



(19) **United States**

(12) **Patent Application Publication**
Steinberg et al.

(10) **Pub. No.: US 2014/0070599 A1**
(43) **Pub. Date: Mar. 13, 2014**

(54) **MINING INSTALLATION FOR EXTRACTING SEAM-TYPE OR MASS-DEPOSIT MINERAL MATERIALS, AND MINING MACHINE FOR THE SAME**

Publication Classification

(75) Inventors: **Jens Steinberg**, Lunen (DE); **Joachim Raschka**, Bochum (DE); **Frank Herrmann**, Chemnitz (DE); **Hartmut Mohe**, Schlettau (DE)

(51) **Int. Cl.**
E21C 27/24 (2006.01)
E21C 35/12 (2006.01)
E21C 31/08 (2006.01)
(52) **U.S. Cl.**
CPC *E21C 27/24* (2013.01); *E21C 31/08* (2013.01); *E21C 35/12* (2013.01)
USPC **299/64**

(73) Assignee: **Caterpillar Global Mining Europe GmbH**

(57) **ABSTRACT**

(21) Appl. No.: **14/116,614**

A mining machine for extracting seam-type or mass-deposit mineral materials includes a conveyor for carrying away mined material, a machine frame that can be moved along the conveyor and that includes at least one drum, which is equipped with extracting tools, is rotatable about its drum axis and is adjustable in height relative to a machine frame by a swivel arm. The drum axis of the drum is parallel to the direction of travel of the mining machine, and the extracting tools are mounted in groups on tool carriers which are arranged on the circumference of the drum so as to be rotatable about rotation axes disposed transversely in relation to the drum axis.

