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(54) **HOISTING APPARATUS**

HEBEVORRICHTUNG

APPAREIL DE LEVAGE

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Description

[0001] The present invention relates to a hoisting apparatus for hoisting a load, in particular anodes or anode blocks as used in a furnace for the production of aluminum, according to the preamble of claim 1.

[0002] In an aluminum factory a very important part of the production process are the anodes. Anodes are used in the electrolysis processes, whereas they are being used up in this process. Thus, for each ton of aluminum approx. 500 kg of anode material is being consumed. Generally, these anodes are made from carbon and pitch. When they are produced in a first step, they are transported by conveyors to a storage area, where they are handled by anode stacking cranes, putting the anodes in storage. Next, the anodes are taken out of storage by the anode stacking crane, taken to a conveying system that transports them to the baking furnace where they are handled by a different crane, the furnace tending assembly. Subsequently, the anodes are baked in the furnace, where they get their required properties, taken from the furnace and placed on a conveyor system that takes them again to a storage where they are taken again by an anode stacking crane and placed in storage. Next, the anodes are taken out of storage and placed on a conveyor that takes them to a rodding shop where a rod is attached and they can be used in the electrolysis process.

[0003] Both, the anode stacking crane and the furnace tending assembly have either mechanically (e.g., by gravity) or hydraulically operated clamping members, e.g., gripping jaws, described exemplary in US 4,326,937 A, US 3,719,300 A, WO 2004/079046 A2, and US 4,133,570 A. In case of mechanical operated gripping jaws, according to e.g., US 4,133,570 A, on both types of cranes, the clamping force to the anode is provided by a lever mechanism using the weight of the parts of the gripping mechanism and the anode to create enough clamping force so that the anode stays grabbed and can get lifted.

[0004] All conventional gravity-based mechanisms can be locked using a locking mechanism in order to block a movement of the gripping jaws against each other, wherein this blocking is only carried out when the gripping jaws are opened and no load or anode is grabbed. This enables the gripping jaws to be positioned above the load, wherein after reaching the correct position the locking of the gripping jaws is suspended, such that the load or anode can be grabbed using the gravity-based mechanism. A locking during transportation of the load is not provided for in the known gravity-based mechanisms. This can lead to an unintentional opening of the gripping jaws when the load or anode is e.g., unintentionally lowered onto something, e.g., onto the edge of a furnace pit, as the gravitational effect is suspended in this case.

[0005] Accordingly, it is the object of the present invention to provide a hoisting apparatus, which allows an easy and secure hoisting of a load, in particular an anode as used in a furnace for the production of aluminum.

[0006] This object is achieved by a hoisting apparatus according to the features of claim 1. Preferred embodiments are referred to in the subclaims.

[0007] Thus, according to the invention, a hoisting apparatus for gripping and lifting a load, e.g., an anode, is provided, wherein the hoisting apparatus comprises a locking mechanism having a nut rotatably connected to an inner housing of the hoisting apparatus and screwed onto a spindle, wherein the spindle is fixedly connected to an outer housing of the hoisting apparatus, directly or indirectly, such that the nut rotates on the spindle if/when the inner housing is moved against an outer housing along the lifting direction, wherein the nut is further fixedly connected to a brake disc, preferably in a coaxial configuration, and the brake disc is interacting with a brake unit, e.g., a brake caliper, attached to the inner housing in such a way, that in an activated state of the brake unit a rotation of the brake disc and the nut is prevented in order to also prevent the gripping jaws (or grabbing jaws) of the hoisting apparatus to move against each other along the gripping direction, which is ensured by preventing a relative movement of the inner housing against the outer housing containing the movable gripping jaws at each side, each connected to the outer housing by a parallelogram linkage. In a corresponding manner it is provided that in a released state of the brake unit a rotation of the brake disc and the nut is allowed in order to also allow the gripping jaws to move against each other along the gripping direction by also allowing a relative movement of the inner housing against the outer housing.

[0008] Thus, when needed, the locking mechanism can easily prevent or block a movement of the inner housing, which is operatively connected to each gripping jaw by a lever mechanism, against the outer housing along a (vertical) lifting direction by preventing a rotation of the nut on the spindle. Otherwise, in the unlocked state, this relative movement of the inner housing against the outer housing causes the gripping jaws to move relative to each other along the gripping direction in the present gravity-based mechanisms, e.g., closer together to grab or apart from each other to release a load or anode. As the rotation of the brake disc or the nut can be prevented in every relative position of the gripping jaws by bringing the brake unit into the activated state, it is also possible to lock a relative movement of the gripping jaws against each other when a load is transported. This can prevent an unintentional opening of the gripping jaws when the load or anode is e.g., unintentionally lowered onto something, e.g., onto the edge of a furnace pit, as the suspended gravitational effect even when using a gravity-based mechanisms isn't leading to a relative movement of the housings against each other.

[0009] According to another aspect of the invention, the nut of the locking mechanism comprises an outer guiding groove and at least one bearing is fixedly connected to the inner housing, wherein the at least one

bearing is movably received in the outer guiding groove to rotatably connect the nut to the inner housing. This ensures, that the nut can easily be coupled to the vertical movement of the inner housing simultaneously allowing the nut to rotate onto the spindle, when the inner housing is moved relative to the outer housing.

[0010] According to another aspect of the invention, the brake unit, e.g., brake caliper, comprises at least one brake pad, preferably two brake pads above each surface (top/bottom) of the brake disc, wherein the brake disc is at least partially positioned inside a gap of the brake unit in such a way that the at least one brake pad containing friction material layers on its surface can be pressed flat against the brake disc in the activated state of the brake unit in order to prevent a rotation of the brake disc by friction. In doing so, the rotation of the brake disc can be allowed or prevented in an easy and effective way, when there is a need to lock the gripping jaws.

