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(54) Title: A BUCKET FOR USE IN A RECLAIMER

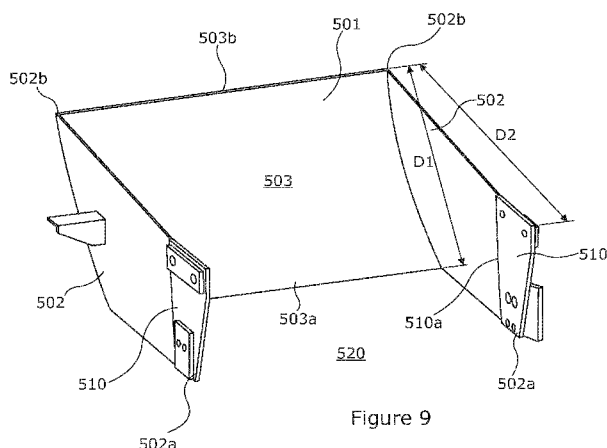


Figure 9

(57) Abstract: A bucket (501) for a reclaimer having a first end (502a) and a second end (502b), the bucket comprising two side walls (502) extending from the first end (502a) to the second end (502b); a bucket portion (503) disposed between the two side walls (502) in the second end (502b), the bucket portion (503) having a first lateral edge (503a) and a second lateral edge (503b), the second lateral edge (503b) of the bucket portion (503) arranged further towards the second end (502b) than the first lateral edge (503a) so that at least part of the bucket portion (503) has an inclination with respect to a reclaiming surface (520); wherein the two side walls (502) extend past the first lateral edge (502a) of the bucket portion (503) towards the first end (502a) so that the distance (D2) between the first end (502a) and the second lateral edge (503b) is greater than the distance (D1) between the first end (502a) and the first lateral edge (503a). Also disclosed is a reclaimer apparatus incorporating the same and a method for reclaiming material from a stockpile using such an arrangement with a cleaning device.

A BUCKET FOR USE IN A RECLAIMER

FIELD OF THE INVENTION

5

This invention relates to a reclaimer for recovering bulk materials, for example in the mining, cement and minerals industries, and more particularly to a bucket for use in such a reclaimer.

10

BACKGROUND OF THE INVENTION

15

Stackers and reclaimers are used in stockyards to stack minerals, ore, and other granular raw materials in piles, and then redistribute them for processing and shipment. Stackers are used to produce these large piles or stacks. Reclaimers are used to collect and redistribute the material from stacks or piles of bulk materials.

20

Typically, stackers and reclaimers are used in metallurgy and mining; cement, chemical, and power production; and at terminals that handle bulk materials. Examples of materials that are handled include alluvium, coal and coking coal, clay, gypsum, lignite, limestone, potash, petcoke, phosphates, slag, and Sulphur.

25

Many types of reclaimers are known. For example, there are portal-type and bridge-type reclaimers and drum, bucket wheel and bucket chain reclaimers. Some reclaimers reclaim material in the lateral direction (across a material pile) while other reclaimers reclaim longitudinally (up or down a material pile). Some reclaimers use scraper blades and others use buckets in order to reclaim and transport material from the stockpile. Typically such scraper blades/buckets are attached to chains that rotate the buckets around an end of a chain arm.

30

Traditionally, buckets used in reclaimers were designed for longitudinal reclaiming only. For lateral reclaiming scraper blades were traditionally being used. However, scraper blades are not advantageous especially for reclaiming

e.g. wet and/or sticky materials because they cannot be cleaned during operation, they have a low degree of fill and therefore a lower throughput and the digging force of the blade produces a higher load on the reclaimer structure and parts as compared to a bucket.

5

Presumably because of the disadvantages associated with scraper blades, in recent years there has been an increased use of buckets in reclaimers especially e.g. for reclaiming wet and/or sticky materials.

10 However, traditional buckets on reclaimers (both longitudinal and lateral) are not adequate and have become a significant issue. First, because side reclaimers reclaim downwards, bucket efficiency is poor meaning that there is a low degree of fill due to the reclaiming angles. Much of the material tends to back spill onto the material pile or accumulate outside of the bucket edge.

15

Second, prior art buckets are heavy because of their own structural weight and because they carry a heavy material load (e.g. - the entirety of the load is carried by the bucket structure). As a result, traditional buckets and reclaimers utilizing such buckets are expensive due to the amount of material that must be used in the construction of the bucket and because the reclaimer must be designed so that the structural steel can support the high loads in the bucket. Such a design has a negative cost impact on the design of other parts of the reclaimer such as the pylon, pull rod, hoist, main frame, counter weight, bogies, rails and foundation.

25

It will be clearly understood that any reference herein to background material or information, does not constitute an admission that any material, information, forms part of the common general knowledge in the art, or is otherwise admissible prior art.

30

OBJECT OF THE INVENTION

It is an object of the invention to overcome or at least alleviate one or more of the above problems and/or provide the consumer with a useful or commercial choice.

SUMMARY OF THE INVENTION

- 5 A bucket is provided for a reclaimer. The bucket has a first end and a second end and the bucket may include: two side walls extending from the first end to the second end; a bucket portion disposed between the two side walls in the second end, the bucket portion having a first lateral edge and a second lateral edge, the second lateral edge of the bucket portion arranged further towards the second
10 end than the first lateral edge so that at least part of the bucket portion has an inclination with respect to a reclaiming surface; wherein the two side walls extend past the first lateral edge of the bucket portion towards the first end so that the distance between the first end and the second lateral edge is greater than the distance between the first end and the first lateral edge.
- 15 In an exemplary embodiment of the bucket, D1 is half of D2. In an exemplary embodiment of the bucket, the first lateral edge may be arranged further towards the first end than the second end.

In some embodiments, the bucket may further comprise chain connection devices disposed on the two side walls. In an exemplary embodiment, the chain
20 connection devices are arranged further towards the first end than the second end.

In an exemplary embodiment, the bucket portion may be one piece. In an exemplary embodiment, the bucket portion may be two or more pieces that are connected together. In an exemplary embodiment, the first lateral edge may be
25 substantially straight. In an exemplary embodiment, at least a portion of the bucket portion or the side walls may be coated with a wear-resistant component.

A reclaimer apparatus is also provided. The reclaimer apparatus may include a chain disposed on a chain arm having a first end; at least one bucket as described herein for collecting material from a stockpile, the bucket being

disposed on the chain; and a cleaning device for cleaning the bucket as the chain rotates the bucket about the first end, the cleaning device being disposed on the first end of the chain arm.

5 A method for reclaiming material from a stockpile is also provided herein. The method may include attaching the bucket as described herein to a chain; rotating the chain about a first end of a chain arm; dumping material from the bucket onto a conveyor; and cleaning the bucket with a cleaning device mounted to the first end wherein the edge of the cleaning device scrapes material from a bucket portion of the bucket as the chain rotates the bucket about the first end of the
10 chain arm.

Other details, objects, and advantages of the invention will become apparent as the following description of certain present exemplary embodiments thereof and certain present exemplary methods of practicing the same proceeds.

BRIEF DESCRIPTION OF THE DRAWINGS

15 Embodiments of the invention, by way of example only, will be described with reference to the accompanying drawings in which:

Figure 1 shows an overview of a bridge-type reclaimer, more specifically FLSmidth's Circular Blending System.

20 Figure 2 shows an overview of a bridge-type reclaimer, more specifically FLSmidth's Longitudinal Bridge Scraper.

Figure 3 shows an overview of a longitudinal bucket chain reclaimer, particularly FLSmidth's Bucket Excavator.

Figure 4 shows a front view of a longitudinal bucket chain reclaimer, particularly FLSmidth's Bucket Excavator.

25 Figure 5 shows a close-up view of the chain arm of a longitudinal bucket chain reclaimer.

Figure 6 shows an overview of a portal-type reclaimer, more specifically FLSmidth's Longitudinal Portal Scraper.

Figure 7 shows a front/side-angled view of a prior art bucket.

Figure 8 shows bottom view of a prior art bucket on a chain arm.

- 5 Figure 9 shows a front view of a bucket according to an exemplary embodiment of the invention.

Figure 10 shows a bottom view of a bucket according to an exemplary embodiment of the invention.

- 10 Figures 11A-C show varying views of a bucket according to the invention rotating about a first end of a chain arm and a cleaning device.

Figures 12A-B shows a computer simulation model of material fill for a prior art bucket.

- 15 Figure 13 shows a computer simulation model comparison of the material fill for a prior art bucket (left) vs. a bucket according to an exemplary embodiment of the invention (right).

DETAILED DESCRIPTION OF THE INVENTION

- Referring to Figures 1 through 6, various prior art reclaimers and/or reclaimer stackers are shown. Figures 1 and 2 depict bridge-type reclaimers 100. Figure 1 depicts FLSmidth's Circular Blending System where the bridge-type reclaimer 100 is being used in conjunction with a circular blending system stacker 200 for continuous stacking in a ring-shaped pile. In Figure 1 the stacker 200 is mounted on a central column 4, which allows rotation of the stacker 200 in both directions simultaneously with the vertical movement of a jib 2 and a conveyor belt on the jib 3. The stacker 200 shown in Figure 1 also has an incoming belt conveyor 1 for transporting material to be stacked, a luffing unit 5, an operator cabin 7 (which can be located on the stacker or the reclaimer) and a jib counterweight 6. The reclaimer 100 in Figure 1 has a raking harrow 8 mounted on the reclaimer 100

which rotates anti clockwise around the central column 4. The sweeping movements of the harrow system (which may additionally include a raking car 9) cause material to slide to the base of the reclaimer where a chain 10 containing a scraper blade 300 conveys the material to an outlet hopper 13 which directs the material onto an outgoing belt conveyor 14 to either another hopper or direct to, for example, a cement raw mill. Figure 1 also depicts a hydraulic chain tension unit 11 and a bogie 12 (on the reclaimer 100).

