ADJUSTABLE CONTINUOUS MINING MACHINE OF THE BORING TYPE

Fig. 3

Fig. 4

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ADJUSTABLE CONTINUOUS MINING MACHINE OF THE BORING TYPE

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This invention relates to improvements in continuous mining machines of the boring type particularly adapted for operation in low seams of coal.

A principal object of the invention is to provide a simple and improved form of adjustable mounting for the boring heads of a continuous mining machine on the main frame of the mining machine, arranged to adjustably support and transmit the end thrust from the boring heads onto the main frame of the machine.

A further object of the invention is to provide a continuous mining machine for coal and the like of the boring type, in which a plurality of boring heads both directly into the coal face, together with an adjustable support for the boring heads on the main frame of the machine, utilizing jacks for supporting and vertically adjusting the boring heads with respect to the main frame, and in which the axial thrusting loads are transmitted from the boring heads to the main frame of the machine directly through the adjusting jacks.

Still another object of the invention is to provide a simplified form of continuous boring miner having a plurality of boring heads supported on a transversely extending support frame therefor, together with spaced jacks adjustable supporting the support frame for the boring heads on the main frame of the machine in which a slidable engaging connection between said jacks and one of the frames takes the boring end thrusts and transfers the thrusts through the jacks directly to the main frame of the machine.

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 where:

Figure 1 is a view in side elevation of a continuous mining machine constructed in accordance with the invention;

Figure 2 is a front end view of the machine shown in Figure 1, with certain parts removed;

Figure 3 is an enlarged fragmentary plan view of the forward end portion of the machine shown in Figure 1, with certain parts thereof broken away and certain other parts shown in horizontal section; and

Figure 4 is an enlarged fragmentary side elevational view of the forward portion of the machine, with certain parts broken away and certain other parts shown in vertical section in order to show certain details of the support for the boring head support frame on the main frame and the thrust transferring connection between said frames.

In the embodiment of the invention illustrated in the drawings, Figure 1 is a general side elevational view of a continuous mining machine of the boring type, in which a plurality of boring heads 11 bore directly into the working face of a mine to cut out the entire seam of coal from the mine floor to the mine roof by driving intersecting bores directly into the coal face. Spaced rotary cutters 13, supported rearwardly of the boring heads 11 and mounted on a transverse shaft 14 journaled for rotation about a horizontal axis extending perpendicular to the axis of rotation of the boring heads 11, are provided to cut along the roof in the spaces between the boring heads 11, to cut out the remaining cut of unmined coal and provide a flat roof from one rib of the working place to the other.

The upstanding cut of unmined coal left between the boring heads extending upwardly from the mine floor may be cut out by cutter chains 15 of gathering devices 16 for picking up the mined coal from the ground and progressing the mined coal upwardly along and around the apron 17 onto the receiving end of an endless conveyor 19, as in my joint application with Frank Cartlidge, on Boring Type Mining Machine, Serial No. 665,065, filed June 11, 1957.

The machine is transported from working place to working place, the boring heads 11 are advanced into the working face and the rotary cutters 13 and cutter chains 15 are advanced to cut the depending and upstanding cut of unmined coal and to gather and load the mined coal onto the conveyor 19 by continuous traction tread devices 20, driven from individual motors 21, herein shown as being mounted between said traction tread devices and supporting a main frame 23 for the machine.

The mounting of the motor 21 between the traction tread device 20, the drive from said motor to said traction tread devices and the support of the main frame 23 on said traction tread devices may be of any well-known form, and is no part of the present invention so need not herein be shown or described further.

The conveyor 19 may be a well known form of center strand endless chain and flight type of conveyor, which is laterally flexible to accommodate lateral swinging movement of an overhanging discharge end portion 24 of the conveyor by operation of a hydraulic swing jack 25, as is well known to those skilled in the art, so not herein shown or described further.

The main frame 23 has spaced arms 26 and 27 extending along each side thereof, forwardly of the forward end thereof and on opposite sides of the continuous traction tread devices 20 (Figure 3). The arms 26 and 27 form outboard supports for a hollow transversely extending beam 29, extending over the conveyor 19 in advance of the forward ends of the traction tread devices 20. The beam 29 forms a support for an outboard gear housing or support frame 30 for the boring heads 11, supporting said support frame 30 for vertical and tilting movement with respect thereto, as will hereinafter be more fully described as this specification proceeds.

The boring heads 11 are well known forms of boring heads commonly used in boring types of continuous mining machines like those shown in my joint application with Frank Cartlidge, Serial No. 665,065, so need only herein be shown and described in sufficient detail to render the present invention readily understandable.

Each boring head 11 has a central hub 31 mounted on a drive shaft 33, rotatably mounted in the gear housing or support frame 30 and driven from suitable reduction gearing (not shown) journaled within said gear housing.

The reduction gearing (not shown) is driven from a motor and speed reducer 35 mounted on the main frame 23 through spaced constant velocity universal couplings 36 on said main frame and support frame and connected together by an extendible drive shaft 37.

