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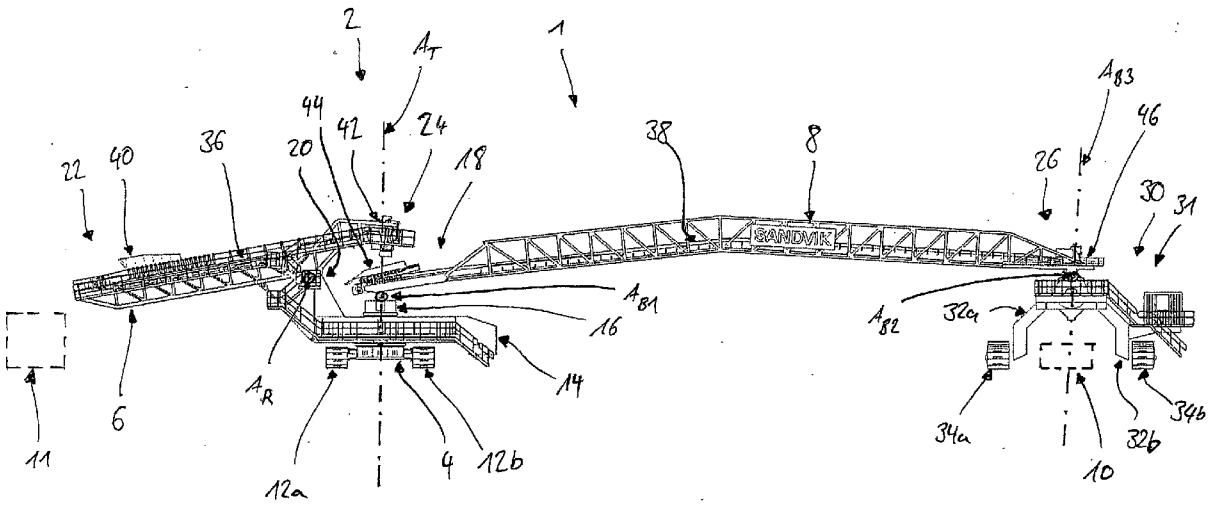


Fig. 1

(57) Abstract: A mobile transfer conveyor (1) for transferring excavated material in a surface mine from a mining machine to a further conveyor (10), comprising: a mobile vehicle unit (2), the vehicle unit (2) comprising a vehicle chassis (4) and a receiving boom (6) for receiving the excavated material, and a discharge bridge (8) for receiving the excavated material from the receiving boom (6) and transferring the received material to the further conveyor (10), wherein the receiving boom (6) is rotatable about a substantially vertical transfer axis (A T) with respect to the vehicle chassis (4) and the discharge bridge (8). Moreover, the invention concerns a system and a method.

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Mobile transfer conveyor

Field of invention

The invention relates to a mobile transfer conveyor for transferring excavated material in a surface mine from a mining machine to a further conveyor. Moreover, the invention concerns a surface mining system comprising a mobile transfer conveyor of the type mentioned above, a mobile surface miner and a stationary, relocateable or shiftable further conveyor. Furthermore, the invention relates to a method of transferring excavated material from a mining machine to a further conveyor, using the mobile transfer conveyor of the above mentioned type.

A surface miner is a mobile mining machine that operates by cutting rock in a surface mining environment. Such surface miners are used in rock that is too hard for free dig operations. Moreover surface miners are used for selective mining operations, and which only selected blocks are excavated. Due to this fact that mining gets more and more expensive and the amount of overburden removal needs to be kept to a minimum, a more selective mining method that reduces the haulaging costs from mining is required.
Currently, such surface miners are used in connection with trucks or lorries for conveying the excavated material. Alternatively they discharge their cuttings directly next to them where they are later picked up by mobile fleet equipment (e. g. front end loaders). A

drawback of the usage of lorries and trucks is that truck change lead to waiting times of the surface miner and results in lower productivity. Moreover, truck haulage is significantly more expensive than continuous transport.

From fully mobile independent crushing and conveying systems (IPCC) or bucket wheel excavators it is known that these systems are connected to a stationary conveyer, such as a conveyor belt by means of a transfer conveyor.

Background art

A transfer conveyor for example is known from US 5,404,988. The disclosed connecting belt bridge is provided with the feed end side and the discharge side end each supported on their respective travelling means, wherein the discharge side travelling means include a travelling unit which is not railbound, the connecting belt bridge being pivotally supported on the discharge side travelling means about a vertical as well as a horizontal axis and on the feed side travelling means by a longitudinally displaceable single point support including a support beam which can be horizontally aligned and has at its feed side end a feed jib hinged on by way of a horizontal transverse axis. This connecting belt bridge is not usable in combination with a surface manner.

Moreover, the combination with bucket wheel excavators and such transfer conveyors are known. For example US 2014/0067194 A1 discloses such a device and a corresponding method for detecting and tracking the position of such a mobile transferring device.

From DE 19839744 A1 a transfer bridge is known for connecting different mining machines in a surface mine. However, again this transfer device is not useable with surface miners.

Summary of the Invention

Therefore, an object of the present invention is to provide a mobile transfer conveyor for transferring excavated material in a surface mine from a mining machine to a further

conveyor which allows to connect the mining machine, in particular surface miner, to the further conveyor, e.g. conveyor belt, for continuous excavation and haulaging material.

This problem is solved by a mobile transfer conveyor comprising a mobile vehicle unit, vehicle unit comprising a vehicle chassis and a receiving boom for receiving the excavated material, and a discharge bridge for receiving the excavated material from the receiving boom and transferring the received material to the further conveyor, wherein the receiving boom is rotatable about a substantially vertical transfer axis with respect to the vehicle chassis and the discharge bridge. The receiving boom receives excavated material from the mining machine, e.g. surface miner. The receiving boom is mounted to the vehicle chassis and rotatable about a substantially vertical axis. Therefore the receiving boom can follow in its rotational position and also by means of moving the vehicle unit, the mining machine. The discharge bridge receives the excavated material from the receiving boom and transfers this received material to the further conveyor. The further conveyor may be a stationary conveyor, as e.g. a conveyor belt. Even though such conveyor belts are considered as being "stationary" it is to be understood, that also these conveyor belts may be moved, however, they are not mounted on a vehicle unit or a self-propelled or the like. Therefore they are considered to be "stationary". The term "material" covers any excavated or hold materials, such as mining soils, overburden, or, oil sand, minerals, coal and the like. Due to this arrangement, it is possible to use a mining machine, in particular a surface miner, in a continuous manner without the need for truck haulage. The mining machine therefore is continuously connected to a conveyor system, namely the further conveyor. The mobile vehicle unit preferably is self propelled.

Due to this fact, it is also possible to bring electric power to the mining machine and the mining site, and the mining machine can be supplied with electricity and therefore it is possible to reduce green house gases and the operating costs.

According to a first preferred embodiment the discharge bridge comprises a receiving end and a discharge end, wherein the discharge bridge is supported on the vehicle chassis with the receiving end. The receiving end of the discharge bridge preferably is mounted against the vehicle chassis, such that a predetermined relationship between the receiving boom, in

particular a discharge end of the receiving boom and the discharge bridge is achieved. The mobile vehicle unit according to this embodiment supports both, the receiving boom and the receiving end of the discharge bridge and is in the position to move both in a common manner.

In yet another preferred embodiment the discharge bridge is rotatable about the vertical transfer axis with respect to the vehicle chassis. According to this embodiment, both, the receiving boom as well as the discharge bridge are rotatable about the same axis, namely the transfer axis. This common transfer axis does provide for a simple transfer point between a discharge end of the receiving boom and the receiving end of the discharge bridge.

Moreover it is preferred that the discharge bridge is rotatable about a substantially horizontal axis. This allows, that a vertical offset between the vehicle unit and the further conveyor, in particular the conveyor belt, can be bridged. Usually, the further conveyor, in particular the conveyor belt, is placed on a different height with respect to the mining machine. The mining machine might be placed on a lower height, when a low block operation is carried out or an increased height, when high block operation is carried out. The mining machine removes material from the ground and therefore changes its heights with respect to the further conveyor and therefore it is in particular preferred, that the discharge bridge is rotatable about the substantially horizontal axis.

In yet a further preferred embodiment the mobile transfer conveyor comprises a bridge support unit, wherein the discharge end of the discharge bridge is supported by the bridge support unit. This bridge support unit may be placed adjacent to the further conveyor, such that excavated material is transferred from the discharge bridge to the further conveyor.

Preferably the bridge support unit is self-propelled. This allows the bridge support unit to move along the further conveyor or in accordance with the further conveyor in case the further conveyor is not formed as a belt conveyor.

According to a preferred embodiment the bridge support unit comprises a lifting device for lifting and lowering the discharge end of the discharge bridge. This allows to adjust the height of the discharge end with respect to the further conveyor and thus to provide an adapted material flow from the discharge bridge to the further conveyor. The lifting device may be formed as a pneumatic or hydraulic drive, or comprise an electric motor for driving a spindle drive or the like.

In yet another embodiment the support unit is formed as a portal crawler for moving along the further conveyor. In case the further conveyor is formed as a conveyor belt this embodiment is particular preferred. The portal crawler can be placed over the conveyor belt and move along the conveyor belt, such that excavated and haulaged material is transferred from the discharge bridge to the further conveyor. Such a portal crawler can also be provided with a crusher for crushing the excavated or haulaged material.