[0011] According to another aspect of the invention, a lever mechanism is assigned to each clamping jaw, wherein each lever mechanism is constructed identical, and each lever mechanism is coupled to the inner housing, e.g., via an equalizer. This allows to transfer a vertical movement (along the lifting direction) of the inner housing against the outer housing into a uniform horizontal motion (along the gripping direction) of the gripping jaws relative to each other. According to a further aspect, each lever mechanism comprises an angle lever having two lever arms merging into each other at a pivot point, whereas said angle lever is pivotably connected to the outer housing at said pivot point and the first lever arm of said angle lever is pivotably connected to the assigned clamping jaw and the second lever arm of said angle lever is pivotably connected to a straight lever of the same lever mechanism, wherein the straight lever is in turn pivotably connected to the inner housing, e.g., via the equalizer. This represents an easy and effective way of mechanically transferring the respective motions into each other, wherein preferably an additional linking member is assigned to each clamping jaw, wherein each linking member is pivotably connected to the outer housing and the assigned clamping jaw, and wherein the first lever arm of said angle lever and the linking member assigned to the same clamping jaw are forming the respective parallelogram linkage allowing the assigned clamping jaw to move essentially into the gripping direction. Thus, a uniform and steady motion of the gripping jaws is ensured in an easy way.

[0012] Features and advantages of the present invention will become apparent upon reading of the following detailed description along with the accompanied drawings, wherein:

Fig. 1 shows a hoisting apparatus in a side view with gripping jaws in an open state;

Fig. 2 shows a detailed view of the hoisting apparatus according to Fig. 1, with gripping jaws in a closed state grabbing a load, e.g., an anode; and

Fig. 3-6 show detailed views of the locking mechanism attached to an inner housing of the hoisting apparatus according to Fig. 1.

[0013] Fig. 1 shows a hoisting apparatus 1 having an outer housing 2 containing movable clamping members, e.g., gripping jaws 3, 4, on each side and an inner housing 5 that can be moved relative to the outer housing 2, wherein this movement is guided by several rollers R or guide wheels attached to the outer housing 2 running on guide rails G on the inner housing 5 (see Fig. 3). The inner housing 5 is connected to a lifting means, e.g., a motor (not shown), suitable to lift a load L (see Fig. 2) that is to be grabbed using the gripping jaws 3, 4. For example, the inner housing 5 can be connected to the lifting means by wire ropes or rope sheaves.

[0014] Preferably, the load L is an anode (or a plurality of anodes) as used in a furnace for producing aluminum. As such, the hoisting apparatus 1 may be part of an anode stacking crane to put or pick new or baked anodes into or out of a storage, or a furnace tending assembly, which handles the anodes in the area of the baking furnace, where the anodes get their properties required for the subsequent electrolysis process.

[0015] With reference to Fig. 2 and 3, the respective gripping jaws 3, 4 are each connected to the outer housing 2 by a linking member 6, a lever for example, each running between a first shaft 7 on the outer housing 2 and a second shaft 8 on horizontal arms 3a, 4a of the respective gripping jaws 3, 4. An additional lever mechanism 9a, 9b individually connects the gripping jaws 3, 4 to an equalizer 10, which in turn is attached to the inner housing 5. If the inner housing 5 is moved against the outer housing 2 in a lifting direction D2 (vertical direction) the lever mechanisms 9a, 9b transfer this vertical movement into the gripping jaws 3, 4, causing an essentially horizontal movement of the gripping jaws 3, 4 in a gripping direction D1, as described below.

[0016] As the lever mechanisms 9a, 9b for both gripping jaws 3, 4 are designed identical, each gripping jaw 3, 4 is affected in the same way. Thus, upon raising the inner housing 5 against the outer housing 2, e.g., by actuating the lifting means, the gripping jaws 3, 4 are uniformly moved closer together and upon lowering the inner housing 5 against the outer housing 2, the clamping jaws 3, 4 are uniformly moved apart from each other. If (upon raising the inner housing 5) both clamping jaws 3, 4 come into contact with the load L in a grabbed state, a clamping force is acting on the load L, whereas said clamping force is, in particular, dependent on the weight of all the elements carried by the inner housing 5, namely the load L as well as the mentioned mechanical components 6, 9a, 9b, 2. Thus, the lever mechanism 9a, 9b converts the gravitational force acting on the inner housing 5 into the clamping force acting on the load L.

[0017] Each of said lever mechanism 9a, 9b contains an angle lever 11, having a first lever arm 11a and a second lever arm 11b merging into each other at a pivot point 14, as well as a straight lever 12. The first lever arm 11a of each angle lever 11 is pivotably connected to the respective horizontal arm 3a, 4a of the gripping jaws 3, 4 by a third shaft 13. The second lever arm 11b of each angle lever 11 is pivotable connected to one of said straight levers 12 by a fourth shaft 15. Each straight lever 12 is in turn pivotably connected to the equalizer 10 by a fifth shaft 16.

[0018] Further, each of said angle levers 11 is pivotably connected to the outer housing 2 at the pivot point 14 by a sixth shaft 17. As a result, the first lever arm 11a and the linking member 6 assigned to the same gripping jaw 3, 4 form a parallelogram linkage Pa, Pb. This ensures an essentially horizontal movement of the gripping jaws 3, 4 in the gripping direction D1 and thus an effective force application to the load L, when the inner housing 5 is moved in the vertical direction (lifting direction D2) against the outer housing 2.

[0019] The relative movement of the inner housing 5 against the outer housing 2 can be blocked by a locking mechanism 18 as shown in Fig. 3 to 6, in order to prevent a relative movement of the clamping jaws 3, 4 against each other, when needed. According to the invention, the locking mechanism 18 allows to block the relative movement of the housings 2, 5 and the gripping jaws 3, 4 against each other in every relative position. Consequently, the gripping jaws 3, 4 can be locked in an open position, e.g., when moving the crane containing the hoisting apparatus 1 above the load L to be grabbed or after releasing the load L, as well as in a closed position or grabbed state when a clamping force is acting on the load L. As a result, an accidental opening of the gripping jaws 3, 4 can be prevented in the closed position or grabbed state, e.g., in case the grabbed load L is lowered onto an object, e.g., onto the edge of a furnace pit, which would automatically lead to a relative movement of the inner housing 5 against the outer housing 2, if such a locking mechanism 18 isn't used.

[0020] Therefore, the locking mechanism 18 is attached to the inner housing 5, e.g., onto an inner plate 19 connected to the inner housing 5, as shown in Fig. 5. The inner plate 19 has an opening 20 through which a spindle 21 having a threaded region 21a protrudes, as can be seen in Fig. 3 or 4. The spindle 21 is connected or fixed by fixing means 23 to an attachment plate 22 at the underside of the outer housing 2, wherein, in the shown embodiment, the spindle 21 is connected with or attached to an additional non-threaded rod 24 (in one-piece design or two-piece design), which is fixed to the attachment plate 22 by the fixing means 23. Thus, the spindle 21 and the non-threaded rod 24 are passing all the way through the inner housing 5 in vertical direction. In a further embodiment, the spindle 21 might be directly fixed to the outer housing 2 or the attachment plate 22 without an additional non-threaded rod 24.

