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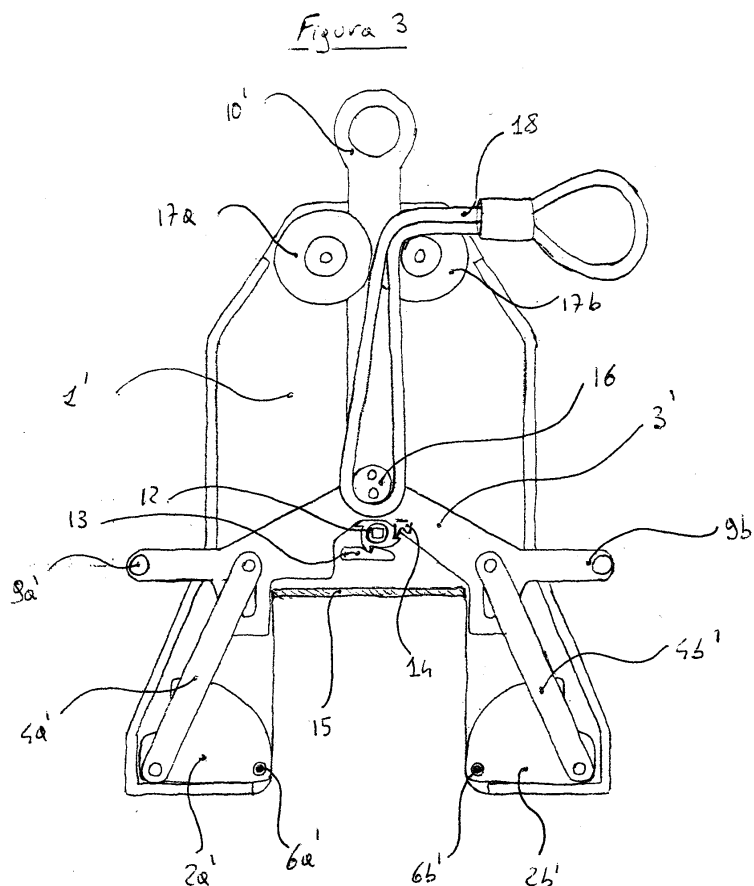
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(54) **Self-locking heavy load lifting device**

(57) An auto-locking device for lifting heavy substantially slab-shaped loads (5), comprises a support casing (1) and at least two opposed jaws (2a,2b) to grip the slab-shaped load (5). Each of the two jaws (2a,2b), in particular, rotates on a pivot (6a,6b) integral with the

support casing (1) and is linked by a tie-rod (4a,4b) to a frame (3) which moves axially with respect to the support casing (1). Each tie-rod (4a,4b), during the movement of the frame (3), causes the corresponding jaw (2a, 2b) to rotate on the said pivot (6a,6b) integral with the support casing (1).



Description

[0001] The present invention relates to an auto-locking device for lifting substantially slab-shaped heavy loads, of the type in which two opposed jaws, articulated on a support casing, close on the load to be lifted.

[0002] Claw pincer type grabs in which articulated levers adjust the opening of the jaws which grip the load are used to grasp and transport heavy loads, particularly in the building trade. In many of these grabs there are mechanical means that continually apply a gripping force via the levers proportional in strength to the load, and further mechanical means that subsequently raise the gripped load.

[0003] To avoid the continuous application of force to the arms of the gripping levers, auto-locking devices have been conceived which, due to the geometry of the levers and to the employment of devices to modify the reciprocal position of the latter, allow the weight of the load being lifted to be used to hold the same load, without the need to employ the aforesaid mechanical means to continually apply a gripping force on the levers.

[0004] For instance, a similar device endowed with an articulated system in which the constituent elements of the same articulated system are disposed in such a way during the tightening on the heavy load as to prevent the disengagement of the jaws from the load during the lifting, is described in Italian Patent No. 1291745 in the name of the same applicant.

[0005] However, while being auto-locking, such devices require the application of a not inconsiderable force on the extremities of the articulated system during the activity of tightening on the load and the employment of a regulation device for tightening the same jaws to vary the grip of the jaws on the load. Furthermore, whenever the load is subject to bumps or vibrations during the lift, the articulated system could lose the auto-locking conformation and release the load being lifted, making it necessary to repeat the gripping and lifting operations.

[0006] One objective of the present invention is to resolve the aforementioned drawbacks and propose an auto-locking device for lifting heavy substantially slab-shaped loads that does not require the use of considerable gripping force and that prevents accidental release of the lifted load.

