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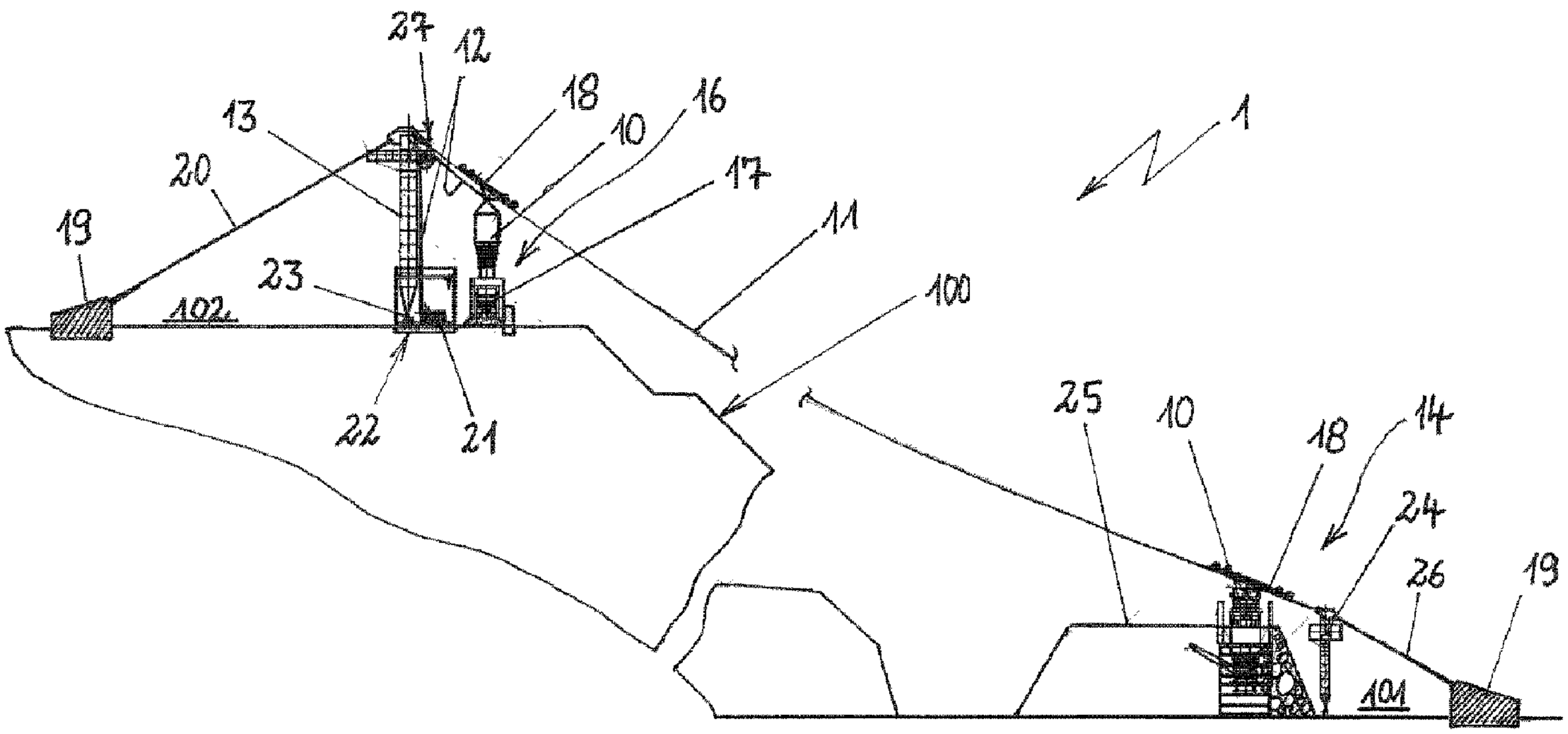

Fig. 1

(57) Abrégé/Abstract:
The present invention relates to a conveying system (1) for open-cast mining that is designed to be arranged above an inclined embankment (100) of an open-cast crater and by means of which raw materials can be conveyed from a lower height level (101) on a working floor of the open-cast mine to an upper height level (102) on the ground adjoining the open-cast pit, wherein at least one conveying vessel (10) is provided which can be loaded with raw materials at the lower height level (101) and from which the

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(57) Abrégé(suite)/Abstract(continued):
raw materials can be unloaded at the upper height level (102), and wherein at least one carrier cable (11) for load take-up and guidance and a pulling cable (12) for moving the conveying vessel (10) are provided, and wherein a supporting element (13) to which the carrier cable (11) is fastened and on which the pulling cable (12) is guided is set up at least at the upper height level (102). In order to obtain a simplified design of the conveying system, there is provision according to the invention that a truck-feeding station (14) onto which the conveying vessel (10) can be guided is set up at the lower height level (101), with the result that the raw materials can be filled from a truck (15), which can be moved onto the truck-feeding station (14), into the conveying vessel (10) by means of a pouring operation, and that a raw material-receiving station (16) above which the conveying vessel (10) can be guided is set up at the upper height level (102), with the result that the raw materials can be unloaded from the conveying vessel (10) into a raw material-receiving means (17), with the result that the conveying system (1) is designed to be incorporated in a truck transport operation for the raw materials.

Abstract

The present invention relates to a conveying installation (1) for opencast mining, designed for arrangement over an oblique slope (100) of an opencast mine pit, by means of which conveying installation raw materials can be conveyed from a lower height level (101) on an extraction level of the opencast mine to an upper height level (102) at ground level adjacent to the opencast mine pit, wherein at least one conveying container (10) is provided which can be loaded with raw materials at the lower height level (101) and from which the raw materials can be unloaded at the upper height level (102), and wherein at least one bearing cable (11) for load-bearing and control and one traction cable (12) for moving the conveying container (10) are provided, and wherein, at least at the upper height level (102), a support element (13) is set up, to which the bearing cable (11) is attached and on which the traction cable (12) is guided.

