May 15, 1956 J. S. ROBBINS 2,745,648

TILTABLE SUPPORTS FOR CUTTER HEADS OF BORING TYPE MINING MACHINES

Filed Nov. 6, 1953 3 Sheets-Sheet 1

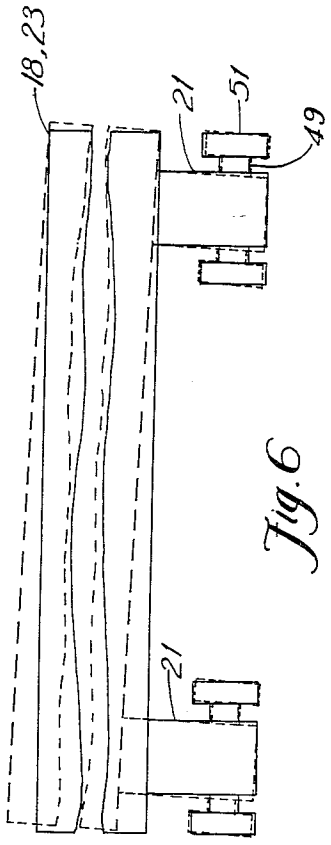

Fig. 6

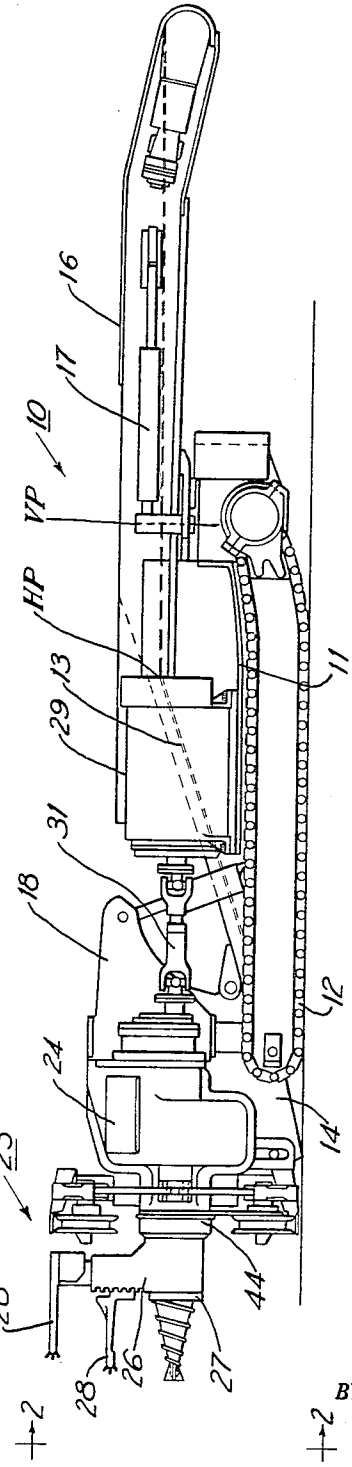

Fig. 1

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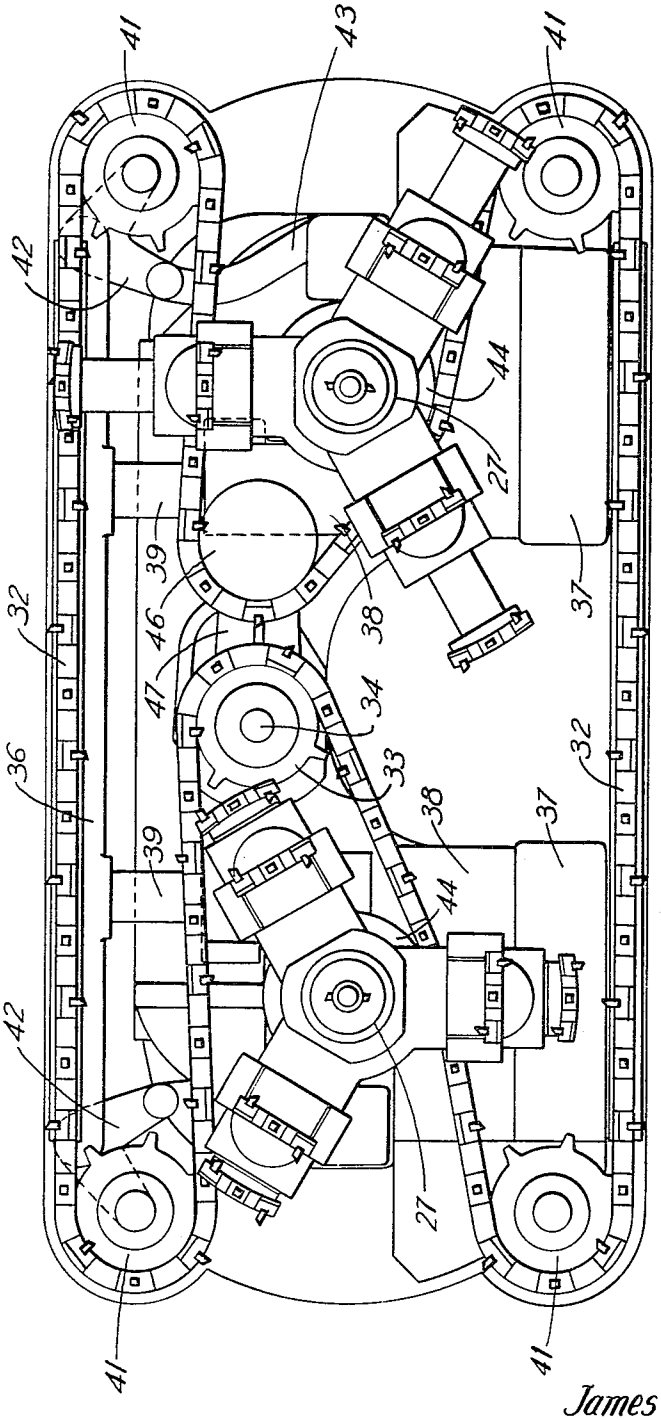

