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(54) APPARATUS FOR FACILITATED LIFTING OF WEIGHTS, IN PARTICULAR OF PIT COVERS

(57) An apparatus (1) for facilitated lifting of weights comprises a supporting structure (2) which comprises at least one horizontal bracket (4) supporting one of said weights (3) and having opposite ends (4a, 4b); an upright (5), fixed to the bracket (4) at a related constrained end (4b); fixed supports (6), relative to which the upright (5) is movable guided at least in both directions along a vertical line (7); and balancing means (8) associated with the upright (5) and reacting against the weight (3) applied to said at least one bracket (4). The balancing means (8) comprise at least one fixed anchor (11); at least one fixed pulley (13b); and a stretch (14) of cable with a first end (14a) hooked to the anchor (11), the cable being wound around at least around one said fixed pulley (13b) and bearing a counterweight (16) at a second end (14b), said stretch (14) of cable and said counterweight (16) applying on the upright (5) a thrust in the opposite direction to the weight (3) supported by at least one said bracket (4).

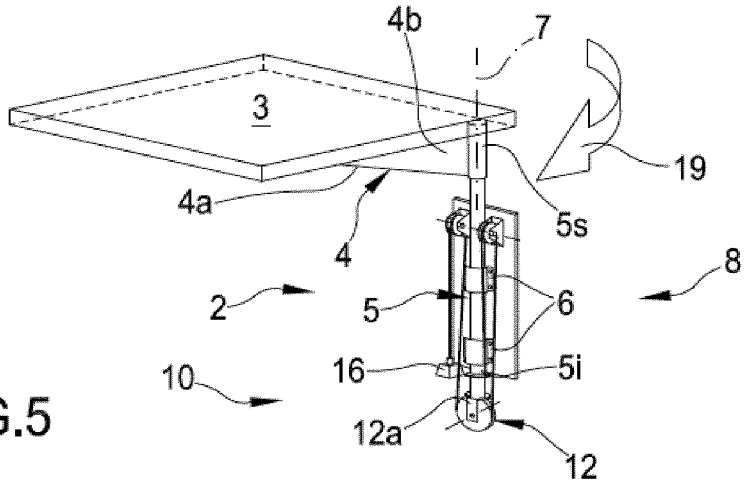

FIG.5

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Description

[0001] The handling of covers of pits or manholes, for example pits in the ground, intended for access operations, relating to the inspection of recording or measuring units, and/or the operation of operating units housed inside them, if performed using only the physical strength of an operator, involves in general operations that are not very ergonomic, that are tiring and often carry the risk of accidents or injuries.

[0002] In fact, said covers, often have heavy concrete or metal structures, in particular because they have to be stiff enough and have a suitable load-bearing capacity to withstand any pedestrian and vehicular traffic that may pass over them.

[0003] In such situations, recurring for example, in some types of pits that house service apparatuses and equipment for swimming pools, that require frequent and regular opening for inspection, control, maintenance and hygiene, in addition to the above-mentioned disadvantages there is the further disadvantage of an even heavier weight compared with similar covers, due to the larger dimensions of the pit necessary to allow easier access for reaching the equipment contained in it. In that case, added to the inconvenience to operators of the intrinsic weight of the cover is the further inconvenience caused by many and frequent repeated opening and closing operations to be performed on said pits while the pool is in operation.

[0004] A further disadvantage is the fact that in order to avoid obstructing vehicle transit or tripping people up, said covers are designed - as is known - very frequently to lie flush with the top of the pit and form a continuous surface with the surrounding treadable surface. That means that a further difficulty when handling such covers arises due to the absence of useful grip points, which can only be overcome by having available additional suitable lifting tools. If pit covers are only occasionally lifted, such tools are not always immediately available. And if they are regularly lifted, when such tools are used, they have to be regularly moved backwards and forwards between the storage location and the site where they are used.

[0005] The prior art includes document WO2015/052740 which describes an apparatus for handling pit or manhole covers that allows an operator to open and close a pit by translation, respectively forward and backward, using an auxiliary system for amplifying his or her own muscular strength. In a first embodiment the amplification system is a gear reduction unit associated with the supporting structure of the cover. In a second embodiment the amplification system consists of fluid-driven means operating like a hydraulic cylinder.