For a simplified design of the conveying installation, it is provided according to the invention that, at the lower height level (101), a truck offloading station (14) is set up, to which the conveying container (10) can be guided such that the raw materials can be introduced from a truck (15), which can be driven to the truck offloading station (14), into the conveying container (10) by means of a pouring process, and that, at the upper height level (102), a raw material receiving station (16) is set up, over which the conveying container (10) can be guided such that the raw materials can be unloaded from the conveying container (10) into a raw material receiving means (17), such that the conveying installation (1) is designed for incorporation into a truck transport operation for the raw materials.

[related figure: figure 1]

Conveying system for open-cast mining

Description

The present invention relates to a conveying installation for opencast mining, designed for arrangement over an oblique slope of an opencast mine pit, by means of which conveying installation raw materials can be conveyed from a lower height level on an extraction level of the opencast mine to an upper height level at ground level adjacent to the opencast mine pit, wherein at least one conveying container is provided which can be loaded with raw materials at the lower height level and from which the raw materials can be unloaded at the upper height level, and wherein at least one bearing cable for load-bearing and control and one traction cable for moving the conveying container are provided, and wherein, at least at the upper height level, a support element is set up, to which the bearing cable is attached and on which the traction cable is guided.

PRIOR ART

DE 10 2012 100 765 A1 discloses a steep conveying installation for arrangement on a slope of an opencast mine pit, by means of which steep conveying installation raw materials can be transported from a lower height level, in particular from an extraction level of the opencast mine, to an upper height level, formed in particular by a ground level, the steep conveying installation having a line arranged on the slope. On the line, a first conveying cage and a second conveying cage can travel movably relative to one another, and the conveying cages on the line are connected to one another by means of a common traction mechanism. The line comprises a steel structure of lattice type of construction and comprises rails on which the conveying cages can travel by means of rail wheels. For the fastening of the line, several fastening points are provided at regular intervals, by means of which fastening points the line is anchored in the rock of the slope. The line construction yields a cumbersome design of the steep conveying installation, with

relatively high construction and building costs. For relatively small applications, in which it is sought in particular for setting up and dismantling again to be performed with little outlay, and which do not serve for industrial-scale use, the previously known steep conveying installation has only limited suitability. It is designed more for constant use in a very large opencast mine, and it is an object of the present invention to simplify the design, the construction and the installation of a steep conveying installation. Here, it is the intention in particular for the steep conveying installation to be suitable for overcoming even relatively small conveying heights between the lower and the upper height level. In particular, it is the intention for the conveying installation of the above-described type of construction to be connected to the opencast mine pit only at the fewest possible locations.

Relatively small conveying installations are known from the forestry sector, as presented for example in US 3,011,653 A. Said installation comprises a cable system with a bearing cable and a traction cable, wherein the traction cable is connected to a traveling carriage on which the load can be arranged in suspended fashion. The presented installation is however not dimensioned, and also cannot be qualified, for the conveying of raw materials from an opencast mine, because the loading and unloading of the installation is only expediently possible with wood.

AT 512 828 A2 presents a further conveying installation, in particular for alpine use, wherein the installation is designed for so-called skidding over vertical distances. The presented installation is likewise not suitable for conveying raw materials out of an opencast mine pit of an opencast mine.

DISCLOSURE OF THE INVENTION

It is an object of the invention to further develop a conveying installation for arrangement over an oblique slope of an opencast mine pit, which conveying installation is intended to be suitable for conveying raw materials from a lower height level, from the extraction level of an opencast mine pit, to an upper height level, formed for example by a ground level, and it is the intention for the conveying installation to be of simple design and easy to install. In particular, it is the intention for the conveying installation to be designed such that, despite being suitable for

conveying large masses, said conveying installation is of simple, lightweight construction and comprises only few attachment points to the opencast mine pit at the height levels.

Said object is achieved, proceeding from a conveying installation as per the preamble of claim 1, in conjunction with the characterizing features. Advantageous refinements of the invention are specified in the dependent claims.

According to the invention, to achieve said object, it is provided that, at a lower height level, a truck offloading station is set up, to which the conveying container can be guided such that the raw materials can be introduced from a truck, which can be driven to the truck offloading station, into the conveying container by means of a pouring process, and that, at the upper height level, a raw material receiving station is set up, over which the conveying container can be guided such that the raw materials can be unloaded from the conveying container into a raw material receiving means, such that the conveying installation is designed for incorporation into a truck transport operation for the raw materials.

The essence of the invention is the further development of a conveying belt installation for opencast mining which can be implemented without a line, wherein the conveying installation remains suitable for incorporation into a truck transport operation for the raw materials. The incorporation into the truck transport operation is, in the context of the present invention, achieved simply if the raw materials can be transferred, at least at the lower height level, from a truck into the conveying container of the conveying installation, such that the truck no longer has to overcome any height differences. The truck can remain at the lower height level, that is to say at the extraction level of the opencast mine, and the wear of the truck can be considerably reduced. The raw materials may be rubble, ores, stone, coal or other minerals, wherein the capacity of the conveying container is particularly advantageously coordinated with the capacity of a truck. It is thus possible to establish synchronization between the unloading of the truck at the extraction level of the opencast mine and the filling of the conveying container, wherein, in the context of the present invention, the conveying installation may be implemented

with one conveying container or with two conveying containers, wherein two conveying containers can travel relative to one another in shuttle operation.

The simple design of the conveying installation with a cable system comprising at least one bearing cable and one traction cable permits a simple, filigree construction of the conveying installation without the arrangement of a line on the slope of the opencast mine pit, such that the conveying installation can also be qualified for relatively small opencast mining operations, quarries or open mines. Many mining operations operate with trucks in stone or limestone quarries with loads of 15 t to 35 t, depending on the truck, and have to manage a transport capacity of 500 t/h to 1000 t/h. The conveying installation of the present invention is intended to be qualified for this segment, which is achieved by virtue of the fact that the conveying installation can be of simple design but can be loaded by trucks at the lower height level.

