(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 231 988 A1**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
18.10.2017 Bulletin 2017/42

(51) Int Cl.:
E21F 13/06 *(2006.01)*

(21) Application number: **16164966.0**

(22) Date of filing: **12.04.2016**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

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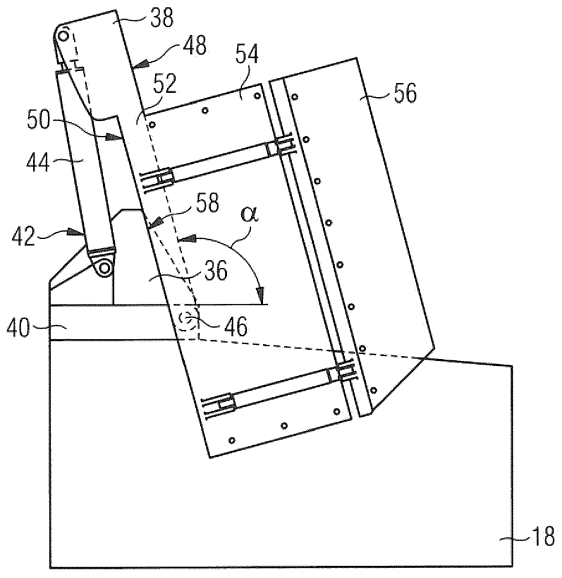
(54) DEVICE FOR A ROCK FEEDER USED IN UNDERGROUND APPLICATIONS

(57) A rock feeder deflector device (30) for a rock feeder (10) used in underground mining applications. The rock feeder (10) has a material transport portion (20) for transporting rock material (12) to a conveyor (14). The rock feeder deflector device (30) comprises a mounting portion (36) configured to be connected to the rock feeder (10); a guiding plate (38) movably connected to the mounting portion (36); and a moving mechanism (42) arranged between the mounting portion (36) and the guiding plate (38). The moving mechanism (42) is configured to move the guiding plate (38) relative to the mounting portion (36) between an operative position configured to guide rock material (12) to the material transport portion (20) and an inoperative position.

FIG 2



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Description

Technical Field

[0001] The present disclosure generally relates to a rock feeder used in underground mining applications and, in particular, to a rock feeder deflector device and a rock feeder abutment device for the rock feeder. The present disclosure relates further to a retrofit kit for the rock feeder.

Background

[0002] In underground mining systems, a rock feeder is used for continuous ore extraction. For example, in caving exploitation, fragmented or fractured rock material is extracted at several draw points, loaded onto a conveyor by a plurality of rock feeders and transported to, for example, a crusher or the like. In this manner, a continuous flow of rock material can be achieved which is why this type of underground mining application is also known as "continuous rock flow mining application". To load rock material onto the conveyor, the rock feeder is arranged underneath the draw point. Concrete walls are built around the rock feeder to form a cave for guiding the rock material towards the rock feeder.

[0003] The present disclosure is directed, at least in part, to improving or overcoming one or more aspects of prior systems.

Summary of the Disclosure

[0004] In one aspect, the present disclosure relates to a rock feeder deflector device for a rock feeder used in underground mining applications. The rock feeder includes a material transport portion for transporting rock material to a conveyor. The rock feeder deflector device comprises a mounting portion configured to be connected to the rock feeder; a guiding plate movably connected to the mounting portion; and a moving mechanism arranged between the mounting portion and the guiding plate. The moving mechanism is configured to move the guiding plate relative to the mounting portion between an operative position configured to guide rock material to the material transport portion and an inoperative position. In the inoperative position, no rock material is guided to the material transport portion.

[0005] In another aspect, the present disclosure relates to a rock feeder for use in underground mining applications, in particular continuous rock flow mining applications. The rock feeder comprises a base configured to accumulate rock material falling onto the base; a material transport portion arranged inside the base and configured to transport the rock material from the base to a conveyor; a connection portion arranged on a top side of the base adjacent the material transport portion and remote from the conveyor; and a rock feeder deflector device as exemplarily disclosed herein, wherein the rock feeder deflector device is connected to the connection portion via the mounting portion of the rock feeder deflector device.

[0006] Other features and aspects of this disclosure will be apparent from the following description and the accompanying drawings.

Brief Description of the Drawings

[0007]

Fig. 1 shows an exemplary arrangement of an underground mining application using a rock feeder to feed rock material to a conveyor;

Fig. 2 shows a side view of an operative position of an exemplary rock feeder deflector device for the rock feeder of Fig. 1;

Fig. 3 shows as side view of an inoperative position of an exemplary rock feeder deflector device for the rock feeder of Fig. 1;

Fig. 4 shows a top view of an operative position of another exemplary rock feeder deflector device having pivotable side extension plates with extension parts;

Fig. 5 shows a rear view of an operative position of another exemplary rock feeder deflector device having at least one height extension plate;

Fig. 6 shows a top view of two rock feeder abutment devices connected to the rock feeder of Fig. 1; and

Fig. 7 shows a schematic cross-sectional view through an exemplary rock feeder abutment device abutting side walls of an extraction drift of the rock feeder.

Detailed Description

[0008] The following is a detailed description of exemplary embodiments of the present disclosure. The exemplary embodiments described herein are intended to teach the principles of the present disclosure, enabling those of ordinary skill in the art to implement and use the present disclosure in many different environments and for many different applications. Therefore, the exemplary embodiments are not intended to be, and should not be considered as a limiting description of the scope of protection. Rather, the scope of protection shall be defined by the appended claims.

[0009] The present disclosure is based in part on the realization that the continuous rock flow mining application is not limited to caving exploitation where the rock feeder operates some months or even years at a specific draw point, but can also be used in stoping exploitation. In stoping exploitation, the rock material is usually deposited in a vein type manner. In stoping exploitation, the rock feeder operates at a particularly shorter time period underneath a specific draw point compared to the time periods used in caving exploitation. The building of concrete walls around the rock feeder as done in caving ex-

ploitation is thus impractical and inefficient for use in stoping exploitation.

[0010] The present disclosure is based in part on the realization that instead of building concrete walls around the rock feeder, a rock feeder deflector device is provided. The rock feeder deflector device is a separate unit that is mountable to the rock feeder and allows the rock feeder to be moved between different draw points in a significantly shorter time period compared to the rock feeder that needs concrete walls around it. Thus, by using the rock feeder deflector device, the rock feeder can be efficiently used also in stoping exploitation.

[0011] The rock feeder deflector device includes a mounting portion configured to be connected to a connection portion of the rock feeder. The connection portion is already present at the rock feeder and typically arranged on a top side of a base of the rock feeder adjacent a material transport portion (pushing plate) of the rock feeder and remote from the conveyor. The rock feeder deflector device further includes a guiding plate movably connected to the mounting portion and configured to guide rock material towards the material handling portion. A moving mechanism is arranged between the guiding plate and the mounting portion. The moving mechanism moves the guiding plate between an operative position in which the rock material is guided towards the material handling portion and an inoperative position in which no rock material is guided towards the material handling portion.

[0012] The present disclosure may further be based in part on the realization that the guiding plate can be pivoted relative to the mounting portion such that in the operative position, the guiding plate and the mounting portion form an angle of more than 90° (90 degrees) between them to provide a loading ramp for the rock material. Conversely, in the inoperative position, the guiding plate and the mounting portion may from an angle of about 0°, i.e. the guiding plate and the mounting plate are substantially parallel to each other. In the inoperative position, the guiding plate almost entirely covers the material transport portion which is why in the inoperative position no rock material is guided to the material transport portion. Also, in the inoperative position, the guiding plate functions as a safety device for the material transport portion, for example, during moving of the rock feeder.

[0013] The present disclosure may further be based in part on the realization that the rock feeder deflector device may include several height extension plates and side extension plates connected to the guiding plate such that the height and the width of the guiding plate can be adjusted to the height and width of the extraction drift where the rock feeder is positioned in. By adjusting the size of the guiding plate to the size of the extraction drift, an efficient and flexible way for guiding rock material to the material transport portion is provided. This efficient and flexible guidance of rock material is particularly beneficial for stoping exploitation as in stoping exploitation the shape and size of the extraction drifts can often vary between one another because no concrete walls are used inside the extraction drifts. Also, the height and width of the guiding plate can be readily adapted to the height and width of the extraction drift at hand.

[0014] The present disclosure may further be based in part on the realization that the side extension plates can be pivoted sideways between a pivoted-in and a pivoted-out position. In the pivoted-in position, the side extension plates align with side faces of the rock feeder thereby forming a compact transport arrangement.

[0015] Moreover, the present disclosure may further be based in part on the realization that the side extension plates and the height extension plates may include extension parts. These extension parts may be slidably connected to the side and/or height extension parts and may be slidable between a retracted position and an extended position to decrease and increase the width of the guiding plate.