Fig. 2

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Fig. 3

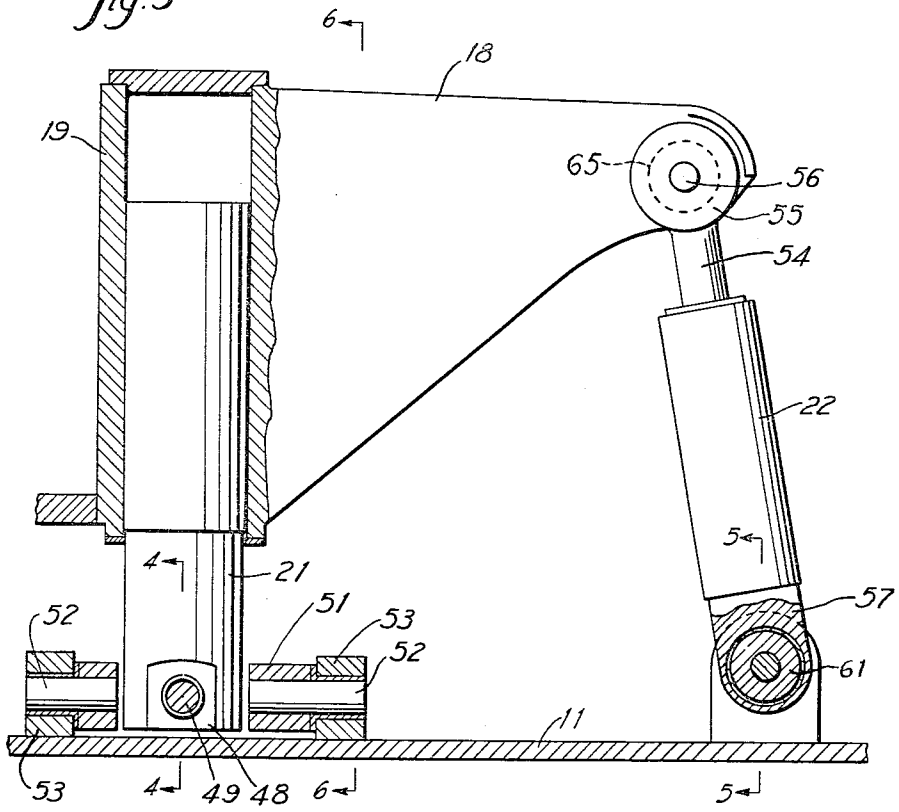


Fig. 4

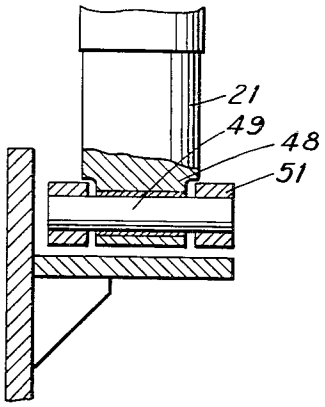
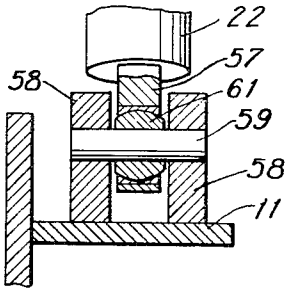


Fig. 5



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TILTABLE SUPPORTS FOR CUTTER HEADS OF BORING TYPE MINING MACHINES

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Application November 6, 1953, Serial No. 390,519

3 Claims. (Cl. 262—7)

This invention relates to improvements in mining machines of the type having multiple boring heads, the general type being disclosed in McKinley Patent No. 1,603,261, and more particularly to a novel support for the cutting head of such machine, whereby it may be tilted to compensate for an effect known as "spiralling," when one of the cutter arms may tend to cut at a different level than its juxtaposed arm during forward motion of the cutter head.

In the improved machines of the general type referred to where the head is tilted to correct for the spiralling effect, the cylinders for raising and lowering the cutter head are rigidly fixed at their upper ends to the gear casing for the cutter head. Consequently, when the head is tilted in a plane parallel to the working face of the seam, the lower swivelled ends of the cylinders must change their spacing as determined by the distance between the cylinders divided by the cosine of the angle of tilt.

Heretofore in accommodating such different dimension one of the cylinders has been mounted at its lower end upon a ball joint while the other cylinder has been mounted upon a ball joint arranged to slide upon a gib or the like.

Such contrivances have been needlessly costly, and of course, do not make for symmetry of assembly. According to the present invention, however, each of cylinders is provided with identical means enabling the cylinders to tilt with respect to the machine frame, and also enabling the cylinders to be connected to the machine frame whilst the projected distance between the cylinders in the frame during tilting is greater than that when no tilt takes place. Such means also affords a positive connection of the cylinders and the cutter head to the machine, not ordinarily possible with ball joint construction.

It is a principal object of the invention, therefore, to mount the cutter head of a multiple bore type mining machine in an improved fashion, the mounting for such cutter head being characterized by the employment of gimbals which enable the head to have tilting movement as desired and the cylinders to have the necessary translative movement laterally of the machine frame.

Other objects and important features of the invention will be apparent from a study of the specification following taken with the drawings which together illustrate a preferred embodiment of the invention and what is now considered to be the best mode of practicing the principles thereof. Other embodiments may be suggested to those having the benefit of the teachings herein, and it is therefore intended that the scope of the invention not be limited by the precise form herein illustrated nor otherwise than by the purview of the subjoined claims.