[0007] A further objective of the present invention is to propose an auto-locking device for lifting heavy loads that is particularly simple to produce and fast to use.

[0008] Another objective of the invention is to propose a device for lifting heavy loads that allows the load transported to be tilted without losing the grip on the same load.

[0009] These and other objectives are achieved by the auto-locking device for lifting heavy substantially slab-shaped loads according to the first independent claim and the following dependent claims.

[0010] The auto-locking device for lifting heavy sub-

stantially slab-shaped loads according to the present invention comprises a support casing and at least two opposed jaws to grip the slab-shaped load. In particular, each of the two jaws rotates on a pivot integral with the casing and is connected by means of a tie-rod to a frame which moves axially with respect to the casing. During the sliding movement of the frame, each tie-rod causes its corresponding jaw on the aforesaid pivot integral with the casing to rotate.

[0011] According to a particular embodiment of the present invention, each of the tie-rods consists of a connecting rod linked in rotation in correspondence to one of its extremities to the moving frame and, in correspondence to the other extremity, to the corresponding revolving jaw. Each jaw, furthermore, could present a substantially curved surface in contact with the heavy load.

[0012] According to another aspect of the present invention, the device for lifting heavy substantially slab-shaped loads comprises means for linking and releasing the frame with respect to the casing during the lifting of the heavy slab-shaped load.

[0013] According to a further aspect of the invention, the device comprises a device for alternately activating and deactivating such means of linking and releasing the moving frame with respect to the casing.

[0014] In a particular form of embodiment of the invention, the means for linking and releasing the frame with respect to the casing comprises a revolving ratchet plate, attached to the casing, that can adopt a first position of engagement with abutting lugs on the frame and a second position of disengagement with the same. Furthermore, the activation/deactivation device of such means for linking and releasing the frame with respect to the casing comprises a ratchet gear of the rotary motion type, where its gearwheel is integral with the revolving plate.

[0015] Some preferential embodiments of the device according to the present invention will be described below, by way of example and not of limitation, with reference to the attached drawings, in which:

Figure 1 is a profile view in section of an unloaded device for lifting loads, according to a particular aspect of the present invention;

Figure 2 is a profile view in section of a particular embodiment of the present invention engaged in gripping the load;

Figure 3 is a side view partially in section of a further embodiment according to the present invention;

Figure 4 is a prospective view of the means for linking and releasing the frame with respect to the casing of a device according to a particular aspect of the invention;

Figure 5 is a side view in section of the means of figure 4 joined to a gearwheel of a ratchet gear according to another aspect of the present invention; and

Figure 6 is a front view of the ratchet gear of figure 5.

[0016] With reference to Figure 1, the auto-locking device for lifting heavy slab-shaped loads 5, according to a preferential embodiment of the present invention, comprises a support casing 1 and two jaws 2a and 2b linked in rotation, respectively by means of the pivots 6a and 6b, to the same casing 1.

[0017] The lifting device further comprises a frame 3 which, joined at 11 to the casing 1, is free itself to move axially with respect to the latter. In particular, the articulation 11 is defined by connecting a long slot on the frame 3 and a pin integral with the casing 1.

[0018] The moving frame 3 is "T"-shaped and is connected in correspondence of its arms to two connecting rods 4a and 4b. Each connecting rod 4a and 4b presents one extremity equipped with a slot within which runs a pivot pin integral with the frame 3 to achieve a flexing and moving connection 8a and 8b between each connecting rod 4a and 4b and the same frame 3. The extremity of each connecting rod 4a, 4b not engaged with the frame 3 is connected by means of a hinge to the corresponding jaws 2a, 2b.

[0019] The arms and the stem of the "T"-shaped frame 3 are fitted, in correspondence of their extremities, with means of hookup 9a, 9b, 10 that allow the same frame 3 to be grasped and handled, and set it in relative motion with respect to the casing 1. In particular, the means 9a, 9b could be connected to handles, to allow the manual operation of the lifting device, while the means 10 could be connected to mechanical lifting devices, such as for instance the hook of a hoist or of a capstan.

[0020] The jaws 2a, 2b presents furthermore, as shown in figure 2, a substantially curved surface of contact with the load to be lifted and that contact surface could be advantageously equipped with toothings (see Figure 1) to more effectively grip the load 5 to be transported.

