Oct. 2, 1956 C. A. WILMS 2,765,154

BORING TYPE MINING MACHINE WITH TILT LIMITING MEANS

Filed Nov. 12, 1953 3 Sheets-Sheet 1

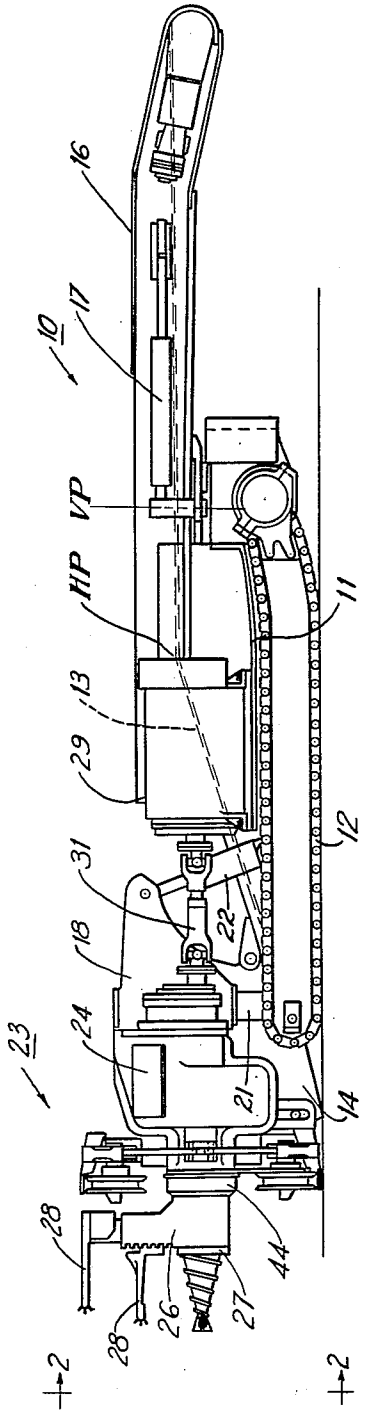

Fig. 1

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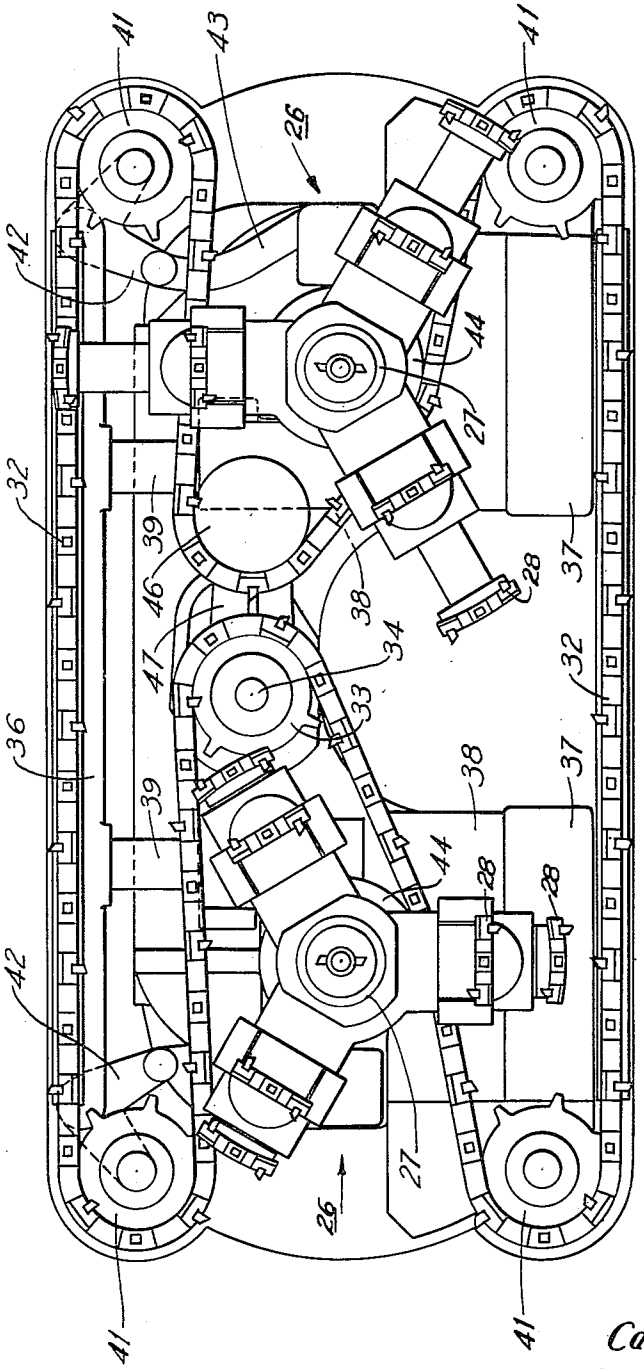