According to an alternative embodiment, the bridge support unit comprises a cantilevered discharge conveyor. Such a cantilevered discharge conveyor has the possibility to move away from the further conveyor, in case the further conveyor is formed as a conveyor belt, which is not easily possible with a portal crawler. Therefore, such a cantilevered discharge conveyor in particular is beneficial when two of the mobile transfer conveyors are used in connection with the same further conveyor. Then such cantilevered discharge conveyor has the possibility to pass the other mobile transfer conveyor in a simple manner.

According to a further preferred development of the invention, the receiving boom is carried by a rotatable frame of the vehicle unit which is rotatable together with the receiving boom relative to the vehicle chassis about the transfer axis. Preferably the receiving boom is coupled to the rotatable frame by a pivot joint allowing the receiving boom to the rotatable about a horizontal axis. The receiving boom comprises a receiving end and a discharge end, wherein the discharge end preferably is arranged in the area of the transfer axis. The receiving end may be brought into connection with the mining machine, in particular surface miner, for receiving excavated or haulaged material from the mining machine. In that the receiving boom is coupled to the rotatable frame by a pivot joint, the receiving boom can be rotated about the horizontal axis thus allowing the receiving end to

be altered in its height. This allows an adapted connection between the receiving boom and the mining machine.

Moreover it is preferred that the discharge end of the receiving boom together with the rotatable frame forms a substantially U-shaped structure. The opening of this U-shaped structure is configured to receive the receiving end of the discharge bridge. Usually the U is preferably arranged such that both legs of this U are arranged above each other and the back of the U is arranged in a substantially vertical manner. This U-shaped structure can therefore be considered as a laying U-shaped structure. Receiving the receiving end of the discharge bridge within the opening provides a beneficial arrangement between the receiving end of the discharge bridge and the discharge end of the receiving boom for transferring material from the receiving boom to the discharge bridge. Moreover this arrangement allows a simple support of the receiving end of the discharge bridge at the vehicle unit.

In this regard it is also preferred that the receiving boom comprises a discharge opening and the discharge bridge comprises a receiving chute, wherein the discharge opening is arranged substantially vertically above the receiving chute. Preferably, the discharge opening the receiving chute is arranged along the transfer axis. This arrangement leads to a simple transfer of material from the receiving boom to the discharge bridge irrespective of a rotational position of the receiving boom and the discharge bridge to each other. Therefore, continuous transfer and haulage of excavated material is facilitated in a simple manner.

According to a second aspect of the invention, invention concerns a surface mining system comprising the mobile transfer conveyor of at least one of the previously described preferred embodiments of a mobile transfer conveyor according to the first aspect of the invention, a mobile surface miner, and a stationary, relocatable or shiftable further conveyor, wherein the mobile transfer conveyor connects the surface miner with the conveyor belt for transferring excavated material for facilitating continuous excavation and haulaging of material. Also according to this aspect, the term “material” covers any excavated or haulaged materials, such as mining soils, overburden, ore, oil sand, minerals,

coal and the like. The term "connects" does not necessary define that a physical connection i.e. by fixing or mounting means, is provided. Rather a connection in material flow is sufficient.

As it concerns the preferred embodiments of the mobile transfer conveyor and the benefits thereof, reference is made to the above description of the mobile transfer conveyor according to the first aspect of the invention.

In a preferred embodiment of the surface mining system, a horizontal angular relationship between the receiving boom, the discharge bridge and the further conveyor is adjustable so that a transfer connection between the surface miner and the further conveyor can be maintained in a predetermined mining block. The surface miner moves in the predetermined mining block in the mining site for excavating material. The surface miner may be adapted to selectively mine the surface of the predetermined mining block the further conveyor is stationary, relocatable or shiftable, however not self-propelled or moveable in connection with the mobile surface miner. The further conveyor in particular is formed as a conveyor belt which is stationary for a predetermined or specific time frame, e. g. for a plurality of mining blocks. In that the surface miner is connected, in material flow, to the further conveyor, only by means of the receiving boom and the discharge bridge, and the conveyer belt relationship between the receiving boom and the discharge bridge can be varied, the mobile surface miner is facilitated for selective mining operation within reach of the mobile transfer conveyor, which connects the mobile surface miner with the further conveyor. Therefore continuous mining is facilitated and the need for truck hautage is avoided.

According to a further third aspect of the invention, the above mentioned problem is solved with a method of transferring excavated material from a mining machine to a further conveyor, using the mobile transfer conveyor as described in any of the above mentioned preferred embodiments of a mobile transfer conveyor according to the first aspect of the invention, wherein the method comprises the steps of: positioning a mining machine in a first position on a mining block; positioning the vehicle unit and the receiving boom such that it receives excavated material from the mining machine; positioning the discharge

bridge such that excavated material is discharged on the further conveyor; excavating material with the mining machine and moving the mining machine to a second position on the mining block; while excavating material following the mining machine by rotating the receiving boom, the discharge bridge, and or moving the vehicle unit, such that continuous excavation is facilitated.

Again, as its concerns preferred embodiments and benefits, reference is made to the above described mobile transfer conveyor according to the first aspect of the invention and the surface mining system according to the second aspect of the invention.

Brief description of drawings

In the following the invention is described with respect to the accompanying drawings joints in more detail, in which

Fig. 1 shows a side view of a mobile transfer conveyer according to a first embodiment;

Fig. 2 shows the mobile transfer conveyer of Fig. 1 in a further state;

Fig. 3 shows the mobile transfer conveyer of Fig. 1 and Fig 2 in a further state;

Fig. 4 shows a top view of a portion of the mobile transfer conveyer Fig. 1 to Fig. 3;

Fig. 5 shows a second top view of the mobile transfer conveyer of Figs. 1 to Fig. 4;

Fig. 6 shows a perspective view of the mobile transfer conveyer of Figs. 1 to Fig. 5 in a first estate;

Fig. 7 shows a second perspective view of the mobile transfer conveyer of Figs. 1 to Fig.6 in a further state;

Fig. 8 shows another perspective view of the mobile transfer conveyer of Figs. 1 to Fig. 7 in a further state;

Fig. 9 shows a side view of the receiving boom in a first estate;

Fig. 10 the receiving boom of Fig. 9 in a second state;

Fig. 11 shows a side view of a bridge support unit according to a first embodiment;

Fig. 12 shows a mobile transport conveyer according to a second embodiment; and

Fig 13 shows two mobile transport conveyers of a second embodiment connected to a single further conveyer belt.

Detailed description of embodiments

A mobile transfer conveyor 1 according to the invention comprises a mobile vehicle unit 2. The mobile vehicle unit 2 comprises a vehicle chassis 4 and a receiving boom 6 for receiving excavated material. Moreover, the mobile transfer conveyer 1 comprises a discharge bridge 8 for receiving excavated material from the receiving boom 6 and transferring this received material to a further conveyer 10. The vehicle unit 2 is formed as a self propelled vehicle unit, which can move without additional retractor or the like. The vehicle unit 2 comprises two crawler tracks 12a, 12b for moving on the ground.

On the chassis 4 a frame 14 is provided, which carries the receiving boom 6 and is rotatable about a substantially vertical transfer axis (A_T). Moreover, the chassis 4 carries a bridge connector 16, which carries a receiving end 18 of the discharge bridge 8. The bridge connector 16 is rotatable with respect to the vehicle chassis 4, and particular rotatable about the transfer axis (A_T). Therefore, both, the receiving boom 6, as well as the discharge bridge 8 are rotatable about the same vertical axis (A_T).

The receiving boom 6 is amount against the frame 14 by means of a pivot hinge 20. By means of this pivot hinge 20 the receiving boom 6 is pivotable about a horizontal axis A_{B1}. By means of pivoting the receiving boom 6, a receiving end 22 of the receiving boom 6 can be raised and lowered, as well as a respective discharge end 24 of the receiving boom 6.

The discharge bridge 8 comprises a discharge end 26, which is carried by a bridge support unit 30. According to this fist embodiment, the bridge support unit 30 is formed as a portal crawler 31, comprising first and second support legs 32a, 32b and first and second crawler tracks 34a, 34b. By means of the first and second support legs 32a, 32b the portal crawler 31 is able to move over the further conveyer 10, which may be formed as a conveyor belt and with respect to Fig. 1 would travel in a perpendicular direction to the plane of the drawing. The bridge support unit 30 is formed as a self propelled bridge support unit, such it is able to crawl along the further conveyor 10 without additional retractor means.

For transferring the material along the receiving boom 6 and the discharge bridge 8, both, the receiving boom 6 and the charge bridge 8 comprise belt conveyors 36, 38, which can better be seen in Fig. 4 to 11. When in use, material excavated by the mining machine, in particular surface miner, will be received at a receiving chute 40 formed at the receiving end 22 of the receiving boom 6. The material will than be transported by means of the belt 36 to a discharge opening 42 which is provided in the receiving boom 6 substantially coaxial with the transfer axis (A_T). The material falls down by means of gravity and is received by the receiving chute 44 formed at the receiving end 16 of the discharge bridge 8. The receiving chute 44 is provided substantially vertically below the discharge opening 42 and around the transfer axis (A_T). The material will be received on the belt 38 and transported to the discharge end 26 of the discharge bridge 8. The discharge end 26 is provided with a discharge opening 46 such that the excavating material is discharged to the further conveyer 10.