At the upper height level, the conveying installation comprises a raw material receiving station, which is for example likewise formed by a truck loading station, and the raw material receiving means may be formed by at least one truck which is moved at the upper height level, that is to say at ground level, without the need to overcome further height differences. It is however alternatively also possible for the raw material receiving station to form a bunker station and/or a crusher station for comminuting the raw materials, and/or to form a belt installation station into which the raw materials can be unloaded from the conveying container. If the raw material receiving station is formed by a belt installation station, this may likewise comprise a bunker or a receiving funnel such that at least the content of a conveying container can be unloaded onto the belt installation station.

The raw material receiving station at the upper height level may particularly advantageously be formed adjacent to the support element. The support element, the drive unit and/or the raw material receiving station may be accommodated on a common foundation or on multiple foundations arranged adjacent to one another, such that substantially only one upper platform has to be provided for the installation of the conveying belt installation at the upper height level. There is

consequently no need for further support elements distributed over the transport path.

At the upper height level, there may be provided a mass-based anchor to which the support element is braced by a bracing tension means. In the same way, at the lower height level, there may be provided a mass-based anchor to which a lower support element is braced by a bracing tension means. The mass-based anchors may preferably be of high mass and at least partially sunk into the ground at the upper height level and at the lower height level, at the edge of and in the opencast mine pit respectively. It is alternatively also possible for some other anchoring point to be selected, which is not imperatively based on a high resting mass, for forming a fastening point of the bracing tension means. The mass-based anchors particularly advantageously form a fastening unit with the support elements at the upper height level and at the lower height level in each case, wherein the bracing tension means are not formed by a lengthened bearing cable. The bearing cable extends preferably between the upper and the lower support element. The tensile force in the bearing cable is however in this case accommodated substantially by the bracing tension means, and the tensile force in the bearing cable may be equal to the tensile forces in the bracing tension means. This is the case in particular if the support elements are in the form of hinged supports, for which purpose the support elements are received by means of at least one hinged joint. In one refinement of the conveying installation, the conveying installation does not imperatively also comprise a support element at the lower height level, and the mass-based anchor at the lower height level may be arranged behind the truck offloading station such that the conveying container can be moved to the truck offloading station in an accurately positioned manner.

In a further advantageous embodiment, at least one traveling carriage is provided on which the conveying container is arranged in suspended fashion, wherein the traveling carriage is guided on the bearing cable, and wherein the traction cable is attached to the traveling carriage. At the upper height level, there is preferably provided a drive unit into which the traction cable can be pulled and out of which the traction cable can be deployed, wherein the drive unit is arranged adjacent to

the support element. The arrangement of the drive unit adjacent to the support element offers the advantage that the drive unit and the support element at the upper height level can be accommodated by means of a common foundation. The upper support element preferably comprises a diverting roller over which the traction cable is guided, which yields a further simplification of the overall construction.

In the same way, the support element may be arranged at the lower height level adjacent to the truck offloading station. This offers the advantage of using the truck offloading station, which preferably comprises a truck ramp, as a foundation for accommodating the support element.

The conveying container is preferably constructed such that the raw materials can be loaded into the conveying container from an upper container side in the truck offloading station, wherein the conveying container can be unloaded from a lower container side in the raw material receiving station. In the truck offloading station, the conveying container is guided to below the level at which the trucks travel, such that said trucks can fill the conveying containers by way of a pouring process. For this purpose, a truck ramp serves as a major constituent part of the raw material receiving station. By contrast, at the raw material receiving station, conveying containers are moved to a level above a raw material receiving means, for example a further truck, in order for the raw materials to be unloaded from the conveying container again likewise under the action of gravitational force.

Finally, the conveying installation may be refined such that two bearing cables which run parallel to one another are provided, wherein a conveying container is received by means of a respectively associated traveling carriage on each of the bearing cables, and wherein the traction cable connects the two conveying containers to one another for shuttle operation of the conveying containers. For such an embodiment of the conveying installation, it is preferably the case that the support element at the upper height level is designed to be wide enough that both bearing cables can be guided over a single support element. For example, it is furthermore possible for only one bracing tension means to be provided between

the upper support element and the mass-based anchor, which bracing tension means is correspondingly dimensioned for two bearing cables. It is also possible for the support element to be in the form of a hinged support with corresponding hinged joints, even though two bearing cables are provided. The bearing cables must have a spacing to one another which enables two conveying containers to travel in shuttle operation, such that one conveying container is moved up the slope of the opencast mine pit as a further conveying container is moved down.

In this way, the advantage is achieved that the inherent mass of the conveying containers and of the traveling carriages cancel one another out, such that the conveying installation can be operated in an energy-efficient manner.

EXEMPLARY EMBODIMENT OF THE INVENTION

Further measures which improve the invention will be presented in more detail below together with the description of a preferred exemplary embodiment of the invention on the basis of the figures, in which:

figure 1 shows an overall view of the conveying installation arranged on a slope of an opencast mine pit,

figure 2 shows a plan view of the truck offloading station at the lower height level of the conveying installation,

figure 3 shows a plan view of the raw material receiving station at the upper height level of the conveying installation, and

figure 4 shows a side view of the raw material receiving station at the upper height level.

Figure 1 shows a conveying installation 1 in an overall view, and the conveying installation 1 is arranged over an oblique slope 100 of an opencast mine pit. Here, the conveying installation 1 extends between a lower height level 101 and an upper height level 102 and is also connected to the opencast mine pit only at these height

levels 101 and 102. The lower height level 101 represents an extraction level for the extraction of raw materials, for example rubble, ores, coal or other minerals. The conveying installation is dimensioned such that it can convey for example approximately between 500 t/h and 1000 t/h.