[0021] The locking mechanism 18 further comprises a nut 25 having an inner thread 25a such that the nut 25 can be screwed onto the threaded region 21a of the spindle 21 allowing a vertical movement of the nut 25 along the spindle 21. The nut 25 has an outer guide groove 25b in which at least one bearing 26, e.g., an annular bearing 26 or circular arranged bearings 26, is received. The at least one bearing 26 is fixedly connected to the inner housing 5, e.g., by an annular bracket 27. Consequently, by moving the inner housing 5 relative to the outer housing 2 up (to close the grab) or down (to open the grab), the at least one bearing 26 received inside the outer guide groove 25b pushes the nut 25 up or down. This automatically causes a rotation of the nut 25 in order to allow the nut 25 to move up or down the threaded region 21a of the spindle 21. The thread pitch of the threaded region 21a and the inner thread 25a is selected accordingly to allow this rotation of the nut 25 when a relative movement between the housings 2, 5 occur.

[0022] Further, the nut 25 is coaxially connected with a brake disc 28, such that the brake disc 28 is also rotating around the same rotational axis as the nut 25 upon relative movement of the inner housing 5 against the outer housing 2. The brake disc 28 is at least in part placed inside a gap 29 of a brake unit 30 (brake caliper) having brake pads 30a, 30b and an actuating means 30c. The brake unit 30 is fixed to the inner housing 5, e.g., also to the inner plate 19.

[0023] In dependence of the switching position of the actuating means 30c the brake unit 30 is activated or released, wherein in the activated state of the brake unit 30 the brake pads 30a, 30b are (from above and below) pressed flat against the surface of the brake disc 28 placed inside the gap 29, whereby a braking force is generated as the friction material layers on each of the brake pads 30a, 30b are touching the brake disc 28. Consequently, the rotation of the brake disc 28 as well as the nut 25 on the spindle 21 is prevented in the activated state of the brake unit 30. This also blocks a relative movement of the housings 2, 5 against each other, such that the relative movement of the gripping jaws 3, 4 is also locked in the current position as the lever mechanisms 9a, 9b is fixed. If the brake unit 30 is brought into the releasing state by switching the actuating means 30c accordingly, the brake pads 30a, 30b are lifted from the surface of the brake disc 28. Consequently, a rotation of the brake disc 28 is permitted again and the locking of the gripping jaws 3, 4 is suspended.

[0024] This enables the gripping jaws 3, 4 to be brought into a locked or an unlocked state in every position by operating the actuation means 30c at the appropriate point in time. If a load L should be grabbed, the gripping jaws 3, 4 can be locked (locked state) by bringing the brake unit 30 into the activated state while the gripping jaws 3, 4 are positioned above the load L. Once they are positioned above the load L the actuating means 30c are actuated such that the brake unit 30 is brought into the released state (brake pads 30a, 30b lifted from the brake

disc 28) in order to allow the gripping jaws 3, 4 to move closer together in this unlocked state by moving the inner housing 5 up relative to the outer housing 2, as described above. Once the load L is grabbed and lifted the actuating means 30a are actuated such that the brake unit 30 is brought into the activated state (brake pads 30a, 30b pressed against the brake disc 28) in order to lock the gripping jaws 3, 4 in the current position (locked state). Thus, if the load L is lowered onto something, e.g., unintentionally, the gripping jaws 3, 4 stay closed and the load L can be securely carried by the hoisting apparatus 1.

List of reference signs

[0025]

1	hoisting apparatus
2	outer housing
3, 4	gripping yaws
3a, 4a	horizontal arms of the gripping yaws 3, 4
5	inner housing
6	linking members
7	first shaft
8	second shaft
9a, 9b	lever mechanism
10	equalizer
11	angle lever
11a	first lever arm
11b	second lever arm
12	straight lever
13	third shaft
14	pivot point
15	fourth shaft
16	fifth shaft
17	sixth shaft
18	locking mechanism
19	inner plate
20	opening
21	spindle
21a	threaded region
22	attachment plate
23	fixing means
24	non-threaded rod
25	nut
25a	inner thread
25b	outer guide groove
26	bearing
27	bracket
28	brake disc
29	gap
30	brake unit (brake caliper)
30a, 30b	brake pads
30c	actuating means
D1	gripping direction
D2	lifting direction
G	guide rail
Pa, Pb	parallelogram linkage
L	load
R	roller

Claims

1. Hoisting apparatus (1) for gripping and lifting a load (L), e.g., an anode, comprising,

- an outer housing (2) containing movable gripping jaws (3, 4) at each side, each connected to the outer housing (2) by a parallelogram linkage (Pa, Pb) to allow said clamping jaws (3, 4) to move into a gripping direction (D1),
- an inner housing (5) operatively connected to each gripping jaw (3, 4) by a lever mechanism (9a, 9b) in such a way, that a movement of the inner housing (5) against the outer housing (2) along a lifting direction (D2) causes the gripping jaws (3, 4) to move relative to each other along the gripping direction (D1), and
- a locking mechanism (18) configured to allow or to prevent a relative movement of the inner housing (5) against the outer housing (2) in order to allow or to prevent the gripping jaws (3, 4) to move against each other along the gripping direction (D1),

characterized in that,

the locking mechanism (18) comprises a nut (25) rotatably connected to the inner housing (5) and screwed onto a spindle (21), wherein the spindle (21) is fixedly connected to the outer housing (2) such that the nut (25) rotates on the spindle (21) when the inner housing (5) is moved against the outer housing (2) along the lifting direction (D2), wherein the nut (25) is further fixedly connected to a brake disc (28) and the brake disc (28) is interacting with a brake unit (30) attached to the inner housing (5) in such a way, that in an activated state of the brake unit (30) a rotation of the brake disc (28) and the nut (25) is prevented in order to also prevent the gripping jaws (3, 4) to move against each other along the gripping direction (D1).