The receiving boom 8 is coupled to the bridge connector 16 by means of a pivoted joint and is rotatable about a horizontal axis A_{B1}. Moreover, the discharge bridge 8 is connected on its discharge end 26 to the bridge support unit 30 by a pivot joint and is rotatable about a horizontal axis A_{B2}, which is parallel to the axis A_{B1}. Due to these two pivot joints, the relative height of the mobile vehicle unit 2 and the bridge support unit 30 can be altered, as shown in Fig. 2.

In Fig. 2, the bridge support unit 30 is positioned on a high block, while the mobile vehicle unit is positioned on a low block (see also Fig. 4-8). This arrangement is used when low block operation by the mobile mining machine (not shown in Fig. 2) is carried out. As can be seen in Fig. 2, due to this pivoted arrangement and due to the fact that the axis A_{B1} crosses or is relatively close to the transfer axis (A_T), safe transfer of excavated material from the receiving boom 6 to the discharge bridge 8 is ensured, irrespective of the relative high positions of the mobile vehicle unit 2 and the bridge support unit 30 to each other.

In Fig. 3 the mobile transfer conveyer 1 of Figs. 1 and 2 is shown from the other side, thus from behind with respect to Figs. 1 and 2. Moreover, the bridge support unit 30 has been pivoted to show that the discharge bridge 8 is not only rotatable about axis (A_{B2}) with respect to the bridge support unit 30, but also rotatable about a vertical axis (A_{B3}) which is substantially parallel to transfer axis (A_T). In this arrangement, the bridge support unit 30 is placed over the further conveyer 10, which is formed as a conveyer belt.

Due to the overall pivotable connection, in which the receiving boom 6 is rotatable about the vertical axis (A_T), the discharge bridge 8 is pivotable about the vertical axis (A_T) and the vertical axis (A_{B3}), and furthermore, the receiving boom 6 is rotatable about horizontal axis (A_R) and the discharge bridge 8 is rotatable about the horizontal axis (A_{B1}) and (A_{B2}), the vertical as well as the horizontal position of the receiving end 22 of the receiving boom 6 relative to the further conveyer 10 can be altered in a broad variety.

This is illustrated in Figs. 4 and 5, which show top views of the transport conveyer 1 according to Figs. 1 to 3.

In Fig. 4, the mobile vehicle unit 2 together with the receiving boom 6 is positioned on a lower block 100 on the mining site. The bridge support unit 30 (not shown in Fig. 4; see Fig. 5) is positioned on a high block 102 of the mining site. The high block 102 and the low block 100 are connected by a slope 104. In Fig. 4 the mining machine 11, in particular surface miner, is in a first position and therefore, also the receiving boom 6 is in a first position P_1, such that the receiving end 22 of the receiving boom 6 receives excavated material from the mining machine 11. Therefore, the receiving boom 6 is rotated about an

angle α_1 about the axis (A_T) with respect to the discharge bridge 8. When now the mining machine 11 moves to a second position P_2 (see Fig. 5) for mining a specific spot of the block 100, the mobile transfer conveyer 1 has to move, such that the connection in material flow from the mining machine 11 to the further conveyer 10 (see Fig. 5) is maintained, such that continuous mining is facilitated. In this exemplary embodiment shown in Figs. 4 and 5 it is sufficient that the receiving boom 6 is further rotated so that an angle α_2 is provided between the receiving boom 6 and the discharge bridge 8. The mobile vehicle unit 2 is controlled such that the frame 14 rotates about the axis (A_T) and together with the frame 14, also the receiving boom 6 rotates.

Figs. 6 and 7 show the same example of Figs. 4 and 5 in a perspective view. As can be seen from Figs. 6 and 7, due to the pivotable connection of the discharge bridge 8 to the bridge connector 16 and the bridge support unit 30, it is possible to bridge the height difference between the high block 102 and the low block 100. Also the other way around is possible, when the mobile vehicle unit 2 is positioned on the higher block 102 and the bridge support unit 30 is positioned on the low block 100.

Figs. 9 to 11 show details of the mobile transfer conveyor 1 as shown in Figs. 1 to 8. According to Figs. 9 and 10 the mobile vehicle unit 2 is shown carrying the receiving boom 6. While in Fig. 9 the receiving boom 6 is pivoted to about the horizontal axis A_R to a first position P_3, the receiving boom 6 is pivoted in Fig. 10 to a second position P_4.

The receiving boom 6 comprises a first portion 50 comprising the receiving end 22 and a second portion 52 comprising the discharge end 24. The pivot connection 20 is provided between the first and the second portions 50, 52. As a substructure, the receiving boom 6 comprises a framework 54. The framework 54 carries the belt 36 and the other superstructures as e.g. the receiving chute 40. In the first portion 50 of the receiving boom 6 the framework 54 substantially extends along a first straight axis F_1. The framework 54 in the second portion 52 of the receiving boom 6 is angled and comprises second and third axis F_1, F_3. The pivot connection 20 is substantially arranged at the crossing area of the first and second axis F_1, F_2. The second axis F_2 is angled with respect to the first axis F_1, such that the second axis F_2 protrudes slightly upwards with respect to the first axis F_1. The

third axis F_3 is again angled with respect to the second axis F_2, in particular downwards and is substantially parallel to the first axis F_1. In this embodiment, the third axis F_3 is slightly angled to the first axis F_1, even though this is not necessary. The angle between the first and second axis F_1, F_2 is approximately 45°, and the angle between the second and third axis F_2, F_3 is also approximately 45°.

The frame 14, which is rotatable arranged on the chassis 4 of the mobile vehicle unit 2 comprises a first substantially horizontal portion 56 and an angled support portion 58. The angled support portion 58 extends at an end of the horizontal portion 56 substantially in an angle of approximately 45°. As can be in particular inferred from Figs. 9 and 10, the second portion 52 of the receiving boom 6 and frame 14, together describe a U-shaped structure. In this regard, axis F_3 can be seen as forming a first leg of the U and the horizontal portion 56 of the frame 14 can be seen as forming a second leg of the U. The angled support portion 58 and the second axis F2 together form a back of this U. The U-shaped structure forms an opening 60 between the second portion 52 of the receiving boom 6 and the frame 14. This opening 60 is intersected by the transfer axis A_T. Inside the opening 60, the receiving end 18 of the discharge bridge 8 (which is only shown in part in Fig. 9 and 10) is received. The receiving end 18 comprises a receiving chute 44 and is rotatable and pivotabt supported by the bridge support 16, which in turn is supported on the chassis 4. As described above, the bridge support 16 is rotatable about the transfer axis A_T and also the frame 14 is rotatable about this transfer axis A_T. The transfer axis A_T runs through the receiving chute 40 and substantially through the discharge opening 42 of the discharge end 24 of the receiving boom 6. This is true for both, the first position P_3 and the second position P_4. Moreover, this is true for all rotatable positions about the transfer axis A_T as can be inferred also from Figs. 4 to 8. Excavated material will be received in the receiving chute 40 transported by means of belt 36 to the discharge opening 42, transferred by means of gravity from the discharge opening 42 to the receiving chute 44 and then further transported by means of belt 38. Due to this arrangement, a continuous transport of a material irrespective of the rotational positions of the axis A_T, as well as the pivoted positions about axis A_R and axis A_{B1} is ensured.

Fig. 12 shows the mobile transfer conveyor 1 in a second embodiment. While in the first embodiment (cf. Figs. 1 to 11) the bridge support unit 30 is formed as a portal crawler 31, in this embodiment (Fig. 12) the bridge support unit 30 is formed as a single crawler 62 with a lifting device 64. The mobile vehicle unit 2 is formed identical to the first embodiment and insofar reference is made to the above Figs. 1 to 11. Additionally, also the discharge bridge 8 has a different design.

While the discharge bridge 8 of the first embodiment (Figs. 1 to 11) has first and second portions 81, 82 (cf. Fig. 3) defining first and second axis B_1, B_2 which are slightly angled to each other such that the discharge bridge 8 is curred, the discharge bridge 8 according to the second embodiment (Fig. 12) comprises first and second portions 81, 82 which are parallel to each other but offset, and the portion 81 is offset with respect to portion 81. Moreover, the discharge bridge 8 comprises a third portion 83 which is formed as a nose portion and angles downwardly. The nose 83 is delivered by the lifting device 64 which can lift and lower the nose portion 83 with respect to the further conveyor 10. This arrangement is particularly useful when the mining machine 11 and also the mobile vehicle unit 2 is positioned on a low block 100 and the further conveyor on a high block 102.

This arrangement is shown in Fig. 13 on the left-hand side. On the left-hand side a first mobile transfer conveyor 1a is shown which is formed as known from the second embodiment (Fig. 12). The mobile vehicle unit 2a of the first mobile transfer conveyor 1a is positioned on a low block 100 and the bridge support unit 30a of the first mobile transfer conveyor 1a is positioned on a high block 102. On this high block 102 also the further conveyor 10 is positioned. In the exemplary embodiment shown in Fig. 13 there is a second high block 106, which is even higher than high block 102 and a slope 108 is provided between the second high block 106 and the first high block 102. On the second high block 106 also a mining machine 11b is provided which is connected to the second mobile transfer conveyor 1b. The second mobile transfer conveyor 1b is substantially formed according to the first embodiment (Figs. 1 to 11) the discharge bridge 8b is formed in accordance with the first embodiment. However, the second bridge support unit 30b is differently formed. It comprises a crawler, unit 90 which is positioned adjacent to the further conveyor 10 which is commonly used by the first mobile transfer conveyor 1a and

the second mobile transfer conveyor 1b. The crawler unit 90 comprises a cantilevered discharge conveyor 92 which receives material from the discharge end 26b of the second discharge bridge 8b. The cantilevered discharge conveyor 92 is arranged substantially horizontal and comprises a separate belt 94 which may be independently be driven from the belt 38b of the second mobile transfer conveyor 1b. The cantilever discharge conveyor 92 moreover is rotatable about axis AC, so that the rotatable position can be adapted. Such arrangement in particular is useful when the slope 108 is relatively long and the height difference the second high block 106 and the first high block 102 is large. As can be inferred from Fig. 13, in that no portal crawler 31 as described with respect to the first embodiment is used, it is possible that the first and second bridge support units 30a, 30b can pass each other along the further conveyor 10.