[0021] To grab and lift the heavy slab-shaped load 5, starting from an unloaded state of the device not engaged with the same load 5, as for instance shown in figure 1, it is sufficient to set the device in correspondence of the load and exert a direct upward force F on the frame 3, in such a way that the same frame 3 moves upward with respect to the casing 1, which remains below as a result of the force of gravity.

[0022] The upward slide of the frame 3 with respect to the casing 1 involves, as a result, the translation upward of the connecting rods 4a, 4b which, in their turn, due to the hinges 7a and 7b, causes the rotation of the jaws 2a, 2b on their respective pivots 6a, 6b.

[0023] In this way, as illustrated in figure 2, the curved contact surfaces of the jaws 2a and 2b enter into contact with the slab-shaped load 5 and, due to the friction that develops between the same curved surfaces of the jaws 2a, 2b and the sides walls of the load 5, cause the same load 5 to be gripped.

[0024] In particular, the weight of the load 5 and the friction between the latter and the curved surfaces of the jaws 2a and 2b bring about a further rotation of the jaws 2a and 2b around the pivots 6a and 6b during the lifting with consequent increased tightening on the load 5 by the two jaws 2a, 2b.

[0025] Figure 3 illustrates a further form of embodiment of a device for lifting slab-shaped loads according to a preferential embodiment of the present invention.

[0026] Such device presents, similarly to the devices of Figures 1 and 2, a support casing 1' and a "Y"-shaped moving frame 3' connected, by means of the connecting rods 4a' and 4b', to two jaws 2a' and 2b' hinged at 6a' and 6b' to the same casing 1'. The upward slide of the frame 3' with respect to the casing 1' causes the rotation of the jaws 2a' and 2b' around the pivots 6a' and 6b' and tightens the same jaws 2a' and 2b' on the load to be lifted.

[0027] The illustrated device, unlike the embodiments described previously, is endowed with a cable 18 linked to a pivot 16 integral with the frame 3' and moving in the grooves of one of the guide rollers 17a and 17b integral with the casing 1'.

[0028] By exerting a force of traction on the cable 18, which could advantageously be double or taking hold of both sides of the frame 3' for reasons of equilibrium and stability of the device, the frame 3' is caused to slide relative to the casing 1' and as a consequence the jaws 2a' and 2b' tighten on the load to be lifted.

[0029] The employment of the cable 18 allows the frame 3' to be caused to slide and the device to tighten on the load even when the force applied to the cable 18 is not directed vertically with respect to the ground or whenever the load and the device are tilted with respect to the horizontal.

[0030] The device shown in figure 3 comprises the means for linking and releasing the frame 3' and the casing 1', during the lifting of the load, shown in the following figures 4 and 5. Such means, which prevent or allow the frame 3' to slide with respect to the support casing 1' during the lifting, could be operated in an alternate way by an automatic activation and deactivation device for the same means.

[0031] Nevertheless, it is possible to provide for the means for linking and releasing the frame 3' with respect to the casing 1' to be operated manually, to guarantee the accurate tightening of the jaws 2a' and 2b' on the load during the lifting or during any accidental resting of the load on the ground.

[0032] The activation device of the means for linking/releasing the frame 3' to the casing 1', when present, could comprise a rotary ratchet gear having a gearwheel 12, linked at its center in a revolving way to the casing 1', a push-rod 14, integral with the moving frame 3', as well as a shaped insert 13 that prevents the rotation of the wheel 12 in a pre-defined sense.

[0033] As illustrated in figure 6, the gearwheel 12, pivoted on the casing 1', is pushed to rotate about its center

only in a clockwise [c] sense by the push-rod 14 integral with the moving frame 3'. That happens only when the push-rod 14 moves downward, in the direction of the arrow [b], by a corresponding slide of the frame 3' with respect to the casing 1', while when the frame 3', and accordingly the push-rod 14, move in the opposite direction to [b], the shaped insert 13 prevents the rotation of the wheel 12 in a counterclockwise sense.

[0034] The gearwheel 12, as shown schematically in figure 5, is integral with a lengthened plate 19, linked to the same wheel 12 along the axis of rotation in such a way that each rotation of the wheel 12 produces a corresponding rotation of the plate 19 about its center.