Figure 2 depicts FLSmidth's Longitudinal Bridge Scraper where the bridge type reclaimer 100 is being used in conjunction with a stacker 200. FLSmidth's Longitudinal Bridge Scraper operates with two material piles, one pile is stacked while the other is reclaimed. Material entering from an incoming belt conveyor 1 is discharged from the conveyor belt 3 on the jib 2 of the stacker 200. The stacker 200 may contain a luffing unit 5, a counterweight 6, an operator cabin 7 and/or a stacker bogie 15. The bridge reclaimer 100 reclaims material from the face of the material pile. The bridge reclaimer runs on rails (not shown) on either side of the stockpile. A raking harrow 8 is mounted on the reclaimer 100 and the raking harrow system (which may additionally include a raking car 9) causes material to slide to the material base. A chain 10 containing a scraper blade 300 conveys the material to an outgoing belt conveyor 14 to a hopper or direct to, for example, a cement raw mill. Figure 2 also depicts a hydraulic chain tension unit 11 and a reclaimer bogie 12.

Figure 6 depicts a portal-type reclaimer 100, more specifically FLSmidth's Longitudinal Portal Scraper. Portal-type reclaimers 100 are typically used on piled material where material enters the stockpile via an incoming belt conveyor 1. Material entering from an incoming belt conveyor 1 is discharged from the conveyor belt 3 on the jib 2 of the stacker 200. The stacker 200 may contain a luffing unit 5, a counterweight 6, an operator cabin 7 and/or a stacker bogie 15. The reclaimer 100 has a frame 50 with a chain system for reclaiming material. The chain system has a first chain 10a with a scraper blade 300 and may also have a second chain 10b with a scraper blade 300 for working on the opposite side of the material pile. The two scraper chains (10a, 10b) are linked together via a knee joint 60. The secondary chain system 10b lifts the material to the crest

of the stockpile and the primary chain 10a conveys the material to an outgoing belt conveyor 14.

Figures 3-5 depict a longitudinal bucket chain reclaimer, particularly FLSmidth's Bucket Excavator. The bucket chain reclaimer 100 is used in conjunction with
5 two stackers 200 which stack material via a conveyor belt 3 located on the bridge of the stacker 200. The reclaimer has a chain 10 supported on a chain arm 90 which is suspended at an angle from the bridge girders 75 which support the reclaiming bridge 50. Material is reclaimed from the stockpile when the chain 10 rotates in the longitudinal direction into the pile. The material is collected by
10 the buckets 400 and transported up or down the pile onto an outgoing conveyor belt (not shown) located next to the pile. The buckets 400 on the chain rotate in the longitudinal direction when the chain moves about a first end 91 of the chain arm 90. The chain arm can be moved in the vertical direction via a chain hoist 92 which is attached to the bridge girder 75.

15 Prior art reclaimers, such as those shown in Figures 3-5, use traditional buckets like the ones shown in Figures 7-8. Such prior art buckets are also being used in e.g. reclaimers which traditionally employ scraper blades (as shown in Figures 1-2 and 6) where the scraper blades 300 are being replaced with such buckets 400. Such buckets 400 are not adequate and have become a significant issue
20 because of e.g. the problems discussed in paragraphs [005] through [008] herein.

Referring to Figures 9-11, a new bucket 501 for a reclaimer reclaiming is provided. Figures 9 and 10 depict exemplary embodiments of the bucket 501. In an exemplary embodiment, the bucket has a first end 502a and a second end 502b and two side walls 502 extending from the first end 502a to the second end
25 502b. A bucket portion 503 is disposed between the two side walls 502 in the second end 502b. The bucket portion 503 has a first lateral edge 503a and a second lateral edge 503b. The second lateral edge 503b is arranged further towards the second end 502b than the first lateral edge 503a so that at least part of the bucket portion 503 has an inclination with respect to a reclaiming surface
30 520. The two side walls 502 extend past the first lateral edge 503a of the bucket portion 503 towards the first end 502a meaning that the distance D2 between the

first end 502a and the second lateral edge 503b is greater than the distance D1 between the first end 502a and the first lateral edge 503a. In some embodiments, and as shown in Figure 9, the two side walls are disposed at a substantially 90 degree angle from the second lateral edge 503.

5 As further shown in Figures 9-10, the extension of the two side walls 502 past the first lateral edge 503a of the bucket portion 503 allow for material from the stockpile (or reclaiming surface 520) to more freely flow into the confines of the bucket 501 e.g. the area between the two side walls 502 and up onto the bucket portion 503 and onto the two side walls 502. Material is able to build up on itself
10 within the confines of the bucket 501 and material is also able to build up on the side walls 502 and bucket portion 503. Such an arrangement reduces material spillage back onto the stockpile, the weight of the bucket is reduced, and the load carried by the chain arm and chain, and other parts of the reclaimer, is also reduced.

15 In some embodiments, D1 is half of D2, meaning that the first lateral edge 503a is located at the midpoint between the first end 502a and the second end 502b. In some embodiments, the first lateral edge 503a may be located closer to the first end 502a than the second end 502b.

The bucket 501 has a first end 502a and a second end 502b and two side walls
20 502 extending from the first end 502a to the second end 502b. Chain connection devices 510 may be disposed on the side walls 502. In some embodiments, chain connection devices 510 attach the bucket 501 to the chain 10 which rotates about a first end 91 of a chain arm 90. In some embodiments, the chain connection devices 510 are arranged further towards the first end 502a than the
25 second end 502b in order to maintain stability of the bucket 501 as it rotates about the first end 91 of the chain arm 90 and across the reclaiming surface 520. The first lateral edge 503a of the bucket portion 503 may be arranged between a longitudinal side (510a) of the chain connection devices (510) closer to the second end (502b) and the second end (502b).

30 In some embodiments, the bucket portion 503 can be a single integral piece. In other embodiments, the bucket portion 503 can be one or more pieces that are

welded or fused together to create a desired profiled shape. For example, in some embodiments, and as shown in Figures 9 and 10 the bucket portion 503 is curved or half-moon shaped.

5 In some embodiments the first lateral edge 503a and/or second lateral edge 503b can be substantially straight. In other embodiments the edges could be curved or the edges can also contain ridges or teeth.

10 The bucket 501 is preferably made of steel. In some embodiments, the surfaces of the bucket can be coated with a wear resistant material which is well known to those of skill in the art. Skis or similar dragging devices (not shown) may also be attached to the bottom face (face closer to the reclaiming surface 520) of the bucket portion 503, to the bottom edges of the two side walls 502 or to the first lateral edge 503a, in order to assist the bucket 501 transport over the rough reclaiming surface 520.

15 Figures 12A-B depict a computer simulation of a prior art bucket 400 and its degree of fill with wet and/or sticky material. As shown in Figures 12A and 12B, as the bucket 400 moves longitudinally down the stockpile, there is a low degree of fill (i.e. - the material is coagulating near the front of the bucket and is not accumulating on the side walls or the bucket portion). Figure 13 shows a comparison of the degrees of fill between the prior art bucket 400 (on left) and
20 the bucket 501 of the current invention (on right). With bucket 501, material is filling the area within the confines of the bucket (between the side walls 502) to a greater extent than the prior art bucket 400.

25 Figures 11A-C depict a chain arm 90 with a chain 10. One or more buckets 501 are attached to the chain 90 and the chain rotates around a first end 91 of the chain arm 90. A cleaning device 600 is disposed on the first end 91 of the chain arm 90. The cleaning device 600 cleans the bucket 501 as it rotates about the first end 91. As material builds up on the bucket portion 503 and side walls 502 of the bucket 501, the cleaning device wipes clean the bucket portion 503 and at least a portion of the side walls 502 as the bucket rotates around the first end 91.

It is to be understood that the form of this invention as shown is merely a preferred embodiment. Various changes may be made in the function and arrangement of parts; equivalent means may be substituted for those illustrated and described; and certain features may be used independently from others without departing from the spirit and scope of the invention as defined in the following claims.