2. Hoisting apparatus (1) according to claim 1, wherein in a released state of the brake unit (30) a rotation of the brake disc (28) and the nut (25) is allowed in order to also allow the gripping jaws (3, 4) to move against each other along the gripping direction (D1).

3. Hoisting apparatus (1) according to claim 1 or 2, wherein the nut (25) of the locking mechanism (18) comprises an outer guiding groove (25a) and at least one bearing (26) is fixedly connected to the inner housing (5), wherein the at least one bearing (26) is

movably received in the outer guiding groove (25a) to rotatably connect the nut (25) to the inner housing (5).

4. Hoisting apparatus (1) according to any one of the preceding claims, wherein the brake unit (30) comprises at least one brake pad (30a, 30b), preferably two brake pads (30a, 30b), wherein the brake disc (28) is at least partially positioned inside a gap (29) of the brake unit (30) in such a way that the at least one brake pad (30a, 30b) can be pressed flat against the brake disc (28) in the activated state of the brake unit (30) in order to prevent a rotation of the brake disc (28).

5. Hoisting apparatus (1) according to any one of the preceding claims, wherein a lever mechanism (9a, 9b) is assigned to each clamping jaw (3, 4) and each lever mechanism (9a, 9b) is coupled to the inner housing (5), e.g., via an equalizer (10).

6. Hoisting apparatus (1) according to claim 5, wherein each lever mechanism (9a, 9b) comprises an angle lever (11) having two lever arms (11a, 11b) merging into each other at a pivot point (14), whereas said angle lever (11) is pivotably connected to the outer housing (2) at said pivot point (14) and the first lever arm (11a) of said angle lever (11) is pivotably connected to the assigned clamping jaw (3, 4) and the second lever arm (11b) of said angle lever (11) is pivotably connected to a straight lever (12) of the same lever mechanism (9a, 9b), wherein the straight lever (12) is in turn pivotably connected to the inner housing (5), e.g., via the equalizer (10).

7. Hoisting apparatus (1) according to claim 6, wherein an additional linking member (6) is assigned to each clamping jaw (3, 4), wherein each linking member (6) is pivotably connected to the outer housing (2) and the assigned clamping jaw (3, 4), and wherein the first lever arm (11a) of said angle lever (11) and the linking member (6) assigned to the same clamping jaw (3, 4) is forming the respective parallelogram linkage (Pa, Pb) allowing the assigned clamping jaw (3, 4) to move into the gripping direction (D1).

8. Hoisting apparatus (1) according to any of the preceding claims, wherein each lever mechanism (9a, 9b) is constructed identical.

Patentansprüche

1. Hebevorrichtung (1) zum Greifen und Anheben einer Last (L), beispielsweise einer Anode, enthaltend,

- ein Außengehäuse (2), welches an jeder Seite bewegliche Klemmbacken (3, 4) aufweist, die jeweils über ein Parallelogrammgestänge (Pa, Pb) so mit dem Außengehäuse (2) verbunden sind, dass sich die Klemmbacken (3, 4) in eine Greifrichtung (D1) bewegen können,
- ein Innengehäuse (5), welches mit jeder der Klemmbacken (3, 4) über einen Hebelmechanismus (9a, 9b) in Wirkverbindung steht, derart, dass eine Bewegung des Innengehäuses (5) gegenüber dem Außengehäuse (2) entlang einer Heberichtung (D2) bewirkt, dass sich die Klemmbacken (3, 4) relativ zueinander entlang der Greifrichtung (D1) bewegen, und
- einen Verriegelungsmechanismus (18), welcher so ausgeführt ist, dass er eine relative Bewegung des Innengehäuses (5) gegenüber dem Au-ßengehäuse (2) zulässt oder verhindert, um zuzulassen oder zu verhindern, dass sich die Klemmbacken (3, 4) entlang der Greifrichtung (D1) gegeneinander bewegen,

dadurch gekennzeichnet, dass

der Verriegelungsmechanismus (18) eine Mutter (25) aufweist, die drehbar mit dem Innengehäuse (5) verbunden und auf eine Spindel (21) aufgeschraubt ist, wobei die Spindel (21) fest mit dem Außengehäuse (2) verbunden ist, derart, dass sich die Mutter (25) auf der Spindel (21) dreht, wenn das Innengehäuse (5) gegenüber dem Außengehäuse (2) entlang der Heberichtung (D2) bewegt wird,
wobei die Mutter (25) weiterhin fest mit einer Bremsscheibe (28) verbunden ist und die Bremsscheibe (28) mit einer an dem Innengehäuse (5) angebrachten Bremseinheit (30) zusammenwirkt, derart, dass in einem aktivierten Zustand der Bremseinheit (30) eine Drehung der Bremsscheibe (28) und der Mutter (25) verhindert wird, so dass auch verhindert wird, dass sich die Klemmbacken (3, 4) gegeneinander entlang der Greifrichtung (D1) bewegen.

2. Hebevorrichtung (1) nach Anspruch 1, wobei in gelösten Zustand der Bremseinheit (30) eine Drehung der Bremsscheibe (28) und der Mutter (25) ermöglicht wird, so dass sich auch die Klemmbacken (3, 4) gegeneinander entlang der Greifrichtung (D1) bewegen können.

3. Hebevorrichtung (1) nach Anspruch 1 oder 2, wobei die Mutter (25) des Verriegelungsmechanismus' (18) eine äußere Führungsnut (25a) aufweist und mindestens ein Lager (26) fest mit dem Innengehäuse (5) verbunden ist, wobei das mindestens eine Lager (26) beweglich in der äu-ßeren Führungsnut (25a) aufgenommen ist, um die Mutter (25) drehbar mit dem Innengehäuse (5) zu verbinden.

4. Hebevorrichtung (1) nach einem der vorstehenden Ansprüche, wobei die Bremseinheit (30) mindestens einen Bremsbelag (30a, 30b), vorzugsweise zwei Bremsbeläge (30a, 30b), aufweist, wobei die Bremsscheibe (28) zumindest teilweise innerhalb eines Zwischenraums (29) der Bremseinheit (30) angeordnet ist, derart, dass der mindestens eine Bremsbelag (30a, 30b) in dem aktivierten Zustand der Bremseinheit (30) flach gegen die Bremsscheibe (28) gedrückt werden kann, um so eine Drehung der Bremsscheibe (28) zu verhindern.