[0035] In particular, the wheel 12 presents four equidistant teeth (figure 6) that allow the same wheel to assume, due to the push-rod 14 and to the shaped insert 13, only four different angular positions, separated by 90°. The lengthened plate 19 is then linked to the wheel 12 in such a way as to assume only two positions in correspondence of the four positions reached by the same wheel 12, one horizontal and the other vertical. Therefore the lengthened plate 19 is alternately in vertical or horizontal position with each quarter turn of the gearwheel 12.

[0036] The plate 19, which advantageously presents an elliptical shape, and the wheel 12 could be equipped with a central hole quadrangular in section into which fits a shaft 22, also quadrangular in section, to allow the integral rotation of plate 19 and wheel 12.

[0037] The lengthened plate 19, as shown in figure 4, can engage with lugs 21a and 21b integral with a support plate 20, fixed in turn to the moving frame 3'. The lugs 21a and 21b are reciprocally spaced in such a way as to allow the plate 20 to slide relative to the lengthened plate 19 when the latter is oriented vertically; when the plate 19 is arranged horizontally, however, it bears against lugs 21a and 21b (figure 4), preventing the plate 20 from sliding upward with respect to the lengthened plate 19, and, accordingly, fixing the moving frame 3' to the casing 1' during the lifting of the frame 3'.

[0038] The plate 19, integral with the cogwheel 12 and therefore linked to the casing 1', and the lugs 21a, 21b, integral with the frame 3' by means of the plate 20, constitute the aforementioned means for linking and releasing the frame 3' with respect to the casing 1' during the lifting. Alternatively, the gearwheel 12 and the plate 19 could be pivoted on the moving frame 3', while the push-rod 14 and the lugs 21a and 21b could be fixed to the casing 1'.

[0039] Finally, the device shown in Figure 3 comprises a contact surface 15 fit to bear against the slab-shaped load to be lifted before or during the operation of tightening the jaws 2a', 2b'.

[0040] To tighten the device on the load, first locate the contact surface 15 of the casing 1' corresponding to the upper surface of the slab-shaped load to be lifted. The casing 1' is initially linked to the frame 3' which can not move upward with respect to the same casing 1',

due to the interference of the lengthened plate 19, disposed in horizontal position, against the lugs 21a and 21b.

[0041] Subsequently, resting the contact surface 15 of the casing 1' on the upper surface of the slab-shaped load, the frame 3' slides downwards with respect to the same casing 1', in such a way as to cause the rotation of the gearwheel 12. This rotation involves, consequently, the rotation of the lengthened plate 19 into the vertical position where it no longer interferes with the lugs 21a and 21b and the frame 3' is free to slide upward with respect to the casing 1'.

[0042] Lifting the frame 3' with respect to the casing 1' therefore causes the jaws to tighten on the slab-shaped load to be transported, as described above.

[0043] When it is required to release the lifted load and separate the lifting device from the load, it is sufficient to rest the load on the ground and move the frame 3' downwards, in such a way as to cause both the relaxation of the jaws on the load and, due to the support of the contact surface 15 of the casing 1' on the slab-shaped load, a further rotation of the gearwheel 12 and, consequently, rotation of the lengthened plate 19. The plate 19 is in horizontal position and the upward slide of the same frame 3' with respect to the casing 1' is prevented by the interference against the lugs 21a and 21b.

[0044] To separate the lifting device from the transported load, it is sufficient, at this point, to subject the frame 3' to an upward traction force which, due to the interference between the lengthened plate 19 and the lugs 21a and 21b, causes the frame 3' to lift integrally with the casing 1'. In this way the same frame 3' is prevented from sliding with respect to the casing 1' and, accordingly, the undesired tightening of the jaws 2a and 2b on the load is avoided during the operation of releasing the device from the same load.

40 Claims

1. Auto-locking device for lifting a heavy substantially slab-shaped load of the type comprising a support casing and at least two opposed jaws to grip the heavy load, in which each of said jaws rotates on a pivot integral with said casing, characterized by comprising a frame moving axially with respect to said casing and, for each of said jaws, at least one tie rod that connects said moving frame to a corresponding jaw to cause the jaw to rotate and the relative surface of contact to progressively approach the load during the movement of said frame with respect to the said casing.
2. Device according to Claim 1, characterized by each of said jaws being equipped with a substantially curved surface of contact with the heavy load.