List of Components:

- 1 - incoming belt conveyor
- 2 - stacker jib
- 3 - conveyor belt on jib of stacker
- 5 4 - central column
- 5 - luffing unit
- 6 - stacker jib counterweight
- 7 -operator cabin
- 8 - raking harrow
- 10 9 - raking car
- 10, 10a, 10b - chain
- 11 - hydraulic chain tensioning unit
- 12 - reclaimer bogie
- 13 - outlet hopper
- 15 14 - outgoing belt conveyor
- 15 - stacker bogie
- 50 - frame, reclaiming bridge
- 60 - knee joint
- 75 - reclaimer bridge girder
- 20 90 - chain arm
- 91 - first end of chain arm
- 92- chain hoist
- 100 - reclaimer
- 200 - stacker
- 25 300 - scraper blade

400 - prior art bucket

501 - bucket

502 - bucket side walls

502a - first end bucket

5 502b - second end bucket

503 - bucket portion

503a - first lateral edge of bucket portion

503b - second lateral edge of bucket portion

510 - chain connection devices

10 510a - longitudinal side of the chain connection devices closer to the second end

520 - reclaiming surface

600- cleaning device

D1 - distance between the first end and the first lateral edge

D2 - distance between the first end and the second lateral edge

CLAIMS

1. A bucket (501) for a reclaimer having a first end (502a) and a second end (502b), the bucket (501) comprising:

5 two side walls (502) extending from the first end (502a) to the second end (502b);

a bucket portion (503) disposed between the two side walls (502) in the second end (502b), the bucket portion (503) having a first lateral edge (503a) and a second lateral edge (503b), the second lateral edge (503b) of the bucket
10 portion (503) arranged further towards the second end (502b) than the first lateral edge (503a) so that at least part of the bucket portion (503) has an inclination with respect to a reclaiming surface (520) ,

wherein the two side walls (502) extend past the first lateral edge (503a) of the bucket portion (503) towards the first end (502a) so that the distance (D2)
15 between the first end (502a) and the second lateral edge (503b) is greater than the distance (D1) between the first end (502a) and the first lateral edge (503a).

2. The bucket of claim 1, wherein (D1) is half of (D2).

3. The bucket of claim 1, further comprising chain connection devices (510) disposed on the two side walls (502).

20 4. The bucket of claim 3, wherein the chain connection devices (510) are arranged further towards the first end (502a) than the second end (502b).

5. The bucket of claim 4, wherein the first lateral edge (503a) of the bucket portion (503) is arranged between a longitudinal side (510a) of the chain connection devices (510) closer to the second end (502b) and the second end
25 (502b).

6. The bucket of claim 1, wherein the bucket portion (503) is one piece.

7. The bucket of claim 1, wherein the first lateral edge (503a) is substantially straight.

8. The bucket of claim 1, wherein at least a portion of the bucket portion (503) or the two side walls (502) are coated with a wear-resistant component.

5 9. A reclaimer apparatus comprising:

a chain (10) disposed on a chain arm (90) having a first end (91);

at least one bucket (501) of any one of claims 1-8 for collecting material from a stockpile, the bucket (501) being disposed on the chain (10);

10 a cleaning device (600) for cleaning the bucket (501) as the chain (10) rotates the bucket (501) about the first end (91), the cleaning device (600) being disposed on the first end (91) of the chain arm (90).

10. A method for reclaiming material from a stockpile comprising:

attaching the bucket (501) of any one of claims 1-8 to a chain (10);

rotating the chain (10) about a first end (91) of a chain arm (90);

15 dumping material from the bucket (501) onto a conveyor;

cleaning the bucket (501) with a cleaning device (600) mounted to the first end (91) wherein the edge of the cleaning device (600) scrapes material from a bucket portion (503) of the bucket as the chain (10) rotates the bucket (501) about the first end (91) of the chain arm (90).

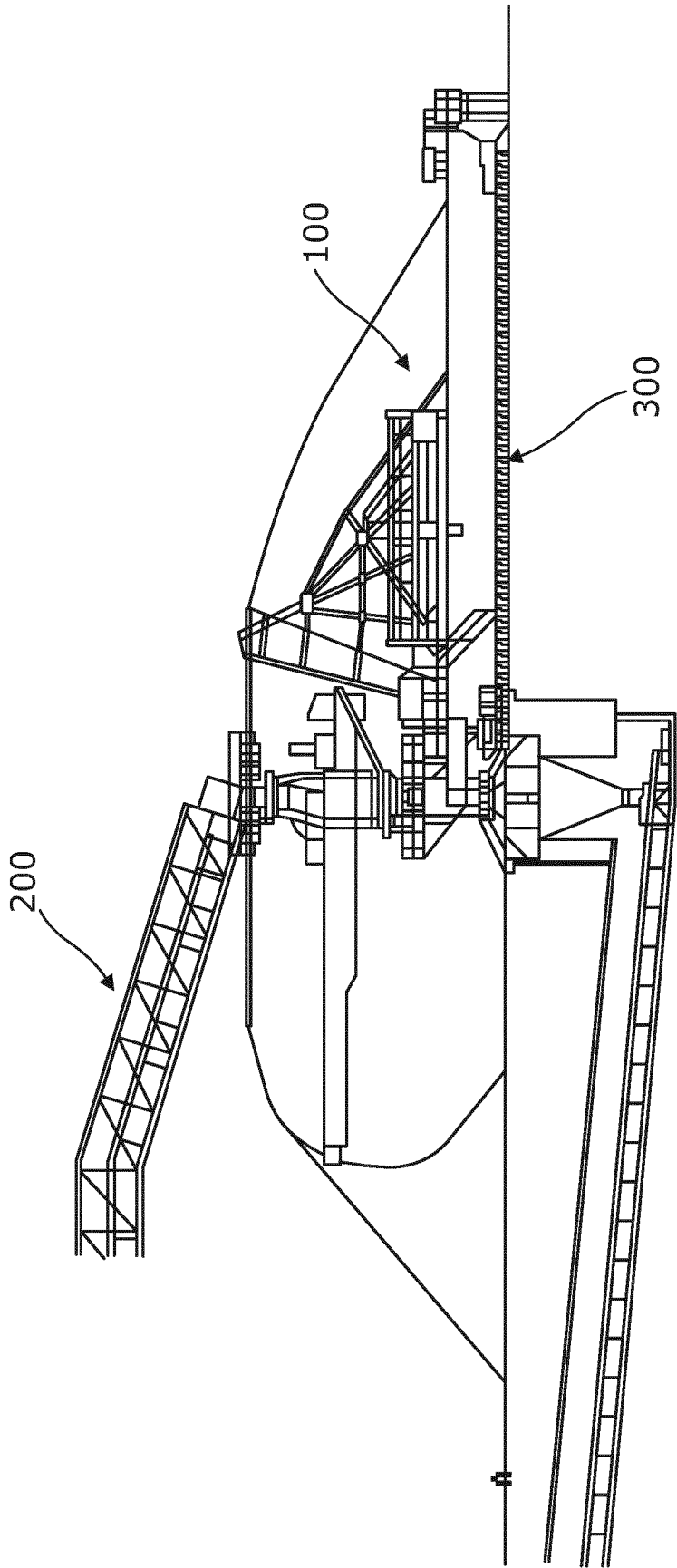


Figure 1
(Prior Art)

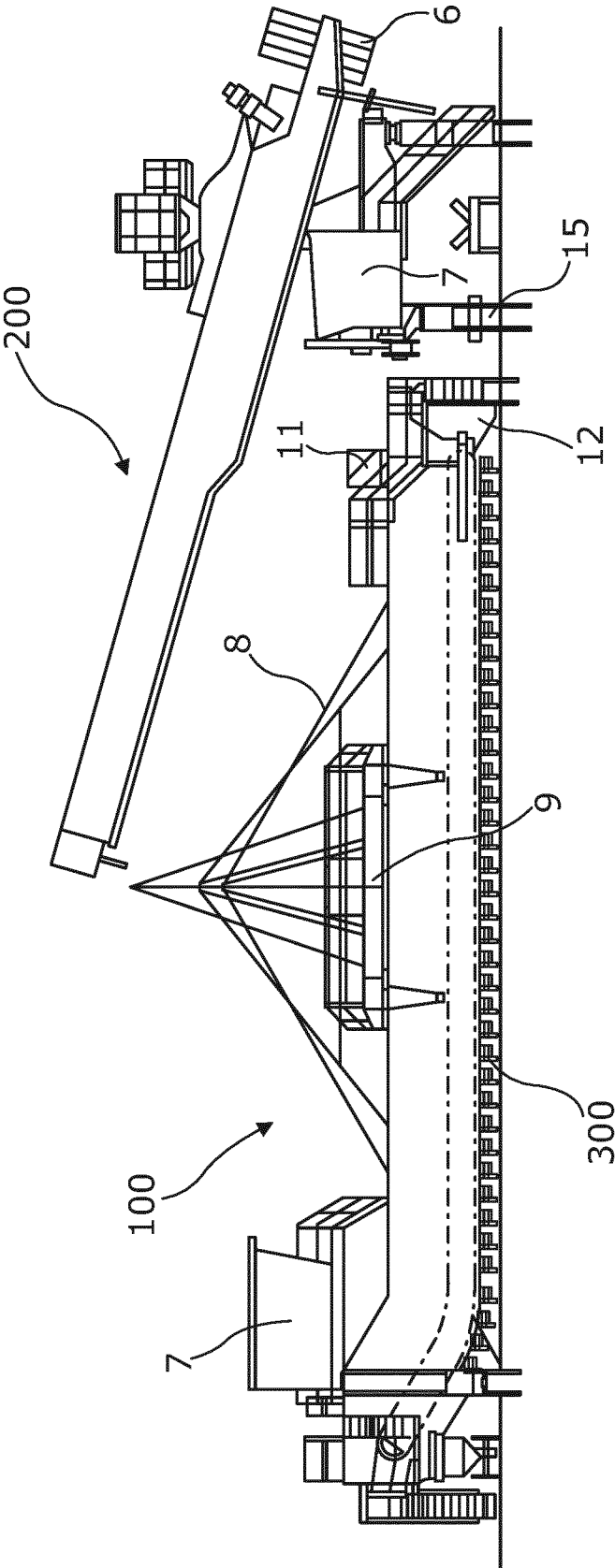


Figure 2
(Prior Art)