[0016] Moreover, the present disclosure may be based in part on the realization that outer edges of the guiding plate, the side extension plates, the extension parts and the height extension plates can be provided with flexible end members. These flexible end members may be made from elastic material such as rubber or the like and function to achieve a form fit or positive locking between the flexible end members and the walls of the extraction drift. Therefore, the "leakage" of rock material through gaps between the guiding plate and the walls can be minimized.

[0017] Moreover, the present disclosure may be further based in part on the realization that moving, pivoting and sliding of any of the guiding plate, side extension plates, height extension plates or extension parts may be realized through hydraulic actuators arranged on the rock feeder deflector device at a side remote from the rock material. These hydraulic actuators may be remotely controlled such that the guiding plate and its extension plates can be accurately adjusted to the extraction drift at hand.

[0018] The present disclosure may be further based in part on the realization that the rock feeder also needs some sort of support within the extraction drift, either during operation of the rock feeder when rock material falls onto the guiding plate and tends to move the rock feeder, or during erection of the guiding plate. The present disclosure therefore also provides a rock feeder abutment device. The rock feeder abutment device is a separate unit connectable to the rock feeder and configured to provide the necessary support for the rock feeder.

[0019] The rock feeder abutment device includes a base member configured to be connected to the rock feeder, a first abutment member movable relative to the base member in a first direction, a second abutment member movable relative to the base member in a second direction opposite the first direction. Both abutment members are configured to abut opposite walls of the extraction drift. A spreading mechanism is supported on the base member and arranged between the two abut-

ment members. The spreading mechanism may be hydraulically actuated and functions to spread the first abutment member and the second abutment member apart from each other such that the first and the second abutment members are spreaded between the opposite walls of the extraction drift, thereby providing the necessary support for the rock feeder.

[0020] The present disclosure may be further based in part on the realization that the rock feeder abutment device can be connected to a second rock feeder abutment device via connecting members such as hydraulic actuators that are retractable and extendable. By combining two rock feeder abutment devices via hydraulic actuators, the rock feeder can be moved within the extraction drift without the use of further machinery. Thus, a self-moving support arrangement for the rock feeder is provided. Moreover, by combining two rock feeder abutment devices, the abutment force on each abutment member is reduced, which allows the use of smaller-sized hydraulic actuators in the spreading mechanism. Furthermore, as an additional benefit, a weight of each rock feeder abutment device can be reduced which makes movement of the whole arrangement easier and more cost effective.

[0021] Moreover, the present disclosure may further be based on the realization that the rock feeder deflector device and the rock feeder abutment device can be included in a retrofit kit for the rock feeder. The retrofit kit provides a convenient and cost effective way of using rock feeders not only in caving exploitation but also in stoping exploitation or other mining applications.

[0022] Referring now to the drawings, Fig. 1 shows a an exemplary arrangement of an underground mining application where a rock feeder 10 is used to continuously feed fragmented or fractured rock material 12 to a conveyor 14. The rock feeder 10 is position underneath a draw cone 16, also known as extraction funnel, and is loaded with rock material 12 falling onto the rock feeder 10 from above. Rock feeder 10 includes a base 18. A material transport portion 20 (a pushing plate) is arranged inside base 18 and reciprocates inside base 18 to perform a loading operation in which rock material 12 is transported from base 18 to conveyor 14. Movement of the pushing plate 20 is performed hydraulically using hydraulic actuators 22 arranged inside base 18 which is why rock feeder 10 may also be called "hydraulic feeder" or "dozer". A typical width of rock feeder 10 is in a range between about 2 m and 2.5 m.

[0023] Rock feeder 10 is positioned inside an extraction drift 24 that is substantially sideways of a conveyor drift 26 where conveyor 14 is positioned in. Thus, rock feeder 10 loads rock material 12 onto conveyor 14 in a sideways direction with respect to conveyor 14. As can be further seen, rock feeder 10 further includes a pushing device 28 which is connected at a rear side of base 18 and is particularly used in caving exploitation applications for moving rock feeder 10 within extraction drift 24. Of course, rock feeder 10 may also be used without pushing device 28.

[0024] As can be further seen in Fig. 1, a rock feeder deflector device 30 is mounted to a top side of base 18. Rock feeder deflector device 30 is used to guide rock material 12 towards material transport portion 20. Rock feeder deflector device 30 will be explained in more detail when referring to Figs. 2 to 5.

[0025] As can be further seen in Fig. 1, a rock feeder abutment device 32 is connected to pushing device 28 at a rear portion thereof. Of course, rock feeder abutment device 32 may also be directly connected to base 18. Rock feeder abutment device 32 abuts side walls of extraction drift 24 and provides a support for rock feeder 10 during operation of the same. Rock feeder abutment device 32 is further explained when referring to Figs. 6 and 7.

[0026] A service drift 34 is arranged sideways of extraction drift 24 and substantially parallel to conveyor drift 26 to provide access to rock feeder abutment device 32, rock feeder deflector device 30 and rock feeder 10.

[0027] Referring now to Fig. 2, rock feeder deflector device 30 is explained in more detail. Rock feeder deflector device 30 includes a mounting portion 36, a guiding plate 38 movably connected to mounting portion 36 and a moving mechanism 42 arranged between mounting portion 36 and guiding plate 38. Moving mechanism 42 includes hydraulic actuators 44 connected to mounting portion 36 and guiding plate 38. Mounting portion 36 is further connected to base 18 via a connection portion 40. Connection portion 40 is arranged on a top side of base 18 adjacent material handling portion 20 (see Fig. 1). Guiding plate 38 is further pivotally connected to connection portion 40 via a pivot point 46. Thus, by operating moving mechanism 42, and in particular hydraulic actuators 44, guiding plate 38 is pivoted relative to mounting portion 36 about pivot point 46.

[0028] Guiding plate 38 further includes a front face 48, a rear face 50 opposite front face 48 and side faces 52 extending between front face 48 and rear face 50. Front face 48 is configured to guide rock material 12 towards material handing portion 20 as indicated in Fig. 1. To increase a width of guiding plate 38, side extension plates 54 are connected to side faces 52. Side extension plates 54 further include extension parts 56 which are slidably connected to side extension plates 54 and which can be extended and retracted. Side extension plates 54 and extension parts 56 are explained in more detail when referring to Fig. 4.

[0029] As can be further seen in Fig. 2, mounting portion 36 includes a stop 58. Stop 58 functions as an abutment for guiding plate 38 when guiding plate 38 is in the erected position. Stop 58 functions as a mechanical stop for guiding plate 38 and prevents a tilt of guiding plate 38 under a load exerted by rock material 12 falling onto guiding plate 38 from above.

[0030] A typical width of guiding plate 38 is in a range between about 2.5 m and about 3 m. A typical length of guiding plate 38 is in a range between about 2 m and

about 3 m.

[0031] Referring now to Figs. 2 and 3, moving mechanism 42 is explained in more detail.

[0032] As explained with reference to Fig. 2, guiding plate 38 abuts stop 58. In this position of guiding plate 38, guiding plate 38 and mounting portion 36 are essentially perpendicular to each other. More specifically, a lower side of mounting portion 36, which is substantially horizontal, and front face 48 of guiding plate 38 form an angle α between them. As can be seen, angle α is larger than 90°. In particular, angle α may be in a range of angles of larger than about 90° and smaller than about 120°. By using an angle α of larger than about 90°, guiding plate 38 forms a loading ramp such that rock material 12 falling onto front face 48 is guided towards material transport portion 20. The position of guiding plate 38 shown in Fig. 2 can therefore also be termed "operative position". In the operative position, guiding plate 38 guides rock material 12 towards material transport portion 20.

[0033] Referring now to Fig. 3, the moving mechanism is explained. Once moving mechanism 42 is operated, hydraulic actuators 44 extend. As a result, guiding plate 38 pivots about pivot point 46. When hydraulic actuators 44 are fully extended, a position of guiding plate 38 is such that guiding plate 38 and mounting portion 36 are substantially parallel to each other. More specifically, a lower side of mounting portion 36, which is substantially horizontal, and front face 48 of guiding plate 38 are substantially parallel to each other. Thus, in the position shown in Fig. 3, an angle between front face 48 and a lower side of mounting portion 36 is about 0°. In other words, an angle between guiding plate 38 and mounting portion 36 is about 0°.

[0034] In the position shown in Fig. 3, guiding plate 38 substantially covers a top side of base 18. Thus, in the position shown in Fig. 3, guiding plate 38 substantially covers material transport portion 20. The position of guiding plate 38 shown in Fig. 3 can therefore be termed "inoperative position", because no rock material 12 is guided towards material transport portion 20. As guiding plate 38 almost entirely covers material transport portion 20 in the inoperative position, the inoperative position also functions as a safety or transport position for rock feeder 10, for example, during moving of rock feeder 10.