5. Hebevorrichtung (1) nach einem der vorstehenden Ansprüche, wobei jeder der Klemmbacken (3, 4) ein Hebelmechanismus (9a, 9b) zugeordnet ist und jeder Hebelmechanismus (9a, 9b) mit dem Innengehäuse (5) verbunden ist, z.B. über einen Ausgleichsverbinder (10).

6. Hebevorrichtung (1) nach Anspruch 5, wobei jeder Hebelmechanismus (9a, 9b) einen Winkelhebel (11) mit zwei Hebelarmen (11a, 11b) aufweist, die an einem Drehpunkt (14) ineinander übergehen, wobei der Winkelhebel (11) an diesem Drehpunkt (14) drehbar mit dem Außengehäuse (2) verbunden ist und der erste Hebelarm (11a) des Winkelhebels (11) drehbar mit der ihm zugeordneten Klemmbacke (3, 4) verbunden ist und der zweite Hebelarm (11b) des Winkelhebels (11) drehbar mit einem geraden Hebel (12) desselben Hebelmechanismus' (9a, 9b) verbunden ist, wobei der gerade Hebel (12) seinerseits drehbar mit dem Innengehäuse (5) verbunden ist, z.B. über den Ausgleichsverbinder (10).

7. Hebevorrichtung (1) nach Anspruch 6, wobei jeder Klemmbacke (3, 4) ein zusätzliches Verbindungsglied (6) zugeordnet ist, wobei jedes Verbindungsglied (6) drehbar mit dem Außengehäuse (2) und der zugeordneten Klemmbacke (3, 4) verbunden ist, und wobei der erste Hebelarm (11a) des Winkelhebels (11) und das derselben Klemmbacke (3, 4) zugeordnete Verbindungsglied (6) das jeweilige Parallelogrammgestänge (Pa, Pb) bilden, welches es der zugeordneten Klemmbacke (3, 4) erlaubt, sich in der Greifrichtung (D1) zu bewegen.

8. Hebevorrichtung (1) nach einem der vorstehenden Ansprüche, wobei alle Hebelmechanismen (9a, 9b) identisch ausgebildet sind.

Revendications

1. Appareil de levage (1) destiné à saisir et soulever une charge (L), par exemple, une anode, comprenant,

   - une enceinte externe (2) qui contient des mâchoires de serrage mobiles (3, 4) de chaque côté, chacune des mâchoires de serrage étant connectée à l'enceinte externe (2) par une liaison en parallélogramme (Pa, Pb) pour permettre auxdites mâchoires de serrage (3, 4) de se déplacer dans un sens de saisie (D1),
   - une enceinte interne (5) fonctionnellement reliée à chaque mâchoire de serrage (3, 4) par un mécanisme de levage (9a, 9b) de telle sorte qu'un déplacement de l'enceinte interne (5) contre l'enceinte externe (2) le long d'un sens de levage (D2) amène les mâchoires de serrage (3, 4) à se déplacer l'une vers l'autre le long du sens de serrage (D1), et
   - un mécanisme de verrouillage (18) configuré pour permettre ou empêcher un déplacement relatif de l'enceinte interne (5) contre l'enceinte externe (2) de sorte à permettre ou empêcher un déplacement des mâchoires de serrage (3, 4) l'une envers l'autre le long du sens de saisie (D1),

   caractérisé en ce que

   le mécanisme de verrouillage (18) comprend un écrou (25) relié de manière rotative à l'enceinte interne (5) et vissé sur une tige (21), la tige (21) étant reliée de manière fixe à l'enceinte externe (2) de telle sorte que l'écrou (25) tourne sur la tige (21) lorsque l'enceinte interne (5) est déplacée contre l'enceinte externe (2) le long du sens de levage (D2),
   l'écrou (25) étant en plus relié de manière fixe à un disque de frein (28) et le disque de frein (28) interagit avec une unité de freinage (30) fixée à l'enceinte interne (5) de telle sorte que dans un état activé de l'unité de freinage (30) une rotation du disque de frein (28) et de l'écrou (25) est empêchée tout en empêchant également les mâchoires de serrage (3, 4) de se déplacer l'une contre l'autre le long du sens de saisie (D1).

2. Appareil de levage (1) suivant la revendication 1, dans lequel, dans un état libéré de l'unité de freinage (30), une rotation du disque de frein (28) et de l'écrou est possible de sorte à permettre aux mâchoires de serrage (3, 4) à se déplacer l'une vers l'autre le long du sens de saisie (D1).

3. Appareil de levage (1) suivant la revendication 1 ou 2, dans lequel l'écrou (25) du mécanisme de verrouillage (18) comprend une rainure de guidage externe (25a) et au moins un palier (26) est relié de manière fixe à l'enceinte interne (5), l'au moins un palier (26) étant reçu de manière mobile dans la rainure de guidage externe (25a) pour relier l'écrou de manière rotative à l'enceinte interne (5).

4. Appareil de levage (1) suivant une des revendications précédentes, dans lequel l'unité de freinage (30) comprend au moins un patin de frein (30a, 30b), de préférence deux patins de frein (30a, 30b), le disc de frein (28) étant au moins partiellement positionné à l'intérieur d'un espace (29) de l'unité de freinage (30) de telle sorte que l'au moins un patin de frein (30a, 30b) peut être aplati contre le disque de frein (28) en état activé de l'unité de freinage (30) de manière à empêcher une rotation du disque de freinage (28).

5. Appareil de levage (1) suivant une ou plusieurs des revendications précédentes, dans lequel un mécanisme de levage (9a, 9b) est affecté à chaque mâchoire de serrage (5), par exemple, via un égalisateur (10).

6. Appareil de levage (1) suivant la revendication 5, dans lequel chaque mécanisme de levage (9a, 9b) comprend un levier coudé (11) ayant deux bras de levage (11a, 11b) qui se confondent à un point pivot (14), tandis que ledit levier coudé (11) est relié de manière rotative à l'enceinte externe (2) audit point pivot (14) et le premier bras de levage (11a) dudit levier coudé (11) est relié de manière rotative à la mâchoire de serrage affectée (3, 4) et le deuxième bras de levier (11b) dudit levier coudé (11) est relié de manière rotative à un levier droit (12) du même mécanisme de levage (9a, 9b), le levier droit (12) étant lui-même relié de manière rotative à l'enceinte interne (5), par exemple, via l'égalisateur (10).