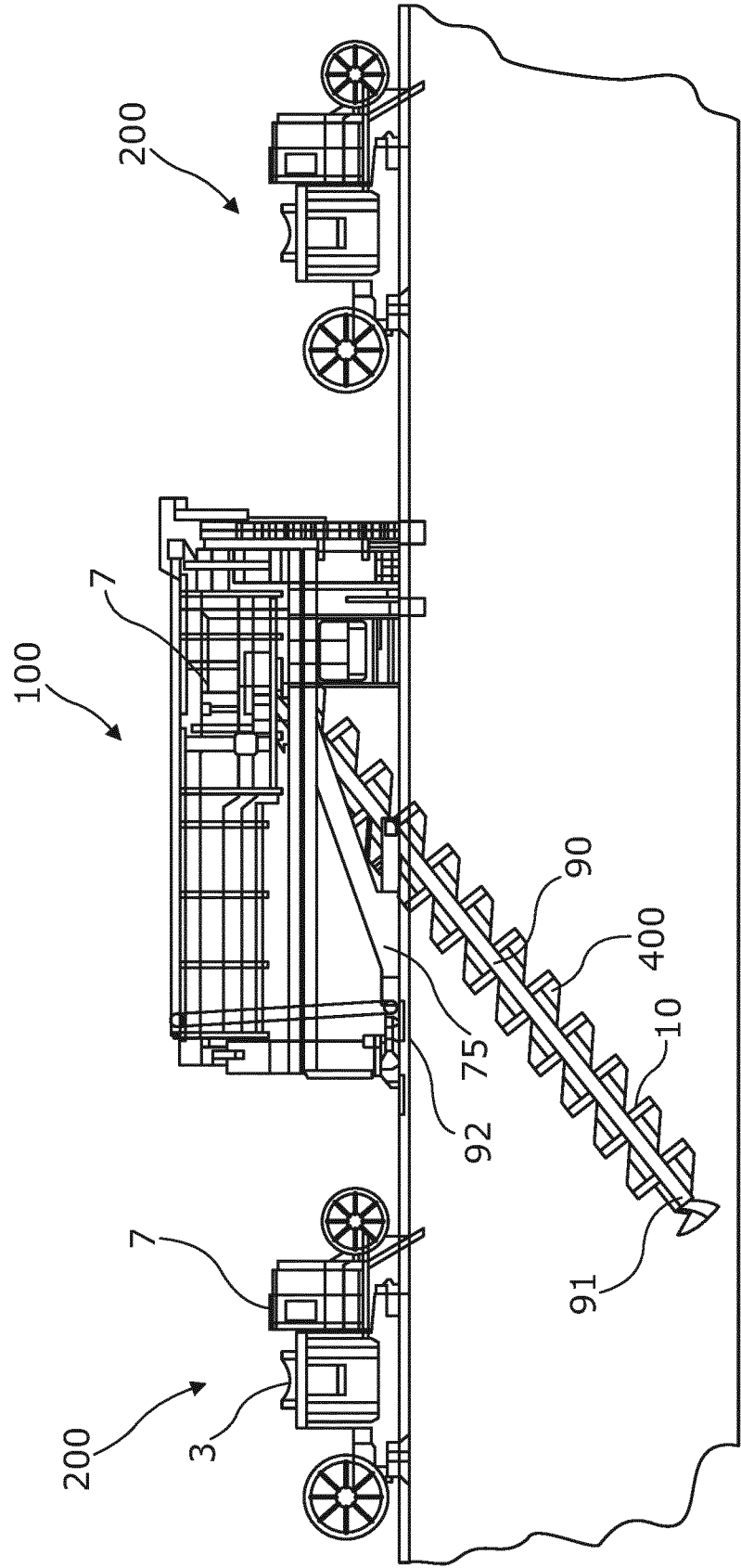


Figure 3
(Prior Art)

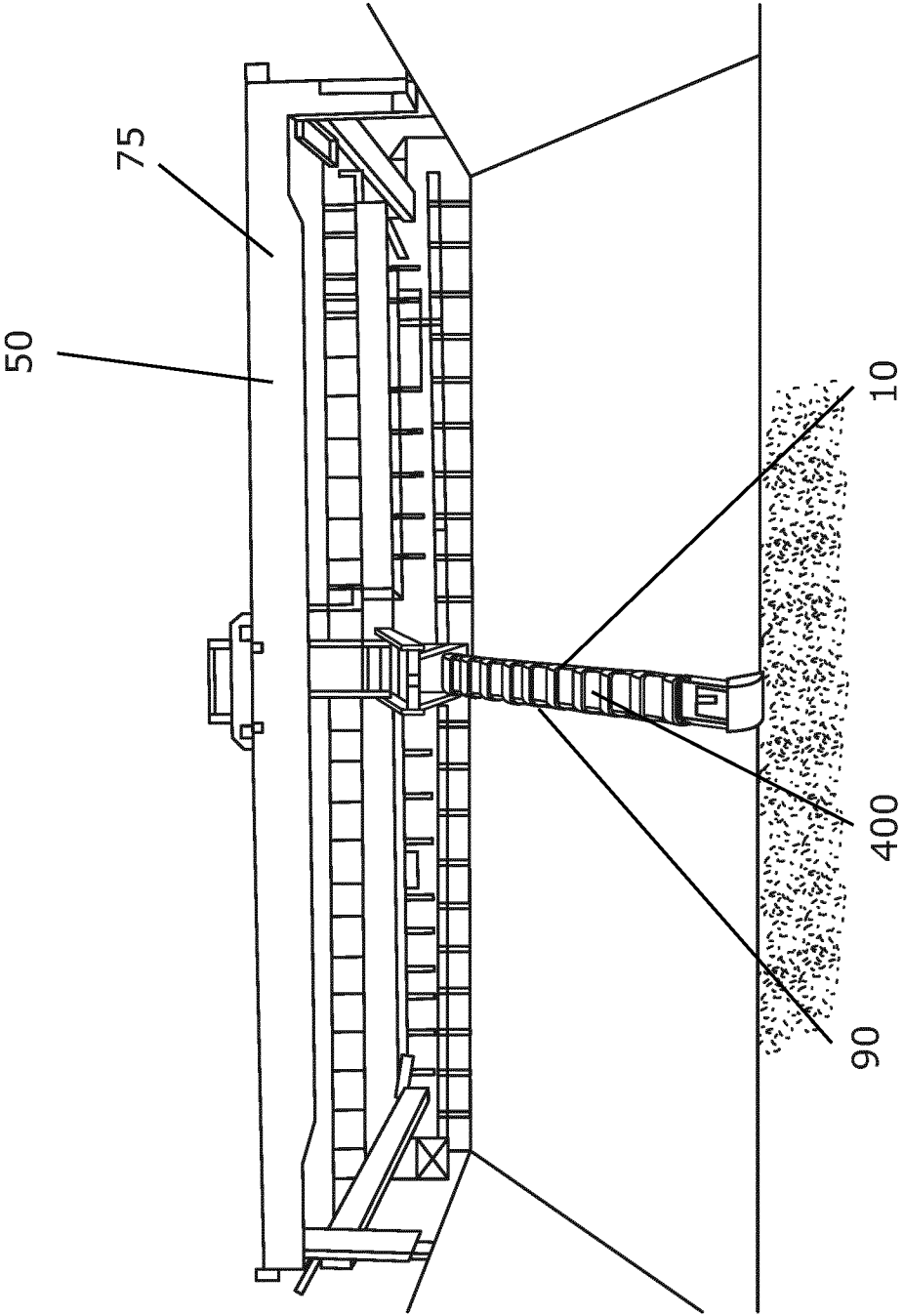


Figure 4
(Prior Art)