[0035] A further criterion to distinguish the operative position (Fig. 2) from the inoperative position (Fig. 3) is that in the operative position, guiding plate 38 abuts stop 58, whereas in the inoperative position, guiding plate 38 is remote from stop 58, i.e. does not abut stop 58.

[0036] Referring now to Fig. 4, side extension plates 54 and extension parts 56 are explained in more detail. As mentioned, side extension plates 54 are connected to side faces 52 of guiding plate 38. As can be seed in Fig. 4 in more detail, side extension plates 54 are pivotally mounted to guiding plate 38 such that side extension plates 54 can be pivoted relative to guiding plate 38 about pivot points 60. A pivot mechanism 62 is arranged between side extension plates 54 and guiding plate 38 to pivot side extension plates 54 about pivot points 60. Pivot mechanism 62 includes hydraulic actuators 64, which are connected at rear face 50 of guiding plate 38 and a rear face of side extension plates 54. By operating pivot mechanism 62, hydraulic actuators 64 extend and retract, thereby pivoting side extension plates 64 about pivot points 60.

[0037] At a lower position in Fig. 4, side extension plate 54 is shown in a pivoted-in position, in which side extension plate 54 is substantially perpendicular to front face 48. Or with reference to a side face 66 of base 18, in the pivoted-in position, side extension plate 54 is substantially parallel to side face 66. Thus, in the pivoted-in position, side extension plate 54 substantially aligns with side face 66 and forms a compact unit.

[0038] At an upper position in Fig. 4, side extension plate 54 is shown in a pivoted-out position. In the pivoted-out position, side extension plate 54 is substantially parallel to front face 48. More specifically, in the pivoted-out position, side extension plate 54 and front face 48 from an angle β between them. Angle β may be in a range between about 135° and about 180°, preferably in a range between about 140° and about 160°. Angle β and a length of side extension plates 54 may be adapted such that in a pivoted-out position, side extension plates 54 abut side walls 68 of extraction drift 24. Side extension plates 54 and angle β may be adapted such that in the pivoted-out position, side extension plates 54 span a width of extraction drift 24 in a range between about 3 m and about 5 m. This is illustrated in Fig. 4 by arrow 70 indicating the half-width of an extraction drift 24 that has a width in a range between about 3 m and about 5 m.

[0039] As already mentioned in connection with Fig. 2, side extension plates 54 also include extension parts 56. Extension parts 56 are slidably connected to side extension plates 54 and are configured to extend and retract relative to side extension plates 54. A sliding distance 72 is configured such that in the pivoted-out position of side extension plates 54 and in the extended position of extension parts 56, side extension plate 54 in combination with extension parts 56 span a width of extraction drift 24 in a range between about 3 m and about 6 m. This is illustrated in Fig. 4 by arrow 74 indicating the half-width of an extraction drift 24 that has a width in a range between about 3 m and about 6 m.

[0040] Referring now to Fig. 5, a rear view of guiding plate 38 in the operative position is shown. As can be seen, side extension plates 54 are in the pivoted-out position and extension parts 56 are in the retracted position. Extension parts 56 can be slided between the retracted position and the extended position using a sliding mechanism 76. Sliding mechanism 76 is hydraulically actuated and includes hydraulic actuators 78 which are connected to side extension plates 54 and extension parts 56.

[0041] As can be further seen in Fig. 5, height extension plates 80 are connected to guiding plate 38 on a top side thereof. Height extension plates 80 are used to increase a height of guiding plate 38. In the embodiment

shown in Fig. 5, guiding plate 38 is extended by a first height extension plate 82 and a second height extension plate 84 mounted in series to first height extension plate 82. First height extension plate 82 includes auxiliary side extension plates 86. Auxiliary side extension plates 86 are pivotally connected to side faces of first height extension plate 82 and are pivotable between a pivoted-in and a pivoted-out position using hydraulic actuators 88 similar to hydraulic actuators 64. Although not shown, auxiliary side extension plates 86 may further include extension parts which are slidably connected to auxiliary side extension plates 86 to increase a width of first height extension plate 82. By providing side extension plates 54, extension parts 56, auxiliary side extension plates 86 and height extension plates 80, a width and a height of guiding plate 38 can be adapted such that guiding plate 38 almost fully covers a width 91 and a height 95 of extraction drift 24.

[0042] Although not shown, also second height extension plate 84 may include auxiliary side extension plates 86.

[0043] As can be further seen in Fig. 5, second height extension plate 84 exemplarily includes a flexible end member 90 connected to outer edges of second height extension plate 84. Flexible end member 90 may be made from rubber or another flexible material. Flexible end member 90 is used to abut on walls of extraction drift 24 such that a leakage of rock material 12 through gaps between the walls of extraction drift 24 and second height extension plate 84 is minimized.

[0044] Although not shown, side extension plates 54, auxiliary side extension plates 86, first height extension plates 82 and extension parts 56 may also include flexible end members similar to flexible end member 90 to minimize gaps between walls of extraction drift 24 and guiding plate 38.

[0045] Referring now to Fig. 6, a top view of rock feeder 10 connected to two rock feeder abutment devices 32 is shown. A first rock feeder abutment device 31 is connected to rock feeder 10. A second rock feeder abutment device 33 is connected to first rock feeder abutment device 31.

[0046] Each rock feeder abutment device 32 includes a base member 96 configured to be connected to rock feeder 10, a first abutment member 92 and a second abutment member 94. First abutment member 92 is movable relative to base member 96 in a first direction. Second abutment member 94 is arranged opposite first abutment member 92 and is movable relative to base member 96 in a second direction opposite the first direction. First abutment member 92 is configured to abut on a first wall of extraction drift 24. Second abutment member 94 is configured to abut on a second wall of extraction drift 24 opposite the first wall. A spreading mechanism 98 is supported on base member 96 and arranged between first abutment member 92 and second abutment member 94. Spreading mechanism 98 is used to spread apart first abutment member 92 and second abutment member 94 such that an abutment between first abutment member 92 and the first wall of extraction drift 24 and an abutment between second abutment member 94 and the second wall of extraction drift 24 is achieved.

[0047] Each first abutment member 92 and each second abutment member 94 includes a plurality of material engagement members 93. Material engagement members 93 are arranged on abutment faces of first and second abutment members 92, 94 and are configured to engage with walls of extraction drift 24. Material engagement members 93 are shaped such that a form fit or positive locking between first abutment member 92 and the first wall of extraction drift 24 and second abutment member 94 and the second wall of extraction drift 24 is achieved. Material engagement members 93 may, for example, be spikes.

[0048] In the exemplary embodiment shown in Fig. 6, spreading mechanism 98 includes four hydraulic actuators. Two first hydraulic actuators 100 are connected to base member 96 and first abutment member 92. Two second hydraulic actuators 102 are connected to second abutment member 94 and base member 96. The first hydraulic actuators 100 are arranged in parallel and along a length direction of first abutment member 92, i.e. a length direction of extraction drift 24. Likewise, the two second hydraulic actuators 102 are arranged in parallel and along a length direction of second abutment member 94, i.e. a length direction of extraction drift 24. In other embodiments, more than two hydraulic actuators per abutment member may be used. Moreover, when first abutment member 92 has the same geometric dimensions as second abutment member 94, as shown, first hydraulic actuators 100 are arranged symmetric to second hydraulic actuators 102.

[0049] Between the pair of first hydraulic actuators 100, a first extendable support member 104 is arranged. First extendable support member 104 is connected to base member 96 and first abutment member 92. Between the pair of second hydraulic actuators 102, a second extendable support member 106 is arranged. Second extendable support member 106 is connected to base member 96 and second abutment member 94. First and second extendable support members 104 and 106 are used to support first and second abutment members 92, 94 in a middle portion thereof. First and second extendable support members 104, 106 prevent a bending of first or second hydraulic actuators 100, 102 when first and second hydraulic actuators 100, 102 are extended or when rock feeder 10 is slightly moved forward or backward in the extended position of first and second hydraulic actuators 100, 102. Thus, first and second extendable support members 104, 106 are configured to absorb bending forces acting on first and second hydraulic actuators 100, 102 and therefore prevent a jamming of first and second hydraulic actuators 100, 102.

[0050] As can be further seen in Fig. 6, base member 96 is formed as a split base member. Base member 96 includes a first base member 108 and a separate second

base member 110. Second base member 110 is arranged adjacent first base member 108 and is connected to first base member 108 via spacer members 112. Spacer members 112 are distance blocks (separators) and used to distance (separate) first base member 108 from second base member 110 by a predetermined distance. Spacer members 112 may be, for example, 50 cm distance blocks such that a width of rock feeder abutment device 32 is increased by 50 cm. It is also possible to use a plurality of spacer members 112 such that a width of rock feeder abutment device 32 can be increased further. For this, spacer members 112 may be connected in series to one another as indicated in Fig. 7 by the dashed line running through spacer members 112.