The conveying installation 1 comprises a conveying container 10 which can travel between a truck offloading station 14 at the lower height level 101 and a raw material receiving station 16 at the upper height level 102.

For the control of the conveying container 10, a bearing cable 11 is stretched between the lower height level 101 and the upper height level 102, and a traveling carriage 18 is provided which travels on the bearing cable 11. The conveying container 10 is in this case arranged in suspended fashion under the traveling carriage 18. The conveying container 10 can be caused to travel by means of a traction cable 12 which is attached to the traveling carriage 18. The conveying container 10 can be caused to travel between the lower height level 101 and the upper height level 102 by means of a traction drive.

At the lower height level 101, the conveying installation 1 comprises a truck offloading station 14 which is designed for the loading of the conveying container 10 with raw materials from trucks. For this purpose, the truck offloading station 14 comprises a truck ramp 25, such that the conveying container 10 can be loaded by virtue of the raw materials being poured through an upper opening into the conveying container 10.

At the upper height level 102, the conveying installation 1 comprises a raw material receiving station 16 in which the conveying container 10 can be caused to travel over a raw material receiving means 17, and when the conveying container 10 is opened, the raw materials can be unloaded via a lower opening side into a raw material receiving means 17.

By way of example, the conveying installation 1 comprises two support elements 13 and 24, and a first support element 13 is set up at the upper height level 102

and a second support element 24 is set up at the lower height level 101. The bearing cable 11 is attached between the two support elements 13 and tensioned. On the side averted from the bearing cable 11, the support elements 13 and 24 are braced to mass-based anchors 19 by bracing tension means 20 and 26, and a first mass-based anchor 19 is arranged at the upper height level 102, such that the bracing tension means 20 extends between the upper mass-based anchor 19 and the support element 13. At the lower height level 101, the further mass-based anchor 19 is arranged behind the support element 24 on the side averted from the bearing cable 11, and the bracing tension means 26 extends between the mass-based anchor 19 and the support element 24. The mass-based anchors 19 form attachment points for the bracing of the support elements 13 and 24, and the mass-based anchors 19 may also be formed by non-mass-based attachment points in the ground.

The conveying container 10 is, for movement purposes, driven by means of a drive unit 21 via the traction cable 12, and the drive unit 21 is arranged adjacent to the upper support element 13. The traction cable 12 can be pulled into the drive unit 21 in order to cause the conveying container 10 to travel upward, and said traction cable can be deployed out of the drive unit in order to cause the conveying container 10 to travel downward, and in the upper region of the support element 13, there is situated a diverting roller 27 about which the traction cable 12 is guided. This yields particularly simple set-up of the drive unit 21 and simple guidance of the traction cable 12. In particular, the drive unit 21 may lie, together with the support element 13, on a single-part or multi-part foundation 22 which is sunk into the ground at the upper height level 102.

The conveying installation 1 is shown by way of example with two support elements 13 and 24, wherein the support element 13 is required for the bracing of the bearing cable 11 at the upper height level 102, whereas the support element 24 at the lower height level 101 may also be omitted, and the bearing cable 11 is braced directly on the lower mass-based anchor 19 at the lower height level 101, for example directly behind the truck offloading station 14.

Figure 2 shows a plan view of the truck offloading station 14 at the lower height level 101. The truck offloading station 14 comprises, as a major constituent part, a truck ramp 25 onto which trucks 15 can travel. By way of example, multiple trucks 15 are shown which are laden with raw materials. The bearing cable 11 runs over the truck ramp 25 and is supported by means of the support element 24 and is braced by means of the bracing tension means 26 and the mass-based anchor 19. The traveling carriage 18 can travel on the bearing cable 11, and the conveying container 10 is arranged in suspended fashion under the traveling carriage 18. The conveying container 10 is situated at a level below the surface of the truck ramp 25, such that the raw materials can be introduced into the conveying container 10 by being poured from the truck 15 through an upper filling opening.

Figure 3 shows a plan view of the raw material receiving station 16 at the upper height level 102. The bearing cable 11 is attached to the support element 13 and is braced to the mass-based anchor 19 by the bracing tension means 20. The drive unit 21 which serves for driving the movement of the conveying container along the bearing cable 11 is arranged directly at the support element 13. The conveying container 10 is received in suspended fashion on the traveling carriage 18, and the traveling carriage 18 can be caused to travel along the bearing cable 11.

The raw material receiving station 16 serves for the unloading of the raw materials from the conveying container 10 into a raw material receiving means 17, which is shown by way of example as a truck 15. As indicated by the arrows, said truck can travel under the conveying container 10, such that the raw materials can be transferred from the conveying container 10 into the truck 15 by pouring through a lower opening.

Figure 4 shows a side view of the raw material receiving station 16 with a raw material receiving means 17 in the form of a truck 15. The view shows the arrangement of the conveying container 10 above the truck 15, and the conveying container 10 is arranged in suspended fashion on the bearing cable 11.

The side view of the support element 13 shows the accommodation of the support element 13 in the form of a pillar which is accommodated in movable fashion on a foundation 22 by means of hinged joints 23. The hinged joints permit a movement of the support element 13 about the hinged joints 23, wherein, owing to the bracing of the bearing cable 11 with a tensile force in a first direction and the bracing to the mass-based anchor in a second direction by the bracing tension means, stability is imparted to the support element 13. The hinged arrangement of the support element 13 by means of the hinged joints 23 on the foundation 22 however makes it possible to realize a simple construction, because no transverse forces are introduced into the support element 13, and said support element can thus be of particularly simple design.

The invention is not restricted in terms of its design to the preferred exemplary embodiment specified above. Rather, numerous variants are conceivable which make use of the presented solution even in fundamentally different embodiments. All of the features and/or advantages that emerge from the claims, from the description or from the drawings, including design details or spatial arrangements, may be essential to the invention both individually and in a wide variety of combinations.