[0006] Another prior art document is DE 19514636. This document describes a manhole cover lifting apparatus with a sprung mechanical action. Depending on the elastic properties of the spring, when opening the pit, the cover is lifted a predetermined and invariable maximum height above the top of the pit. Therefore, the purpose of this invention is to propose a technical solution that solves and overcomes the above-mentioned problems and disadvantages.

[0007] As part of that technical purpose, a first aim of the invention is to allow easy handling of the covers without physical effort by the operator.

[0008] A second aim is to allow very safe, accident-free handling of the covers regardless of how often access has to be gained to the pit.

[0009] A further aim is to allow handling of the covers just with the hands of the operator, without requiring any additional tool or equipment for opening or closing the pit.

[0010] Accordingly, the invention achieves those results by means of an apparatus for facilitated lifting of weights as described in any of the appended claims. Further aims and advantages of this invention will become apparent in the detailed description that follows of an example embodiment of the invention illustrated in the accompanying figures, in which:

- Figure 1 is a perspective assembly view of the invention;
- Figure 2 is an exploded perspective view of the invention of Figure 1, with some parts cut away to better illustrate others;
- Figures 3 and 4 are front views of the invention shown in a first configuration of vertical movement respectively lifted to open and lowered to close the pit;
- Figures 5 and 6 are respectively a perspective assembly view and a view of the invention in a second configuration, to the side of that figure, reached following a movement in the horizontal plane;
- Figure 7 is an enlarged view of a detail of Figure 5;
- Figure 8 is a perspective assembly view of a detail of the invention;
- Figures 9, 10 and 11 are schematic views of a sequence describing operation of the detail shown in Figure 8.

[0011] With reference to the accompanying drawings, the numeral 1 denotes an apparatus for facilitated lifting of weights 3, which in particular are associated with a cover of a pit 21, intended to be regularly accessible, for example for inspection, control, operation or maintenance of generic service units housed in it.

[0012] Figure 1 shows how the apparatus 1 essentially comprises a supporting structure 2 for supporting the weight 3, with which balancing means, labelled 8 as a whole, are operatively associated. The balancing means react against the action of the weight 3 weighing down on the apparatus 1.

[0013] The supporting structure 2 comprises in particular a pair of cantilever horizontal beams, that is to say, a pair of brackets 4 (Figures 3 to 6) with variable height, which are equipped with a first, free end labelled 4a and a constrained end labelled 4b. The two brackets 4 are

connected to each other at 90 degrees from one another in the horizontal plane (Figures 1 and 2) and at their second ends 4b which are welded and converge at a shared vertical edge, labelled 18.

[0014] The brackets 4 are supported projecting horizontally and at the edge 18 by an upright 5, preferably having a circular, cylindrical tubular shape (Figure 2).

[0015] Two fixed supports, labelled 6, support the upright 5, holding it vertical, at intermediate positions between its opposite ends 5s and 5i, leaving the upright 5 itself free to translate in both directions along said vertical line 7 (Figures 3 and 4 observed in comparison).

[0016] As a result of a rotating and translating coupling between them and the upright 5, the supports 6 also leave the upright 5 the further freedom to freely rotate in both directions of a rotation indicated (Figure 5) with the arrow 19 about the line 7 of vertical translation of the upright 5.

[0017] Due to the position of the fixed supports 6, between the ends 5s and 5i of the upright 5, which is vertically movable, the support 6 closest to the brackets 4 acts for the latter as a mechanical end of stroke stop of the free vertical translation downwards of the weight 3 supported. In contrast, the furthest support 6 acts as an end of stroke stop of the vertical translation upwards of the upright 5 and of the brackets 4 connected to it.

[0018] Therefore, it is clear that the distance between the fixed supports 6 may be predetermined depending on the intended application of the apparatus 1. In the case of covers for pits 21, such a stroke will be just greater than the thickness of the cover, that is to say, enough to disengage the cover from the top end of the pit 21.

[0019] In contrast, the rotation of the upright 8 about the vertical line 7 in general may adopt angular travels of any amplitude, if necessary even up to 360 degrees. However, as will become more apparent below, when the weight 3 is associated with a quadrilateral cover such as that shown by way of example in the figures, and when the connection between the weight 3 and the upright 5 is made at an edge 18 that is displaced in an eccentric position relative to the geometric barycentre of the weight 3, or close to the periphery of the cover, a rotation of 90 degrees or at most of 180 degrees is sufficient for most practical needs.