[0051] In case of a split base member, first hydraulic actuators 100 and first extendable support member 104 are connected to first base member 108 and first abutment member 92. Second hydraulic actuators 102 and second extendable support member 106 are connected to second base member 110 and second abutment member 94. By using a split base member in combination with spacer members 112, a width of rock feeder abutment device 32 can readily be adjusted to a width of extraction drift 24 without having to change the size of first and second hydraulic actuators 100, 102. This saves costs and increases the flexibility of rock feeder abutment device 32.

[0052] A typical length of rock feeder abutment device 32 is about 2 m and a typical width of rock feeder abutment device 32 is in a range between about 2.5 m and about 4.5 m or more, depending on whether spacer members 112 are used or not.

[0053] As can be further seen in Fig. 6, first rock feeder abutment device 31 is connected in series to second rock feeder abutment device 33. The connection between the two rock feeder abutment devices 32 is performed by connecting members 116. Connecting members 116 are connected to base member 96 via bores 114 formed at side portions of base member 96. As shown in Fig. 6, connecting members 116 are hydraulic actuators. Of course, in other embodiments, rods may be used instead of hydraulic actuators.

[0054] By connecting two rock feeder abutment devices 32 in series, an abutment force on first and second abutment members 92, 94 is reduced because the entire abutment force is divided by the total number of abutment members (in this case four abutment members instead of two). A reduction of the abutment force per abutment member allows the use of smaller size hydraulic actuators 100, 102 and, thus, saves costs. Furthermore, as an additional benefit, a weight of each rock feeder abutment device 32 can be reduced. This is beneficial, as a typical weight of a single rock feeder abutment device 32 is in a range between about 13 tons and about 18 tons.

[0055] As an additional benefit, by connecting two rock feeder abutment devices 32 in series with hydraulic actuators 116, a self-moving abutment arrangement is provided. As a result, rock feeder 10 can be moved inside extraction drift 24 without the use of further machinery. The self-moving abutment arrangement will be explained in more detail in the industrial applicability section.

[0056] As can be further seen in Fig. 6, rock feeder abutment device 32 includes an adapter member 120. Adapter member 120 is connected to base member 96 at a side portion thereof. Adapter member 120 is configured to connect rock feeder abutment device 32 to rock feeder 10. In the embodiment shown, adapter member 120 is connected to an adapter portion 122 of rock feeder 10. Adapter portion 122 may include pushing device 124 or may be a rear portion of base 18.

[0057] As can be further seen, adapter member 120 includes a first adapter plate 126 and a second adapter plate 128 opposite first adapter plate 126. First adapter plate 126 and second adapter plate 128 are both connected to a side portion of base member 96. First adapter plate 126 is arranged proximal to first abutment member 92. Second adapter plate 128 is arranged proximal to second abutment member 94.

[0058] As can be seen, first adapter plate 126 and second adapter plate 128 each include a cut-out 130. Cut-outs 130 are shaped such that extendable cylinders 132 (protrusions) arranged on pushing device 124 or the rear portion of base 18 may be inserted into cut-outs 130. For this, a width 134 of cut-outs 130 is slightly larger than a width 136 of extendable cylinders 132. Moreover, a distance 138 between first adapter plate 126 and second adapter plate 128 is slightly larger than a width of pushing device 124 or the rear portion of base 18. By using adapter member 120, rock feeder abutment device 32 can be easily connected to rock feeder 10 either via adapter portion 122.

[0059] Referring now to Fig. 7, a schematic cross-sectional view through rock feeder abutment device 32 is shown. As can be seen, first hydraulic actuators 100 and second hydraulic actuators 102 are in the extended position such that first abutment member 92 abuts a first side wall of extraction drift 24 and such that second abutment member 94 abuts a second side wall of extraction drift 24. By using spacer members 112, the width of rock feeder abutment device 32 can be adapted to width 91 of extraction drift 24. Although not shown, it is in principle also possible that first abutment member 92 abuts the roof of extraction drift 24 and second abutment member 94 abuts the floor of extraction drift 24.

[0060] Terms such as "about", "around" or "approximately" as used herein when referring to a measurable value such as a parameter, an amount, a temporal duration, and the like, is meant to encompass variations of $\pm$10% or less, preferably $\pm$5% or less, more preferably $\pm$1% of and from the specified value, insofar as such variations are appropriate to perform in the disclosed invention. It is to be understood that the value to which the modifier "about" refers is itself also specifically, and preferably, disclosed. The recitation of numerical ranges by endpoints includes all numbers and fractions subsumed within the respective ranges, as well as the recited end-

points.

Industrial Applicability

[0061] Exemplary rock feeders suited for rock feeder abutment device 32 and rock feeder deflector device 30 are, for example, rock feeders of the series RF 300 manufactured by Caterpillar Global Mining Europe GmbH. One skilled in the art will, however, appreciate that rock feeder abutment device 32 and rock feeder deflector device 30 are suited for other rock feeders as well.

[0062] In the following, it will be explained how a combination of two rock feeder abutment devices 32 can be used as a self-moving arrangement for moving rock feeder within extraction drift 24. The procedure for moving rock feeder 10 is explained in connection with Fig. 6.

[0063] To start with, spreading mechanism 98 of second rock feeder abutment device 33 is operated such that first and second abutment members 92, 94 of second rock feeder abutment device 33 abut side walls of extraction drift 24.

[0064] Next, spreading mechanism 98 of first rock feeder abutment device 31 is operated such that first and second abutment members 92, 94 of first rock feeder abutment device 31 are out of engagement with walls of extraction drift 24.

[0065] Next, connecting members 116 are operated such that first rock feeder abutment device 31 is pushed away from second rock feeder abutment device 33.

[0066] Next, spreading mechanism 98 of first rock feeder abutment device 31 is operated such that first and second abutment members 92, 94 of first rock feeder abutment device 31 abut walls of extraction drift 24.

[0067] Next, spreading mechanism 98 of second rock feeder abutment device 33 is operated such that first and second abutment members 92, 94 of second rock feeder abutment device 33 are out of engagement with walls of extraction drift 24.

[0068] Next, connecting members 116 are operated such that second rock feeder abutment device 33 is pulled towards first rock feeder abutment device 31.

[0069] Next, the above operations are performed in series until rock feeder 10 is moved forward a predetermined distance within extraction drift. By inverting the above steps, rock feeder 10 is moved backwards.

[0070] A moving distance of rock feeder 10 within extraction drift 24 is typically in a range between about 15 m and about 30 m.

[0071] It should be noted that all hydraulic actuators used in this disclosure can be remotely controlled by an operator of the rock feeder 10. It is also contemplated that several rock feeders 10 equipped with rock feeder deflector devices 30 and rock feeder abutment devices 32 can be connected to each other via a network and that each of the plurality of rock feeders 10 can be controlled by the operator via the network.

[0072] Moreover, rock feeder deflector device 30 and rock feeder abutment device 32 can be provided in a retrofit kit for rock feeder 10. By using the retrofit kit, rock feeders 10 can be equipped with rock feeder deflector device 30 and/or rock feeder abutment device 32 such that rock feeders 10 can be readily used in stoping exploitation applications or other mining applications.

[0073] Although the preferred embodiments of this invention have been described herein, improvements and modifications may be incorporated without departing from the scope of the following claims.

Further aspects

[0074] According to a first aspect, a rock feeder abutment device is disclosed.

1.1 A rock feeder abutment device for a rock feeder used in underground mining applications, the rock feeder being arranged inside an extraction drift for extracting rock material, the rock feeder abutment device comprising:

a base member configured to be connected to the rock feeder;
a first abutment member movable relative to the base member and configured to abut on a first wall of the extraction drift;
a second abutment member arranged opposite the first abutment member, the second abutment member being movable relative to the base member in an opposite direction of the first abutment member and being configured to abut on a second wall of the extraction drift opposite the first wall; and
a spreading mechanism supported on the base member, arranged between the first abutment member and the second abutment member and configured to spread apart the first abutment member and the second abutment member such that the first abutment member abuts the first wall and the second abutment member abuts the second wall.

1.2 The rock feeder abutment device according to 1.1, wherein the spreading mechanism is hydraulically actuated and the rock feeder abutment device further comprises:

a first hydraulic actuator connected to the base member and the first abutment member; and
a second hydraulic actuator arranged opposite the first hydraulic actuator and connected to the base member and the second abutment member.