List of reference designations

1	Conveying installation
100	Slope
101	Lower height level
102	Upper height level
10	Conveying container
11	Bearing cable
12	Traction cable
13	Support element
14	Truck offloading station
15	Truck
16	Raw material receiving station
17	Raw material receiving means
18	Traveling carriage
19	Mass-based anchor
20	Bracing tension means
21	Drive unit
22	Foundation
23	Hinged joint
24	Support element
25	Truck ramp
26	Bracing tension means
27	Diverting roller

Patent claims

1. A conveying installation (1) for opencast mining, designed for arrangement over an oblique slope (100) of an opencast mine pit, by means of which conveying installation raw materials can be conveyed from a lower height level (101) on an extraction level of the opencast mine to an upper height level (102) at ground level adjacent to the opencast mine pit, wherein at least one conveying container (10) is provided which can be loaded with raw materials at the lower height level (101) and from which the raw materials can be unloaded at the upper height level (102), and wherein at least one bearing cable (11) for load-bearing and control and one traction cable (12) for moving the conveying container (10) are provided, and wherein, at least at the upper height level (102), a support element (13) is set up, to which the bearing cable (11) is attached and on which the traction cable (12) is guided,
characterized in that,
- at the lower height level (101), a truck offloading station (14) is set up, to which the conveying container (10) can be guided such that the raw materials can be introduced from a truck (15), which can be driven to the truck offloading station (14), into the conveying container (10) by means of a pouring process, and in that,
- at the upper height level (102), a raw material receiving station (16) is set up, over which the conveying container (10) can be guided such that the raw materials can be unloaded from the conveying container (10) into a raw material receiving means (17),
- such that the conveying installation (1) is designed for incorporation into a truck transport operation for the raw materials.

2. The conveying installation (1) as claimed in claim 1, characterized in that the raw material receiving station (16) forms a truck loading station, wherein the raw material receiving means (17) is formed by at least one truck (15).

3. The conveying installation (1) as claimed in claim 1, characterized in that the raw material receiving station (16) forms a bunker station and/or a crusher station and/or a belt installation station, into which the raw materials can be unloaded from the conveying container (10).

4. The conveying installation (1) as claimed in one of claims 1 to 3, characterized in that the raw material receiving station (16) is formed at the upper height level (102) adjacent to the support element (13).

5. The conveying installation (1) as claimed in one of the preceding claims, characterized in that at least one traveling carriage (18) is provided on which the conveying container (10) is arranged in suspended fashion, wherein the traveling carriage (18) is guided on the bearing cable (11), and wherein the traction cable (12) is attached to the traveling carriage (18).

6. The conveying installation (1) as claimed in one of the preceding claims, characterized in that, at the upper height level (102), there is provided a mass-based anchor (19) to which the support element (13) is braced by a bracing tension means (20), and/or in that, at the lower height level (101), there is provided a mass-based anchor (19) to which a lower support element (24) is braced by a bracing tension means (26).

7. The conveying installation (1) as claimed in one of the preceding claims, characterized in that, at the upper height level (102), there is provided a drive unit (21) into which the traction cable (12) can be pulled and out of which the traction cable (12) can be deployed, wherein the drive unit (21) is arranged adjacent to the support element (13).

8. The conveying installation (1) as claimed in claim 7, characterized in that, at the upper height level (102), there are arranged foundations (22) on which the support element (13) and/or the drive unit (21) and/or the raw material receiving station (16) are accommodated.

9. The conveying installation (1) as claimed in one of the preceding claims, characterized in that at least one of the support elements (13, 24) is in the form of a hinged support, for which purpose the support element (13, 24) is held by means of at least one hinged joint (23).

10. The conveying installation (1) as claimed in one of the preceding claims, characterized in that the support element (24) is arranged at the lower height level (102) adjacent to the truck offloading station (14).

11. The conveying installation (1) as claimed in one of the preceding claims, characterized in that the truck offloading station (14) comprises a truck ramp (25), such that a truck (15) can, in the truck offloading station (14), be driven to a height above the conveying container (10).

12. The conveying installation (1) as claimed in one of the preceding claims, characterized in that the conveying container (10) can be loaded from an upper container side in the truck offloading station (14), and wherein the conveying container (10) can be unloaded from a lower container side in the raw material receiving station (16).

13. The conveying installation (1) as claimed in one of the preceding claims, characterized in that two bearing cables (11) which run parallel to one another are provided, wherein a conveying container (10) is received by means of a respectively associated traveling carriage (18) on each of the bearing cables (11), and wherein the traction cable (12) connects the two conveying containers (10) to one another for shuttle operation of the conveying containers (10).