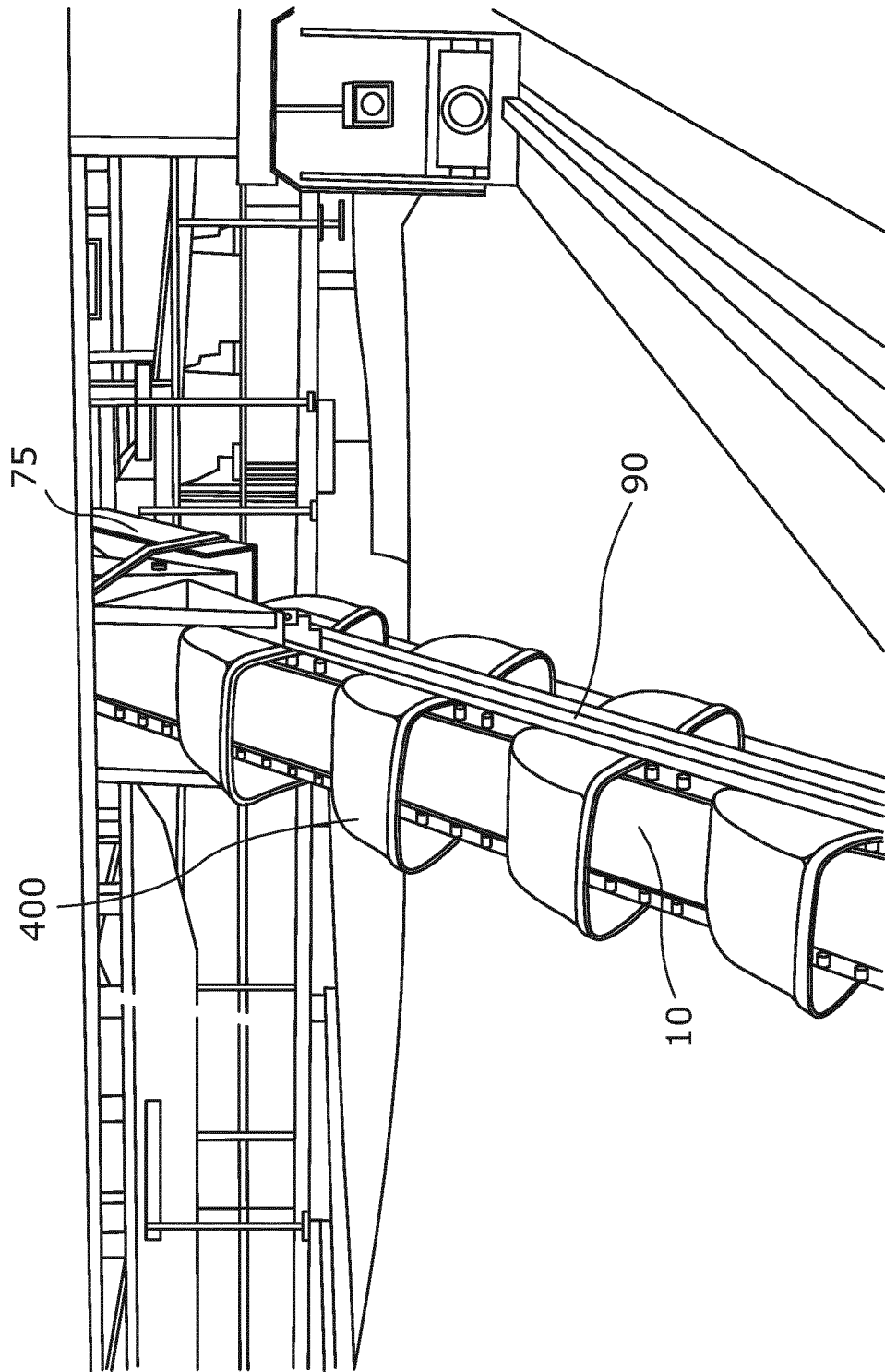


Figure 5
(Prior Art)

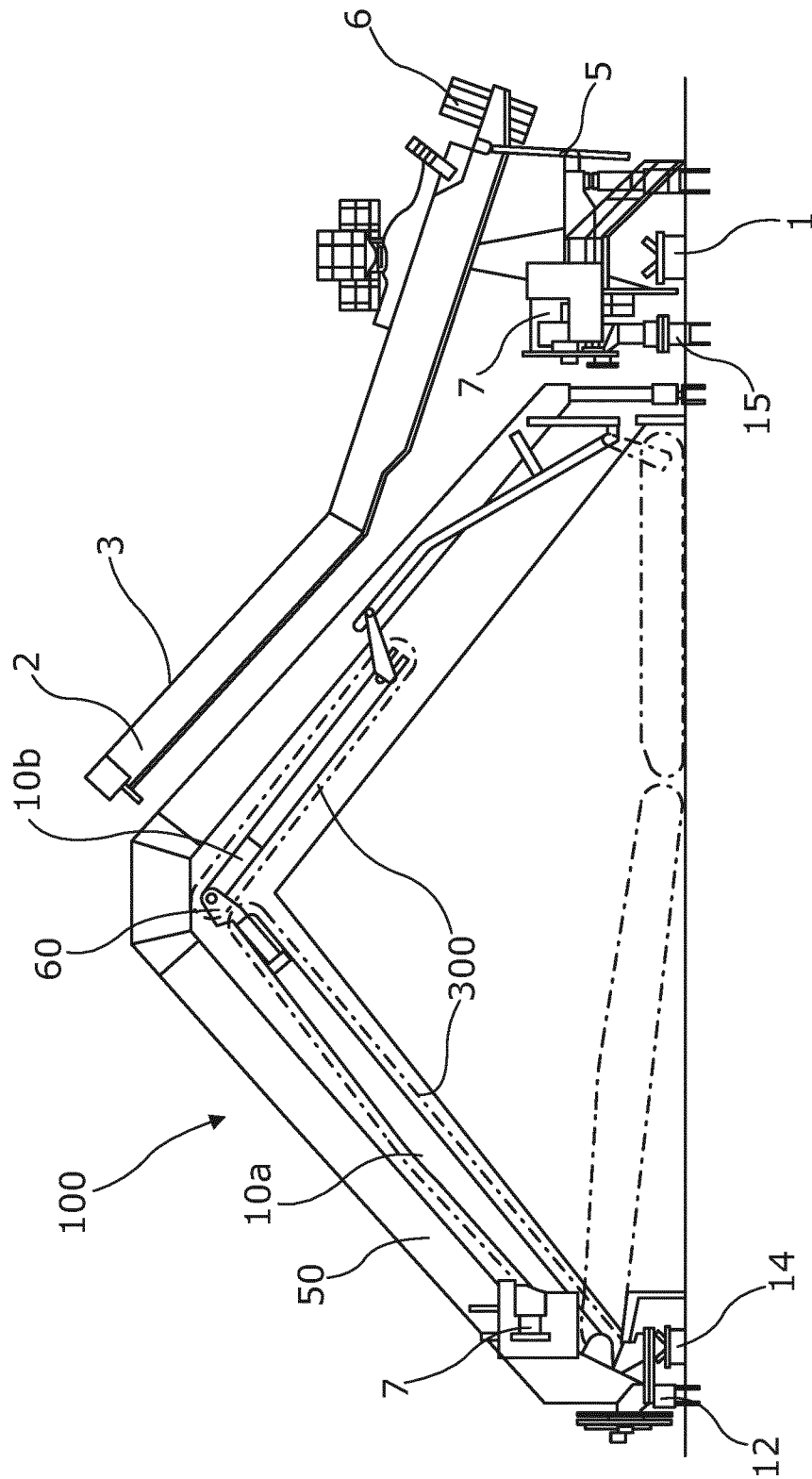


Figure 6
(Prior Art)

7/13

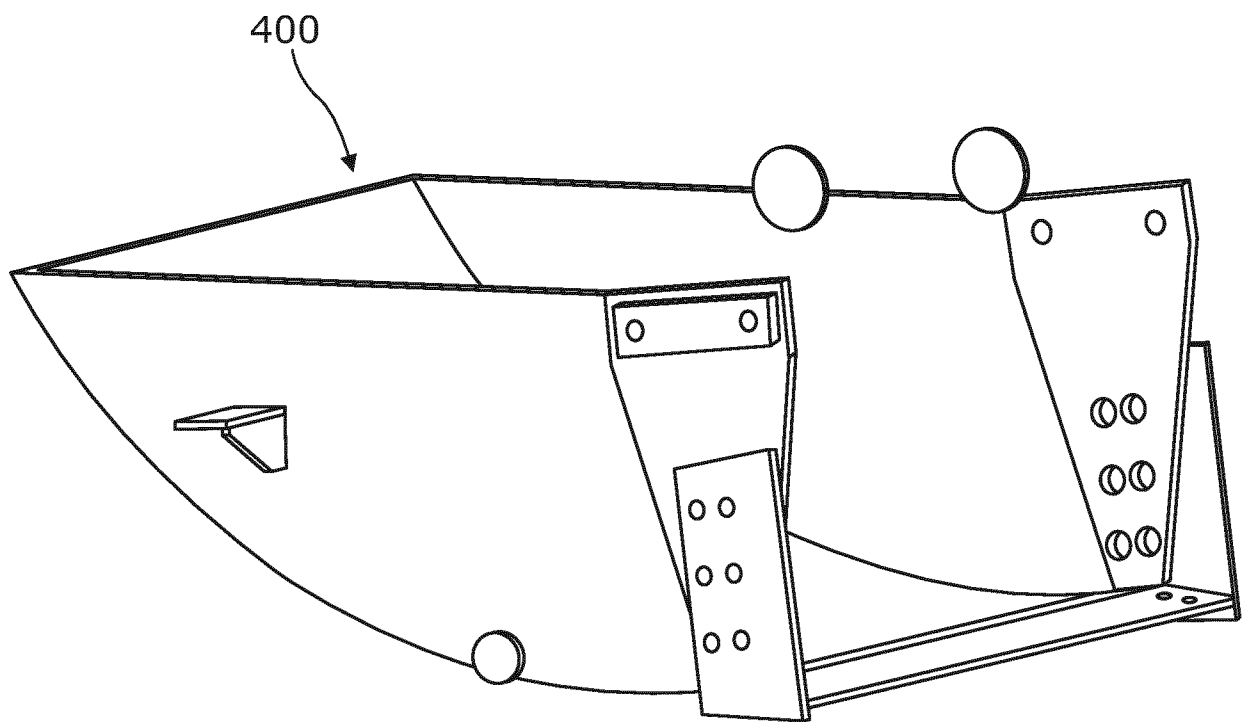


Figure 7
(Prior Art)