1.3 The rock feeder abutment device according to 1.2, wherein the base member includes a first base member and a separate second base member arranged adjacent the first base member and connect-

ed to the first base member via a spacer member, wherein the first hydraulic actuator is connected to the first base member, the second hydraulic actuator is connected to the second base member and wherein the spacer member is configured to distance the first base member from the second base member by a predetermined distance at a width direction of the rock feeder abutment device.

1.4 The rock feeder abutment device according to 1.2 or 1.3, wherein the first hydraulic actuator includes at least two first hydraulic actuators arranged in parallel to each other along a length direction of the first abutment member, and the second hydraulic actuator includes at least two second hydraulic actuators arranged in parallel to each other along a length direction of the second abutment member.

1.5 The rock feeder abutment device according to 1.4, wherein the first abutment member and the second abutment member have the same geometric dimensions and the at least two first hydraulic actuators are arranged symmetric to the at least two second hydraulic actuators.

1.6 The rock feeder abutment device according any one of 1.3 to 1.5 further comprising:

a first extendable support member connected to the first base member and the first abutment member and configured to absorb bending forces acting on the first hydraulic actuator; and
a second extendable support member connected to the second base member and the second abutment member and configured to absorb bending forces acting on the second hydraulic actuator.

1.7 The rock feeder abutment device according to any one of 1.1 to 1.6, wherein the first abutment member includes a first abutment face and the second abutment member includes a second abutment face, wherein the first abutment face and the second abutment face each include a plurality of rock material engagement members configured to generate a positive locking between the first abutment member and the first wall and the second abutment member and the second wall.

1.8 The rock feeder abutment device according to any one of 1.1 to 1.7 further comprising:

at least one connecting member mounted to the base member between the first abutment member and the second abutment member at a side portion of the base member, the at least one connecting member being configured to connect the rock feeder abutment device to an adjacent rock feeder abutment device.

1.9 The rock feeder abutment device according to 1.8, wherein the at least one connecting member is a rod or a hydraulic actuator.

1.10 The rock feeder abutment device according to any one of 1.1 to 1.9, further comprising:

an adapter member connected to the base member at a side portion thereof and configured to connect the base member to an adapter portion of the rock feeder.

1.11 The rock feeder abutment device according to 1.10, wherein the adapter member includes:

a first adapter plate extending sideways from the base member and being arranged proximal to the first abutment member; and
a second adapter plate extending sideways from the base member and being arranged proximal to the second abutment member, wherein a distance between the first adapter plate and the second adapter plate is configured to be larger than a width of the adapter portion.

1.12 The rock feeder abutment device according to 1.11, wherein the first adapter plate and the second adapter plate each include a cut-out, the cut-outs being configured to receive protrusions of the adapter portion.

1.13 A method for moving a rock feeder used in underground mining applications, the rock feeder being arranged inside an extraction drift for extracting rock material, the rock feeder being connected to a first rock feeder abutment device, the first rock feeder abutment device being connected to a second rock feeder abutment device via at least one hydraulically actuated connecting member, wherein each rock feeder abutment device includes:

a base member;
two abutment members arranged opposite to each other and being movable relative to the base member in opposite directions, the two abutment members being configured to abut on opposite walls of the extraction drift; and
a spreading mechanism supported on the base member, arranged between the two abutment members and configured to spread apart the two abutment members to achieve an abutment between the abutment members and the walls of the extraction drift;
the method for moving the rock feeder comprising:

operating the spreading mechanism of the second rock feeder abutment device until the abutment members of the second rock feeder abutment device abut on the walls of the extraction drift;
operating the spreading mechanism of the first rock feeder abutment device until the abutment members of the first rock feeder abutment device are out of abutment with the walls of the extraction drift;
operating the at least one hydraulically actuated connecting member to push the first rock feeder abutment device away from the second rock feeder abutment device;
operating the spreading mechanism of the first rock feeder abutment device until the abutment members of the first rock feeder abutment device abut on the walls of the extraction drift;
operating the spreading mechanism of the second rock feeder abutment device until the abutment members of the second rock feeder abutment device are out of abutment with the walls of the extraction drift; and
operating the at least one hydraulically actuated connecting member to pull the second rock feeder abutment device towards the first rock feeder abutment device.

1.14 The method according to 1.13, wherein the steps of 1.13 are performed until the rock feeder is moved a desired distance within the extraction drift.

1.15 A rock feeder for use in underground mining applications, in particular continuous rock flow mining applications, the rock feeder comprising:

a base configured to accumulate rock material falling onto the base;
a material transport portion arranged inside the base and configured to transport the rock material from the base to a conveyor;
an adapter portion arranged at a side portion of the base adjacent the material transport portion and remote from the conveyor; and
a rock feeder abutment device according to any one of the preceding claims, wherein the rock feeder abutment device is connected to the adapter portion via an adapter member.

[0075] According to a second aspect a retrofit kit for a rock feeder used in underground mining applications is disclosed.

2.1 A retrofit kit for a rock feeder used in underground mining applications, the rock feeder being arranged inside an extraction drift for extracting rock material falling onto a base of the rock feeder, the base having a material transport portion for transporting the rock material from the base to a conveyor, the retrofit kit comprising:

a rock feeder deflector device including:

a mounting portion configured to be connected to a top side of the base adjacent the material transport portion and remote from the conveyor;
a guiding plate movably connected to the mounting portion; and
a moving mechanism arranged between the mounting portion and the guiding plate, the moving mechanism being configured to move the guiding plate relative to the mounting portion between an operative position configured to guide the rock material to the material transport portion and an inoperative position; and

a rock feeder abutment device including:

a base member configured to be connected to the rock feeder;
a first abutment member movable relative to the base member and configured to abut on a first wall of the extraction drift;
a second abutment member arranged opposite the first abutment member, the second abutment member being movable relative to the base member in an opposite direction of the first abutment member and being configured to abut on a second wall of the extraction drift opposite the first wall; and
a spreading mechanism supported on the base member, arranged between the first abutment member and the second abutment member and configured to spread apart the first abutment member and the second abutment member such that the first abutment member abuts the first wall and the second abutment member abuts the second wall.

[0076] Further exemplary embodiments of the retrofit kit are provided by a combination of the rock feeder abutment device according to any one of 1.2 to 1.12 with the rock feeder deflector device according to any one of claims 2 to 14.

Claims

1. A rock feeder deflector device (30) for a rock feeder (10) used in underground mining applications, the rock feeder (10) having a material transport portion

(20) for transporting rock material (12) to a conveyor (14), the rock feeder deflector device (30) comprising:

a mounting portion (36) configured to be connected to the rock feeder (10);
a guiding plate (38) movably connected to the mounting portion (36); and
a moving mechanism (42) arranged between the mounting portion (36) and the guiding plate (38), the moving mechanism (42) being configured to move the guiding plate (38) relative to the mounting portion (36) between an operative position configured to guide rock material (12) to the material transport portion (20) and an inoperative position.

2. The rock feeder deflector device (30) according to claim 1, wherein the moving mechanism (42) is configured to pivot the guiding plate (38) relative to the mounting portion (36).

3. The rock feeder deflector device (30) according to claim 2, wherein, in the operative position of the guiding plate (38), the guiding plate (38) and the mounting portion (36) are substantially perpendicular to each other and, in the inoperative position of the guiding plate (38), the guiding plate (38) and the mounting portion (36) are substantially parallel to each other, and/or
wherein, in the operative position of the guiding plate (38), the guiding plate (38) and the mounting portion (36) form an angle (α) of more than 90 degrees between them.

4. The rock feeder deflector device (30) according to any one of the preceding claims, wherein the moving mechanism (42) is operated hydraulically and includes hydraulic actuators (44) connected to the mounting portion (36) and the guiding plate (38).

5. The rock feeder deflector device (30) according to any one of the preceding claims, wherein the mounting portion (36) includes a stop (58) configured to function as an abutment for the guiding plate (38) when the guiding plate (38) is in the operative position.

6. The rock feeder deflector device (30) according to any one of the preceding claims, wherein the guiding plate (38) includes a front face (48) for guiding the rock material (12), a rear face (50) opposite the front face (48) and side faces (52) extending from the front face (48) to the rear face (50), and the rock feeder deflector device (30) further comprises:

side extension plates (54) arranged on the side faces (52) of the guiding plate (38) and configured to increase a width of the guiding plate (38).

7. The rock feeder deflector device (30) according to claim 7, wherein the side extension plates (54) include flexible end members connected to outer edges of the side extension plates (54), and/or
wherein the side extension plates (54) are pivotably mounted to the side faces (52), and/or
wherein the rock feeder deflector device (30) further comprises:

a pivot mechanism (62) configured to pivot the side extension plates (54) relative to the guiding plate (38) between a pivoted-in position in which the side extension plates (54) are substantially perpendicular to the front face (48) and a pivoted-out position in which the side extension plates (54) are substantially parallel to the front face (48).