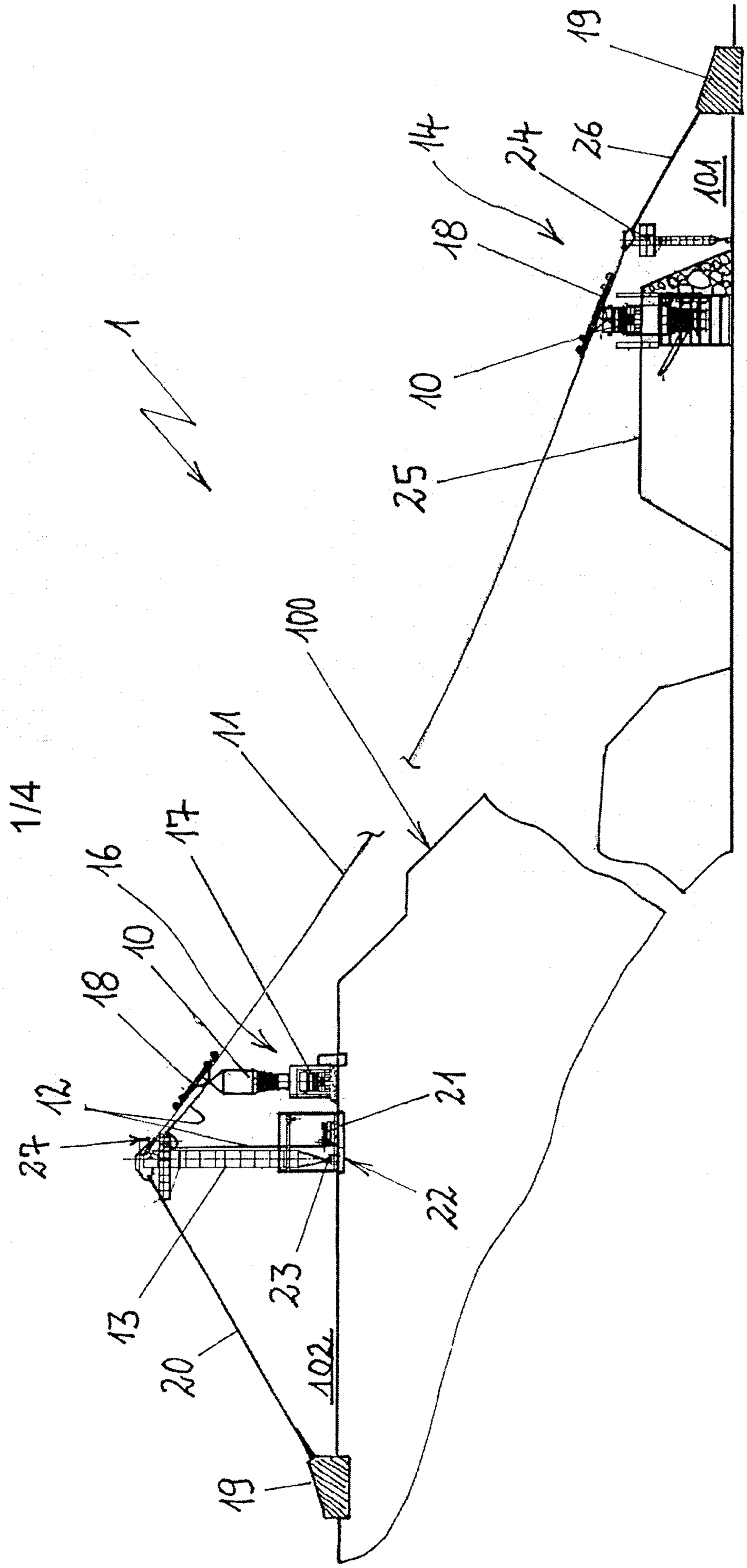
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Fig. 1