List of Reference Signs

1	mobile transfer conveyor
2	mobile vehicle unit
4	vehicle chassis
6	receiving boom
8	discharge bridge
10	conveyer
11	mining machine
12a, 12b	crawler tracks
14	frame
16	bridge connector
18	receiving end
20	pivot hinge
22	receiving end
24	discharge end
26	discharge end
30	support unit
31	portal crawler
32a, 32b	support legs
36	belt conveyors
38	belt conveyors
40	receiving chute
42	discharge opening
44	receiving chute
46	discharge opening
50	first portion
52	second portion
54	framework
56	horizontal portion
58	support portion
60	opening
62	single crawler

64	lifting device
81	first portion
82	second portion
83	third portion
90	unit
92	discharge conveyor
94	belt
100	low block
102	high block
104	slope
106	high block
108	slope

A_T	transfer axis
A_{B1}	horizontal axis
A_{B2}	horizontal axis
A_{B3}	vertical axis
A_R	rotational axis
P_1	first position
P_2	second position
P_3	first position
P_4	second position

Claims

1. A mobile transfer conveyor (1) for transferring excavated material in a surface mine from a mining machine (11) to a further conveyor (10), comprising:

a mobile vehicle unit (2), the vehicle unit (2) comprising a vehicle chassis (4) and a receiving boom (6) for receiving the excavated material, and

a discharge bridge (8) for receiving the excavated material from the receiving boom (6) and transferring the received material to the further conveyor (10),

wherein the receiving boom (6) is rotatable about a substantially vertical transfer axis (A_T) with respect to the vehicle chassis (4) and the discharge bridge (8).

2. The mobile transfer conveyor according to claim 1, wherein the discharge bridge (8) comprises a receiving end (18) and a discharge end (26), wherein the discharge bridge (8) is supported on the vehicle chassis (4) with the receiving end (18).

3. The mobile transfer conveyor according to claim 1 or 2, wherein the discharge bridge (8) is rotatable about the vertical transfer axis (A_T) with respect to the vehicle chassis (4).

4. The mobile transfer conveyor according to any of the preceding claims, wherein the discharge bridge (8) is rotatable about a substantially horizontal axis (A_{B1}).

5. The mobile transfer conveyor according to any of the preceding claims, further comprising a bridge support unit (30), wherein the discharge end (26) of discharge bridge (8) is supported by the bridge support unit (30).

6. The mobile transfer conveyor according to claim 5, wherein the bridge support unit (30) is self propelled.

7. The mobile transfer conveyor according to claim 5 or 6, wherein the bridge support unit (30) comprises a lifting device (64) for lifting and lowering the discharge end (26) of the discharge bridge (8).

8. The mobile transfer conveyor according to any of the preceding claims 5 to 7, wherein the bridge support unit (30) is formed as a portal crawler (31) for moving along the further conveyor (10).

9. The mobile transfer conveyor according to any of the preceding claims 5 to 7, wherein the bridge support unit (30) comprises as a cantilevered discharge conveyor (92).

10. The mobile transfer conveyor according to any of the preceding claims, wherein the receiving boom (6) is carried by a rotatable frame (14) of the vehicle unit (2) which is rotatable together with the receiving boom (6) relative to the vehicle chassis (4) about the transfer axis (A_T).

11. The mobile transfer conveyor according to claim 10, wherein the receiving boom (6) is coupled to the rotatable frame (14) by a pivot joint (20) allowing the receiving boom (6) to be rotatable about a horizontal axis (A_R).

12. The mobile transfer conveyor according to any of the preceding claims, wherein the receiving boom (6) comprises a discharge opening (42) and the discharge bridge (8) comprises a receiving chute (44), wherein the discharge opening (42) is arranged substantially vertically above the receiving chute (44).

13. The mobile transfer conveyor according to claim 12, wherein the discharge opening (42) and the receiving chute (44) are arranged along the transfer axis (A_T).

14. A surface mining system, comprising:
the mobile transfer conveyor (1) of claim 1,
a mobile surface miner (11), and
a stationary, relocatable or shiftable further conveyor (10),
wherein the mobile transfer conveyor (1) connects the surface miner (11) to the further conveyor (10) for transferring excavated material for facilitating continuous excavation and haulaging of material.

15. The surface mining system according to claim 14, wherein a horizontal angular relationship between the receiving boom (6), the discharge bridge (8) and the further conveyor (10) is adjustable so that a transfer connection between the surface miner (11) and the further conveyor (10) can be maintained in a predetermined mining block.

16. A method of transferring excavated material from a mining machine to a further conveyor (10), using the mobile transfer conveyor (1) according to any of claims 1 to 13, comprising the steps of:

- positioning a mining machine (11) in a first position (P_1) on a mining block (100);
- positioning the vehicle unit (2) and the receiving boom (6) such that it receives excavated material from the mining machine (11);
- positioning the discharge bridge (8) such that excavated material is discharged on the further conveyor (10);
- excavating material with the mining machine (11) and moving the mining machine (11) to a second position (P_2) on the mining block (100);
- while excavating material following the mining machine (11) by rotating the receiving boom (6), the discharge bridge (8) and/or moving the vehicle unit (2), such that continuous excavation is facilitated.

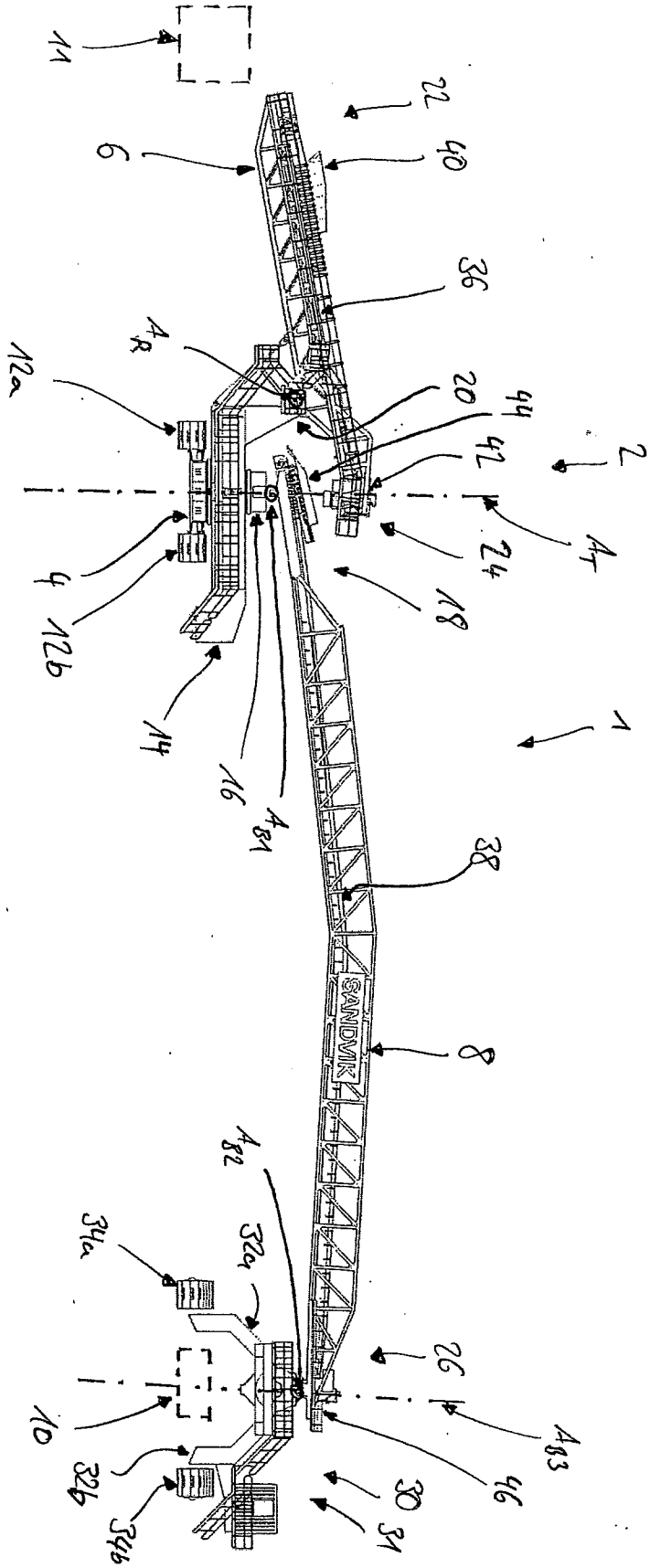

11
22
6
40
36
A_R
12a
20
44
42
2
A_T
24
4
12b
18
1
14
16
A_{B1}
38
SANDVIK
8
A_{B2}
34a
32a
26
10
A_{B3}
32b
46
30
34b
31