Each boring head 11 has segmental cutter bit carrying arms 39 and 40 supported in radial spaced relation with respect to the hub 31, the arm 40 being radially adjustable with respect to the arm 39, to vary the diameter of the bore, as shown and described in Patent No. 2,772,870, dated December 4, 1956, and no part of the present invention so not herein shown or described further. A pilot cutter 41 extends forwardly from the
center of the boring head 11 and has annularly arranged cutter blocks and bits 43 projecting forwardly therefrom, a slight distance in advance of the cutter bit carrying segments 39 and 40.

The transverse shaft 14 and rotary cutters 13 mounted thereon are shown as being spaced rearwardly of the boring heads 11 and supported on bearing supports 45 and 46 extending outwardsly from a support plate 47 mounted on a forward wall 49 of the support frame 30, for vertical adjustable movement with respect thereto along dovetail guides 50. Spaced screw jacks 51 mounted on support feet 53 projecting forwardly of the front wall 49 of the support frame 30 and connected with the plate 47 are provided to vertically move the plate 47 and rotary cutters 13 along the dovetail guides 50 and to hold said plate and the rotary cutters 13 in position to cut along the mine roof between the boring heads 11 as shown and described in my joint application with Cartlidge, Serial No. 665,065, and no part of the present invention so described is shown or described further.

The rotary cutters 13 may be driven from one boring head 11, shown in Figure 2 as being the left hand boring head, through an extensible drive connection indicated generally reference character 54, as in my aforementioned joint application with Frank T. Cartlidge.

Bearing now to the adjustable mounting for the boring heads and support frame 30 on the transverse beam 29 of the main frame 23, two laterally spaced jacks 55 are provided to support the gear housing or support frame 30 on the transverse beam 29 of the main frame 23. The jacks 55 are shown as being hydraulic jacks having cylinders 56 and piston rods 57 extensible from the lower ends thereof upon the admission of fluid under pressure to the head ends of said cylinders.

Each jack 55 is of a similar construction and has laterally extending flanges 59 and 60 extending from the wall of the cylinder 56. The flange 60 is shown as turning at right angles to the body thereof, and as engaging a side wall 61 of the gear housing or support frame 30.

The opposite flange 59 extends along the rear wall of the gear housing or support frame 30. The flanges 59 and 60 may be secured to the gear housing and support frame 30 by cap screws 62.

The piston rod 57 has a hemispherical lower end portion 63 engaging within a socket 64 in a shoe 65. The shoe 65 is mounted on a bearing pad 66 for slidably movement thereon. The bearing pad 66 is in turn mounted on the upper face of a support foot 67 on the end of an arm 69 extending downwardly and forwardly of the beam 29. The admission of fluid under pressure to the head ends of the cylinders 55 will thus elevate the support frame 30 along vertically extending T-shaped guides 70, extending vertically along the forward face of the beam 29, adjacent each end thereof.

Each cylinder 55 has spaced ears 71 extending rearwardly therefrom along opposite sides of an ear 73 projecting forwardly of a slide 75 slidably mounted on the T-shaped guide 70. The ears 71 terminate at their outer ends into arcuate engaging faces 76, having pivotal bearing engagement with sockets 77, formed in the forward face of the slide 75 on opposite sides of the forwardly projecting ear 73 (Figure 4). The axial thrust of the boring heads is thus taken through the cylinders 55 directly on the slides 75 and transmitted to the main frame 23 through the slides 75.

The slides 75 are shown as having channelled guides 79 formed therein, having gibbed rear end portions 89 engaging the rear faces of the T-shaped guides 70 and retaining the boring head support frame 30 and boring heads 11 mounted thereon from forward tilting movement.

The spaced ears 71 of each cylinder 55 are retained to the associated ear 73, by a pivot pin 81. The fit between the pivot pin 81 and the ear 73 is a relatively loose fit, to accommodate the axial thrusting loads to be taken directly on the sockets 77 to avoid introducing shearing thrusts on the pin 81 during the boring operation.

The support frame 30 and boring heads 11 are tilted and leveled by operation of a leveling jack 83 including a cylinder 84 trunnioned within the hollow interior of the beam 29 and extending rearwardly from the rear wall of the gear housing or boring head support frame 30. The tilting jack 83 serves to level the support frame 30 and boring heads 11 during or after vertical adjustment thereof, and to maintain the boring heads 11 in the desired relation with respect to the ground, and also to tilt the support frame 30 and boring heads 11 to change the grade of the place being mined.

It may be seen from the foregoing that the reactions of vertical adjustment of the support frame 30 and boring heads 11 are taken directly on the pads 65, said pads being slidably along the bearing pads 66 to accommodate changes in inclination of the support frame 30 and boring heads 11 with respect to the ground, and that the axial thrusts of boring are taken directly through the direct bearing engaging connection between the cylinders 55 and the slides 75 slidably mounted on the T-shaped slide rails 70.