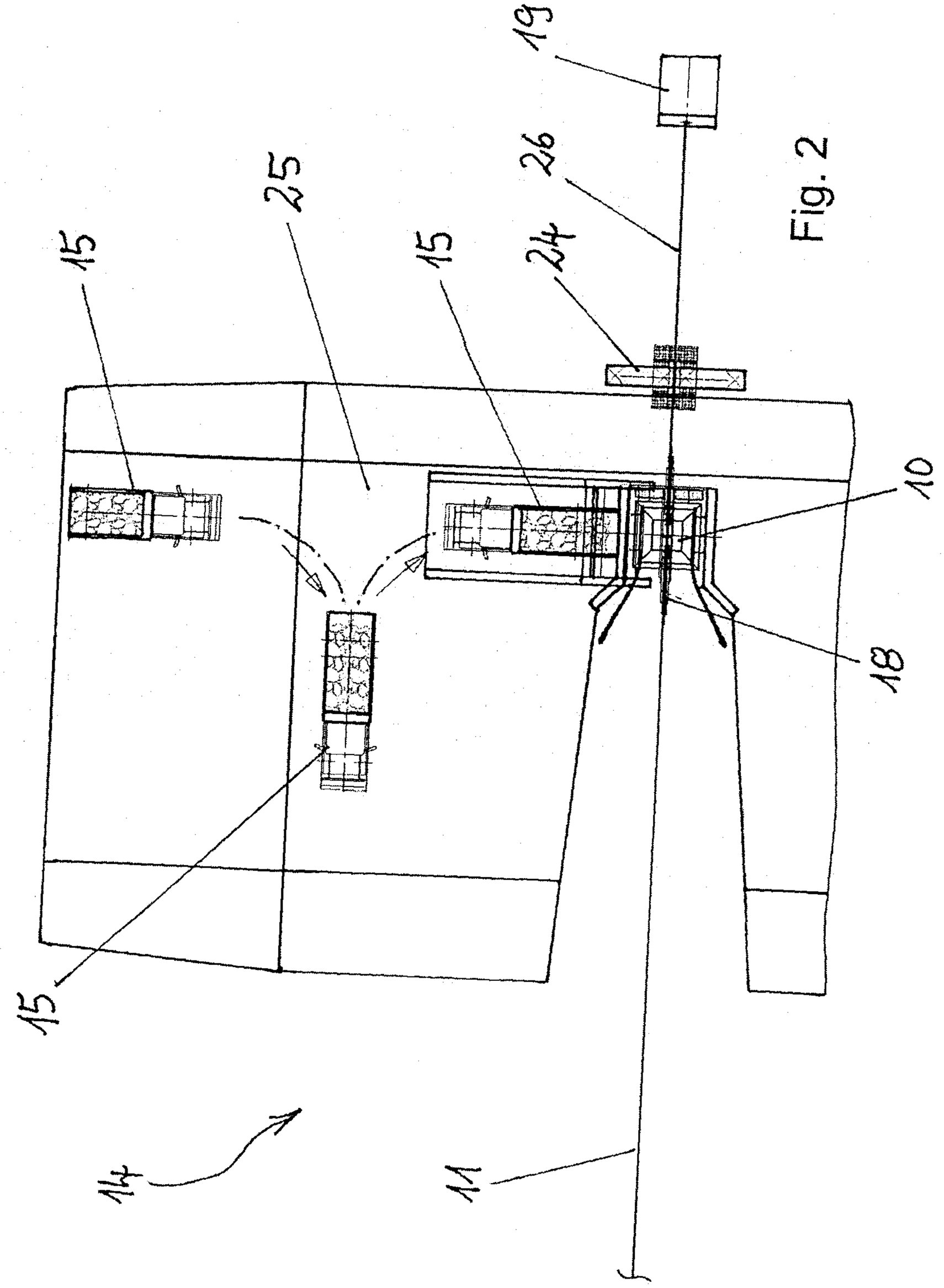

Fig. 2

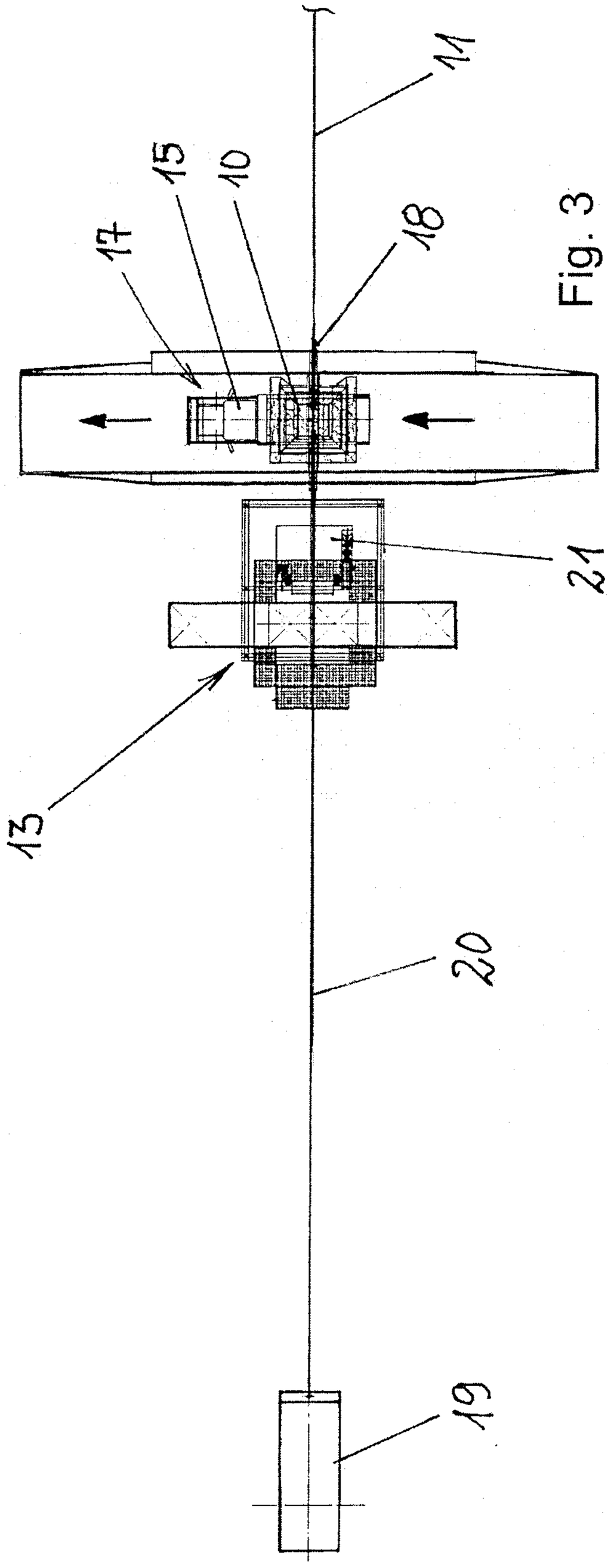

Fig. 3

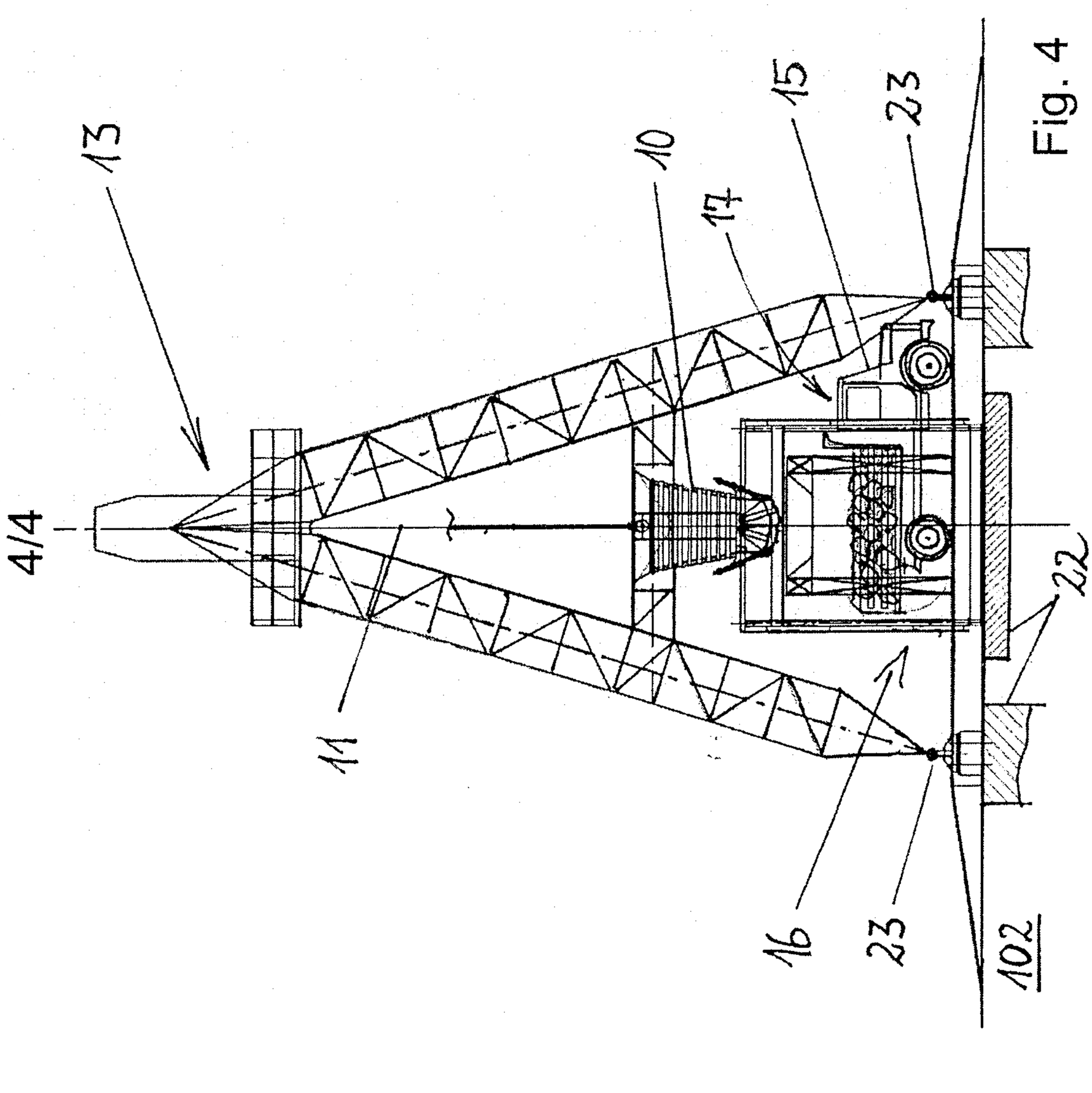