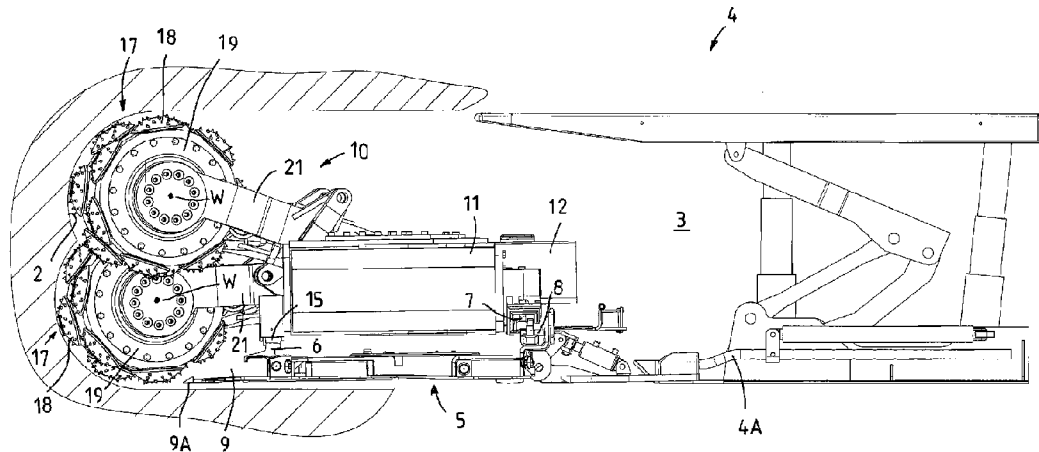
(22) PCT Filed: **May 11, 2012**

(86) PCT No.: **PCT/IB2012/052358**

§ 371 (c)(1),
(2), (4) Date: **Nov. 21, 2013**

(30) **Foreign Application Priority Data**

May 16, 2011 (DE) 20 2011 050 143.4



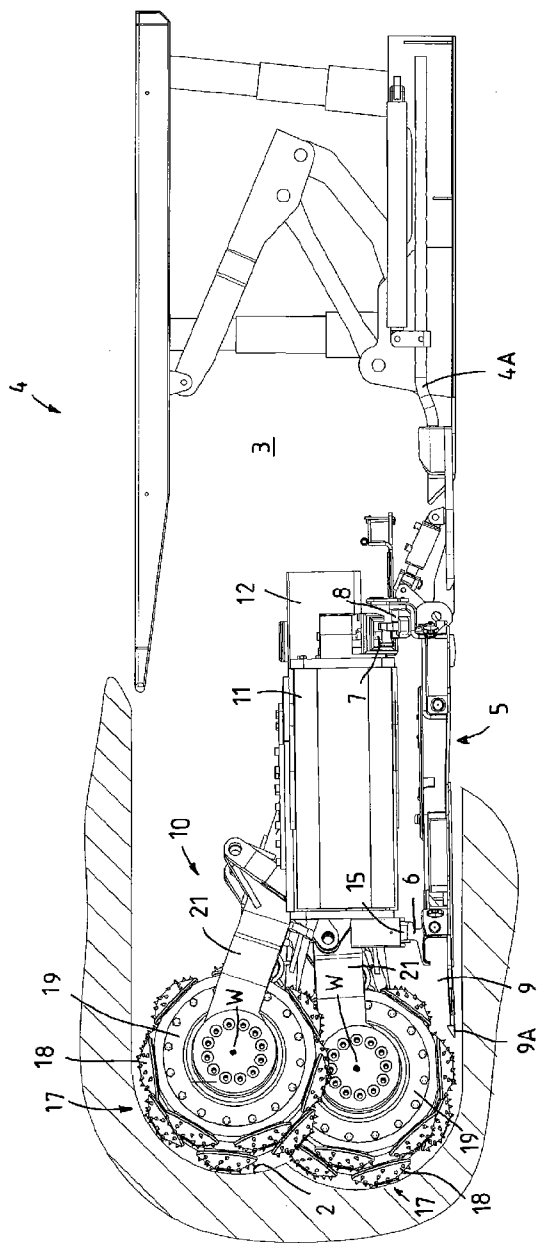


FIG 1

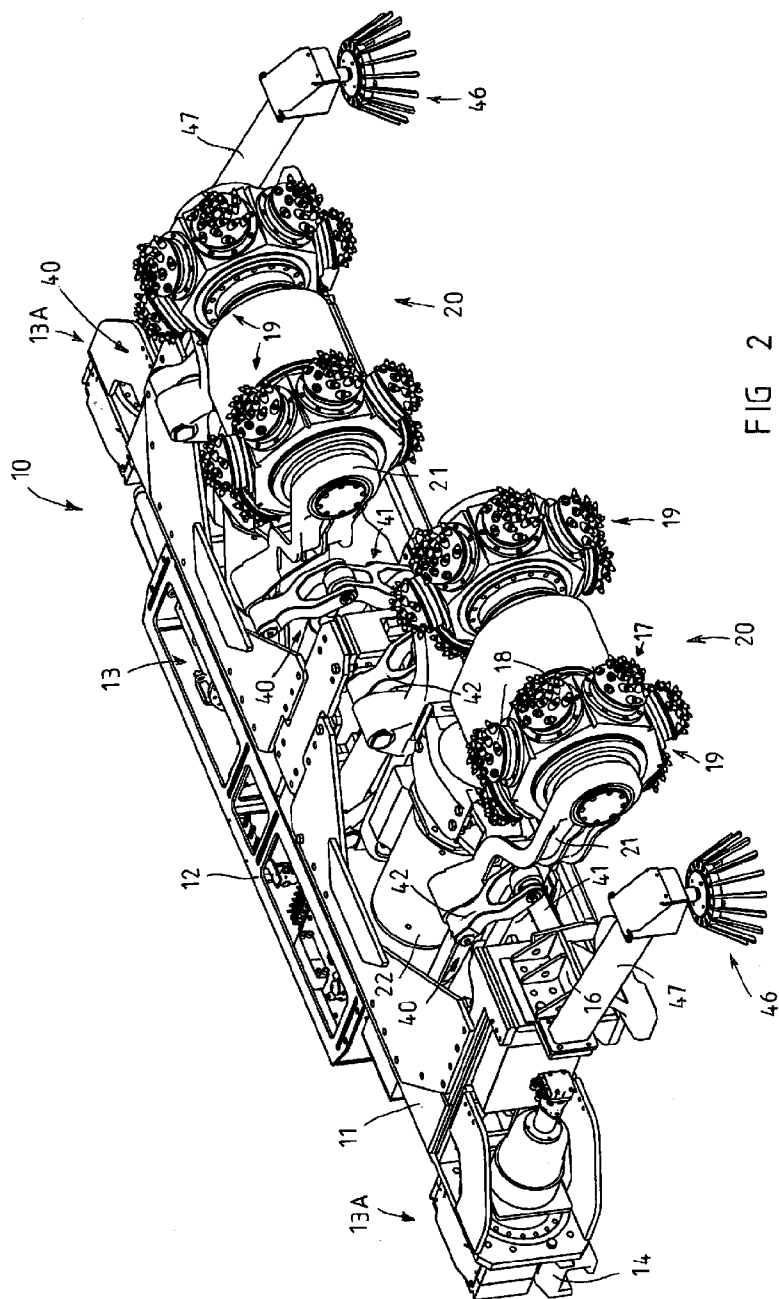


FIG 2

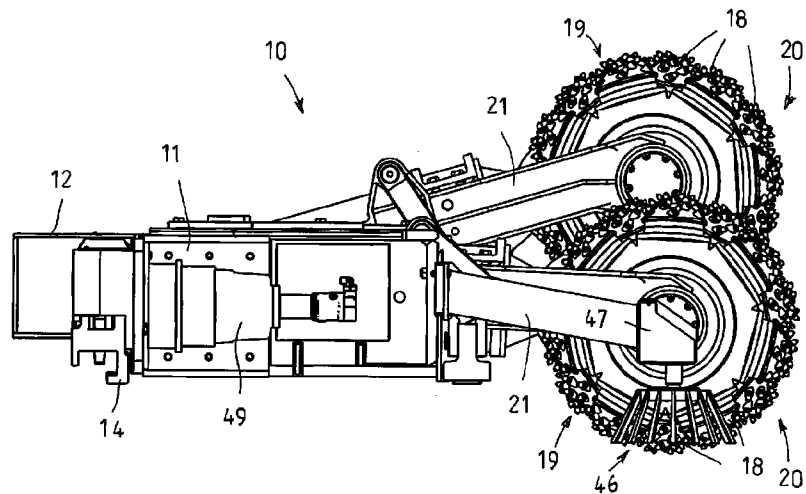


FIG 3

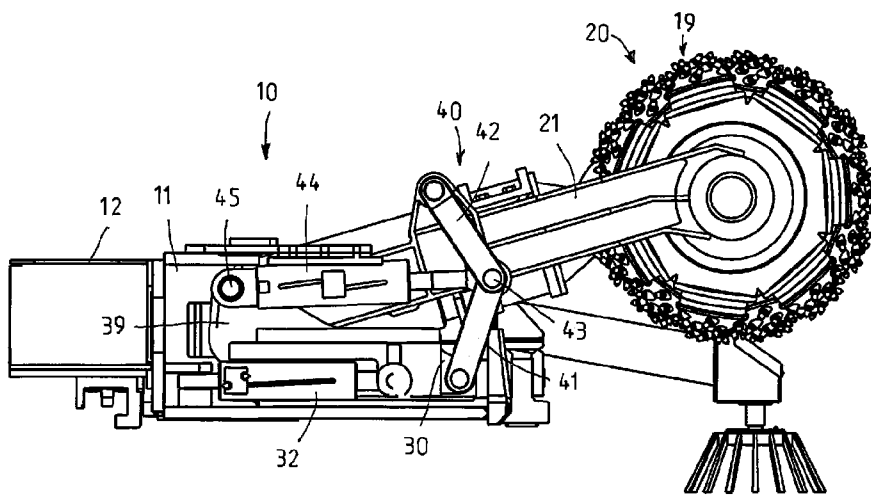


FIG 4

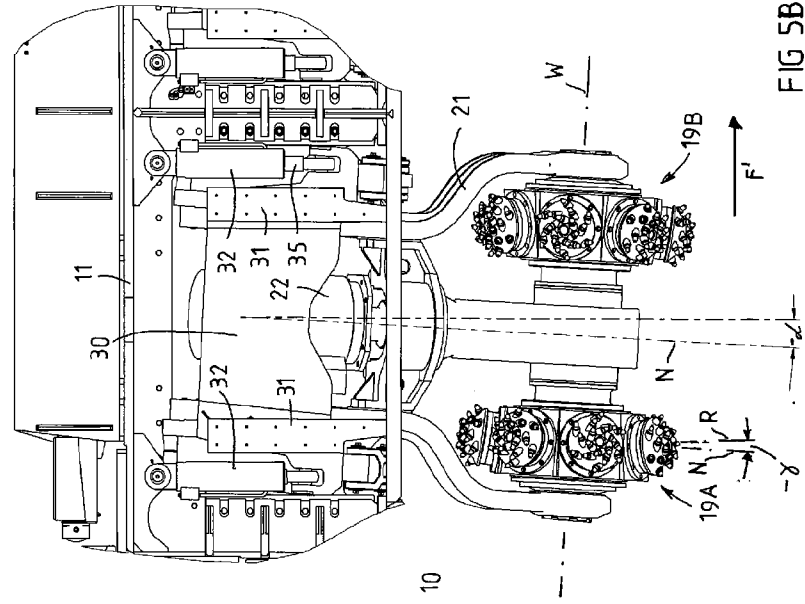


FIG 5B

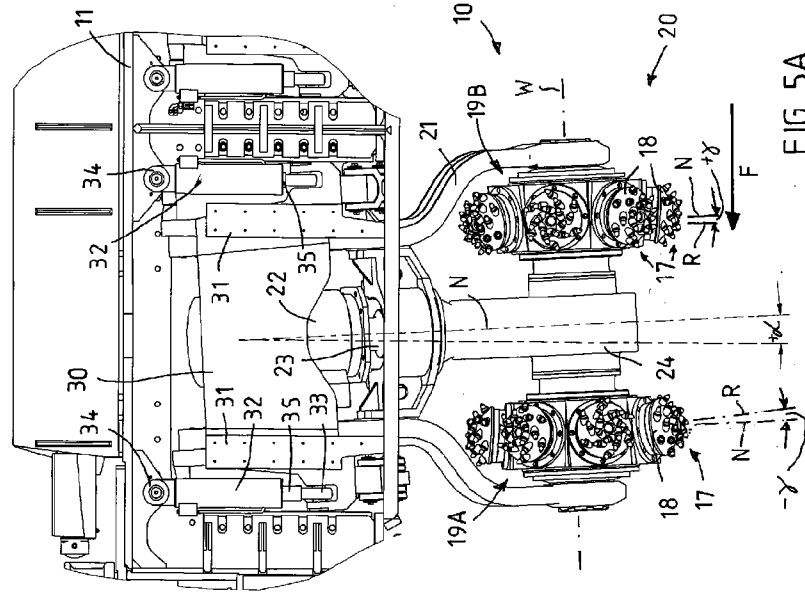


FIG 5A

MINING INSTALLATION FOR EXTRACTING SEAM-TYPE OR MASS-DEPOSIT MINERAL MATERIALS, AND MINING MACHINE FOR THE SAME

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of priority to international patent application number PCT/IB2012/052358, having a filing date of May 11, 2012, which claims the benefit of priority to German patent application number DE202011050143.4 having a filing date of May 16, 2011, the complete disclosures of which are all hereby incorporated by reference for all purposes.

TECHNICAL FIELD

[0002] The invention relates to a Mining installation for extracting seam-type or mass-deposit mineral materials, comprising a conveyor device for carrying away mined material, and comprising a mining machine that can be moved along the conveyor device and that comprises at least one drum, which is equipped with extracting tools, is rotatable about its drum axis and is adjustable in height relative to a machine frame by means of a swivel arm. The invention also relates, in particular, to the mining machine for the same.

BACKGROUND

[0003] For the purpose of extracting seam-type mineral deposits, it is known practice to use a mining installation with a so-called shearer loader as mining machine, which has a machine frame that is guided on the machine carriageway of a conveyor and on which there are disposed two vertically pivotable ranging arms, on each of which there is mounted a cutting drum that can be driven, in particular, by means of a drive motor located in the machine frame and by means of a gear transmission disposed in the ranging arm. The machine frame of the shearer loader is moved, in each case parallel-wise in relation to the conveyor device, or to the machine carriageway, on the conveyor device, and the drum axes of the cutting drums, which on their circumference have helically fitted cutting tools, are perpendicular to the direction of travel; during a drum run, differing height adjustment of the two cutting drums enables material to be extracted over the entire extraction height of the deposit and loaded into the conveyor. Such shearer loaders are distributed, for example, by the applicant, under the brand name 'ELEKTRA®', in differing dimensions and drive powers.