Fig. 2

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Fig. 4

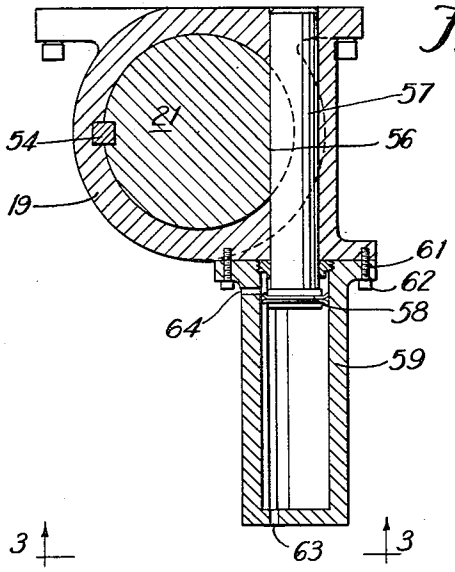


Fig. 3

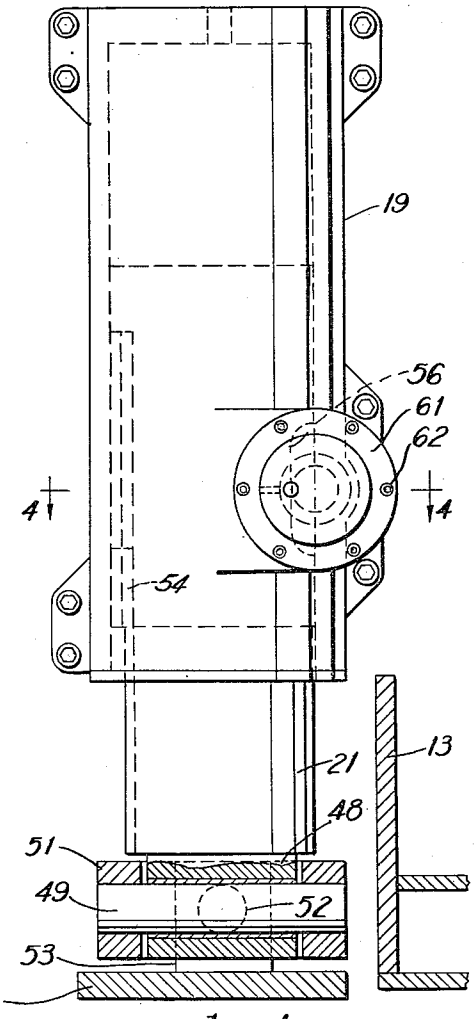


Fig. 5

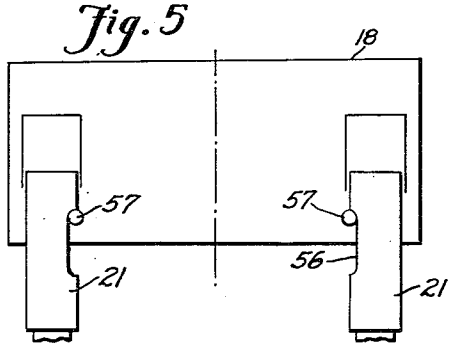
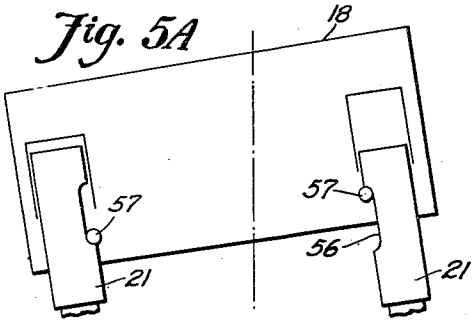