In the drawings:

Fig. 1 is a side view of a multiple bore type of mining machine having embodied therein the improvements according to the present invention;

Fig. 2 is a view of the cutter head of the machine shown in Fig. 1, said view being in the direction of the arrows 2—2 of Fig. 1, and to a larger scale than shown in Fig. 1;

Fig. 3 is a side view to an enlarged scale of the auxiliary frame for supporting the cutter head of Figs. 1 and 2;

Fig. 4 is a section taken along the line 4—4 of Fig. 3, looking in the direction of the arrows, showing details of a gimbal support for the lifting cylinders;

Fig. 5 is a section taken along the line 5—5 of Fig. 3, looking in the direction of the arrows, showing details of a swivelable support for the rear tilting cylinders of the auxiliary frame; and

Fig. 6 is a somewhat schematic view showing the auxiliary frame and the cutter head tilted to a position compensating for the spiralling effect of the cutter head, said view being taken along the plane 6—6 of Fig. 3, looking in the direction of the arrows, but to a reduced scale, and showing the lateral shift of the lifting cylinders with respect to the gimbal supports.

Referring now particularly to Figs. 1 and 2 of the drawings, the improvements according to the present invention are embodied in a mining machine indicated generally by the reference numeral 10, and including a main frame 11 mounted upon crawler treads 12. The main frame 11 affords a support for an endless conveyor 13 having a forward gathering end 14 and a discharge boom 16 at the discharge end of the machine 10. The discharge boom 16 is swingable in a horizontal plane by swing cylinders 17 about a vertical pivot VP, and raised and lowered in a vertical plane about a horizontal pivot HP by raising and lowering cylinders, not shown.

The main frame 11 supports an auxiliary frame 18 which is raised and lowered by a pair of lifting cylinders 19 mounted rigidly at their upper ends on each side of the auxiliary frame 18. The cylinders 19 have pistons 21 which are pivotally anchored at their lower ends to the main frame 11 as will be described in more detail as this specification proceeds. The auxiliary frame 18 is capable of being tilted up and down in a vertical plane substantially coincident with the longitudinal axis of the machine 10 and with respect to the main frame 11 by means of tilting cylinders 22, which also will be described in more detail as this specification proceeds.

The auxiliary frame 18 supports a cutter head indicated generally by the reference numeral 23. The cutter head 23 includes a gear case 24 and a pair of boring arms 26, 26 mounted upon stud shafts 27 journalled in the gear case 24 upon laterally spaced horizontal axes. Each of the boring arms 26 carries cutter bits 28 which extend in a forward direction to dislodge material from the working face of a mine seam as the two arms are rotated. The arms 26 are rotated in timed relationship by means of a motor 29 mounted on the main frame 11 and connected to the gear case 24 by means of a universally connected shaft 31. The arms 26 partially overlap in their paths of rotation 80 as they cut a pair of overlapping contiguous bores. In cutting such overlapping bores, upper and lower cores or ribs are left remaining by the action of the cutter arms 26, and it is conventional in machines of this type to provide means for removing such cores or ribs.

In order to remove the upper and lower core or rib, see Fig. 2, an endless cutter chain 32 driven from a drive sprocket 33 mounted on a shaft 34 extending from the gear case 24 is provided. The endless cutter chain 33 is guided at the top of the coal seam over an upper cutter chain bar 36, and at the bottom of the seam under a similar cutter chain bar 37. These two cutter chain bars 36 and 37 are moved apart in accordance with the thickness of the working seam by means of double acting cylinders 38 and coacting pistons 39. It will be seen that the endless cutter chain 32 will remove the remaining ribs or cores as it moves in its orbital path.

Each end of the cutter chain bars 36 and 37 support idler sprockets 41, each of said sprockets mounted upon

bell cranks 42 pivoted near the ends of the cutter bars 36 and 37 and which are rocked to proper position through the medium of arms 43 coacting with the bell cranks 42 and the cutter bars 36 and 37. The action of the cylinders 38 and the cutter bars 36 and 37 is more clearly described in an application of James S. Robbins Ser. No. 345,157 filed March 27, 1953, for Improvements in Mining Machines.