8. The rock feeder deflector device (30) according to claim 7, wherein in the pivoted-out position, the side extension plate (54) and the front face (48) of the guiding plate (38) form an angle (β) of smaller than 180 degrees between them.

9. The rock feeder deflector device (30) according to claims 7 or 8, wherein the pivot mechanism (62) is operated hydraulically and includes hydraulic actuators (64) connected to the side extension plates (54) and the guiding plate (38).

10. The rock feeder deflector device (30) according to any one of claims 6 to 9, wherein the side extension plates (54) include extension parts (56) slidably connected to the side extension plates (54) and the rock feeder deflector device (30) further comprises:

a slide mechanism (76) configured to slide the extension parts (56) between an extended position and a retracted position.

11. The rock feeder deflector device (30) according to claim 10, wherein the slide mechanism (76) is operated hydraulically and includes hydraulic actuators (78) connected to the side extension plates (54) and the extension parts (56), and/or
wherein the extension parts (56) include flexible end members connected to outer edges of the extension parts (56).

12. The rock feeder deflector device (30) according to any one of the preceding claims, further comprising:

at least one height extension plate (80) connected to a top side of the guiding plate (38) and configured to increase a height of the guiding plate (38).

13. The rock feeder deflector device (30) according to claim 12,
wherein the at least one height extension plate (80) includes a flexible end member (90) connected to outer edges of the at least one height extension plate (80), and/or
wherein the at least one height extension plate (80) includes a front face configured to guide the rock material (12), a rear face opposite the front face and side faces extending from the front face to the rear face, and the at least one height extension plate (80) further includes:

auxiliary side extension plates (86) arranged on the side faces and being pivotable between a pivoted-in position in which the auxiliary side extension plates (86) are substantially perpendicular to the front face and a pivoted-out position in which the auxiliary side extension plates (86) are substantially parallel to the front face.

14. The rock feeder deflector device (30) according to any one of the preceding claims, wherein the mounting portion (36) is configured to be connected to a connection portion (40) of the rock feeder (10).

15. A rock feeder (10) for use in underground mining applications, in particular continuous rock flow mining applications, the rock feeder (10) comprising:

a base (18) configured to accumulate rock material (12) falling onto the base (18);
a material transport portion (20) arranged inside the base (18) and configured to transport the rock material (12) from the base (18) to a conveyor (14);
a connection portion (40) arranged on a top side of the base (18) adjacent the material transport portion (20) and remote from the conveyor (14) ; and
a rock feeder deflector device (30) according to any one of the preceding claims, wherein the rock feeder deflector device (30) is connected to the connection portion (40) via the mounting portion (36).