7. Appareil de levage suivant la revendication 6, dans lequel un élément de liaison supplémentaire (6) est affecté à chaque mâchoire de serrage (3, 4), chaque élément de liaison (6) étant relié de manière rotative à l'enceinte externe (2) et à la mâchoire de serrage affectée (3, 4) et le premier bras de levage (11a) dudit levier coudé (11) et l'élément de liaison (6) affecté à la même mâchoire de serrage (3, 4) forment la liaison en parallélogramme (Pa, Pb) permettant à la mâchoire de serrage affectée (3, 4) de se déplacer dans le sens de saisie (D1).

8. Appareil de levage (1) suivant une des revendications précédentes, dans lequel chaque mécanisme de levage (9a, 9b) est construit de façon identique.

Fig. 1

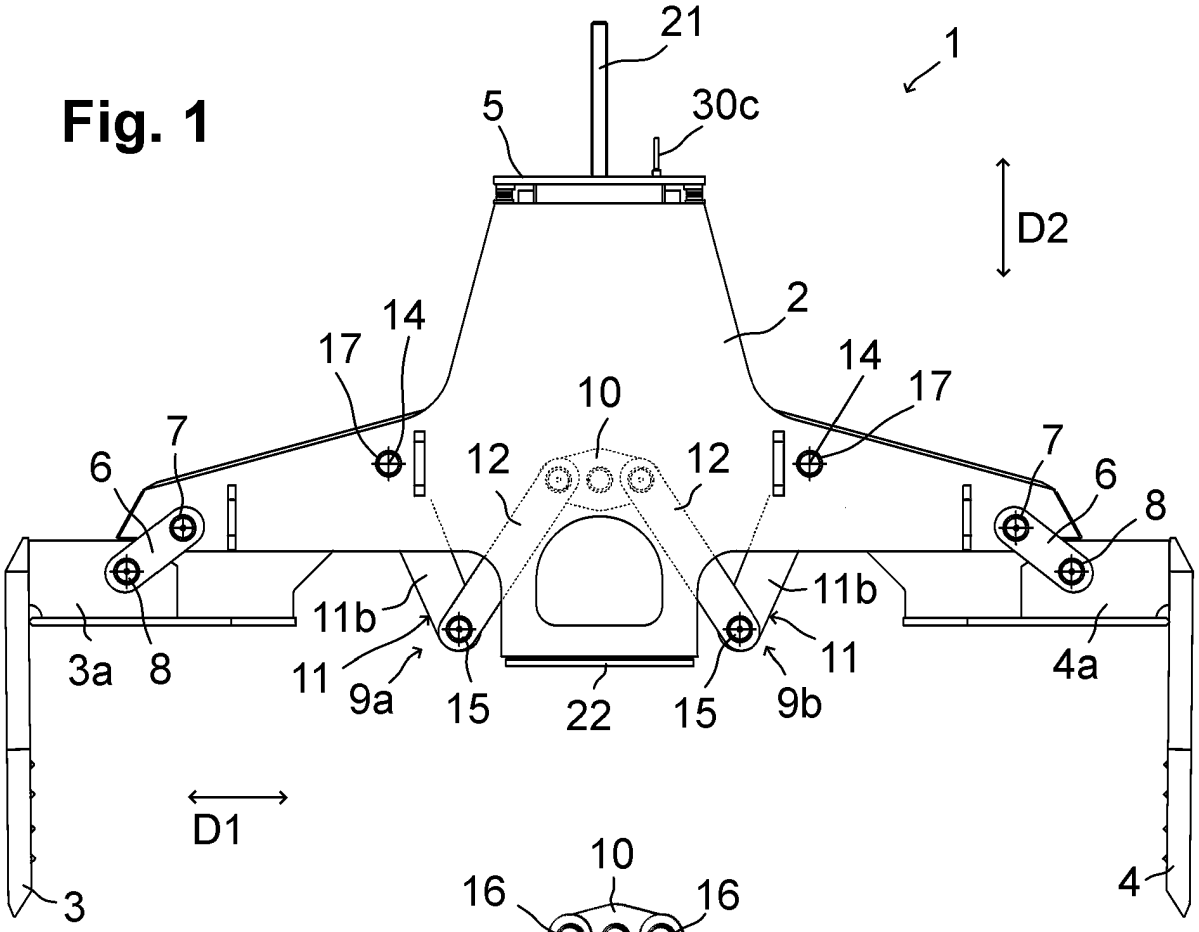
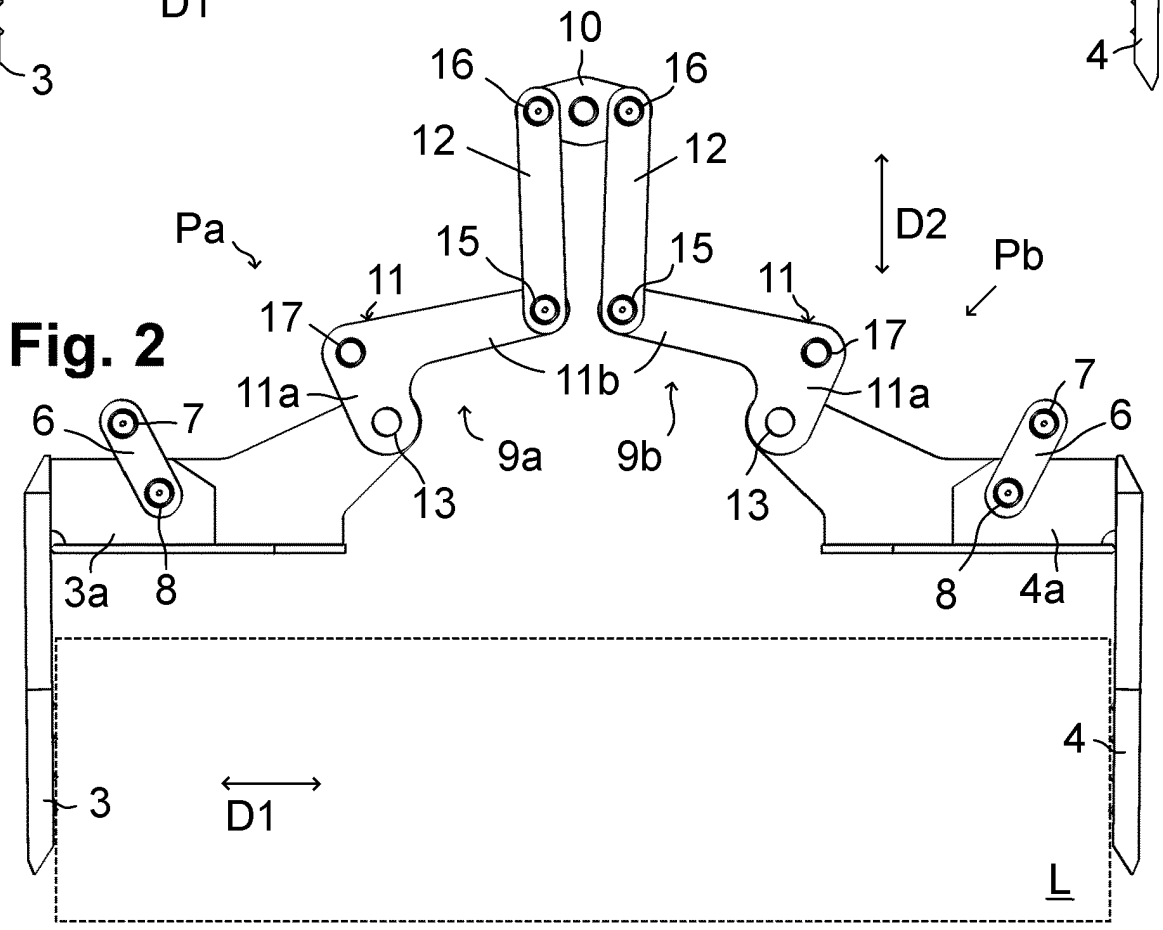