Fig. 4

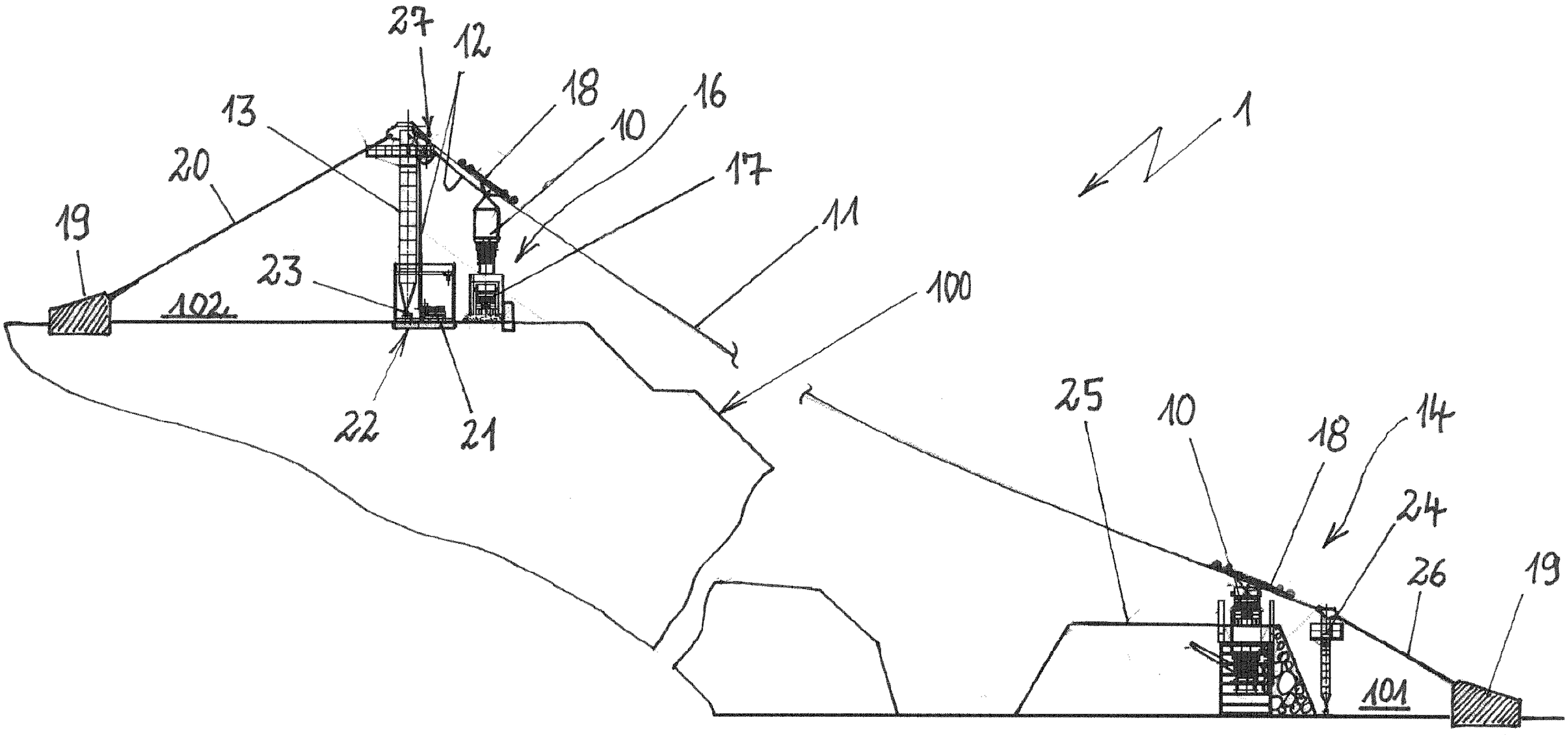
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Fig. 1