Fig. 5A



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United States Patent Office

2,765,154

Patented Oct. 2, 1956

2,765,154

BORING TYPE MINING MACHINE WITH TILT LIMITING MEANS

Carl A. Wilms, Chicago, Ill., assignor to Goodman Manufacturing Company, Chicago, Ill., a corporation of Illinois

Application November 12, 1953, Serial No. 391,493

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 construction for controlling the maximum degree of tilt of the cutting head of such machines, as may be necessary 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, the cutting head may be tilted in a plane parallel to the working face to compensate for the tendency of the cutter head to spiral. Such tendency to spiral may be corrected by tilting the head through an angle of approximately 3°.

The construction according to the present invention may be incorporated in a machine such as that disclosed in a co-pending application of James S. Robbins, Serial No. 390,519, filed November 6, 1953, owned by the assignee of this application, for Improvements in Supports for Cutter Heads of Boring Type Mining Machines. According to the present invention the piston rods of the lifting cylinders for the cutter heads are each provided with a relieved portion past which a fluid actuated pin or locking member is arranged to move. The relieved portions of the pistons are of such dimension that one of the pins engages the top of one of the relieved portions of one cylinder whilst the other pin engages the bottom of the relieved portion of the other cylinder, such positions of the pins being that for the usual maximum angle of tilt.

One of the principal objects of the invention is to provide a simple device which will limit the tilting movement of the cutter head of a multiple bore miner in a plane parallel to the working face to a maximum value, but which will allow tilting of the head to be varied as desired below such maximum value.

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 detailed side view of one of the lifting cylinders for the auxiliary frame shown in Fig. 1;

Fig. 4 is a horizontal section taken along the plane 4—4 of Fig. 3 looking in the direction of the arrows and showing tilt controlling means for the auxiliary frame of Fig. 1;

Fig. 5 is a somewhat schematic showing of the auxiliary frame of Fig. 1, showing the relative positions taken by the auxiliary frame after raising thereof and prior to the operation of the tilt controlling means; and

Fig. 5a shows the positions adopted by the lifting cylinders for the auxiliary frame during tilting thereof, and showing the means for controlling the amount of tilt, the tilt being shown to an exaggerated degree.

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 discharge boom 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 on each side of the auxiliary frame **18**. The cylinders **19** have pistons **21** which are 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 with respect to the main frame **11** by means of tilting cylinders **22**.

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 stub 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 universally connected shaft **31**.

The rotating arms partially overlap in their paths of rotation so as to cut a pair of overlapping bores. As is conventional with machines of the general type referred to, see Fig. 2, an endless chain **32** driven from a drive sprocket **33** is mounted on a shaft **34** extending from the gear case **24**.

The endless chain **33** is guided at the top of the coal seam over a cutter chain bar **36**, and at the bottom of the seam over 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**.

Each end of the cutter chain bars **36** and **37** support idler sprockets **41** each mounted upon bell cranks **42** pivoted to the ends of the cutter bars **36** and **37** 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 are more clearly described in an application of James S. Robbins, Serial No. 399,865, filed December 23, 1953, owned by the assignee of this application, now Patent Number 2,711,889, for Improvements in Mining Machines.

The endless chain 32 is additionally trained around fixed idler shoe 44 on the shafts 27 and an idler 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 Serial No. 391,598, filed November 12, 1953, now abandoned, for Slack Take up Device for Boring Heads of Multiple Bore Type Continuous Miners.

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 overlapping bores made by the cutter arms 26 leave an upper and lower kerf which are removed by the upper and lower runs of the chain 32.

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.

Referring now more particularly to Figs. 3, 4 and 5 of the drawings, the piston rod 21 of the lifting cylinder 19 has a reduced end portion 48 through which passes a bushed pin 49 having its ends received in a gimbal ring 51, said gimbal ring having a swivelable connection upon a trunnion pin 52 received in lugs 53 extending upward from the main frame 11. The precise construction of such a gimbal mounting is that as more clearly shown in the above mentioned copending application of James S. Robbins, Ser. No. 390,519, filed November 6, 1953 for Improvements in Supports for Cutter Heads of Boring Type Mining Machines.