21
1
5
30c
D2
2
14
17
14
17
10
12
12
7
6
6
7
8
11b
11b
11
11
9a
9b
15
15
22
3a
8
4a
D1
3
4

Fig. 2


10
16
16
12
12
D2
Pa
Pb
15
15
11
11
17
17
11a
11b
11a
7
6
6
7
9a
9b
13
13
8
3a
8
4a
4
3
D1
L

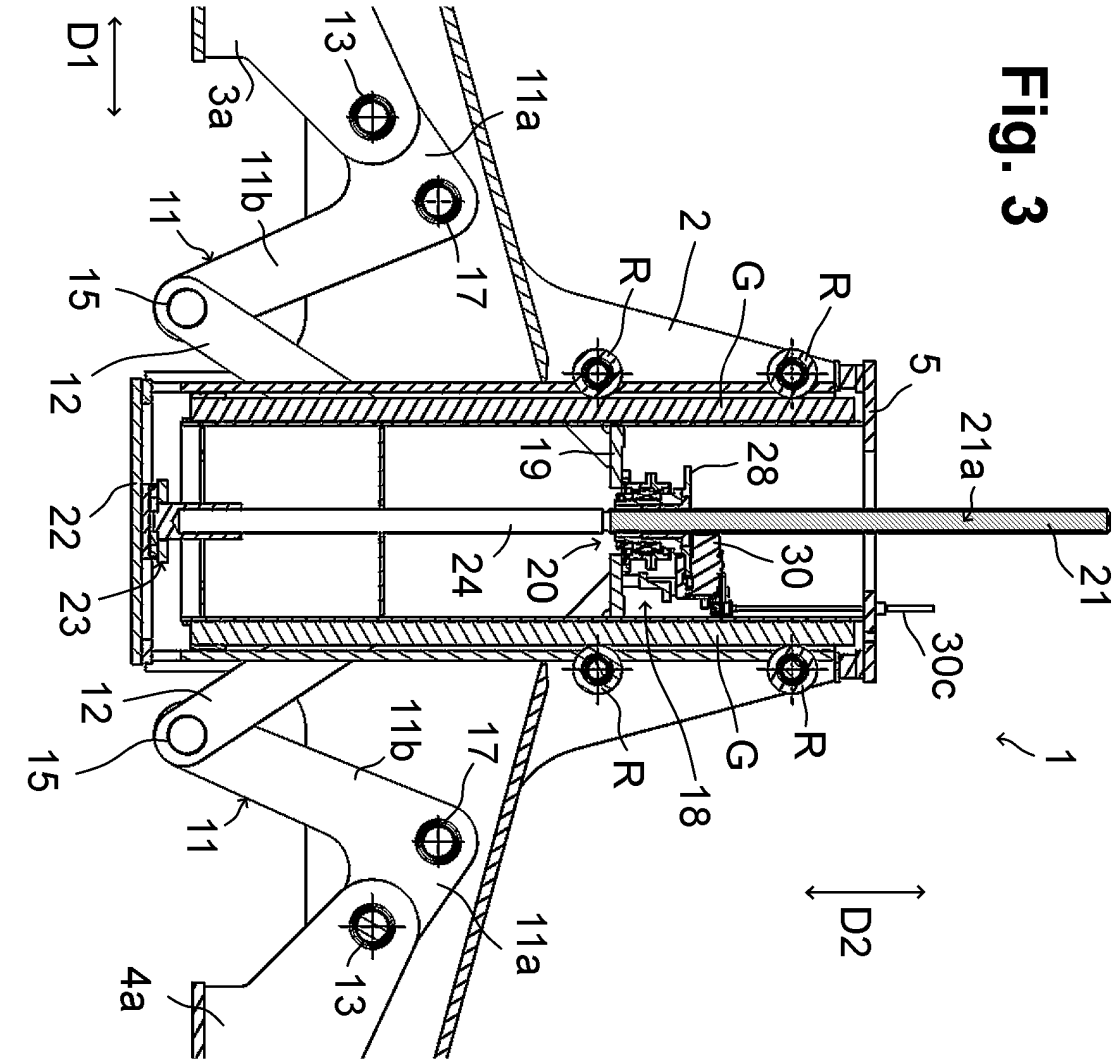
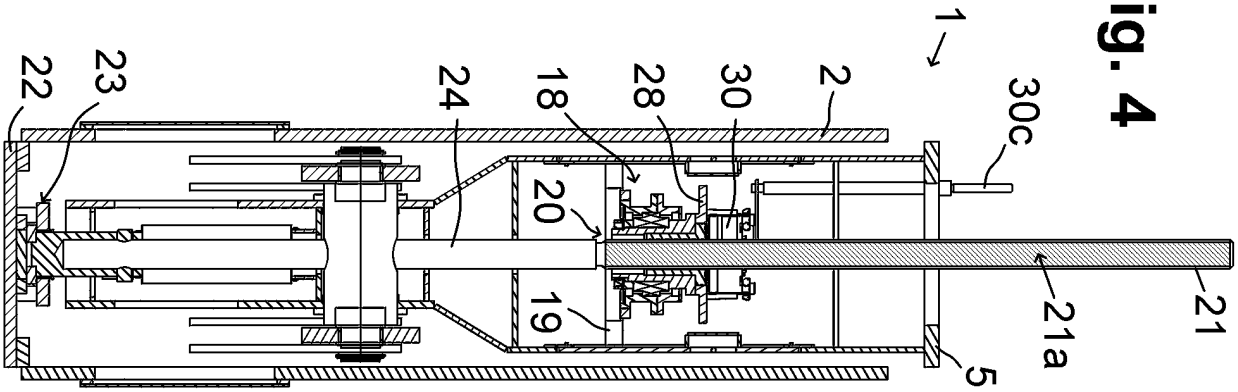