The endless chain 32 is additionally trained around a fixed idler shoe 44 on the shafts 27, and an idler shoe 46 mounted on an arm 47 rocking about the center of the shaft 34. The idler shoe 44 takes positions corresponding to the position of the cutter chain bars 36 and 37 to take up any slack in the endless chain 32 occasioned by retraction of the bars 36 and 37. The means for taking up such slack by controlling the position of the arm 47 and shoe 46 may be that as shown in an application of Carl A. Wilms Ser. No. 391,598, filed November 12, 1953, for Slack Adjusting Device for Cutter Chains of Bore Type Miners, now abandoned.

The arms 26 as seen in Fig. 2 are adjusted in their radius according to the thickness of the seam, and the cutter chain bars 36 and 37 are correspondingly adjusted in their position apart.

The cutter head 23 has a tendency at times to cut a spiral bore in the coal seam, such spiralling being caused in part by variation in characteristics of the seam. Such tendency of the cutter head can be corrected by tilting the auxiliary frame 18 supporting the gear casing 24 and the cutter head 23 in a plane parallel to the working face.

The necessary amount of tilting movement of the auxiliary frame 18 in a plane parallel to the working face has been found not to exceed approximately 3°. However, since the lifting cylinders 19 are rigidly secured at their upper ends, such angular tilt can be accommodated only by lateral shifting of the lower mountings of the piston rods of such lifting cylinders, the shift of such lower mountings being a function of the cosine of the angle of tilt.

Referring now more particularly to Figs. 3 to 6 of the drawings, each piston rod 21 of the lifting cylinders 19 has a reduced end portion 48 through which passes a bushed pin 49. The ends of the pin 49 are pivotally connected to a gimbal ring 51 having bushed trunnions 52, the ends of such trunnions 52 extending into spaced lugs 53 extending upward from the main frame 11.

The auxiliary frame is also tiltable about a horizontal axis extending laterally of the main frame 11 by means of laterally spaced tilting cylinders 22. Each of such cylinders has a lower extension 57, see also Fig. 5, which extends between a clevis 58 mounted on the main frame 11. The clevis 58 supports a pin 59 and a ball joint 61 fitted within the extension 57 so that the cylinder 22 may freely rock with respect to pin 59 and clevis 58.

Each cylinder 22 has a piston rod 54 which terminates in a clevis 55 which straddles the rearward extension of the frame 18, the extension having fitted therein a ball joint 65 with a pin 56 passing through the ball 65 and the clevis 55 in the manner shown.

Since the cylinders 27 are thus universally mounted the frame 18 may tilt in a plane normal to the extensions of the frame without any binding at the points of connection of the cylinders and their piston rods 54.

The auxiliary frame 18 and the cutter head 23 may be rocked about a horizontal axis, the pin 49 acting as a pivoting center, by means of the tilting cylinders 22 according to whether the machine 10 is to be operated on an upgrade or a downgrade.

As has been previously discussed, the cutter head 23 may tend to spiral in the seam of coal because of variations in the structure thereof. Such tendency of the cutter head to spiral may be corrected by tilting the auxiliary frame 18 in a plane parallel to the working face of the seam. Such tilting of the auxiliary frame 18 and the cutter head 23 may be effected by selective operation of the spaced cylinders 19 on each side of the auxiliary frame 18. Means for controlling the flow of pressure fluid to and from the cylinders 19 may be provided, but such control means forms no part of the invention herein.

However, since the cylinders 19 are rigidly fixed at their upper ends to the auxiliary frame 18, such tilting of the frame 18 causes the distance between the cylinders and their pistons 21 as projected on the main frame 11 to be equal to said distance divided by the cosine of the angle of tilt. During such tilting movement the pistons 21 move laterally with respect to the gimbal ring 51, and the distance between the piston 21 at its reduced portion 48 and the gimbal 51 enables the piston to shift laterally of the gimbal upon the pin 49, the gimbal meanwhile also tilting upon its trunnions 52 through an angle equal to the angle of tilt.