As has been previously discussed the lifting cylinders 19 and 21 are arranged to raise the cutter head 23 to proper working position. However, the cutting action of the cutter arms 26 is oftentimes such as to tend to cause the cutter head 23 to spiral in a seam of coal or the like. To counteract such tendency of the cutter head to spiral the auxiliary frame 18 to which the lifting cylinders are rigidly connected are arranged to be tilted through a small angle, not generally more than 3° in a plane parallel to the working face of the seam.

It is desirable, therefore, to control the maximum tilting movement of the auxiliary frame and the cutter head 23 so that the tilting movement need not exceed such 3° angle. Accordingly, means are provided for limiting such tilting movement, and as shown more clearly with respect to Figs. 3 and 4, the piston 21 is guided within the cylinder 19 by means of a key 54 so as to cause at times a relieved portion 56 of the piston 21 to be properly aligned with a pin 57. A piston 58 secured to one end of the pin is slidable within a cylinder 59 held by a flange 61 held to the outside of the operating cylinder 19 by means of cap screws 62. Fluid for actuating the piston 58 and the pin 57 is supplied to the cylinder 59 at pressure ports 63 and 64.

The relieved portion 56 within the piston 21 is of such dimension D as seen in Fig. 5 as to be equal approximately to the distance between the cylinders 19 multiplied by the tangent of the angle of tilt.

It will be seen that when the cylinders 19 are extended to the proper working height the pins 57 may enter the relieved portion 56 of the pistons 21. Thereafter the cylinders may be selectively operated until the auxiliary frame 18 and the cutter head 23 can adopt a position as

seen in Fig. 5, the showing in Fig. 5 of the angle of tilt being exaggerated more clearly to show the relationship of the parts. It will be obvious that by means of the hydraulically actuated pins 57 and the selection of a suitable likewise dimension of the relieved portion 56 that the auxiliary frame 18 and the cutter head 23 are desirably limited in their angle of tilt and that the desired angle of tilt may be nicely controlled by such apparatus.

While the invention has been described in terms of a preferred embodiment thereof it is not intended that the invention be limited by the precise embodiment herein shown nor otherwise by the terms of the appended claims.

I claim as my invention:

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 mounted in spaced relationship laterally of said main frame, said cylinders being fixed rigidly to said auxiliary frame, the pistons of said fluid operated cylinders 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, means connecting said pistons to said main frame including means enabling lateral shifting of each of said pistons with respect to said main frame in accordance with such tilting, the combination therewith of means for enabling said auxiliary frame to have not more than a maximum angle of tilt in a plane parallel to the working face comprising a relieved portion on each of the pistons of said cylinders, a pin supported on said cylinder and arranged to enter the relieved portion on the piston of its associated cylinder, and means for actuating said pins.

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 cylinders and pistons mounted in spaced relationship laterally of said main frame, said cylinders being fixed rigidly to said auxiliary frame, the pistons of said fluid operated cylinders 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, means connecting said pistons to said main frame including means enabling lateral shifting of each of said pistons with respect to said main frame in accordance with such tilting, the combination therewith of means for enabling said auxiliary frame to have not more than a maximum angle of tilt in a plane parallel to the working face comprising a relieved portion on each of the pistons of said cylinders, a locking member supported on each of said cylinders and arranged to enter the relieved portion on the piston of its associated cylinder, and means for actuating said locking members.

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 cylinders and pistons mounted in spaced relationship laterally of said main frame, said cylinders being fixed rigidly to said auxiliary frame, the pistons of said fluid operated cylinders 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, means connecting said pistons to said main frame including means enabling lateral shifting of each of said pistons with respect to said main frame in accordance with such tilting, the combination therewith of means for enabling said auxiliary frame to have not more than a maximum angle of tilt in a plane parallel to the working face comprising a relieved portion on each of the pistons of said cylinders, a locking member supported on each of said cylinders and arranged to enter the relieved portion on the piston of its associated cylinder, and fluid operated means for actuating said locking members.

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