3. Device according to Claim 2, characterized by said surface of contact with the heavy load presenting a toothed profile.
4. Device according to any of Claims 1, 2 or 3, characterized by each of said tie rods comprising a connecting rod linked in rotation in one extremity to said frame and, in correspondence of the other extremity, to the corresponding jaw.
5. Device according to Claim 4, characterized by said connecting rod being linked to said frame in a revolving and moving way.
6. Device according to an any of the preceding claims, characterized by comprising means for linking and releasing said moving frame to said casing, during the lifting of said heavy load.
7. Device according to Claim 6, characterized by said means for linking and releasing said frame to said casing comprising a revolving locking plate that could assume at least one position of engagement with abutting lugs and a second position of disengagement, said plate being hinged to said moving frame and said abutting lugs being integral with said casing, or vice versa.
8. Device according to Claim 7, characterized by said plate being of elliptical section in shape.
9. Device according to an any of Claims 6, 7 or 8, characterized by comprising a device to activate and deactivate alternatively said means for linking and releasing said frame to said casing.
10. Device according to Claim 9 in combination with an any of Claims 7 or 8, characterized by said device comprising at least one rotary ratchet gear, whose gearwheel is integral with said revolving plate.
11. Device according to Claim 10, characterized by said casing comprising a contact surface for the support of said casing on said heavy substantially slab-shaped load.
12. Device according to an any of the preceding claims characterized by said moving frame comprising means of hookup for lifting the device.
13. Device according to Claim 12, characterized by said moving frame being, in plan, substantially "Y"- or "T"-shaped and presenting, in correspondence of one or more of its extremities said means of hookup for lifting the device.
14. Device according to Claim 12, characterized by said means of hookup being connected to a cable moving over one or more guide rollers integral with said casing.
15. Device according to Claim 14, characterized by said moving cable being double.