It may further be seen that this provides a simplified and improved mounting for the boring heads on the main frame, accommodating vertical adjustment and tilting movement thereon by operation of the leveling jack 83 and also transmits the thrusts of boring to the main frame directly through the cylinders of the elevating jacks by direct bearing engagement with the slides slidably mounted on the main frame.

It will be understood that modifications and variations in the present invention may be effected without departing from the spirit and scope of the novel concepts thereof.

I claim as my invention:

1. In a continuous mining machine for cool and the like, a main frame, a support frame spaced in advance of said main frame, a plurality of rotatable mining heads mounted on said support frame, and means supporting said support frame on said main frame and vertically moving said support frame with respect to said main frame and transferring the axial thrusting loads from said mining heads to said main frame comprising hydraulic jack means connected between said frames, a thrust transmitting shoe pivotally connected to said jack means and having slidable engagement with one of said frames, and a leveling jack connected between said frames and tilting said support frame with respect to said main frame and leveling said support frame with respect to the ground.

2. In a continuous mining machine, a mobile main frame, a support frame disposed in advance of said main frame, a plurality of parallel spaced mining heads rotatably mounted on said support frame, and means suitably supporting said support frame on said main frame and vertically moving said support frame with respect to said main frame and transferring the axial thrusting loads from said mining heads to said main frame comprising laterally spaced hydraulic jacks including spaced cylinders mounted on said support frame, slideable shoes disposed beneath said cylinders and having slidable engagement with said main frame, piston rods extending from said cylinders having bearing engagement with said shoes, and slidable thrust transferring means transferring the axial thrusting loads from said mining heads to said main frame through said cylinders, comprising thrust transmitting slides having slidable interengaging connection with said main frame.
and having arcuate bearing sockets therein facing said cylinders, and bearing projections on said cylinders having direct bearing engagement with said sockets.

3. In a continuous mining machine, a main frame, a support frame spaced in advance of said main frame, a plurality of mining heads rotatably mounted on said support frame, a tilting cylinder pivotally connected between said frames for tilting said support frame with respect to said main frame and leveling said support frame with respect to said support frame comprising spaced hydraulic jacks, each including a cylinder secured to said support frame having a piston rod extendible therefrom, slidable shoes slidably mounted on said main frame, each having a socket therein opening for engagement with an associated piston rod, and slidable thrust transferring slides guided on said main frame for slidable movement therealong and having pivotal bearing engagement with said cylinders, for transmitting the axial thrusting loads from said support frame to said main frame directly through said cylinders.

4. In a continuous mining machine, a mobile main frame, a support frame spaced in advance of said main frame, a plurality of mining heads rotatably mounted on said support frame for rotation about parallel axes extending longitudinally of said main frame, a pair of laterally spaced hydraulic jacks, each including a cylinder mounted on said support frame and a piston rod extendible from the lower end of said cylinder, slidable shoes mounted on said main frame, each having a socket therein opening toward an associated piston rod in axial alignment therewith and engaged thereby for supporting said support frame on said main frame for vertical adjustment with respect thereto, a separate thrust transmitting slide pivotally connected to each cylinder and having direct engagement therewith and having slidable interengagement with said main frame for retaining said support frame in spaced relation with respect to said main frame and transmitting the axial thrusts from said boring heads directly to said main frame.

5. In a continuous mining machine, a mobile main frame, a support frame spaced in advance of said main frame, a plurality of mining heads rotatably mounted on said support frame for rotation about parallel axes extending longitudinally of said main frame, a pair of laterally spaced hydraulic jacks, each including a cylinder mounted on said support frame and a piston rod extendible from the lower end of said cylinder, slidable shoes mounted on said main frame, each having a socket therein opening toward an associated piston rod in axial alignment therewith and engaged thereby for supporting said support frame on said main frame for vertical adjustment with respect thereto, a separate thrust transmitting slide pivotally connected to each cylinder and having direct engagement therewith and having slidable interengagement with said main frame for retaining said support frame in spaced relation with respect to said main frame and transmitting the axial thrusts from said boring heads directly to said main frame.

6. In a continuous mining machine, a mobile main frame, a support frame spaced in advance of said main frame, a plurality of mining heads rotatably mounted on said support frame for rotation about parallel axes extending longitudinally of said main frame, a pair of laterally spaced hydraulic jacks, each including a cylinder mounted on said support frame and a piston rod extendible from the lower end of said cylinder, slidable shoes mounted on said main frame, each having a socket therein opening toward an associated piston rod in axial alignment therewith and engaged thereby for supporting said support frame on said main frame for vertical adjustment with respect thereto, spaced thrust transmitting slides having slidable interengagement with said main frame for vertical slidable movement therealong in alignment with said cylinders, said slides having arcuate bearing sockets therein, and said cylinders having bearing projections engageable with said sockets and transmitting the axial thrusts from said boring heads directly to said main frame.

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