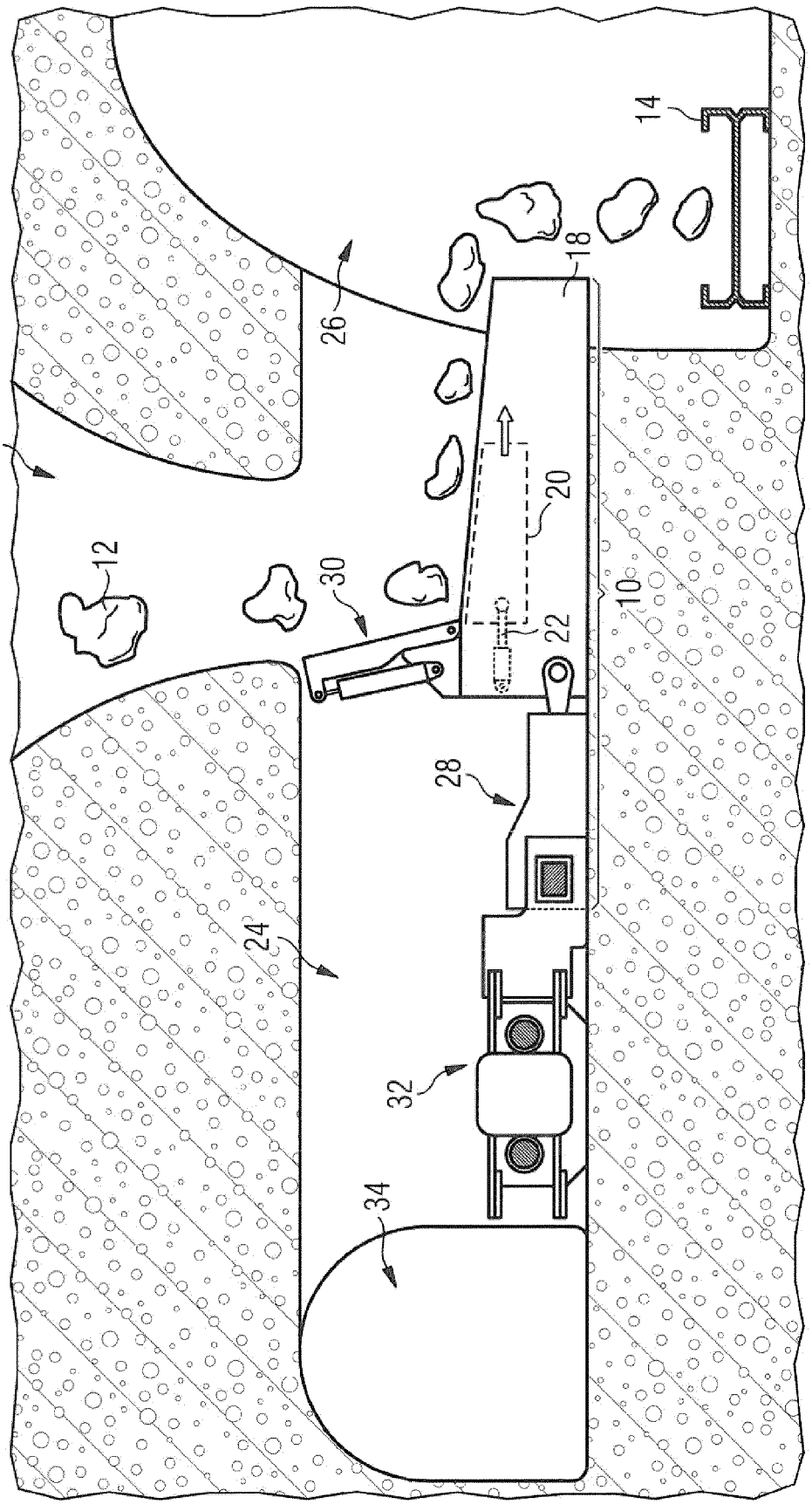

FIG 1

FIG 2

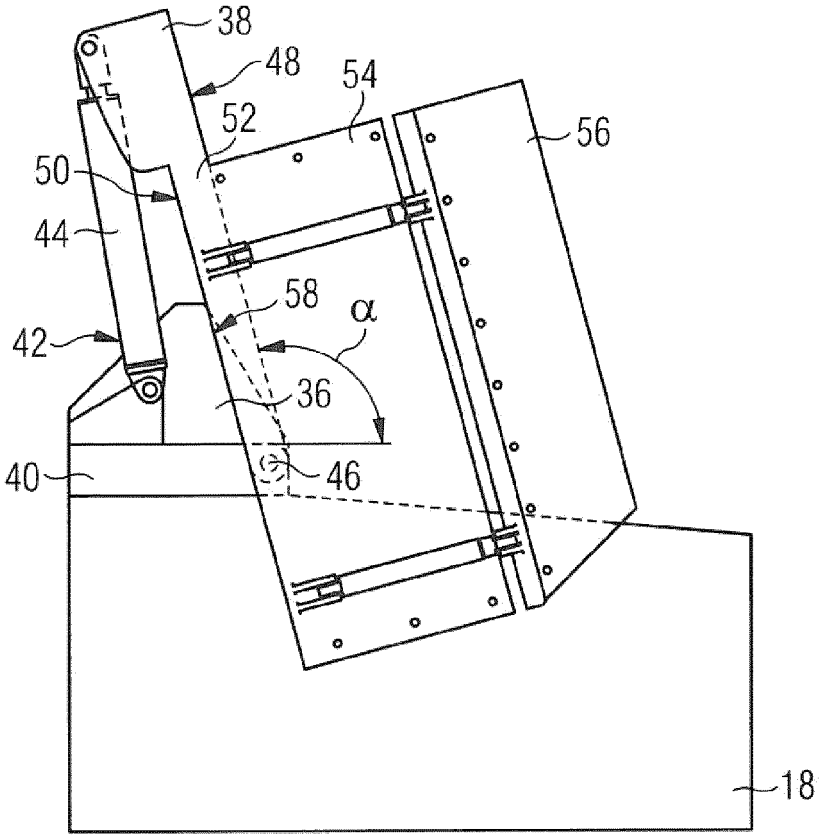
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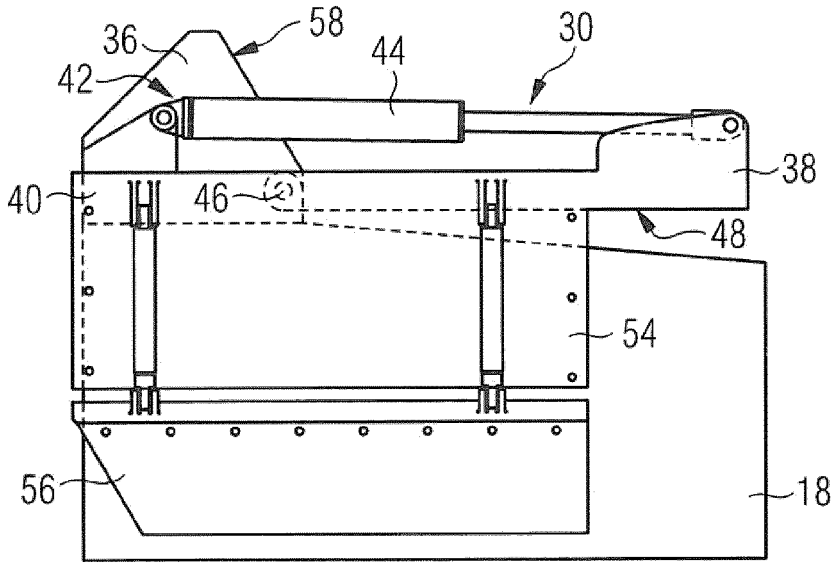
FIG 3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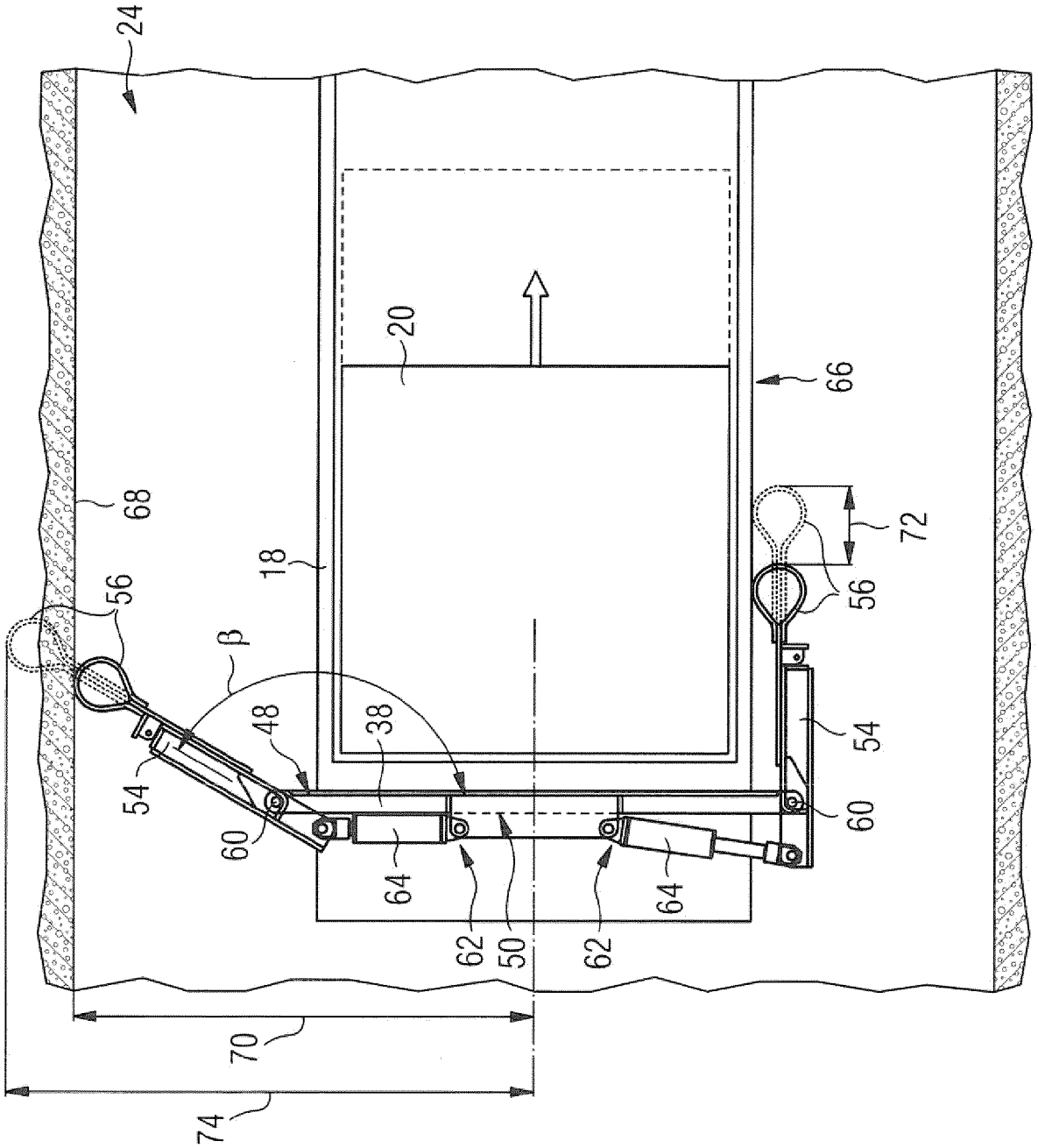