Fig. 1

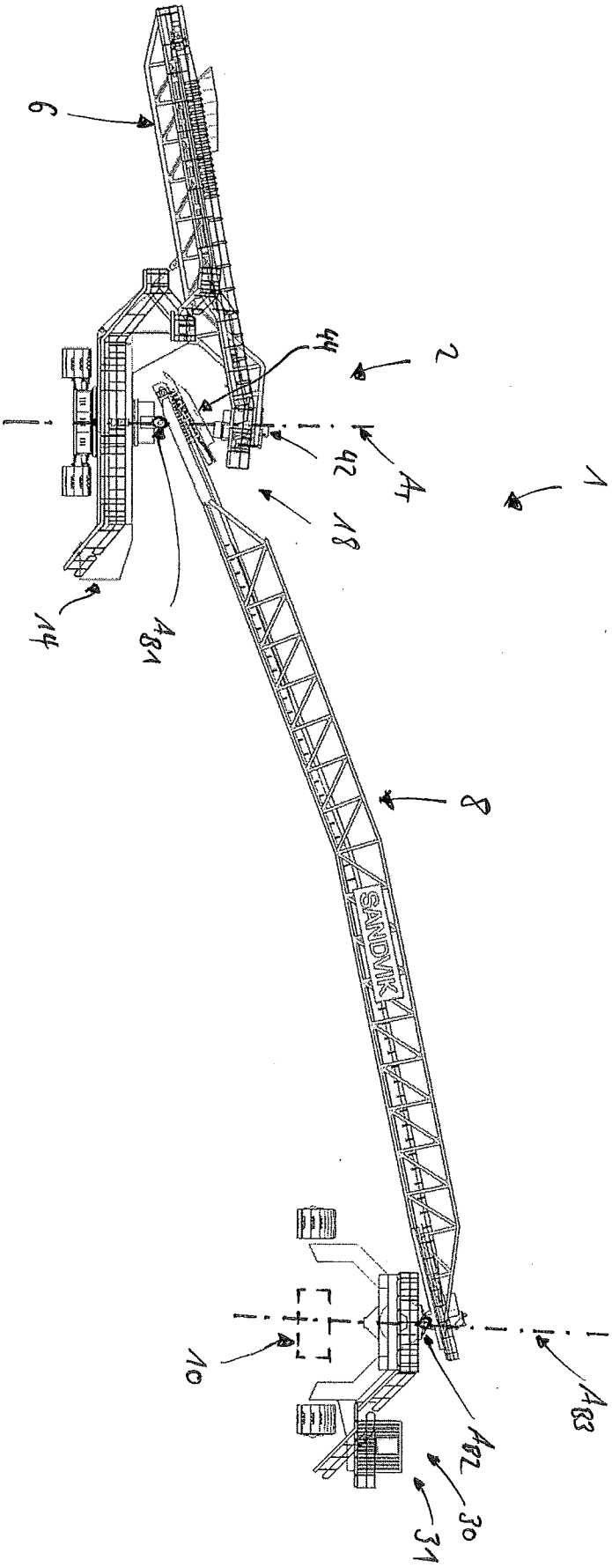


Fig. 2

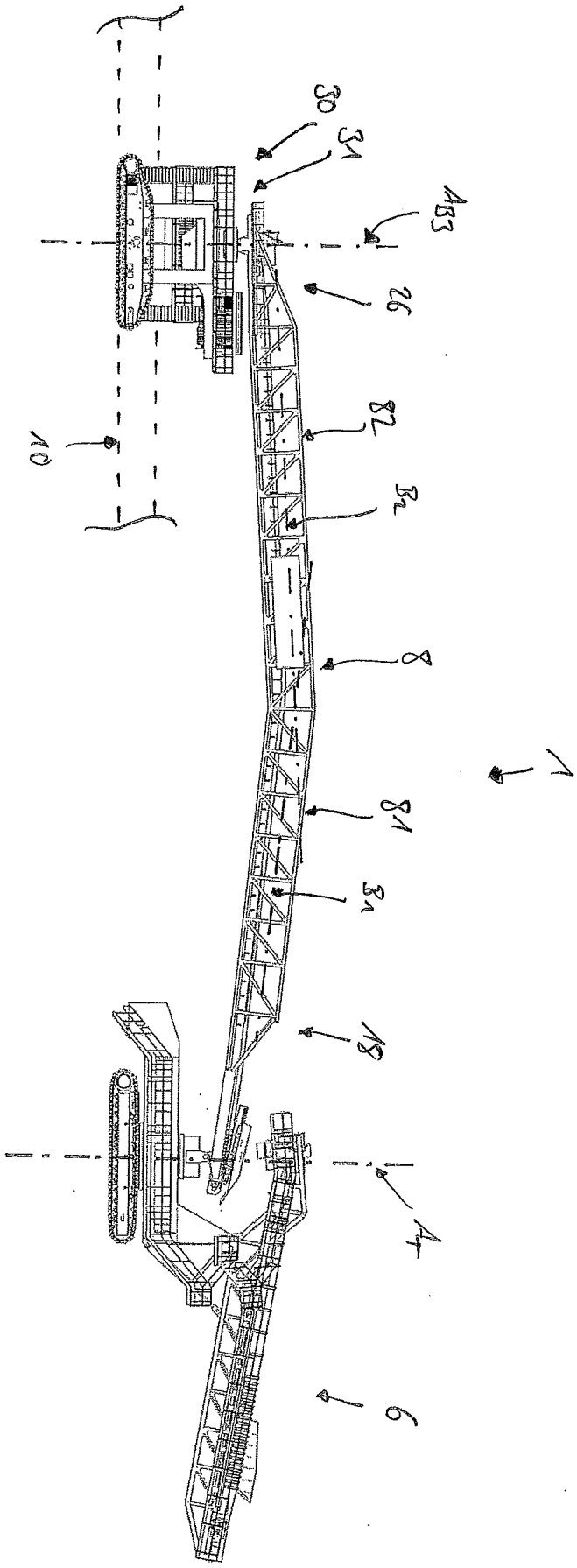


Fig. 3

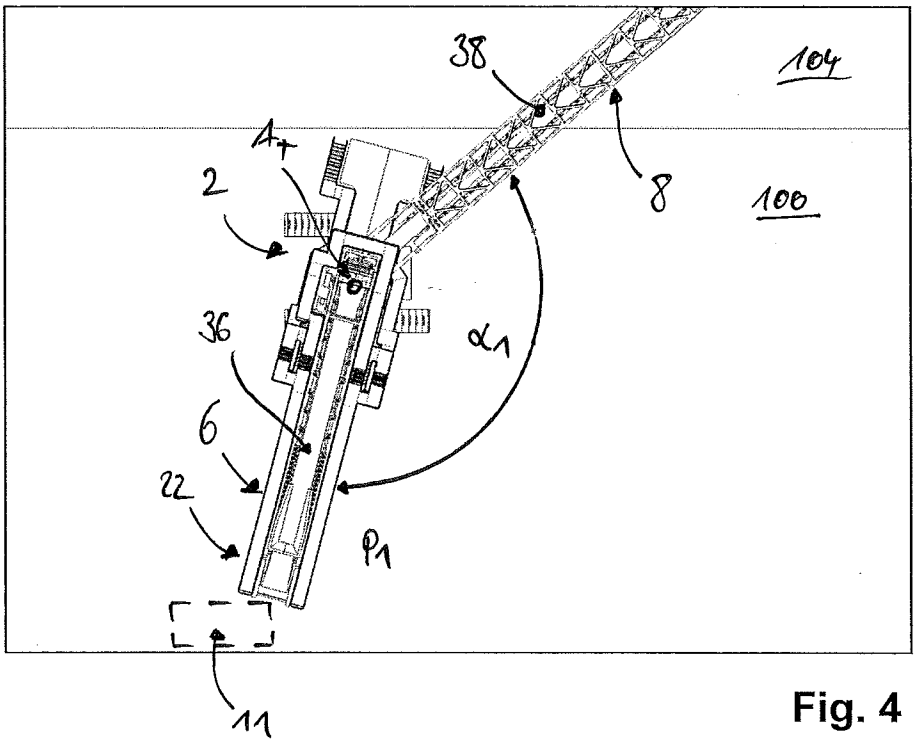

38
104
A_T
2
8
100
36
α_1
6
22
P_1
11

Fig. 4

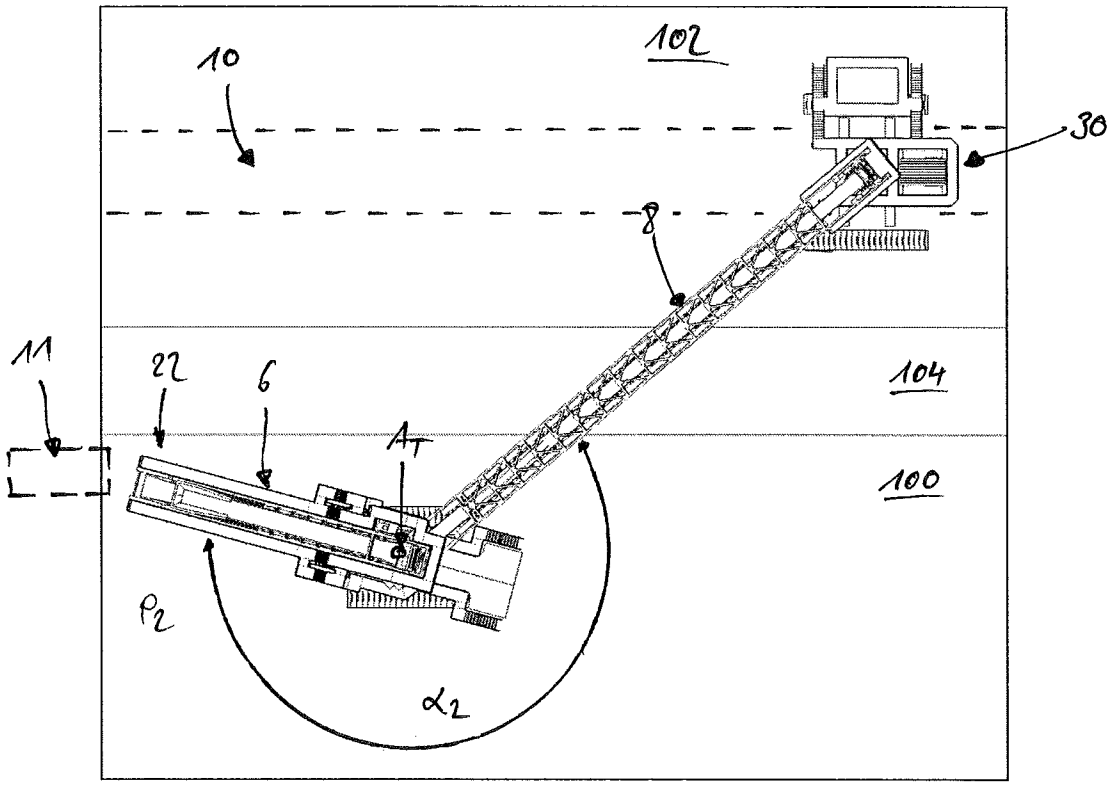

102
10
30
8
11
22
6
104
A_T
100
P_2
α_2

Fig. 5

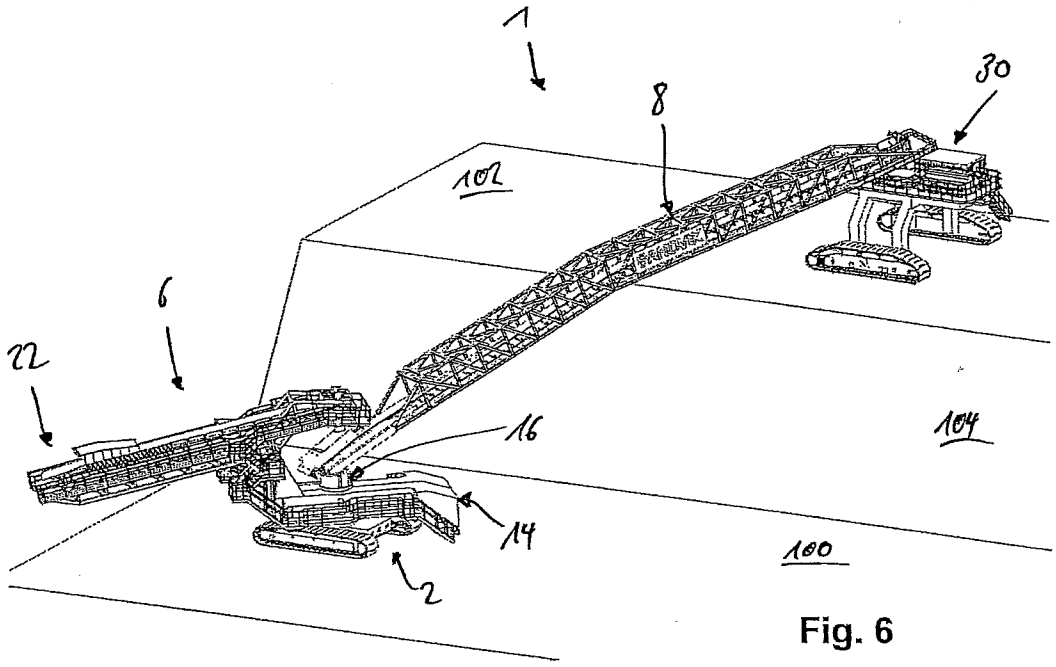


Fig. 6

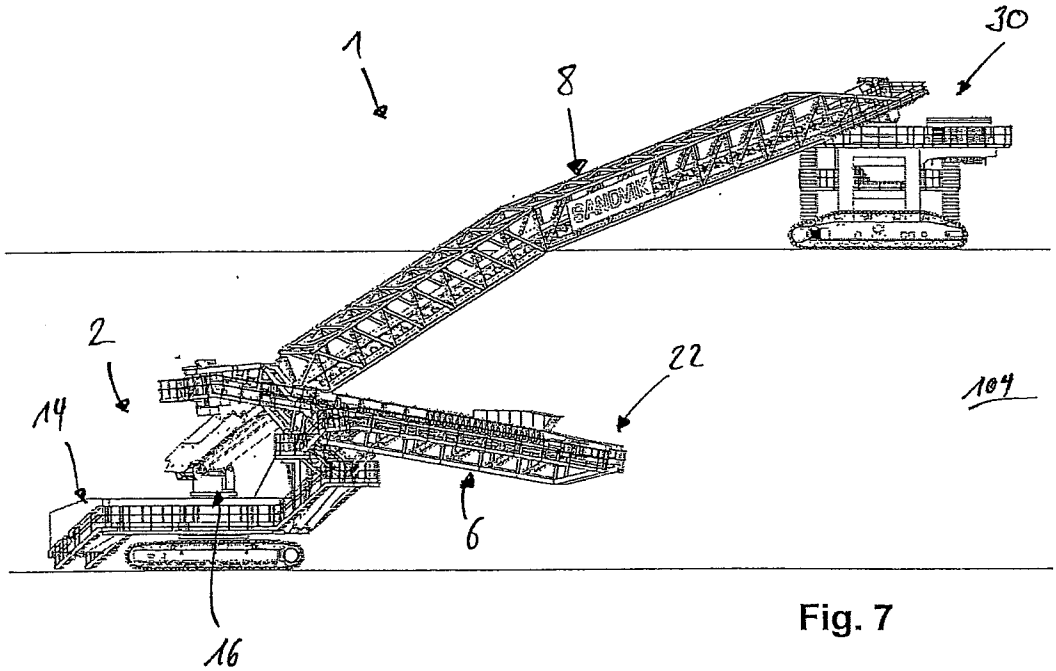


Fig. 7

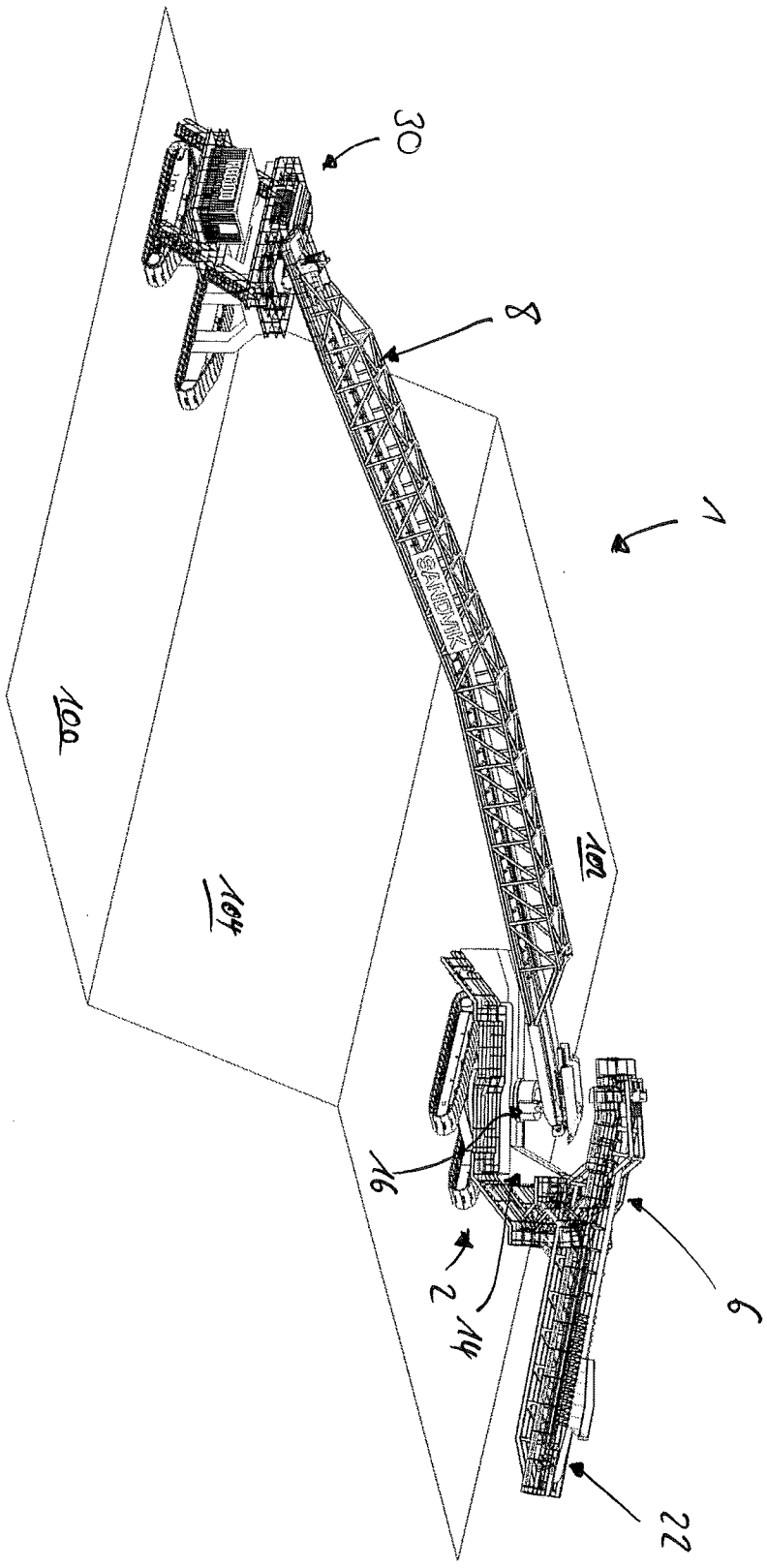


Fig. 8

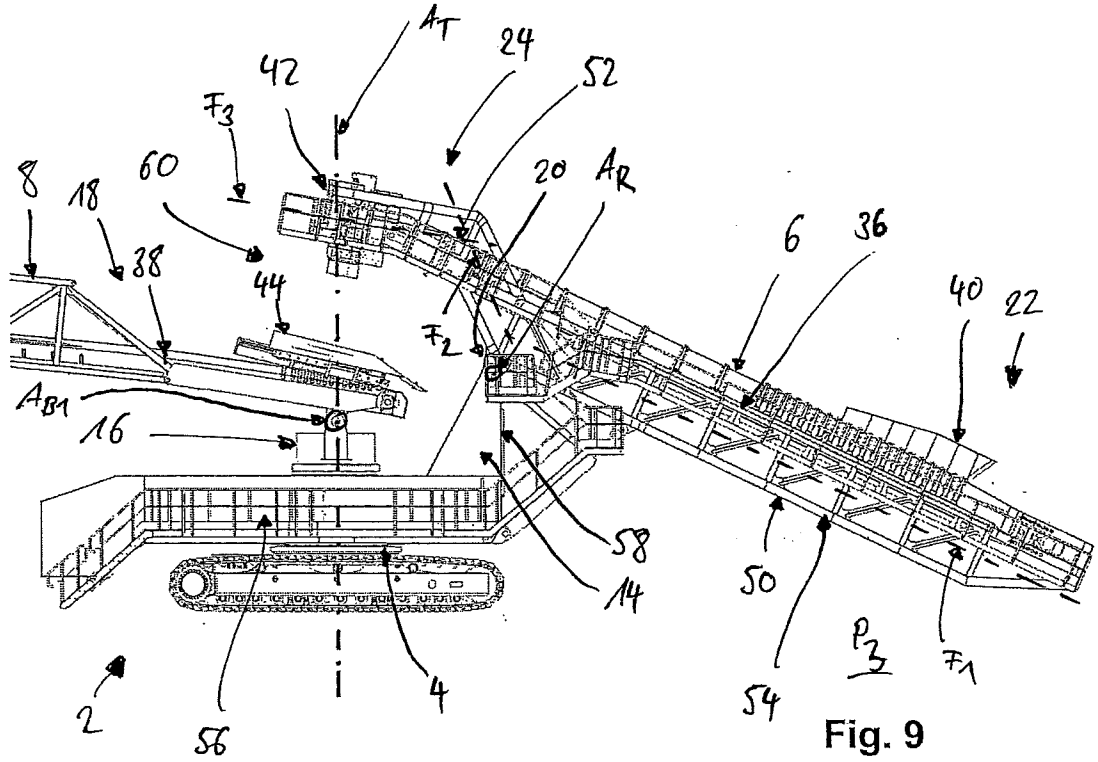

A_T
24
52
42
F_3
60
8
18
38
20
A_R
6
36
40
22
44
F_2
A_{B1}
16
58
14