[0004] A shearer loader, as a mining machine, is normally used together with a support, which consists of a multiplicity of support frames, which are set up next to each other and on which the conveyor abuts, via self-advancing or shift cylinders, in order either to shift the conveyor forward together with the machine carriageway or, if the travel of the self-advancing cylinders has been used up, to draw along the support frames individually, as is known to persons skilled in the art.

[0005] In addition to the extraction of seam-type deposits by longwall mining, e.g. by means of shearer loaders, it may be necessary to use a suitable mining appliance to first undercut a mass deposit that is subsequently to be extracted by a bunker discharge method. For this purpose, it is possible to use, for example, a mining installation such as that described in DE 100 46 497 C2 for ore mining, and which has a drilling

appliance, coupled to a face conveyor, for producing blast holes, and has a loading appliance for charging the face conveyor.

SUMMARY

[0006] The object of the invention is to create a mining installation for extracting seam-type mineral deposits or for undercutting mass deposits, by means of which high extraction capacities can be achieved with, at the same time, reduced tool wear.

[0007] To achieve this object and possibly also to obtain further advantages, there is proposed, according to the invention, a mining installation in which the drum axis of the drum of the mining machine is substantially parallel to the direction of travel of the mining machine, the extracting tools that effect removal of the material being mounted in groups on tool carriers, which are disposed on the circumference of the drum so as to be rotatable about rotation axes disposed transversely in relation to the drum axis.

[0008] Unlike shearer loaders in which the drum axis of the drum is perpendicular to the direction of travel of the mining machine and in which passive extracting tools are used, the mining installation according to the invention proposes an arrangement of the drum axis that is substantially parallel to the direction of travel of the mining machine, each drum being additionally provided with activated extracting tools, namely, extracting tools disposed on rotatable tool carriers. The use of cutting drums having activated working tools, in which the rotation axes of the tool carriers are disposed transversely in relation to the drum axis, is known, for example, from US 2010/0001574A1 of the applicant, the disclosure of which is hereby incorporated by reference in its entirety for all purposes. By overlaying the travel motion with a rotational motion of the cutting drums and with a rotational motion of the tool carriers, it is possible to achieve the result whereby, at any one time, only one extracting tool, or only an extremely small number of extracting tools, is performing extraction work on the front of the material to be extracted, such that the mining installation as a whole can be equipped with a reduced drive power, for example in comparison with a shearer loader. It is particularly advantageous if, during the mining run, although the drum axis of the at least one drum is substantially parallel to the direction of travel, there is nevertheless a certain inclination of the drum axis in relation to the direction of travel, thereby enabling the individual working tools to break out material from the extraction front to be removed, while maintaining a clearance angle, as a result of which the wear on the individual working tools can be reduced.

[0009] According to the particularly preferred design, during the mining run the drum axis is inclined in relation to the direction of travel, the angular offset between the drum axis and the direction of travel preferably being equal to or less than $\pm 6^\circ$, in particular equal to or less than approximately $\pm 3^\circ$. In order to achieve this for both directions of travel, it is particularly advantageous if the alignment of the drum axis relative to the direction of travel is adjustable about a tilt angle, which is preferably equal to or less than a tilt angle of $\pm 6^\circ$, in particular equal to or less than a tilt angle of approximately $\pm 3^\circ$.

[0010] According to a particularly preferred design, the rotation axes of the tool carriers are at an angle of inclination in relation to the normal to the drum axis of the associated drum, the angle of inclination preferably being equal to or less than approximately $\pm 6^\circ$. Expediently in this case, the angle of

inclination and the tilt angle are matched to each other, the angle of inclination preferably being greater than the angular offset, during the mining run, between the direction of travel and the drum axis, by reason of the tilt angle.

[0011] The inclination of the rotation axes has advantages, in particular, if a drum pair is rotatably mounted on each swivel arm, the rotation axes of the tool carriers on the first drum then, according to a particularly advantageous design, being at an angle of $90^\circ - \gamma$ in relation to the drum axis and the rotation axes of the tool carriers on the second drum being at an angle of $90^\circ + \gamma$ in relation to the drum axis. In the case of an angle of inclination of 6° , this would therefore result in an inclination of 84° of the rotation axes of the one tool carriers and in an inclination of 96° of the rotation axes of the other tool carriers. Through an O-shaped twin arrangement of a drum pair, in which the rotation axes of the tool carriers on the one drum are inclined in one direction relative to the radial direction and the rotation axes of the tool carriers on the other drum are inclined in the opposite direction, the tool carriers are used to span conical surfaces around the drum axes, which conical surfaces are open towards opposite sides, or towards opposite directions relative to the normal to the drum axis, such that, for both angular offset positions, by reason of the tilt angle, and therefore for both directions of travel of the mining machine, it is possible to achieve an optimal alignment of the working tools to the material to be removed. It is understood that in this case the first drum is in each case provided only for the mining run in the one direction and the second drum is in each case provided only for the mining run in the other direction. For the purpose of further optimisation, it is advantageous if the tool carriers on the first drum rotate in the opposite direction to the tool carriers on the second drum, with, at the same time, both drums of a drum pair having the same direction of rotation.

[0012] In order to reduce the mechanical resource requirement for driving the drums of a drum pair, it is particularly advantageous if a rotary drive and/or a transmission for the two drums of a drum pair are/is positioned, or disposed, centrally between the first drum and the second drum.

