not herein be shown or described in detail. The side walls 71 are connected with side walls 93 of the discharge section of the conveyor by means of flexible side walls 94 secured to the side walls 71 at their forward ends and extending rearwardly therefrom over the plate 88 and slidably guided therewith over the plate 88 and slidably guided therewith in the guides 95, like the guides 74.

A bottom plate 96 extends between the side walls 93 and forms a support for the material carrying run of the conveyor and has a forward end portion generally conforming to the form of the fan-like plate 88. A drive sprocket 92 at the rear end of the conveyor, forms a drive member for the conveyor. Motors 97, 97 mounted on and extending along the outer sides of the side plates 93 drive said sprocket through suitable gear reduction mechanisms contained in housings 98 extending from the rear ends of the motors 97.

The discharge section 90 is swung from side to side by a hydraulic jack 99, shown in FIGURE 1 as being pivotally connected at one end to the frame 11 and a connector 100, and as by a connector bracket 101 and pivot pin 101. The opposite end of the hydraulic jack 99 is pivotally connected to the outside of a side wall 93 by a suitable connector and pivot pin (not shown).

The intermediate and discharge end sections of the conveyor 39 are suitably supported by the guide means 102 shown. The intermediate portion of the conveyor has parallel spaced side walls 103 extending along and upwardly of the bottom plate 104 and along a vertically compatible material carrying plate 105 of the conveyor.
into axial alignment with the axis of the bearing 19 and to adjust the discharge end of the conveyor to load onto shuttle cars or other material carrying devices by means of a hydraulic jack 103 (FIGURE 2). The hydraulic jack 103 is pivotally pivoted to the main frame 11 by a pivot pin 104 extending through connector brackets 105 on the main frame 11 (FIGURE 1). The opposite end of the hydraulic jack 103 extends between connector brackets 106 depending from the support structure 89, and is pivotally connected therewith, as by a pivot pin 107.

The inclined forward end portion 43 of the conveyor 39 may thus move about the axis of horizontal movement of the boom arm about the bearing 19 and boss 17, and is laterally moved with the boom arm during the mining operation and is also independently adjustable movable up and down about the axes of the coaxial pivot pins 49. The intermediate and discharge end portion of the conveyor may also be adjustable moved up and down about the axes of the coaxial pivot pins 49, moving the axis of the bearing 62 and the pivot pin 91 about arcs struck from the center of the coaxial pivot pins 49 and supporting the discharge end portion of the conveyor for independent lateral adjustment about the axis of the pivot pin 91. The axis of the bearing 62 and the axis of articulation of the conveyor is thus coincident with the axis of the bearing 19 when the intermediate section 50 of the conveyor is in a horizontal position of adjustment, and moves in an arc struck from the centers of the trunnion pins 49 as the intermediate and discharge sections of the conveyor are elevated about said trunnion pins.

The boom 15 is elevated about the axes of the pivot pins 30, disposed on the opposite side of the pivot for the turntable 16 from the pivot pins 49, and beneath said pivot pins, by two stage hydraulic jacks 111. The hydraulic jacks 111 are pivotally mounted at their lower ends on opposite sides of the conveyor 39 on pivot bearing pins 112, mounted at opposite ends of a beam 113 extending across the conveyor 39 beneath the bottom plates thereof and spaced rearwardly of the apron 75. The jacks 111 are pivotally connected between ears 115 depending from the boom 15, on pivot pins 116. While I have herein shown and described one form in which the invention may be embodied, it should be understood that various variations and modifications in the invention may be attained without departing from the spirit and scope of the novel concepts thereof.

I claim as my invention: 1. In a continuous mining machine, a mobile main frame, a turntable pivotally mounted on said main frame for movement about a vertical axis disposed intermediate the ends of said main frame, a forwardly extending boom pivotally mounted on said turntable for movement about a horizontal transverse axis, a rotary mining head rotatably mounted on the forward end of said boom, a conveyor extending longitudinally along said main frame and boom to a position forwardly of the forward end of said main frame into engagement with the ground, trunnion support means on said turntable for said boom, and for pivotally mounting said conveyor on said turntable intermediate the ends of said conveyor, for up and down movement with respect thereto, said conveyor having articulated forward and rear end portions articulated about upright axes, and one of the axes of articulation of said conveyor being coincident with the axis of said turntable for at least one position of adjustment.

2. In a continuous mining machine, a mobile main frame, a turntable pivotally mounted on said main frame for movement about a vertical axis disposed intermediate the ends of said main frame, a forwardly extending boom transversely pivotally mounted on said turntable for movement about a horizontal axis disposed rearwardly of the axis of turning movement of said turntable, a rotary mining head extending across the forward end of said boom and rotatably mounted thereon, a conveyor extending longitudinally of said main frame and along said boom to a position forwardly of the forward end of said main frame, a trunnion pins supported on said turntable on the opposite side of the axis of turning movement thereof from the axis of connection of said boom thereto, said trunnion pins mounting said conveyor on said turntable for up and down pivotal movement with respect thereto intermediate the ends of said conveyor, said conveyor having articulated forward and rear end portions one axis of articulation of which is coincident with the axis of said turntable for at least one position of said conveyor about said transverse axis, and the other axis of articulation of which is spaced adjacent the rear end of said main frame to accommodate the discharge of material to either side of said main frame, and both of said axes of articulation being movable vertically in arcuate paths, the axes of which are struck from the axes of said pivot pins, upon vertical adjustable movement of the rear end portion of said conveyor with respect to said main frame and turntable.