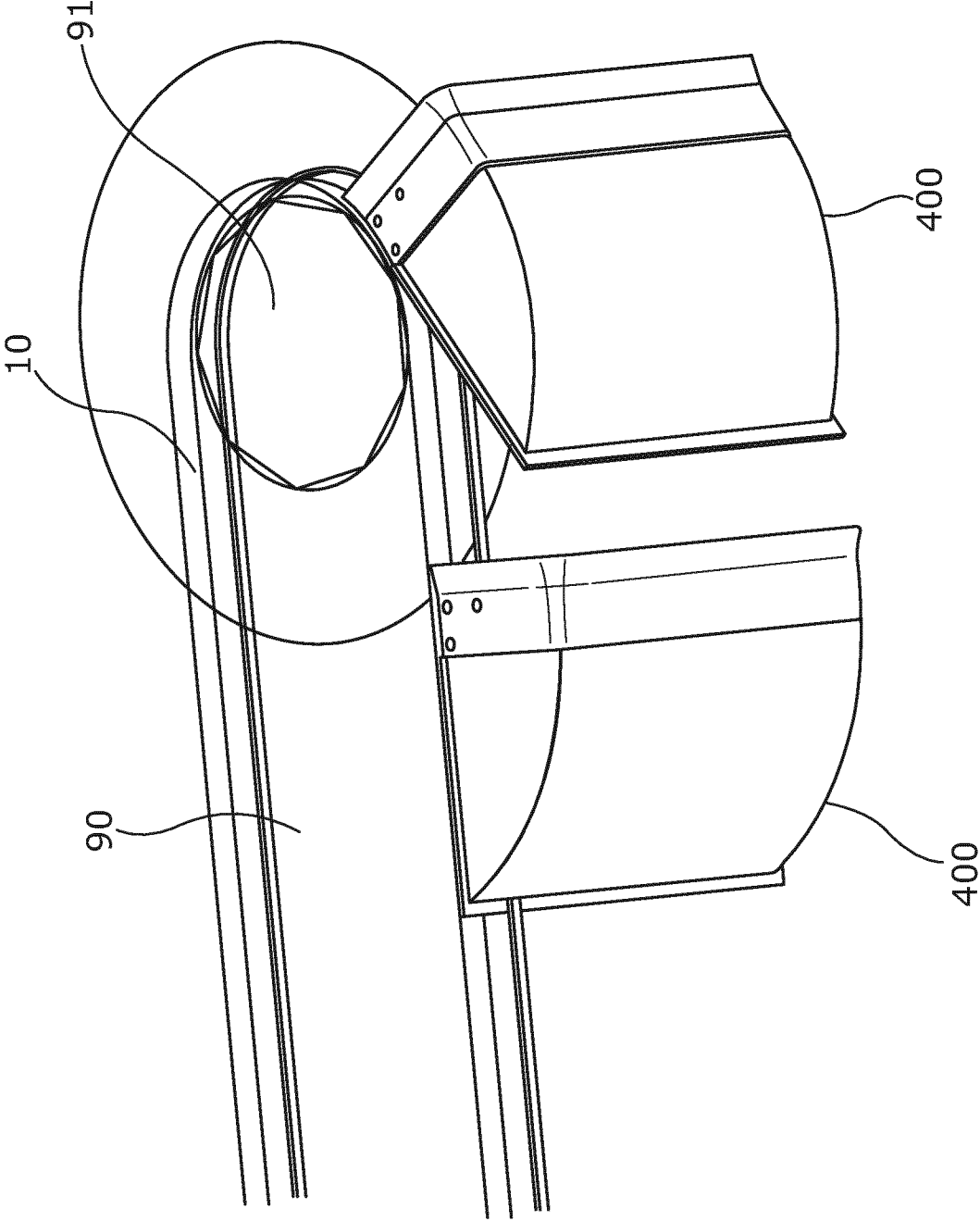


Figure 8
(Prior Art)