[0013] In the case of the particularly preferred design, two height-adjustable and tiltable swivel arms, each supporting a drum pair, are disposed on the machine frame. Two drum pairs enable material to be extracted simultaneously in two differing banks during one mining run, or the drum that is trailing in the direction of travel can be used in an extraction level, or bank, already to remove material in the next cut-depth plane. The adjustment in height of the swivel arms is preferably effected by means of toggle lever joints, to enable the drums to be positioned in a stable manner, with the least possible travel, at differing extraction heights, and to be locked in respect of the reaction forces during the extraction work. An actuating cylinder is preferably assigned to each toggle lever joint. In order, at the same time, to ensure that the tilt function of each drum pair is effected substantially parallelwise in relation to the direction of travel, it is particularly advantageous if the swivel arms and the toggle lever joints, together with the drums supported by them, are mounted on slides, which are held in a tiltable manner in guides on the machine frame. It is particularly advantageous if the actuating cylinders are articulated, at one end, to the slide and, at the other end, to a middle joint of the toggle lever joint, as a result of which the associated swivel arm and the drum axis of the associated drum can be adjusted in height relative to the slide, and therefore also relative to the machine frame.

[0014] In addition, preferably, a pair of thrust cylinders is assigned to each slide, which thrust cylinders are articulated, at one end, to the machine frame and, at the other end, to the slide, such that actuation of the thrust cylinders makes it possible, if necessary, to telescope the slide, together with the swivel arm and drum pair, and therefore to effect an adjustment of the cut depth, without shifting the conveyor device. The thrust cylinders can be dimensioned, in particular, in such a way that at least one, and possibly even two, cut-depth adjustments can be effected without the necessity of moving the conveyor device. As a result of this, the mining machine is able to execute both uphill and downhill runs between a head road and an auxiliary road in a relatively short time, and the entire conveyor device, on which the machine carriageway for the mining machine is mounted, is moved only subsequently.

[0015] A twofold adjustment of the cut depth is particularly advantageous if two drums are being used to remove material in differing extraction levels or banks. Adjustment of the cut depth by extension of the thrust cylinders can be effected, advantageously, at the reversal point in the auxiliary road, while the shifting of the conveyor device and, at the same time, retraction of the thrust cylinders and of the slide are then each effected, in particular, in the main road. In the case of material being removed from the same bank by means of two drums with the thrust cylinder pairs, or slides, at differing stages of extension, shifting is effected after each mining run. In order to save energy, the mining machine can be switched off for a short period during the shifting operation. It is particularly advantageous if the thrust cylinders can be operated separately and the tilt angle of the drum axis, relative to the direction of travel, can be adjusted through differing extension lengths of the thrust cylinders. In the case of this design, therefore, the thrust cylinders can perform a dual function, namely, on the one hand, adjustment of the cut depth and, on the other hand, tilting of the slide, and therefore of the drum axis, upon each reversal of the direction of travel.

[0016] Expediently, the mining machine is provided with travel drives, to act together with a pin gear rod arrangement attached to the conveyor device, and/or clearing elements, such as clearing blades or clearing brushes, are disposed on the machine frame in order to clear the cutting path of lumps of material that have been left lying and that have not been loaded into the conveyor by means of the drums. Further rigid or movable clearing elements, for example clearing blades disposed on both end faces of the machine frame, can also be used to clear lumps of rock from the top side of the conveyor device that is spanned by the machine frame in the manner of a gantry. Further, preferably, the height of the machine frame can be less than the diameter of the drums equipped with tools. In order to achieve a high extraction capacity, it is particularly advantageous if each tool carrier is equipped with a plurality of extracting tools on a plurality of circle segments, the number of extracting tools and the angular spacing between the extracting tools preferably being constant on each circle segment.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] Further advantages and designs of a mining installation according to the invention are given by the following description of an exemplary embodiment, shown schematically in the drawing. In the drawing:

[0018] FIG. 1 shows a schematic side view of a mining installation according to the invention, in use in underground operation;

[0019] FIG. 2 shows a perspective view of the mining machine used in the case of the mining installation according to FIG. 1;

[0020] FIG. 3 shows a side view of the mining machine from FIG. 2;

[0021] FIG. 4 shows the mining machine from FIG. 3, with omission of a front drum pair;

[0022] FIG. 5A shows, in a bottom view of one of the two drum pairs, the inclination of the drum axis in the one direction of travel; and

[0023] FIG. 5B shows, with the same drum pair, the inclination of the drum axis for the opposite direction of travel.

DETAILED DESCRIPTION

[0024] In FIG. 1, reference 1 denotes in general a mining installation according to the invention, which can be used to extract materials, e.g. by longwall mining, in particular abrasive materials, at a mining or extraction wall 2 in an underground face 3 or the like. In order to hold the face 3 open, the mining installation 1 comprises a multiplicity of shield support frames 4, of any design, whose shield cap can be used to hold the underground face 3 open in such a way that material can be extracted at the extraction wall 2 by means of extracting tools on a mining machine 10. The mining machine 10 itself can be moved along a conveyor device 5, which is supported on the filling side by means of a shift beam 4A on the shield support frame 4 in order alternately to shift the conveyor 5 forward according to the progress of extraction at the extraction front 2 or to draw along individual shield support frames 4 of the shield support. In the exemplary embodiment shown, the conveyor device 5 consists of plate belt conveyor, of relatively flat construction, revolving in which there is a conveyor belt, not shown, having connected conveyor plates. The conveyor device 5, by means of which materials extracted from the face by means of the mining machine 10 can be carried away and then transferred to belt conveyors or the like set up in the road, has a guide rail 6 on the extraction wall side, and a guide track 7 on the filling side, and has a pin gear arrangement 8, acting together with which there are travel drives on the mining machine 10, not shown in detail, in order to move the mining machine 10 between a head road and an auxiliary road in the face 3. As shown clearly by the side view in FIG. 1, the plate belt conveyor device 5 used here requires only an extremely low loading height for the material removed by the extracting tools of the mining machine 10, since the conveyor plates run in the conveying side 9, open on the extraction wall side, of the conveyor device 5, which is delimited on the extraction wall side by a loading ramp 9A that projects only a few centimetres. However, instead of the conveyor device 5, operating here with plate belts, it would also be possible to use other conveyor devices, including scraper chain belt conveyor devices.