[0020] As shown in particular in Figure 7, it should be noticed that the balancing means 8 comprise a mechanical amplification system 10 operatively associated with the upright 5 at its lower end 5i, where the upright 5 supports, in particular, an idle pulley 12, freely rotatable about its own horizontal axis of rotation 12a.

[0021] In addition to the pulley 12 supported by the bottom of the upright, the mechanical amplification system 10 also comprises a fixed anchor, labelled 11; two fixed pulleys 13a and 13b; as well as a stretch 14 of cable, which: has its first end 14a hooked to the anchor 11; is wound first around one 13a of the fixed pulleys, then around the movable pulley 12 and finally around the other fixed pulley 13b, along that path forming its own loops whose concavities face in opposite directions, and finally bearing a counterweight 16 at its second end 14b.

[0022] Thanks to known general mechanical principles, by means of the mechanical amplification system 10, a counterweight 16 having modest weight allows the weight 3 supported by the brackets 4 to be kept balanced according to the vertical line 7 even when the weight is considerable.

[0023] Therefore, by applying a very limited force, symbolically indicated with the arrow 20, to the weight 3, that is to say, to the cover with which it is associated in the application example illustrated in the drawings, the user of the apparatus 1 is able to easily lift and lower the weight 3 every time this is necessary and without any significant physical effort.

[0024] If, at the lower end 5i of the upright 5, the connection between the movable pulley 12 and the upright 5 is - for example - of the type floating about the vertical line 7, the operator is able to freely rotate the brackets 4, that is to say, the weight 3 supported by them, without any significant effort even in the horizontal plane. This makes is quite easy to move the weight 3, that is to say, the cover of the pit 21, away from the vertical line of the pit 21, for example to allow completely unobstructed access to the pit (positioning in Figures 5 and 6).

[0025] Advantageously, the apparatus 1 described above may be applied to a load-bearing structure, generically labelled 17, which may be autonomous or may be for example associated with a masonry structure, if necessary even existing at the place of use. However, if said load-bearing structure 17 is produced, in a self-supporting and/or even a self-propelled form, the apparatus 1 acquires its own autonomy and versatility that allows it to be applied even as an autonomous lifting apparatus, usable in very general and varied cases.

[0026] It should be noticed that the embodiment of the amplification system 10, as well as being effective, safe and stable, advantageously allows a single operator to be able to perform in a fully autonomous, easy, fast and economical way any action required relative to a pit 21.

[0027] Figures 8 to 11 show a construction detail of an alternative embodiment particularly advantageous in terms of efficient use and increased intrinsic safety of the apparatus 1.

[0028] In fact, Figure 8 shows how at its upper end 5s, the upright 5 may operate in combination with a fixed support, labelled 25 as a whole, equipped with a slot 26 consisting of a notch having a composite shape, that is to say, composed of two component parts 26c and 26r, a first 26c of which preferably has a cylindrical circular outline, the second part 26r in contrast preferably having a prismatic rectangular outline.

[0029] At its upper end 5s, the upright 5 bears a coaxial sleeve 27, preferably cylindrical, from which a projection 28 extends radially, projecting horizontally and having a substantially prismatic shape with a rectangular-outline cross-section that is shaped to match the part 26r, with an equally rectangular outline, of the slot 26.

[0030] The upright 5 is stably engaged through the slot

26, in a freely rotatable coupled condition, with the circular part 26c of the slot 26 that is shaped to match the cross-section of the upright 5.

[0031] Thanks to the shape of the resulting coupling between the upright 5, the slot 26, the projection 28 and the sleeve 27, cylindrical turning and prismatic translating coupling conditions are established between the upright 5 and the support 25. The first of these conditions corresponds to a freedom of rotation about the vertical line 7; the second condition corresponds to a freedom of longitudinal translation along the vertical line 7.

[0032] These two movement possibilities allow the upright 5, that is to say, the weight 3 connected to it, to translate vertically guided by the rectangular part 26r of the slot 26 as shown in Figures 9 and 10, and then to rotate about the vertical line 7 when a user manually rotates the projection 28 (Figure 11) after the projection 28 has been taken out of the rectangular part 26r of the slot 26. The geometric structure described above basically provides two advantages.