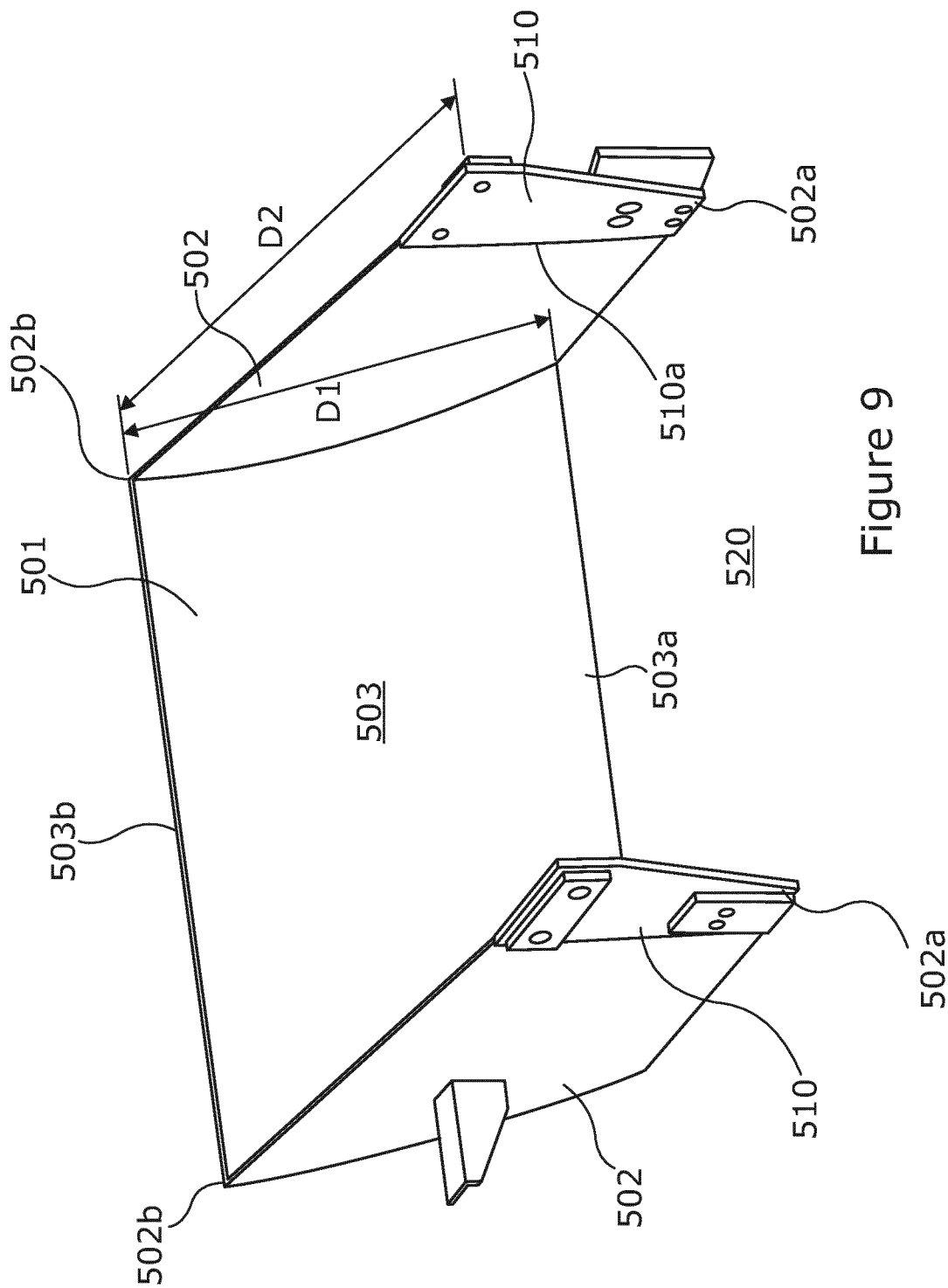


Figure 9

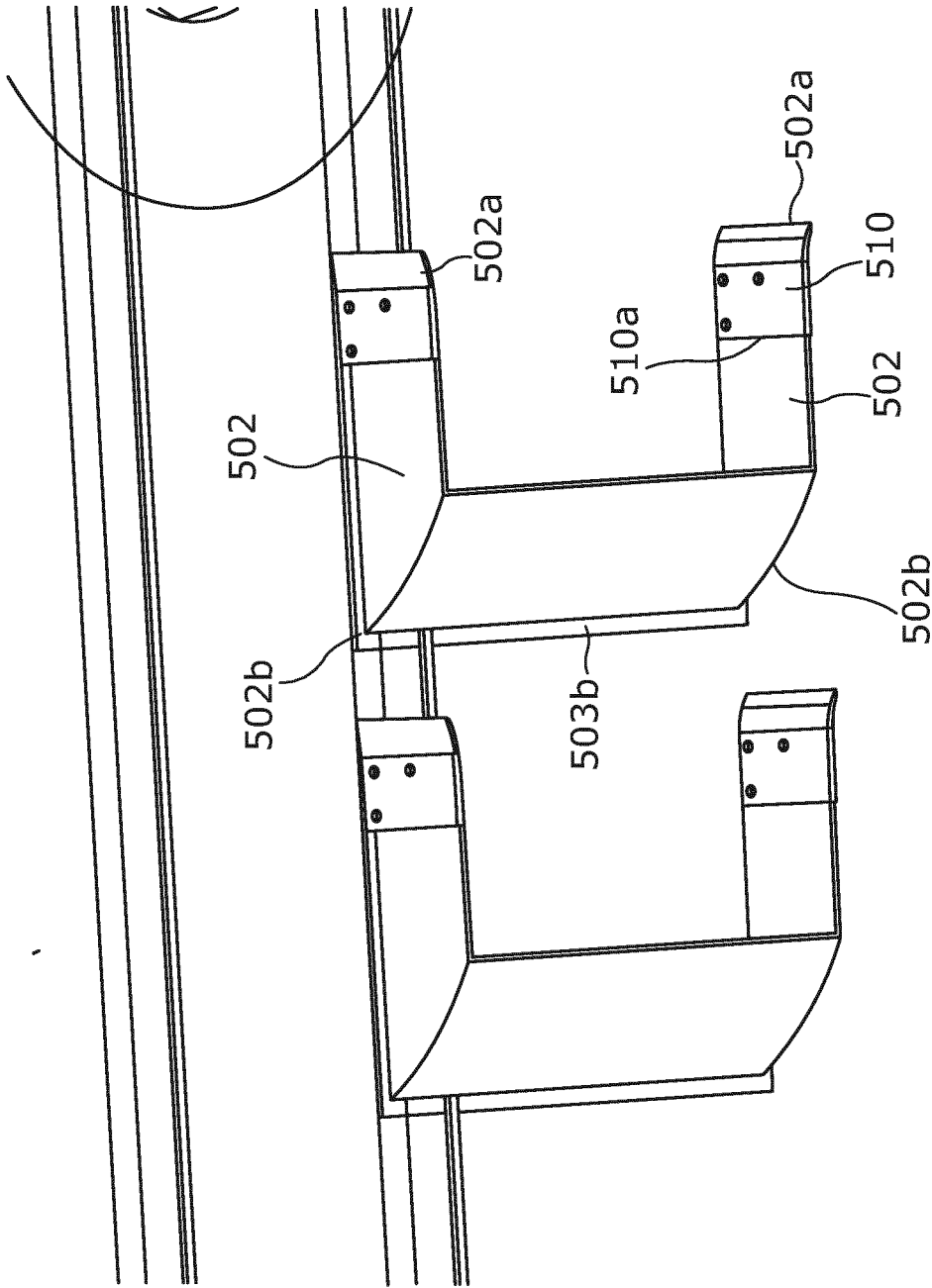


Figure 10

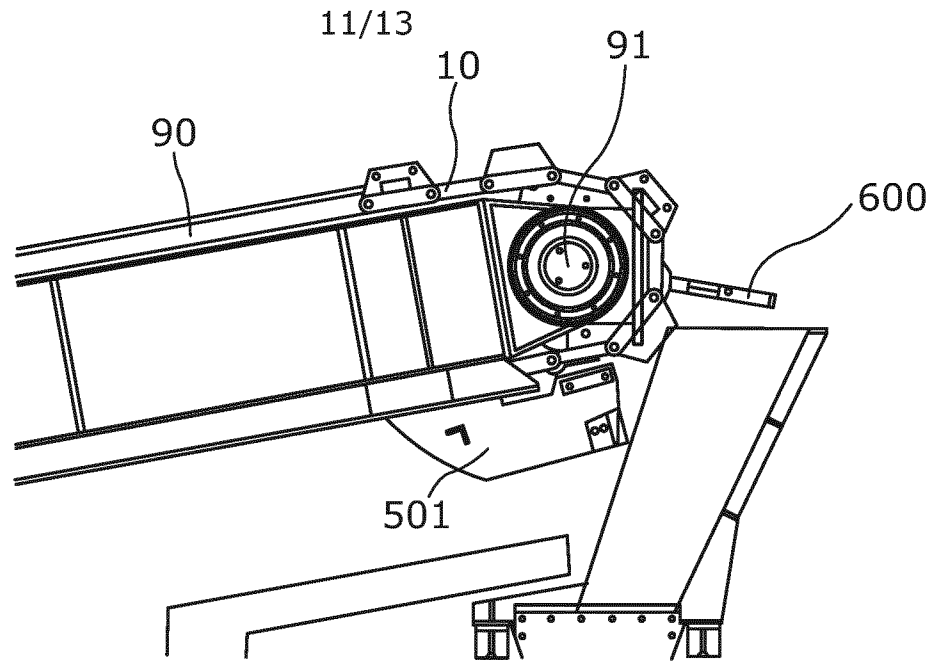


Figure 11A

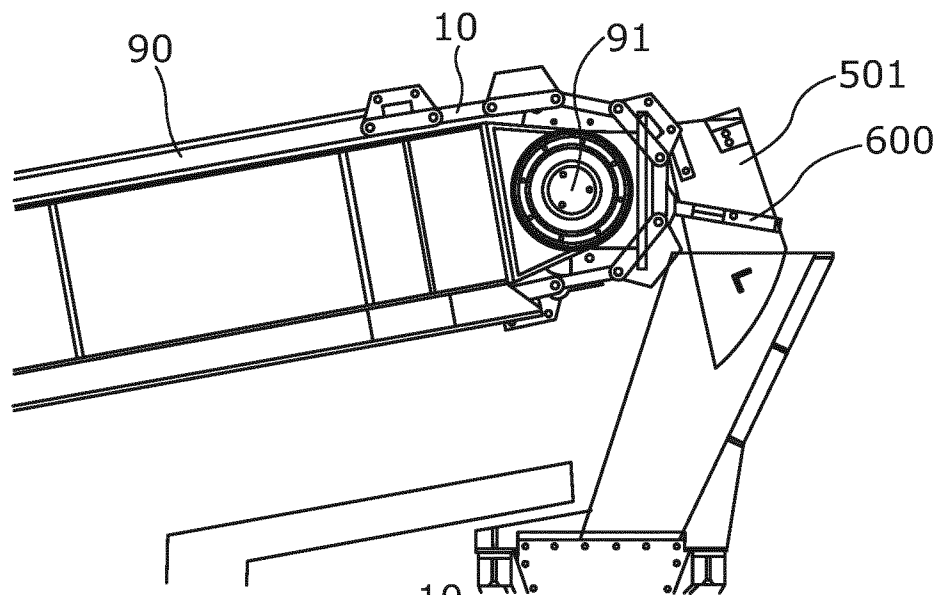


Figure 11B

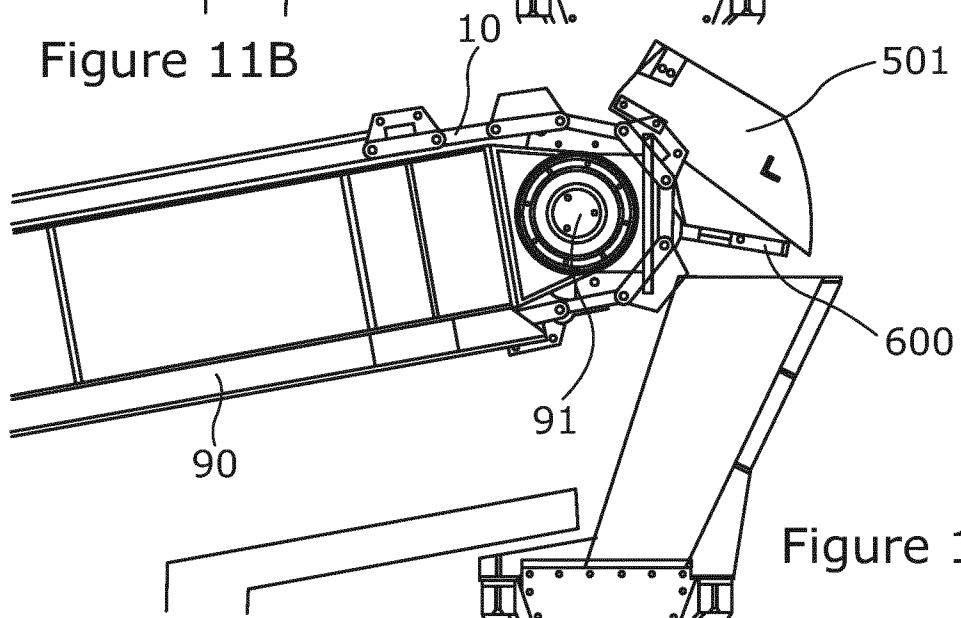


Figure 11C

12/13

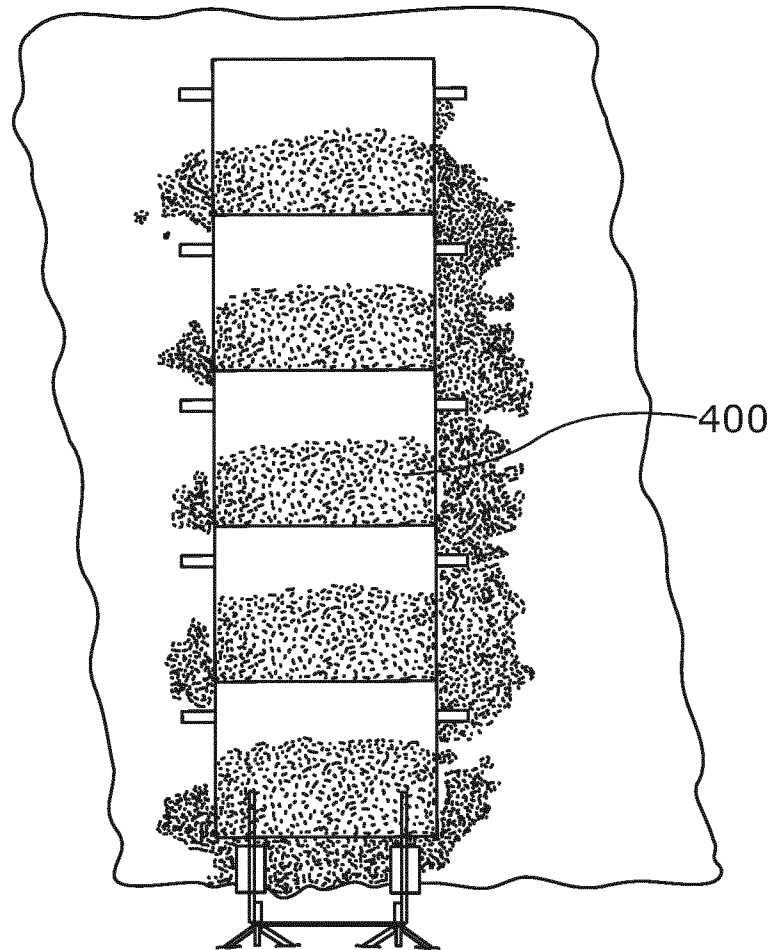


Figure 12A

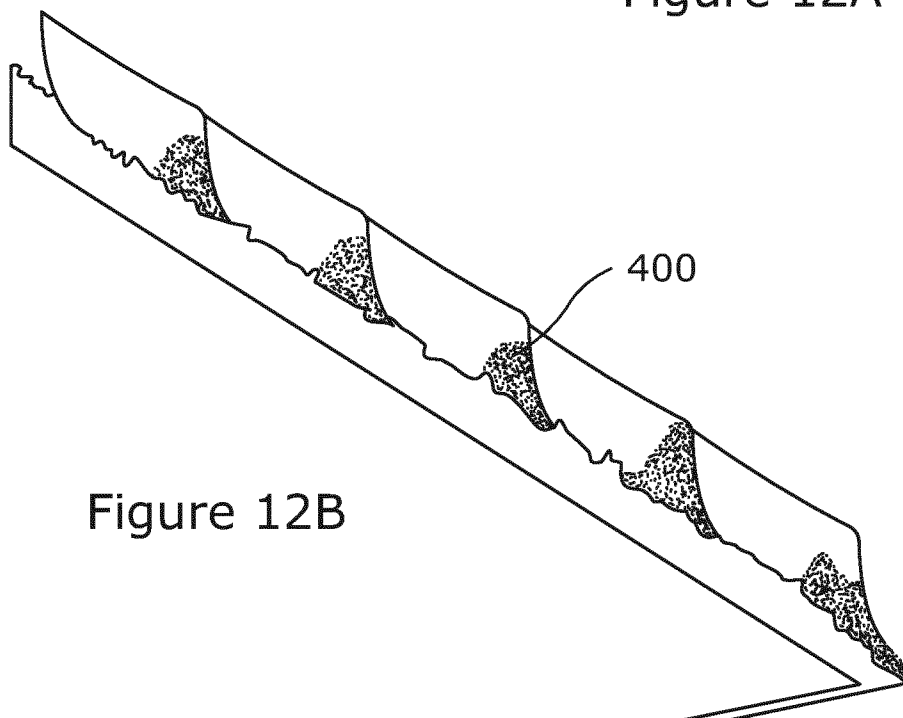


Figure 12B

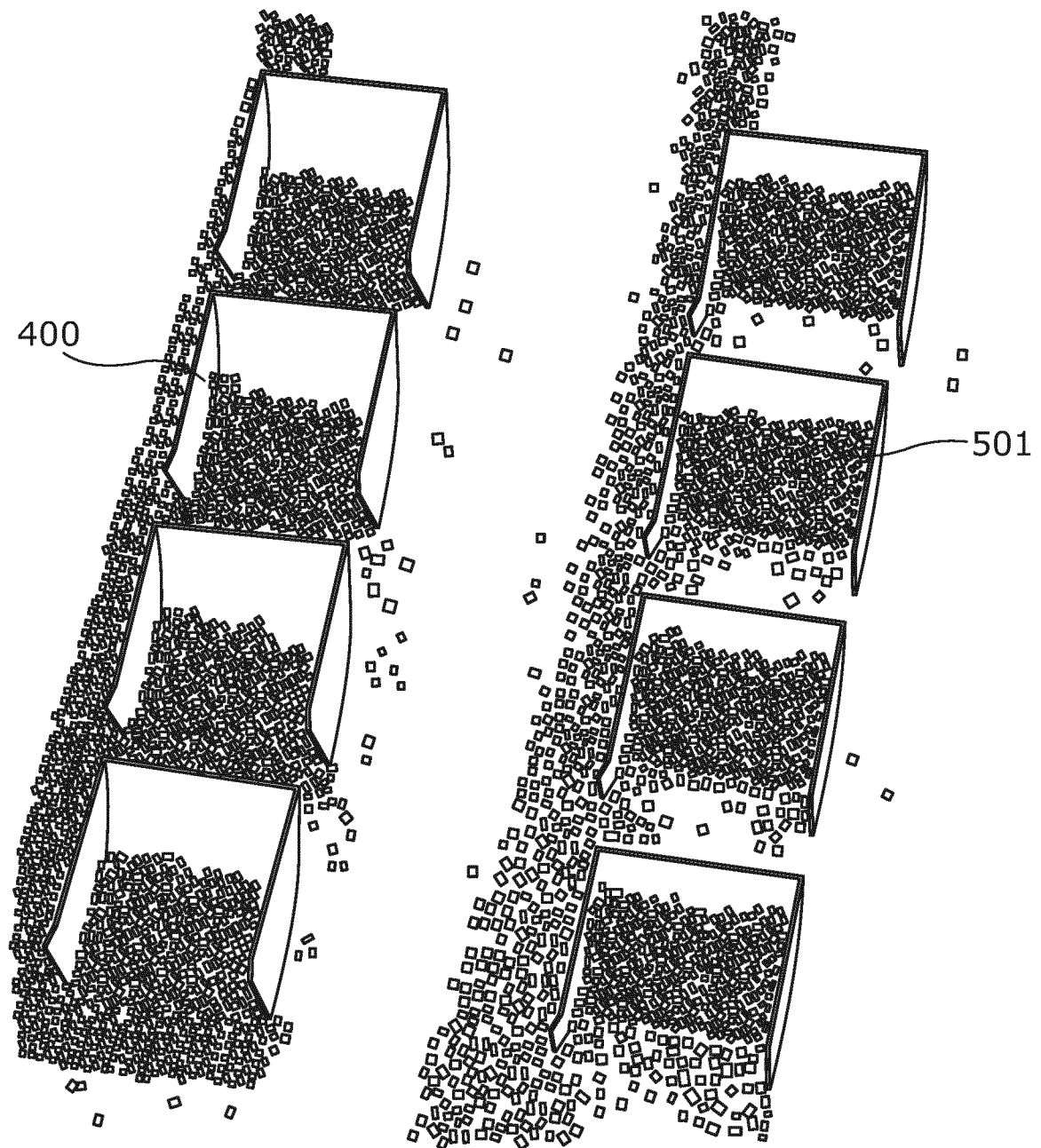


Figure 13

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/061891

A. CLASSIFICATION OF SUBJECT MATTER INV. E02F3/08 B65G17/12 B65G17/36 E02F3/12 E02F3/14 E02F3/18 E02F3/60 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 B28C 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														
C. DOCUMENTS CONSIDERED TO BE RELEVANT <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;">Category*</th> <th style="width: 70%;">Citation of document, with indication, where appropriate, of the relevant passages</th> <th style="width: 20%;">Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; vertical-align: top;">X</td> <td>US 1 398 365 A (DENNIS ARTHUR C) 29 November 1921 (1921-11-29) figures 1a, 2, 4, 6,7 -----</td> <td style="text-align: center; vertical-align: top;">1-10</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">X</td> <td>DE 648 171 C (GUSTAV BAUER DIPL ING; SCHMIDT PAUL) 23 July 1937 (1937-07-23) the whole document -----</td> <td style="text-align: center; vertical-align: top;">1</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">X</td> <td>US 2 981 012 A (MEYER HENRY L) 25 April 1961 (1961-04-25) figures 1-2,5 -----</td> <td style="text-align: center; vertical-align: top;">1,3-7,9, 10</td> </tr> </tbody> </table>			Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X	US 1 398 365 A (DENNIS ARTHUR C) 29 November 1921 (1921-11-29) figures 1a, 2, 4, 6,7 -----	1-10	X	DE 648 171 C (GUSTAV BAUER DIPL ING; SCHMIDT PAUL) 23 July 1937 (1937-07-23) the whole document -----	1	X	US 2 981 012 A (MEYER HENRY L) 25 April 1961 (1961-04-25) figures 1-2,5 -----	1,3-7,9, 10
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☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.														
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Date of the actual completion of the international search 24 August 2016		Date of mailing of the international search report 02/09/2016												
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Laurer, Michael												

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2016/061891

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 1398365	A	29-11-1921	NONE	
DE 648171	C	23-07-1937	NONE	
US 2981012	A	25-04-1961	NONE	