50
54
P_3
F_1
2
56
4

Fig. 9

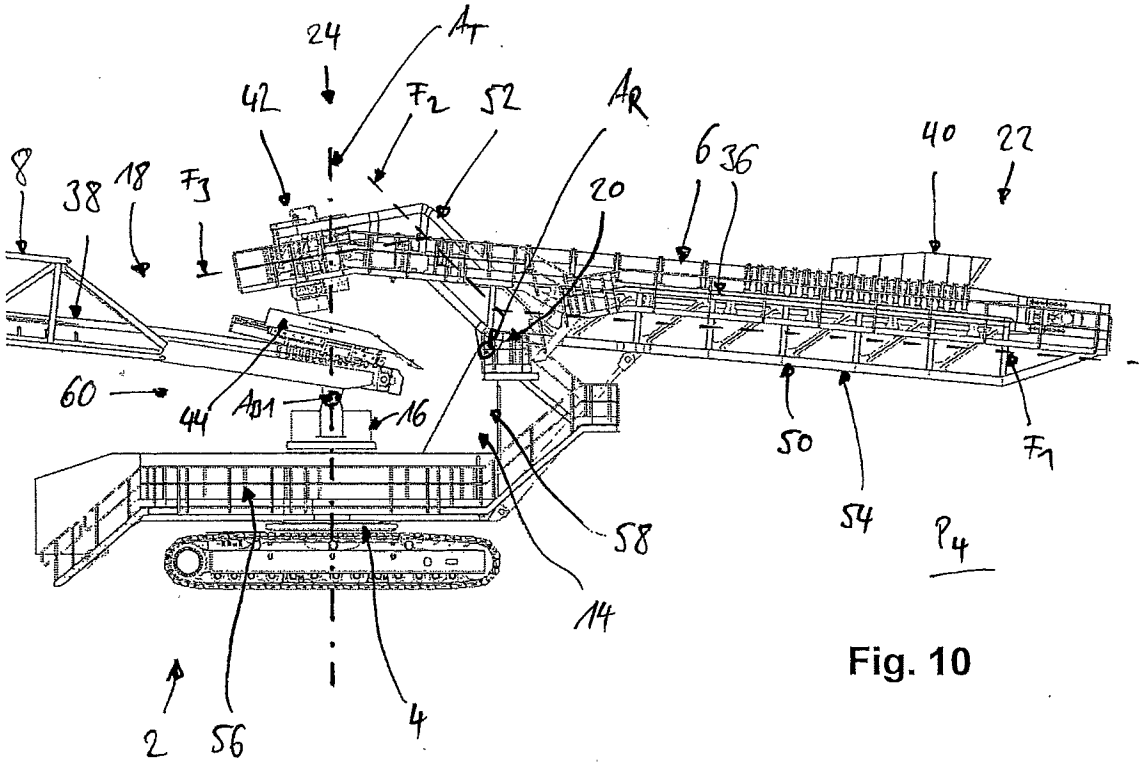

24
A_T
42
F_2
52
A_R
8
38
18
F_3
20
6
36
40
22
60
44
A_{B1}
16
50
54
F_1
58
14
P_4
2
56
4

Fig. 10

Fig. 11

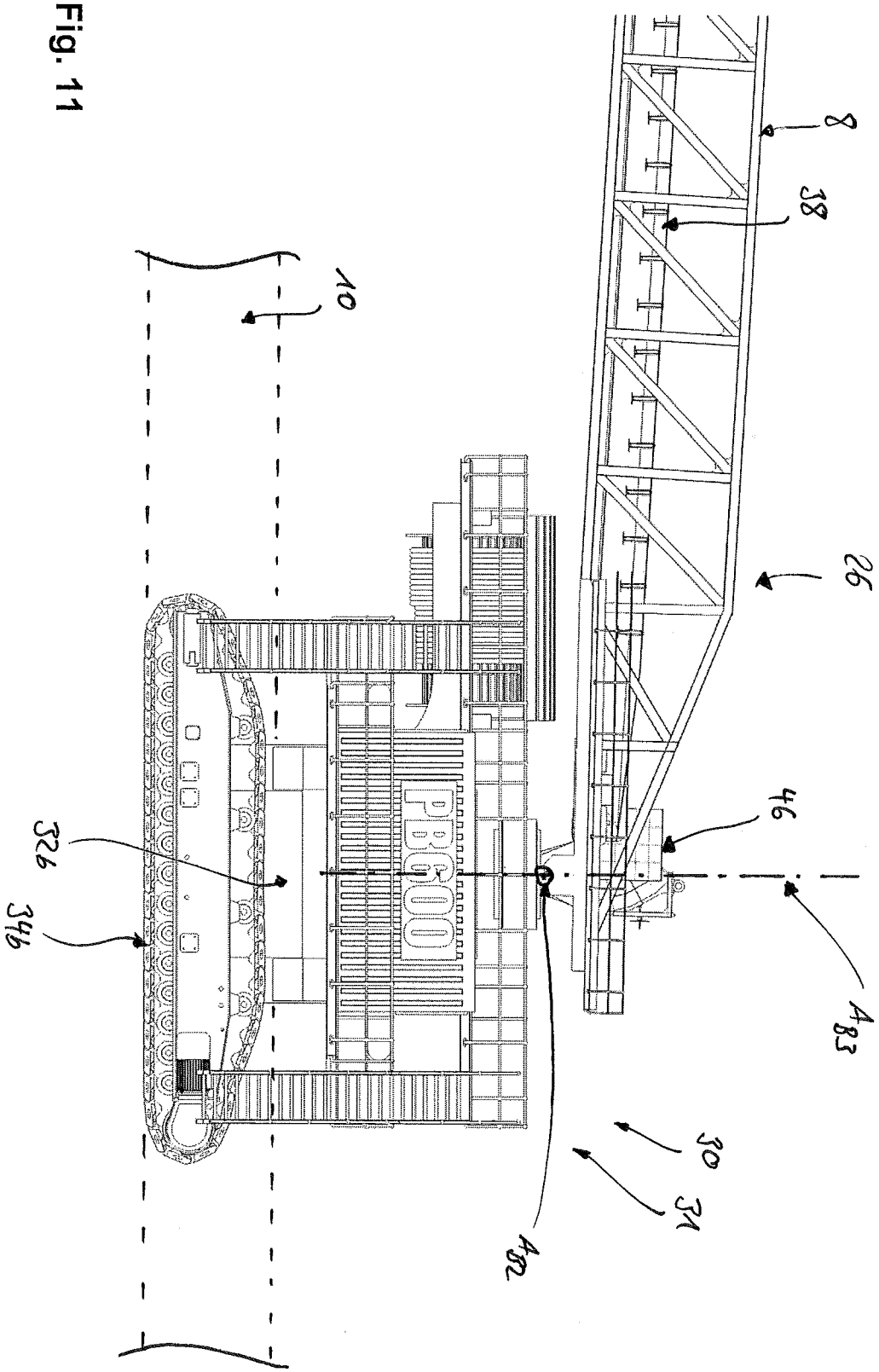
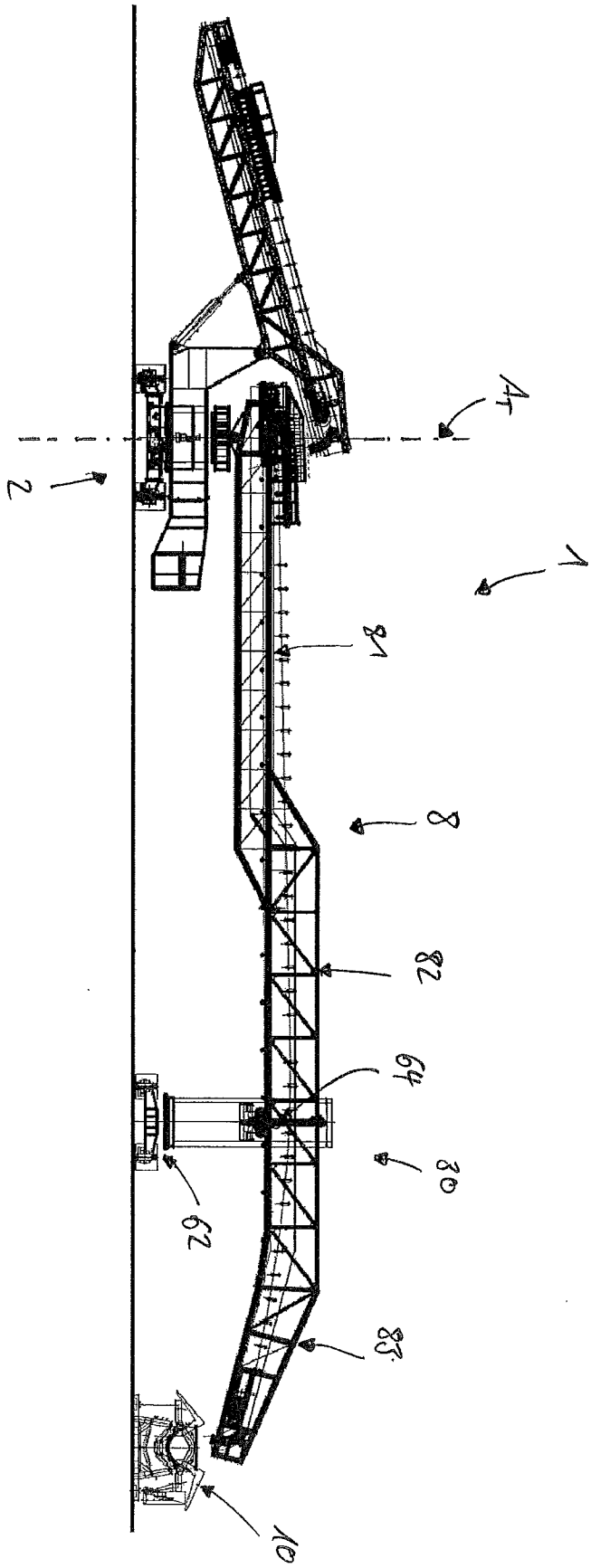


Fig. 12



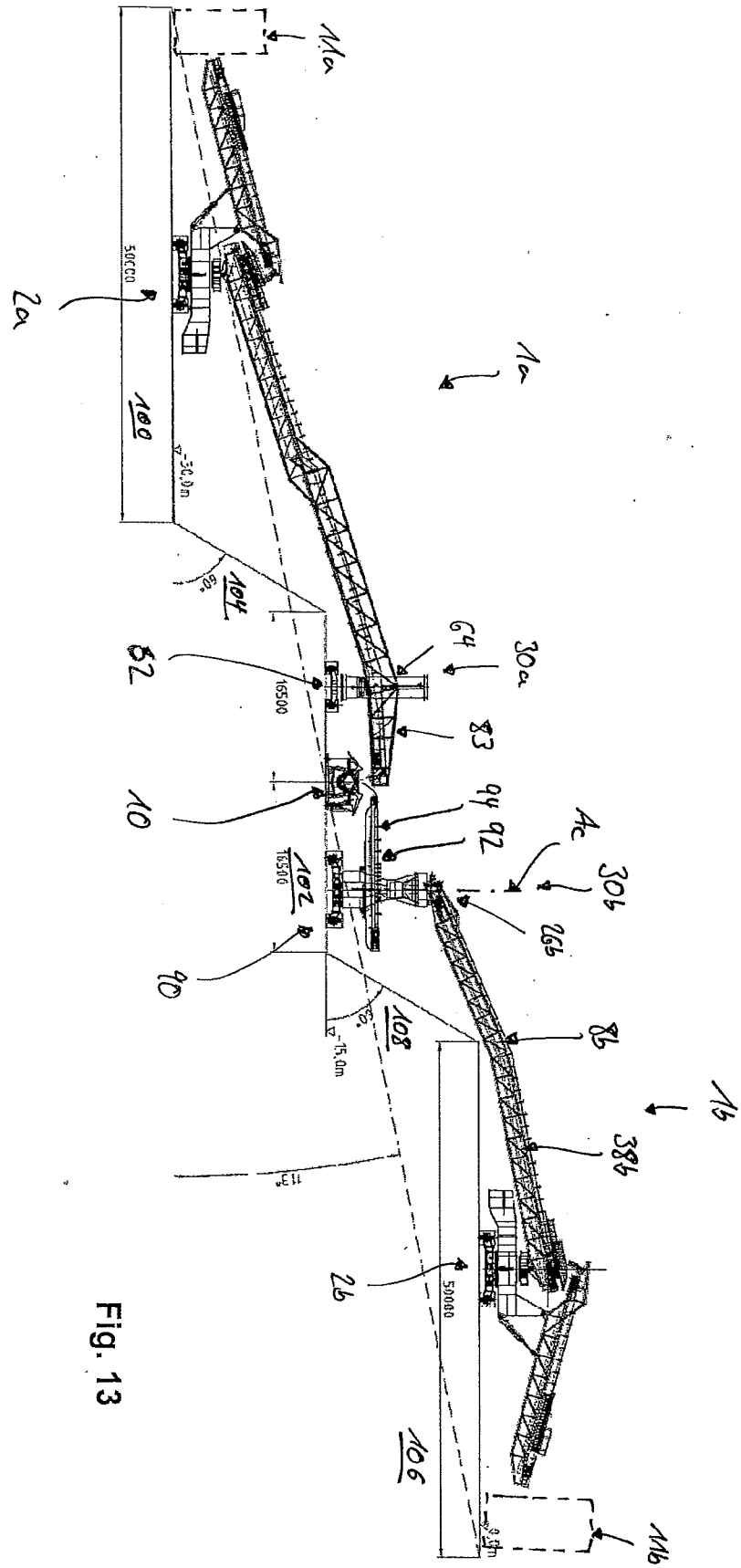

11a
50000
2a
100
30.0m
104
60°
64
30a
62
16500
83
10
94
92
Ac
304
265
102
16500
90
108
15.0m
85
1b
38b
2b
50000
106
11b

Fig. 13

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/061575

A. CLASSIFICATION OF SUBJECT MATTER
INV. E02F7/02 B65G41/00
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E02F B65G E21C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	DE 39 12 215 A1 (PRZED PANSTWOWE OGOLNOKRAJOWE [PL]) 26 October 1989 (1989-10-26) figure 1 and 2 -----	1,2,4, 14-16
X	US 5 090 549 A (THIEL HANS-JOACHIM [DE]) 25 February 1992 (1992-02-25) column 2, line 24 - column 3, line 21; figure 1 and 2 -----	1,2,4, 10-14,16
	-/--	

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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"P" document published prior to the international filing date but later than the priority date claimed

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
31 January 2017	08/02/2017

Name and mailing address of the ISA/	Authorized officer
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INTERNATIONAL SEARCH REPORT

International application No
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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1

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International application No
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