In Fig. 6 there is shown schematically the auxiliary 18 and the cutter head 23, and the shift of the pistons 21 upon the pins 49 with respect to the gimbal 51. Such shifting of said elements being shown in the phantom outline.

It will be seen from the foregoing description that there has been provided a unique and novel construction for supporting the auxiliary frame and the cutter head of a multiple bore type of miner. The assembly described for supporting the lifting cylinders 19 insures at all times that there will be no separation of the auxiliary frame 18 from the main frame 11, there being a positive connection between the main frame and the auxiliary frame at all times.

While the invention has been shown and described in terms of a preferred embodiment thereof, such embodiment is intended not to be limitative of the invention, the scope thereof being intended to be limited only by the terms of the claims appended.

I claim:

1. In a mining machine of the type having a cutter head with cutter arms arranged to cut contiguous bores, a main frame including means for propelling same along a mine floor or the like, an auxiliary frame mounted on said main frame and having said cutter head extending therefrom, lifting means for raising and lowering said auxiliary frame with respect to said main frame, comprising fluid operated cylinders and pistons therefor mounted in spaced relationship laterally of said main frame, said cylinders being fixed rigidly at their upper ends to said auxiliary frame, said fluid operated cylinders and their pistons being selectively extensible in order to provide a position of limited tilt of said auxiliary frame to correct any tendency of said cutter arms to deviate from the cutting of a straight bore, and means for mounting each of said cylinders and their pistons so as to accommodate a greater projected distance on said main frame between said cylinders in accordance with such tilting of the auxiliary frame comprising a member having a swiveling connection with said main frame, a swivelling connection from the piston of said cylinder to said member including a pin passing through said piston and said member, said piston being arranged to move laterally of such swivelable member upon said pin in accordance with such tilting movement.

2. In a mining machine of the type having a cutter head with cutter arms arranged to cut contiguous bores, a main frame including means for propelling same along a mine floor or the like, an auxiliary frame mounted on said main frame and having said cutter head extending therefrom, lifting means for raising and lowering said auxiliary frame with respect to said main frame, comprising fluid operated piston and cylinder means mounted in spaced relationship laterally of said main frame and having one of the elements of said piston and cylinder means fixed rigidly at their upper ends to said auxiliary frame, said fluid operated piston and cylinder means being selectively extensible in order to provide a position of limited

tilt of said auxiliary frame to correct any tendency of said cutter arms to deviate from the cutting of a straight bore, and means for mounting each of said piston and cylinder means so as to accommodate a greater projected distance on said main frame therebetween in accordance with such tilting of the auxiliary frame comprising a gimbal having a swiveling connection with said main frame, a swivelling connection between the other of the elements of said piston and cylinder means and said gimbal including a pin passing through the other of said elements, said last named element sliding upon said pin during such tilting of the auxiliary frame.

3. In a mining machine of the type having a cutter head with cutter arms arranged to cut contiguous bores, a main frame including means for propelling same along a mine floor or the like, an auxiliary frame mounted on said main frame and having said cutter head extending therefrom, lifting means for raising and lowering said auxiliary frame with respect to said main frame, comprising fluid operated piston and cylinder means mounted

in spaced relationship laterally of said main frame and having one of the elements of said piston and cylinder means fixed rigidly at their upper ends to said auxiliary frame, said fluid operated cylinder and piston means being selectively extensible in order to provide a position of limited tilt of said auxiliary frame to correct any tendency of said cutter arms to deviate from the cutting of a straight bore, and means for mounting each of said cylinder and piston means so as to accommodate a greater projected distance on said main frame between said cylinder and piston means in accordance with such tilting of the auxiliary frame comprising a member having a swivelling connection with said main frame, a swivelling connection from the other of the elements of said piston and cylinder means to said member including a pin passing through the last named element of said cylinder and piston means, said last named element moving on said pin longitudinally thereof during such tilting movement.

No references cited.