D1
13
3a
11b
11
15
12
22
23
12
15
11
4a
13
11a
17
2
R
G
R
5
19
28
21a
24
20
30
21
30c
1
18
G
R
R
11b
17
11a
D2

Fig. 3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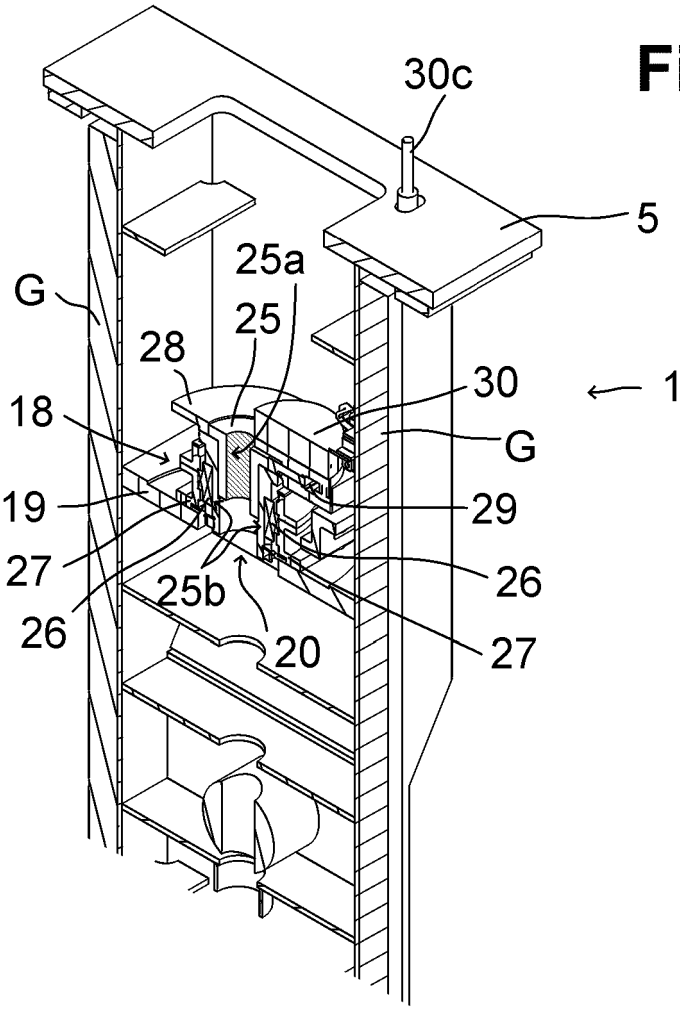
23
24
18
28
30
2
30c
20
19
21a
21
5

Fig. 4

Fig. 5


30c
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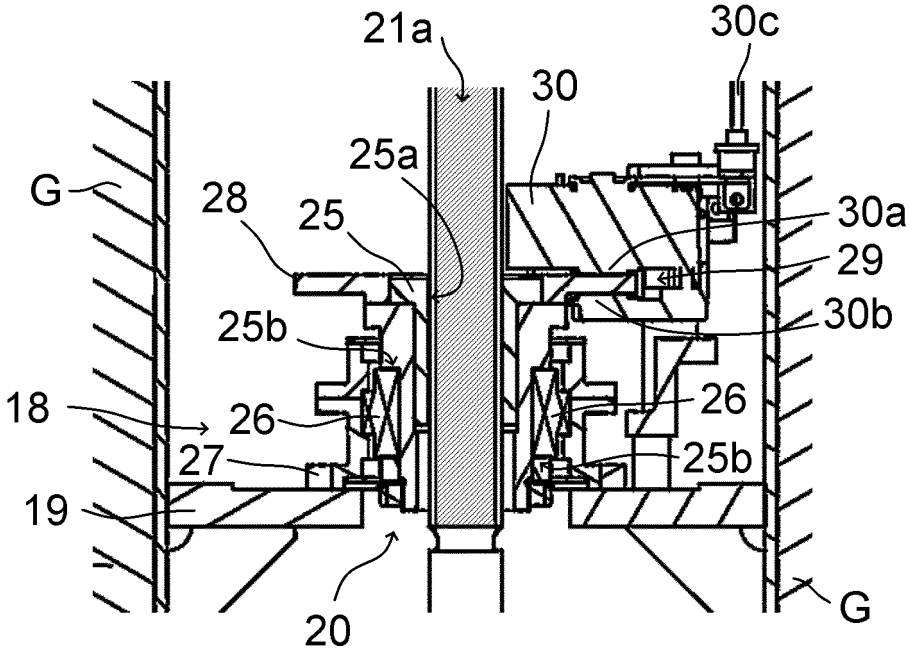
25a
G
25
28
30
1
18
G
19
29
27
26
25b
26
20
27

Fig. 6


21a
30c
30
25a
G
28
25
30a
29
30b
25b
18
26
26
27
25b
19
20
G

REFERENCES CITED IN THE DESCRIPTION

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