Figura 1

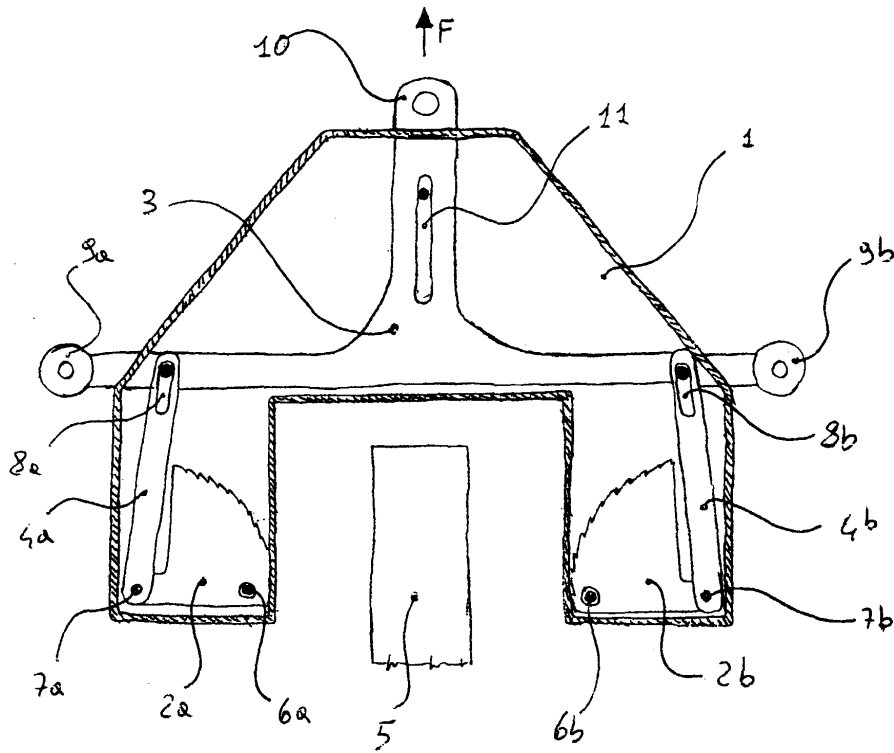


Figura 2

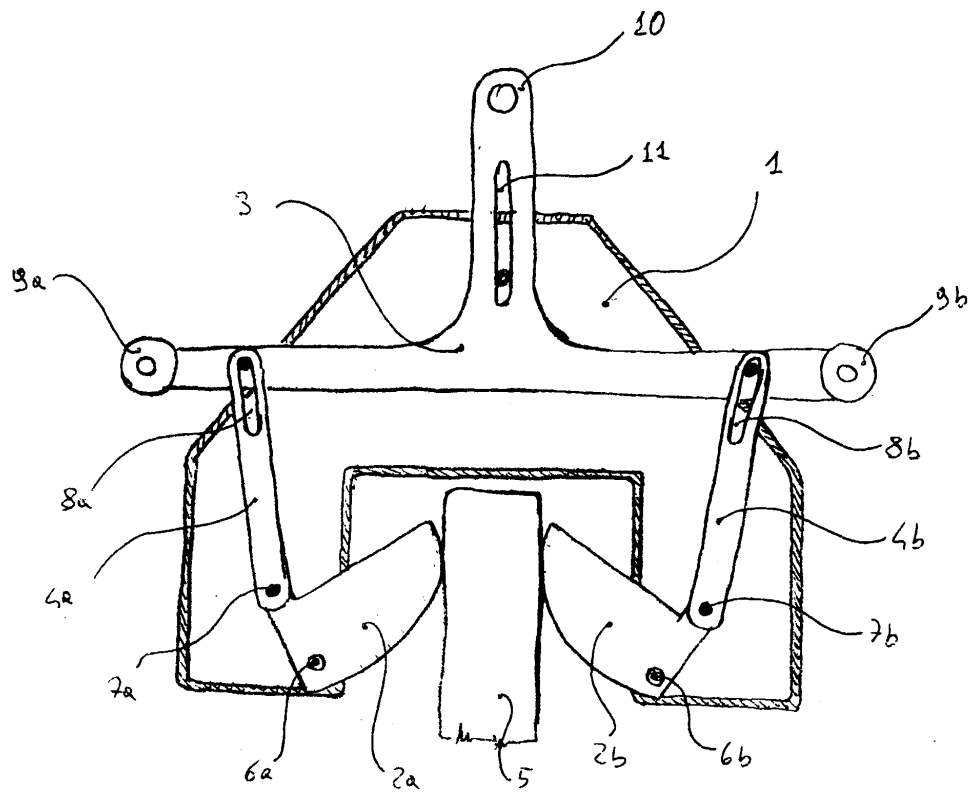


Figura 3

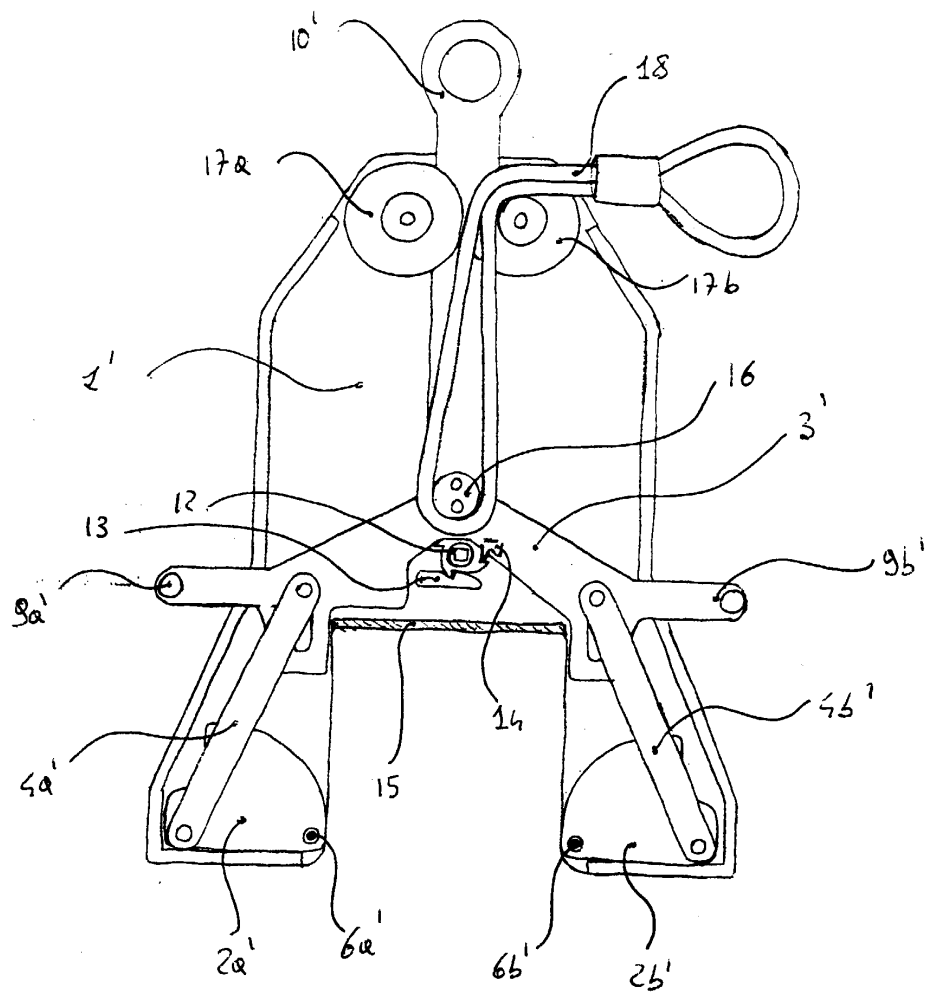


Figura 6

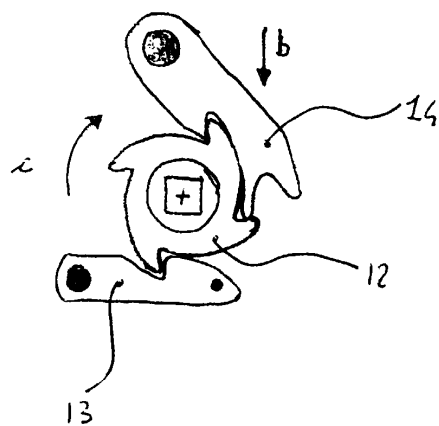


Figura 5

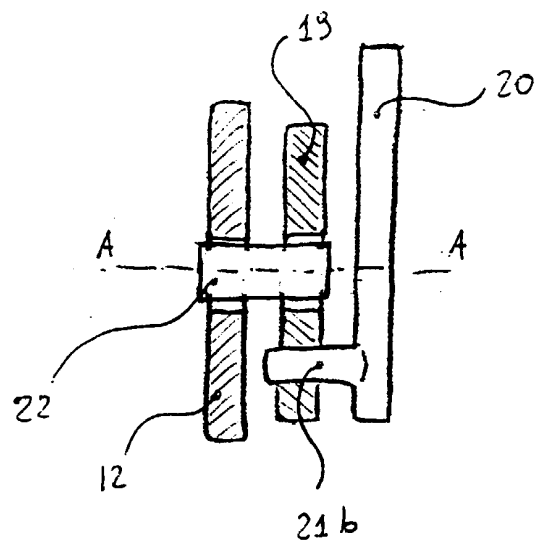
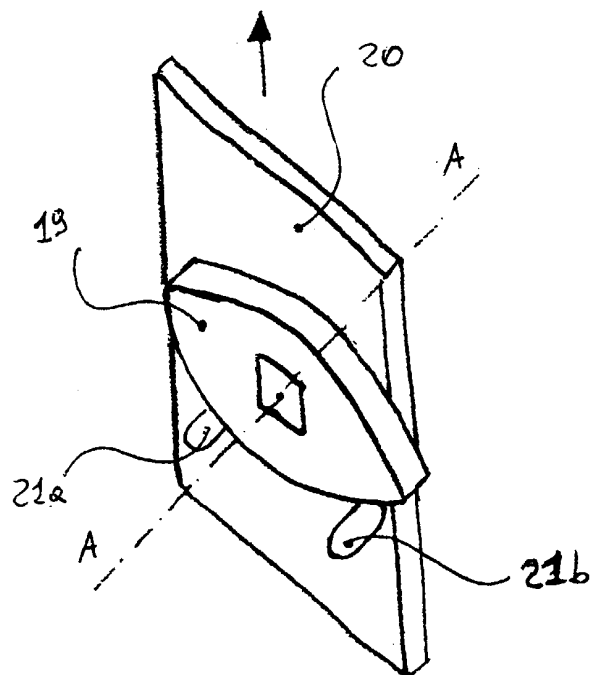


Figura 4





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 83 0210

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	DE 11 23 096 B (SCHIERHOLZ) * column 2, line 29 - column 4, line 6 * * figures 1-3 *	1,2,4	B66C1/48
Y		3	
A		5,12	
Y	US 2 310 869 A (RACZ) 9 February 1943 (1943-02-09) * page 1, left-hand column, line 44 - page 1, left-hand column, line 46 * * figure 1 *	3	
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A	CH 483 358 A (FEHR) 31 December 1969 (1969-12-31) * column 2, line 28 - column 2, line 30 *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			B66C B65G
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		14 October 1999	Farizon, P
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 99 83 0210

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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14-10-1999

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US 2310869	A	09-02-1943	NONE	
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82