FIG 4

FIG 5

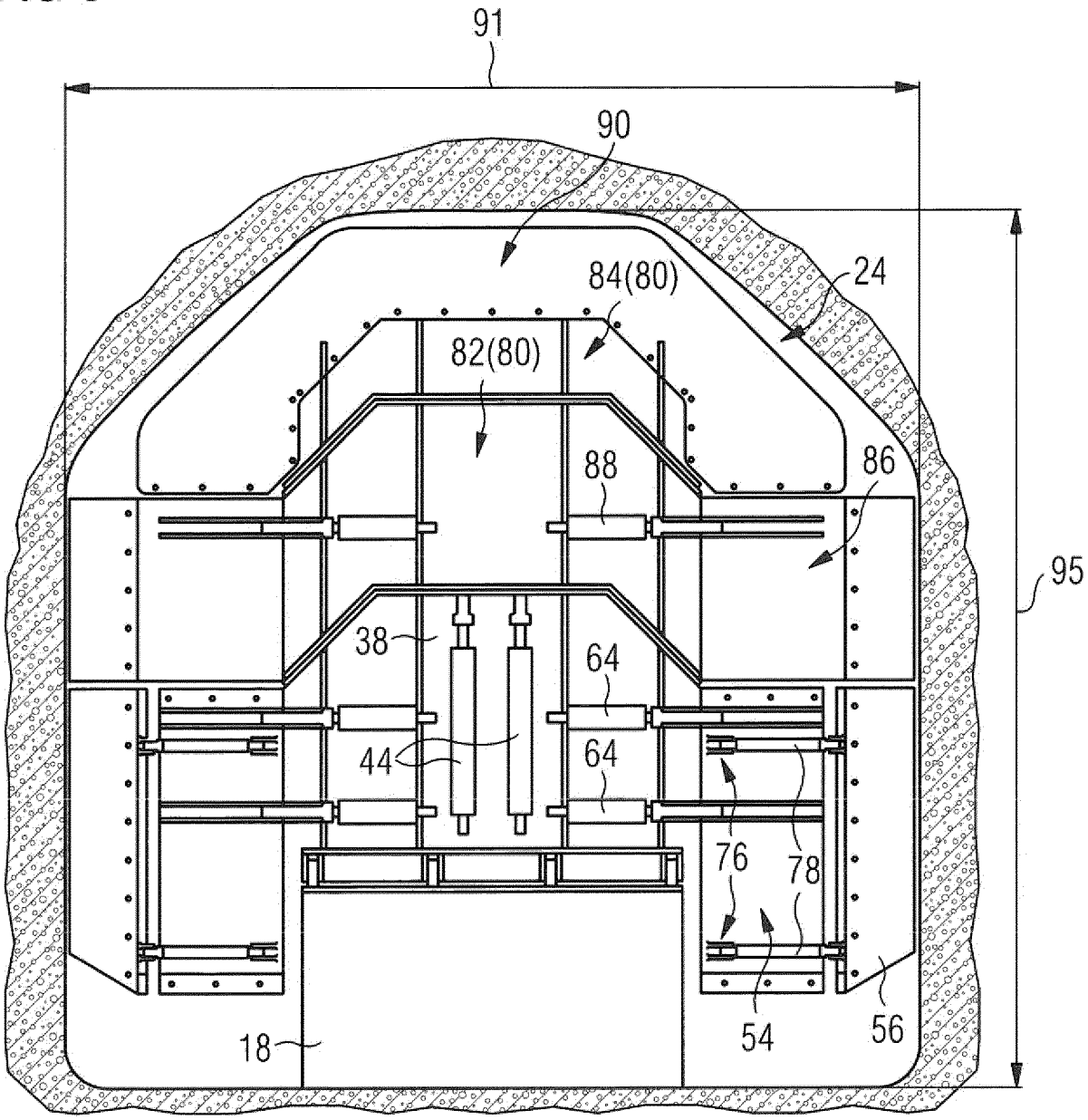
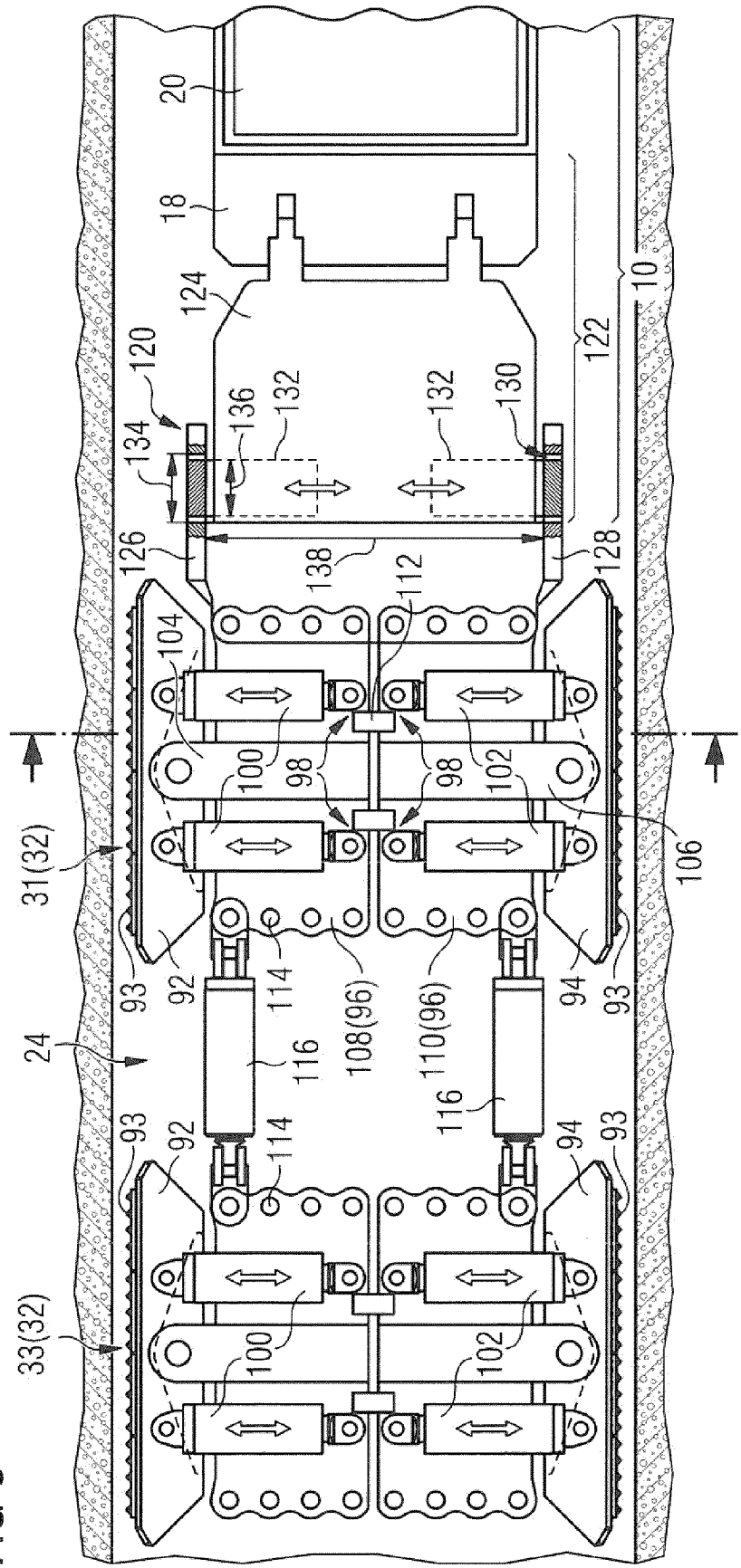


FIG 6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102
106
31(32)
93
92
114
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110(96)
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24
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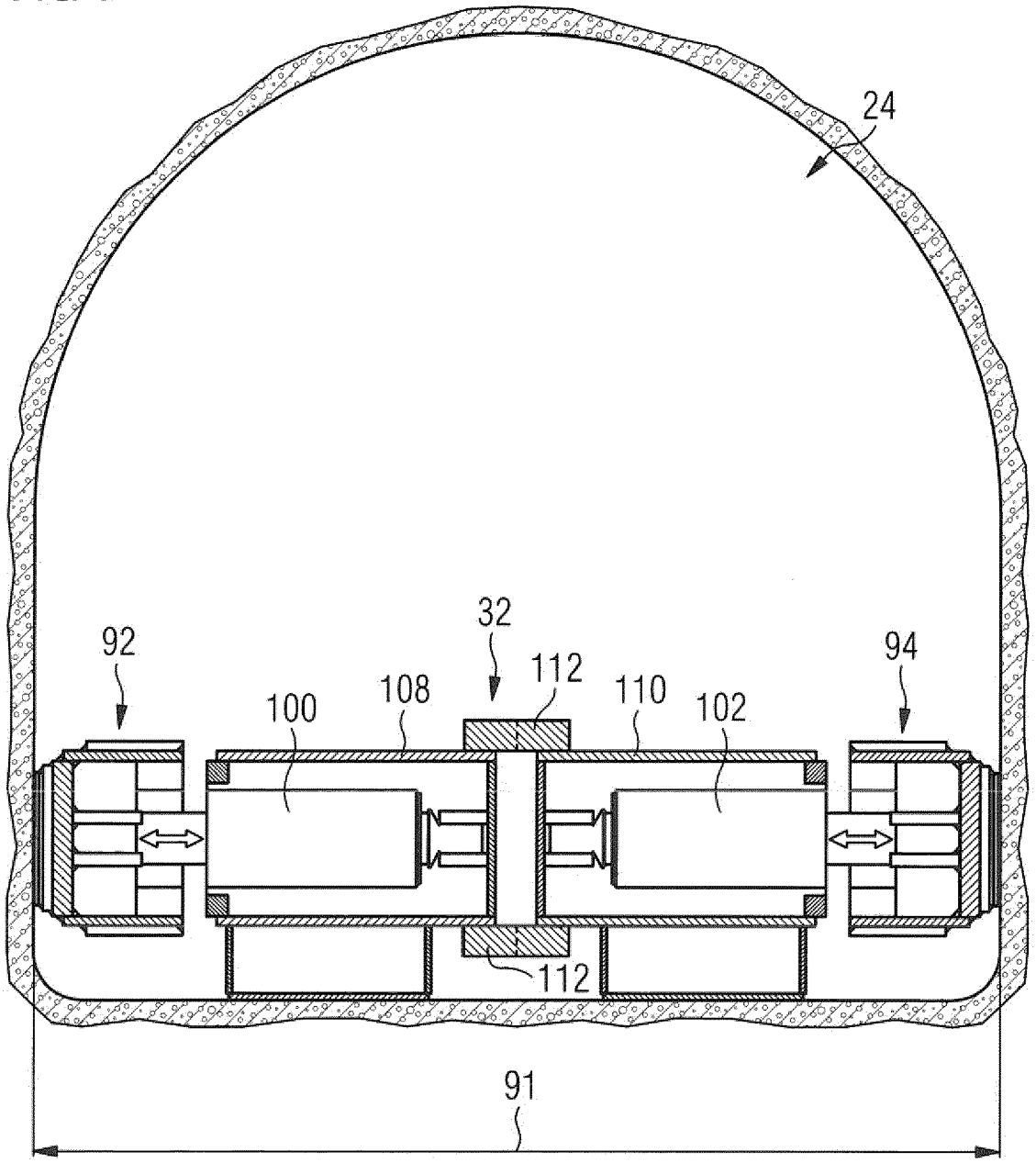
114
94
93
33(32)
100
102

FIG 7



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EUROPEAN SEARCH REPORT

Application Number
EP 16 16 4966

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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E21F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	15 September 2016	Schneiderbauer, K

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