[0033] The first is that the weight 3, that is to say, the cover (in particular having a rectangular shape), retains an orientation consistent with perfect and constant vertical alignment with the top of the pit 21. Subsequent rotation of the projection 28 (compare Figures 10 and 11) moves the projection 28 out of alignment with the rectangular part 26r of the slot 26 and into a condition that inhibits their mutual vertical translation, resulting in absolute safety in preventing any accidental descent of the weight 3 towards the top of the pit 21. With precisely inverse movements, carried out in the sequence of Figures 11, 10 and 9, the weight 3 can be lowered to the top of the pit 21 with its orientation absolutely identical to that of lifting. That means that, when closing the pit 21, the user avoids trial and error attempts to find the correct alignment of the cover with the top of the pit 21. This adds to the safety and convenience of use of the apparatus 1 the further advantage of speeding up all operations as much as possible, thereby eliminating wasted time between one operation and another.

[0034] In conclusion, the invention fulfils the aims and demonstrates intrinsic effectiveness and safety in terms of accident-prevention, even thanks to a wide variety of uses and the possibility of building it inexpensively.

[0035] The invention described above is susceptible of evident industrial application. It may also be modified and adapted in several ways without thereby departing from the scope of the following claims.

Claims

1. An apparatus for facilitated lifting of weights comprising a supporting structure (2) comprising at least one horizontal bracket (4) supporting one of said weights (3) and having opposite ends (4a, 4b); an upright (5), fixed to the bracket (4) at a related constrained end (4b); fixed supports (6), relative to which the upright (5) is movable guided at least in both directions along a vertical line (7); and balancing means (8) associated with the upright (5) and reacting against the weight (3) applied to said at least one bracket (4); the apparatus (1) being **characterised in that** said balancing means (8) comprise at least one fixed anchor (11); at least one fixed pulley (13b); and a stretch (14) of cable with a first end (14a) hooked to the anchor (11), the cable being wound around at least one said fixed pulley (13b), and bearing a counterweight (16) at a second end (14b), said stretch (14) of cable and said counterweight (16) applying on the upright (5) a thrust in the opposite direction to the weight (3) supported by at least one said bracket (4).

2. The apparatus according to claim 1, **characterised in that** said balancing means (8) comprise a force mechanical amplification system (10) operating in reaction to the, weight (3) supported by said one or each bracket (4).

3. The apparatus according to claim 2, **characterised in that** said force mechanical amplification system (10) comprises a said fixed anchor (11) and at least one said fixed pulley (13b); a movable pulley (12) able to translate together with the upright (5); and a said stretch (14) of cable with a said first end (14a) hooked to the anchor (11), the cable being wound around the movable pulley (12) and at least around said fixed pulley (13b) and bearing a said counterweight (16) at a second end (14b), said stretch (14) of cable and said counterweight (16) applying on the upright (5) a thrust in the opposite direction to the weight (3) supported by the bracket (4).

4. The apparatus according to claim 1 or 2 or 3, **characterised in that** the supporting structure (2) comprises two of said brackets (4) interconnected in a horizontal plane and together supporting said weight (3).

5. The apparatus according to one of the preceding claims, **characterised in that** said upright (5) has a tubular shape.

6. The apparatus according to claim 1, **characterised in that** said upright (5) is movable on said supports (6) guided in rotation about said vertical line (7).

7. The apparatus according to claim 1, **characterised in that** said upright (5) has a circular cylindrical shape.

8. The apparatus according to any of the preceding claims, **characterised in that** it comprises a load-bearing structure (17) to which at least said supports (6) and at least said fixed pulley (13b) are connected.

9. The apparatus according to any of the preceding claims, **characterised in that** said at least one bracket (4) is rotatable about said vertical line (7).

10. The apparatus according to claim 4, **characterised in that** said two brackets (4) converge at an edge (18) displaced in an eccentric position relative to the weight (3).

11. The apparatus according to any of the preceding claims, **characterised in that** said weight (3) is associated with a cover of a pit (21).