[0025] The present invention relates, in particular, to the structure of the mining machine 10, as explained in the following with additional reference to the figures that follow, and to the mode of operation of the same that is made possible as a result. The mining machine 10 has a comparatively elongate machine frame 11, which is parallel to the mining breast in the direction of travel of the mining machine 10, and which has a structural length of, for example, approximately 5 m to 7 m with, at the same time, a comparatively low frame

height of, preferably, less than 1 m. Provided on the back side of the machine frame 11 there is a mounting box 12, in which, for example, drive motors 13 for travel drives 13A can be accommodated. Realized on the back side of the machine frame 11, at least close to both outside ends, there are guide shoes 14, by means of which the mining machine 10 is guided on the filling-side guide track (7, FIG. 1) of the conveyor device. The driving toothed wheel of the drive device that acts together with the pin gear arrangement (8, FIG. 1) can be disposed, for example centrally in the middle box element, centrally between the two guide shoes 14 or, alternatively, as shown, a respective hydraulic travel drive 13A can be disposed close to each guide shoe 14, the pump of the travel drive being driven by means of the drive motor 13. For the purpose of guiding the mining machine 10 and supporting the machine frame 11 on the guide rail (6, FIG. 1), guide rollers (15, FIG. 1) can be disposed on the front side of the machine frame 11, which guide rollers are mounted, for example, on the underside of holding brackets 16.

[0026] The extraction of material at the working breast 2 is effected by means of individual extracting tools 17, preferably constituted by round-shank picks, a multiplicity of preferably identical extracting tools being disposed on a rotatable tool carrier 18 in each case and, further, a plurality of tool carriers 18, of identical structure, being disposed on the circumference of a drum 19 that is rotatable about a drum axis W. In the exemplary embodiment shown, eight tool carriers 18, for example, are disposed on each drum 19, and each tool carrier 18 is equipped with three picks, as extracting tools 17, on each of three circle segments around the rotation axis of the tool carrier 18. The overlaying of the rotation of the drum 19 with the rotation of the tool carriers 18 enables material to be extracted at the extraction wall 2 by means of activated extracting tools 17, each individual pick cutting out, or picking out, a material chip at the extraction wall; the rotational motion of the tool carrier 18 in this case moves the pick further in the direction of action and, at the same time, the rotation of the drum 19 then causes another pick, on the same tool carrier 18 or on the tool carrier succeeding in the circumferential direction of the drum 19, to excavate material. The mode of operation of a corresponding drum is described, for example, in US 2010/001574 A1, to the disclosed content of which reference is made supplementally.

[0027] The mining machine 10 according to the invention for the mining installation 1 according to the invention is designed for longwall mining of seam-type deposits or for undercutting mass deposits, in which the mining machine 10 is moved along the conveyor device 5, by means of which the mined material is carried away out of the extraction region. The travel path of the mining machine 10 is therefore determined by the position of the conveyor device, and although the machine frame 11 is guided with motional play on the conveyor device 5 by the guide shoes 14 and the guide roller 15, there is otherwise no degree of freedom between the machine frame 11 and the conveyor device 5.

[0028] For advantageous extraction in both directions of travel of the mining machine 10, in each case in the exemplary embodiment shown, two drums 19, constituting a drum pair, are provided per drum axis W, each drum pair 20 being adjustable in height relative to the machine frame 11 by means of a swivel arm 21. In order then to achieve favourable and advantageous extraction conditions in the case of the mining machine 10, having activated working tools 17, for both directions of travel, the position of the drum axis W

about which the respective drum 19 can be rotated can be altered slightly, by a few angular degrees, relative to the direction of travel of the machine frame 11, the direction of travel of the machine frame 11 being basically parallel to the alignment of the conveyor device 5. The two slightly tiltable drum pairs 20, with the associated swivel arms 21, have the same structure, and the structure of the drum pair 20 is now to be explained with reference, in particular, to FIGS. 5A and 5B.