3. A continuous mining machine in accordance with claim 2 in which hydraulic jack means are provided pivotally move said turntable and the forward end portion of said turntable about the axis of connection of said turntable to said main frame, other hydraulic jack means are pivotally connected between said main frame and the rear end portion of said conveyor for vertically moving the rear end portion of said conveyor about the coaxial axes of said trunnion pins, and still other hydraulic jack means are connected between said turntable and the forward end portion of said conveyor for vertically moving the forward end portion of said conveyor about the axes of said trunnion pins.

4. In a continuous mining machine, a mobile main frame, a turntable pivotally mounted on said main frame for movement about a vertical axis, a forwardly extending boom transversely pivotally mounted on said turntable for movement about a horizontal axis disposed rearwardly of the axis of pivotal movement of said turntable, a transversely extending rotary mining head rotatably mounted on the forward end of said boom, a longitudinally extending conveyor extending from a position adjacent the ground in advance of said main frame beneath the mining head and over the top of said main frame and having a rear end portion transversely pivotally mounted on said turntable for up and down movement about a horizontal axis disposed on the opposite side of the axis of turning movement of said turntable from the axis of pivotal connection of said boom thereto, the portion of said conveyor extending from a position adjacent the ground in advance of said main frame being laterally movable with said boom by lateral movement of said turntable and being articulated about a generally upright axis coincident with the axis of pivotal movement of said turntable in at least one tilted position of the rear end portion of
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said conveyor about its axis of connection to said turntable,
said rear end portion of said conveyor having a discharge end portion horizontally swingable about a generally upright axis spaced rearwardly of said turntable,
and gathering mechanism extending along opposite sides of the portion of said conveyor extending from a position adjacent the ground for transferring the cuttings onto said conveyor.

5. In a continuous mining machine, a mobile main frame, a turntable pivotally mounted on said main frame for movement about a vertical axis disposed intermediately thereof,
a forwardly extending boom pivotally mounted on said turntable for movement about a horizontal axis disposed rearwardly of the axis of turning movement of said turntable,
a rotary mining head rotatably mounted on the forward end of said boom,
a longitudinally extending conveyor extending along said main frame from a position in advance of the forward end thereof and rearwardly beyond the rear end thereof and having a forward end portion trunnioned on said turntable forwardly of the axis of turning movement thereof,
and a rear portion extending rearwardly therealong and mounted for up and down angular movement about the trunnion axis of connection of the forward end portion of said conveyor to said turntable,
said rear portion of said conveyor having a forward end portion forming a rearward continuation of the inclined forward end portion of said conveyor and articulated about an axis coincident with the axis of pivotal movement of said turntable in at least one position of vertical adjustment of the rear portion of said conveyor to said turntable and having a discharge end section articulated about a generally upright axis parallel to the axis of articulation of the forward end portion of said rear portion of the conveyor,
and means vertically moving the forward and rear end portions of said conveyor about their trunnion axes of connection of said turntable, independently of each other.

6. A continuous mining machine in accordance with claim 5 wherein gathering mechanism extends along opposite sides of the forward end portion of the conveyor and is tiltable with the forward end portion of the conveyor at a level below said rotary mining head for transferring the mined material onto said conveyor.

7. In a continuous mining machine,
a mobile main frame,
a turntable pivotally mounted on said main frame for movement about a vertical axis,
a forwardly extending boom having parallel spaced arm portions pivotally mounted on said turntable for movement about a horizontal axis disposed rearwardly of the axis of pivotal movement of said turntable,
a rotary mining head rotatably mounted on the forward end of said boom and extending transversely thereof,
a longitudinally extending conveyor extending from a position in advance of said main frame adjacent the ground along said main frame between said arm portions of said boom and beyond the rear end of said main frame,
a trunnion mounting for said conveyor on said turntable disposed forwardly of the axis of turning movement of said turntable,
hydraulic jacks means connected between said turntable and the portion of said conveyor extending forwardly of said turntable for raising and lowering the forward end portion of said conveyor with respect to the ground,
the portion of said conveyor extending forwardly of said turntable being articulated about a generally upright axis spaced rearwardly of said trunnion mounting and coincident with the axis of turning movement of said turntable for at least one tilted position of the rear end portion of said conveyor,
the rear end portion of said conveyor also having a discharge end section horizontally swingable about a generally upright axis parallel with the axis of articulation of the forward end portion of said conveyor and disposed adjacent the rear end of said main frame,
and gathering mechanism disposed forwardly of said turntable and extending forwardly of and along opposite sides of the forward end portion of said conveyor and tiltable about the trunnion axis of connection of the forward end portion of said conveyor to said turntable and disposed at a level below said mining head,
for transferring the material mined thereby onto said conveyor.

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