12. The apparatus according to any of the preceding claims, **characterised in that** said upright (5) is equipped with a projection (28) projecting cantilever-style transversally to the vertical line (7) and **in that** it comprises a fixed support (25) equipped with a slot (26) shaped with at least one part (26r) complementing a cross-section of said projection (28), said projection (28) being designed to translate guided in the part (26r) of the slot (26), vertically, with identical orientation of the weight (3) relative to the pit (21) about the vertical line (7), and being designed to rotate about the vertical line (7) for interacting with the support (25) in such a way as to prevent the accidental descent of said weight (3) towards the pit (21) for which it is intended.

13. The apparatus according to claim 12, **characterised in that** said slot (26) comprises a component part (26c) having a circular shape which complements the shape of said upright (5).

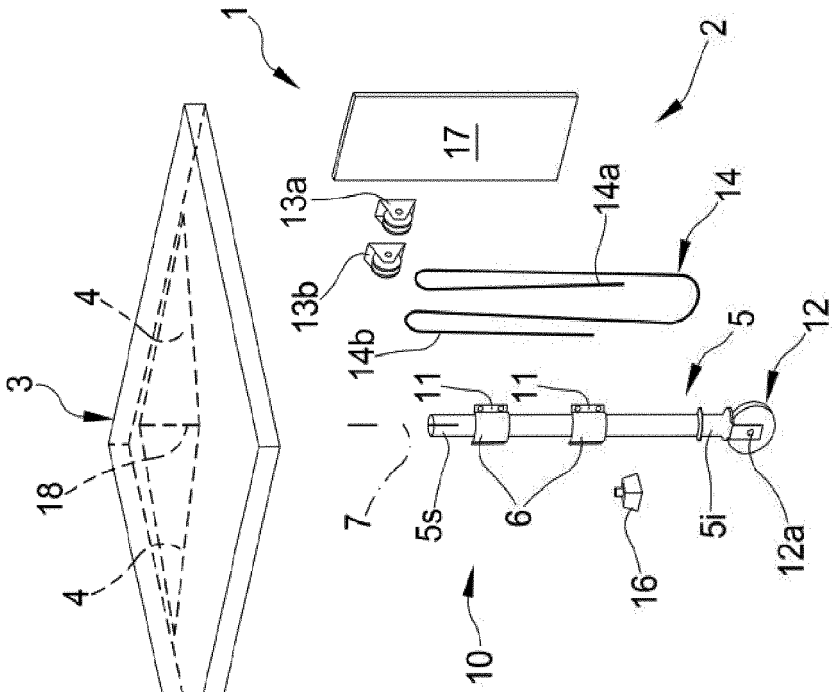

1
2
17
13a
13b
14a
14
14b
4
3
18
4
11
11
5
12
7
5s
6
5i
12a
16
10

FIG.2

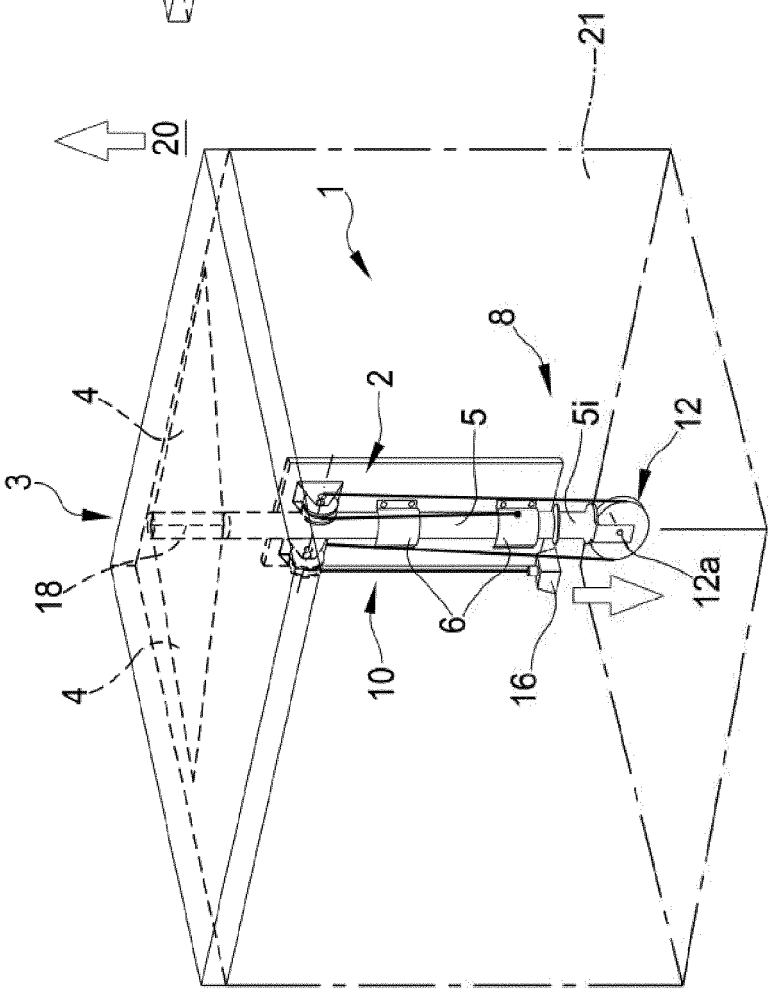

21
20
1
8
2
4
5
5i
12
3
18
12a
6
10
16
4

FIG.1

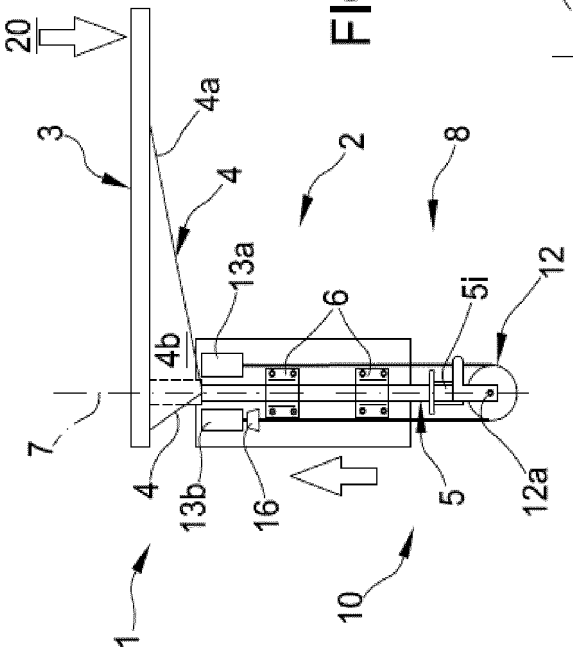


FIG.4

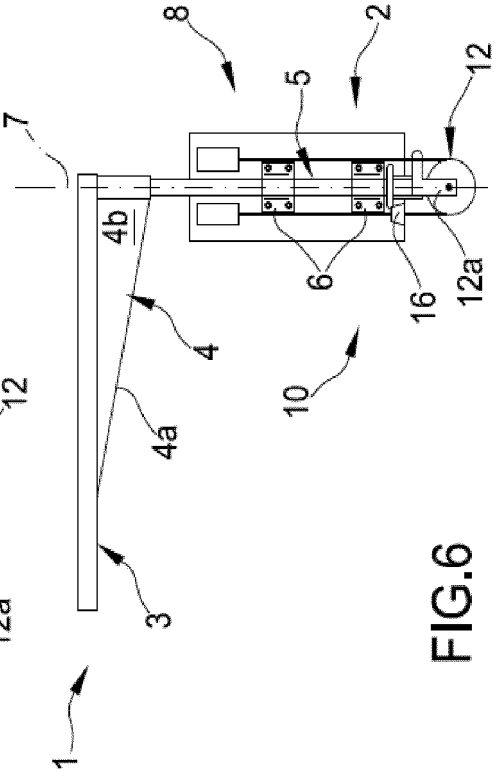


FIG.6

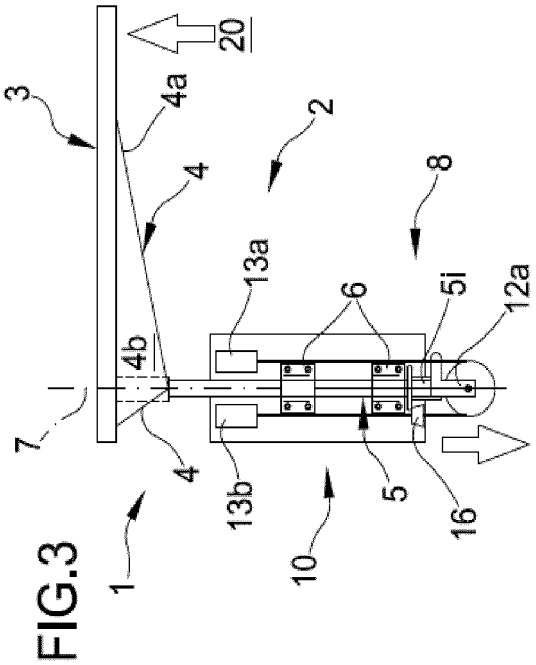


FIG.3

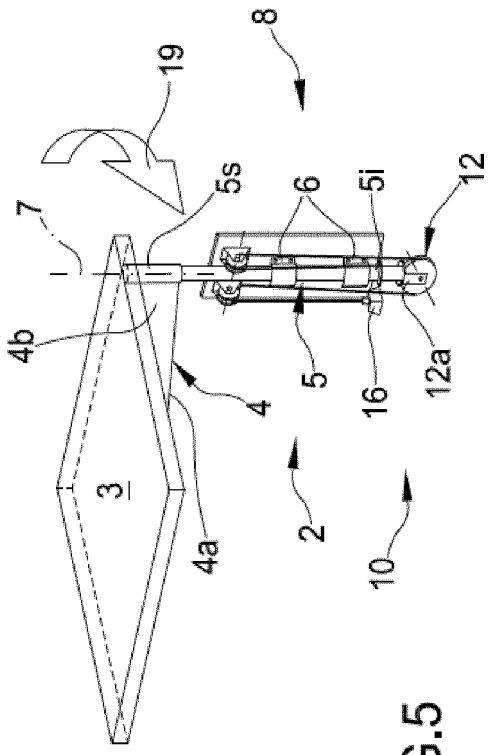
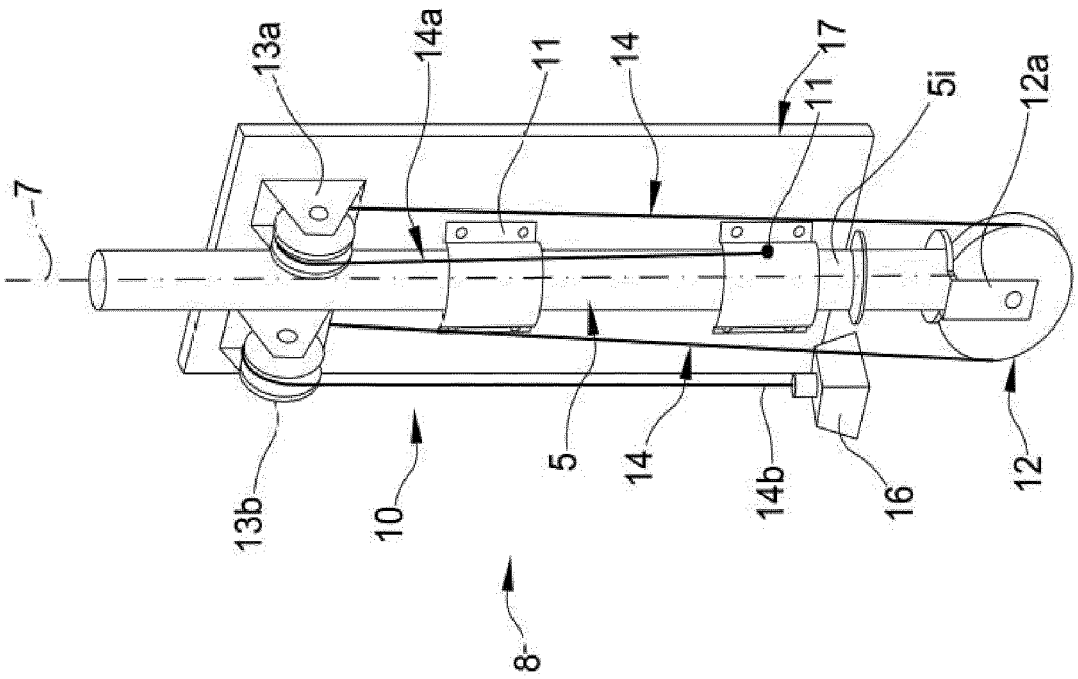