[0029] To better distinguish them, in FIGS. 5A and 5B one drum of the drum pair 20 is denoted by reference 19A, and the other drum is denoted by reference 19B. The two drums 19A, 19B of a drum pair 20 are rotatably mounted at the front ends of the fork-like swivel arm 21, the rotary drive 22 for simultaneously driving both drums 19A, 19B in the same direction of rotation being disposed centrally between the two drums 19A, 19B, but offset to the filling side between the rear ends of the swivel arm 21. The output shaft of the rotary drive 22 can be coupled, via a clutch 23, to a transmission disposed in the transmission housing 24, centrally between the two drums 19A, 19B. FIG. 5A shows the drum pair 20 in the operating position during the mining run in the direction of travel F from right to left. The drum axis W (or the normal N to the drum axis W) is inclined by the tilt angle $+\alpha$ relative to the direction of travel F, as a result of which the extracting tools 17 on the tool carriers 18 of the drum 19A are located closer to the extraction front than the tools on the drum 19B. In FIG. 5A, therefore, during the mining run of the mining machine 10 in the direction of travel F, it is exclusively the activated working tools 17 on the drum 19A that effect extraction work, while the drum 19B runs freely and has no contact with material to be removed. At the same time, none of the rotation axes R of the tool carriers 18 on the drums 19A, 19B is perpendicular to the drum axis W, the rotation axes R being instead inclined in relation to the normal N to the drum axis W, at an angle $-\gamma$ in the case of the drum A and at an angle $+\gamma$ in the case of the drum 19B. The two rotation axes R therefore taper towards each other, and the two drums 19A, 19B, with their tool carriers, form an O arrangement. The angle of inclination γ can be equal in magnitude to the tilt angle α , and be approximately 6° , as in the exemplary embodiment shown, but, in particular, it can also be greater than the tilt angle. Because of the O arrangement of the rotation axes R of the tool carriers 18 on the drum 19A relative to the drum 19B, it is possible, with additional inclination of the drum axis W relative to the direction of travel F, or relative to the opposite direction of travel F' (FIG. 5B), to achieve an extremely favourable contact ratio between the individual picks on the tool carriers 18 and the material to be removed from the extraction front during the mining run, each individual tool pick 17 having a sufficient clearance angle, during the contact with the material, to break out material chips from the extraction wall. As the mining machine 10 runs in the opposite direction of travel F', the drum axis W is accordingly inclined by the tilt angle $-\alpha$ relative to the direction of travel F', such that, in the case of this direction of travel, it is exclusively the tools 17 on the drum 19B that perform mining work, while none of the tools on the drum 19A has any contact with material. In order also to ensure, at the same time, that the material broken away by the individual working tools 17 on the tool carriers 18 is broken away in the same direction in each case and that the extraction conditions produced are the same for both directions of travel, the directions of rotation of the tool carriers 18 on the drum 19A are opposite to those on the drum 19B.

[0030] In the exemplary embodiment shown, in the case of the mining machine 10 the ability of the drum axis W to be tilted relative to the direction of travel F, or relative to the opposite direction of travel F', is achieved in that the drum pairs 20, together with the swivel arm 21 and a swivel device for the swivel arms 21, are mounted on a slide 30, which is accommodated and guided in a laterally tiltable manner in associated slide guides 31 that are fixedly connected to the machine frame 11. For the purpose of adjusting, or tilting, the slide 30 inside the guide 31, two thrust cylinders 32 are provided for each drum pair 20, or for each slide 30, which thrust cylinders are articulated, by their front end 33, to the slide 30 and, by their rear end 34, to the machine frame 11. The rear end 34 of the thrust cylinders 32 is mounted so as to be rotatable about an axis projecting vertically from the machine frame 11, and the two hydraulic thrust cylinders 32 can be operated in such a way that their cylinder rods 35 attain differing extension lengths, making it possible to achieve tilting of the slide 30 relative to the machine frame 11. The length of the slide guide for the slide 30 on the machine frame 11 and the delivery length of the thrust cylinders 32 is preferably selected in such a way that, not only can the slide 30 be tilted relative to the machine frame 11, but at least one cut depth adjustment can also be achieved at the same time, in that telescoping of both thrust cylinders 32 causes the entire slide 30, together with the swivel arm 21 and the drum pair 20, to be pushed forward relative to the machine frame 11, and thus also relative to the direction of conveyance, in the direction of the material wall. Telescopic extension of the slide 30 and, consequently, advancing of the drum axis W therefore makes it possible, e.g. for the return run (uphill travel), without movement of the conveyor device, for material again to be removed during the return run, over the entire length of the conveyor device, and therefore from the entire extraction wall, to the same cut depth as during the downhill run. Shifting of the conveyor device 5 is preferably effected only when the entire mining machine 10 is back in the main road. Since the slide 30 can be telescoped, it is also possible, during a mining run, to effect a second removal of material in the same bank by means of the active drum 19 of the succeeding drum pair 20, such that twice the cut depth is extracted during one mining run. A method variant in which both the downhill run, from the main road to the auxiliary road, and the uphill run, from the auxiliary road to the main road, are effected with removal of material, without the conveyor device of the mining installation being moved, or a method variant in which removal of material is effected in the same bank by means of differing telescoped drum pairs or drums, may be of independent inventive significance.

[0031] Each drum 19 is dimensioned in such a way that the diameter of the drum 19, equipped with tool carriers 18 and tools 17, is greater than the height of the machine frame 11, as particularly evident from FIGS. 1, 3 and 4. A mining machine 10 could, in principle, be provided with only one drum pair 20, disposed so as to be tiltable on a slide, since it is then already possible to remove material in both directions of travel by means of the activated tools 17 on each drum 19. In order that flexibility can also be achieved in respect of the extraction height, however, it is particularly advantageous if two drum pairs 20 are disposed on a machine frame 11, each drum pair 20 being adjustable in height by means of a separate swivel arm 21, independently of the other drum pair. During the mining run, the swivel arms 21 for the drum pairs 20 are set in such a way that in each case the drum pair 20 that is

leading in the direction of travel is higher than the trailing drum pair 20, such that the trailing drum pair can also additionally assume a loading function and push material, removed by the leading drum pair 20, over the loading ramp and onto the conveyor belt of the conveyor device 5.

[0032] FIGS. 2 to 4 show the mining machine 10 for drum travel from left to right, or into the plane of the drawing, since the respectively rear swivel arm 21, with an associated drum pair 20, is higher than the front swivel arm 21. The swivelling of the swivel arms 21 is effected, utilizing the advantages of a toggle lever, by means of a toggle lever joint 40, a lower toggle lever arm 41 being connected in a jointed manner to the slide 30 so as to be swivellable about a substantially horizontal swivel axis, a second toggle lever arm 42 being articulated to the swivel arm 21 so as to be swivellable about a horizontal axis, and the first toggle lever arm 41 and the second toggle lever arm 42 being connected to a middle joint 43, acting upon which, at the same time, there is also an actuating cylinder 44, in order to lower or raise the swivel arm 21 by extension or retraction of the actuating cylinder 44 and simultaneous contraction or spreading of the toggle lever arms 41, 42. The swivel arm 21 in this case is swivelled about the pivot point of the swivel arm 21 at the rear end relative to the slide 30. Each swivel arm 21 in this case is supported, on both sides of the rotary drive 22, by means of a respective toggle lever joint 40 and associated toggle lever arms 41, 42, and provided on both sides there are actuating cylinders 44, which act on a middle joint 43 of the toggle lever joint 40. The rear end 45 of each actuating cylinder 44 is supported on a mounting part 39 of the slide 30, as shown clearly by FIG. 4.

[0033] In addition, provided on the front side, or extraction wall side, of the machine frame 11 there are clearing brushes 46 for both directions of travel, which clearing brushes are connected to the machine frame 11 via cantilever arms, and which may optionally be rotatable.

[0034] The invention is not limited to the exemplary embodiment shown, and, for persons skilled in the art, numerous modifications, intended to be included within the protective scope of the appended claims, ensue from the preceding description. The description has been based primarily on the use of the mining machine in longwall mining for the extraction of seam-like deposits, the front length also being any optional short length. The machine could also be used, however, for opening or undercutting mass deposits that are subsequently to be extracted by a bunker discharge method, particularly when, for example, highly abrasive material is found there.

1-20. (canceled)

21. A mining machine for extracting seam-type or mass-deposit mineral materials, comprising:

a conveyor for carrying away mined material;

a machine frame that can be moved along the conveyor and that comprises at least one drum, which is equipped with extracting tools, is rotatable about its drum axis and is adjustable in height relative to a machine frame by a swivel arm;

wherein the drum axis of the drum is substantially parallel to the direction of travel of the mining machine, and wherein the extracting tools are mounted in groups on tool carriers which are disposed on the circumference of the drum so as to be rotatable about rotation axes disposed transversely in relation to the drum axis.

22. A mining machine according to claim 21, wherein the drum axis of the drum is substantially parallel to the direction of travel of the mining machine.

23. A mining machine according to claim 2, wherein during a mining run the drum axis is inclined in relation to the direction of travel, and an angular offset between the drum axis and the direction of travel being equal to or less than $\pm 6^\circ$.

24. A mining machine according to claim 21, wherein alignment of the drum axis relative to the direction of travel is adjustable about a tilt angle (α).

25. A mining machine according to claim 21, wherein the rotation axes of the tool carriers are at an angle of inclination (γ) in relation to the normal to the drum axis of the drum, the angle of inclination (γ) being equal to or less than approximately $\pm 6^\circ$.

26. A mining machine according to claim 25, wherein the angle of inclination (γ) and the tilt angle (α) are matched to each other, the angle of inclination (γ) being greater than the angular offset by reason of the tilt angle (α).

27. A mining machine according to claim 26, wherein a drum pair is rotatably mounted on each swivel arm, the rotation axes of the tool carriers on the first drum being at an angle of $90^\circ - \gamma$ in relation to the drum axis and the rotation axes of the tool carriers on the second drum being at an angle of $90^\circ + \gamma$ in relation to the drum axis.

28. A mining machine according to claim 27, wherein the rotation axes of the tool carriers of the first drum and of the second drum face towards each other.

29. A mining machine according to claim 27, wherein a rotary drive for the two drums is positioned centrally between the first drum and the second drum of the drum pair.

30. A mining machine according to claim 27, wherein the tool carriers on the first drum rotate in the opposite direction to the tool carriers on the second drum.

31. A mining machine according to claim 21, wherein two height-adjustable and tiltable swivel arms, each supporting a drum pair, are disposed on the machine frame.

32. A mining machine according to claim 21, wherein the swivel arms are adjustable in height by toggle lever joints.

33. A mining machine according to claim 32, wherein an actuating cylinder is assigned to each toggle lever joint.

34. A mining machine according to claim 33, wherein the swivel arms and the toggle lever joints are mounted on slides, which are held in a tiltable manner in guides on the machine frame.

35. A mining machine according to claim 34, wherein the actuating cylinders are articulated, at one end, to the slide and, at the other end, to a middle joint of the toggle lever joint, as a result of which the associated swivel arm and the drum axis of the associated drum is adjustable in height.

36. A mining machine according to claim 34, wherein a pair of thrust cylinders is assigned to each slide, which thrust cylinders are articulated, at one end, to the machine frame and, at the other end, to the slide.

37. A mining machine according to claim 36, wherein the thrust cylinders are operatable separately and the tilt angle of the drum axis, relative to the direction of travel, is adjustable through differing extension lengths of the thrust cylinders.

38. A mining machine according to claim 21, further comprising travel drives, to act together with a pin gear rod arrangement attached to the conveyor device, and clearing elements are disposed on the machine frame.

39. A mining machine according to claim **21**, wherein the height of the machine frame is less than the diameter of the drums equipped with tools.

40. A mining machine according to claim **21**, wherein each tool carrier is equipped with a plurality of extracting tools on a plurality of circle segments, the number of extracting tools and the angular spacing between the extracting tools preferably being constant on each circle segment.

* * * * *