FIG.5

FIG.7



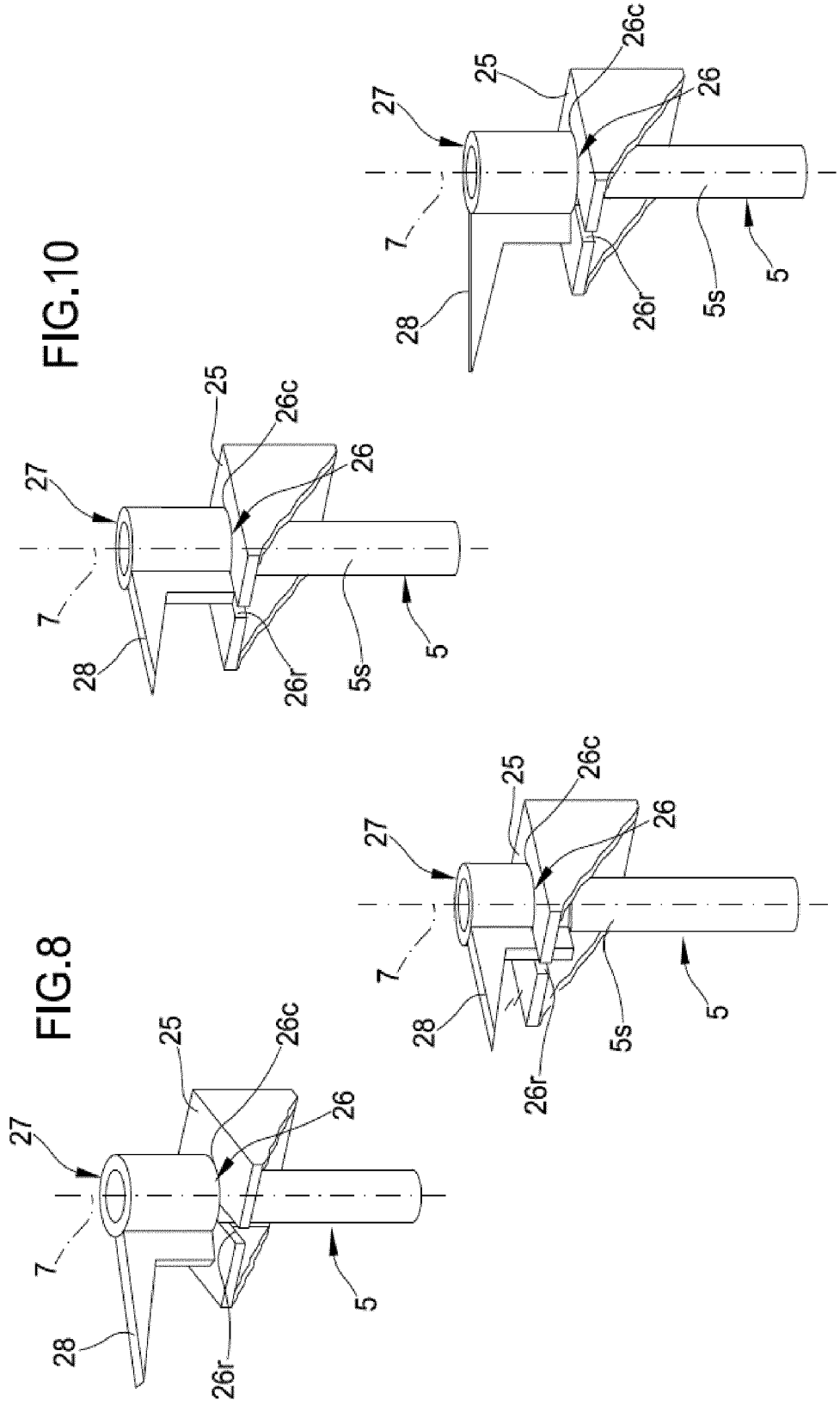


FIG.8

FIG.9

FIG.10

FIG.11

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EUROPEAN SEARCH REPORT

Application Number
EP 17 02 0271

DOCUMENTS CONSIDERED TO BE RELEVANT

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			TECHNICAL FIELDS SEARCHED (IPC) E02D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	22 November 2017	Özsoy, Sevda

CATEGORY OF CITED DOCUMENTS

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22-11-2017

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- DE 19514636 **[0006]**