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Description

The present invention relates to a lifting clamp, and more particularly relates to an improvement of the slot-width adjusting mechanism in a lifting clamp of the type having a wedge which is slidably guided on a guiding plane inclining to the median plane of the slot of the clamp at an acute angle convexed toward the opening of the slot.

In a clamp for lifting heavy materials in the prior art, it was common to provide ridged or roughened gripping surfaces for gripping jaws in order to prevent the material gripped therebetween from slipping out of the clamp. However, the ridged or roughened gripping surfaces tend to damage the material at the gripped surfaces. This damage is not confined to the surface of the material but also reaches to its interior structure or texture of the material and causes the deterioration of the strength of the material. Therefore, there has been a need for clamps which do not damage the material to be lifted. Since the provision of ridged or roughened gripping surfaces aims to avoid the accidental slipping out, the demand for clamps which do not damage the material to be lifted contradicts the demand for a safety clamp which prevents the accidental slipping.

Also it was common to provide a clamp with a slot-width adjustment mechanism for enabling the clamp to be utilized for lifting a variety of materials which have different thickness at the portion to be gripped.

It has been known a clamp having a slot-width adjustment mechanism of the type as shown in the Reference Drawing attached herewith. With reference to the drawing, a clamp having a pair of leg portions defining a slot for receiving a material to be lifted is shown. Disposed on one of leg portions 1 is a guide plate 2 having a guide surface 2a which inclines to median plane M of slot S at an acute angle $\varnothing$ convexed toward the opening of the slot. A wedge 3 having a flat gripping surface 3a is slidably guided on guiding surface 2a. Driving means for driving the wedge to-and-fro along the guiding surface comprises a screw rod 4, one end of which is screwed through a threaded sleeve 3a which in turn pivoted on a pair of pins secured to wedge 3, and the other end of which is slidably supported on a sleeve 5 which in turn is pivoted on a pair of pins secured to bell crank arm 6. Screw rod 4 is provided with a pair of escutcheons 5a and 5b on the opposite side of sleeve 5 with predetermined play. A coil spring 7 is disposed between escutcheon 5a and sleeve 5 to urge the screw rod toward wedge 3. Bell crank arm 6 is pivoted on a pin 8 secured to the body. Shackle 9 is pivoted on a pin secured to bell crank arm 6 for linking the wedge to the shackle.

There has been found to be some problems in the slot-width adjusting mechanism of the type shown in the Reference Drawing (hereinafter referred to as wedge type clamp).

One is, wedge 3 tends to be moved back along

the guiding surface when a gripping force is applied to gripping surface 3a. This problem is caused on the fact that when gripping force A is applied to surface 3a, a reaction force having a component B in the opposite direction and a component C in the upward direction is produced on rear surface of wedge 3. When a heavier material is to be lifted, a greater gripping force is required, and thus the greater reaction component C is produced. Therefore, even if the wedge is sufficiently pressed against the material before lifting operation, the wedge tends to be moved back from the slot during the lifting operation. Vibrations and/or shocks during the lifting operation increase the tendency of this moving back. As the length of the backward movement of the wedge becomes closer to the maximum travel of the opposing movable jaw, the probability of slipping out becomes larger.

It is apparent that the reaction component C can be minimised when the inclination angle $\varnothing$ is minimised. However, when the inclination angle is minimised, longer travel distance in vertical direction of the wedge is required for obtaining a predetermined lateral travel distance for adjusting slot width. This requires a longer leg portion which in turn entails a problem of increase of the empty weight of the clamp. It is desirable to restrict the backward movement of the wedge within a tolerable distance without decreasing the inclination angle.

Another problem in the wedge type clamp resides in the driving means for driving the wedge along the guiding surface to-and-fro. In a typical driving mechanism, a threaded rod is utilized for driving the wedge as shown in the Reference Drawing. However, this requires too much time to drive the wedge. Therefore it is desirable to provide a slot-width adjusting mechanism which can be quickly operated. In another type of driving mechanism, the wedge is urged with a spring toward the advancing direction, and is retractable by a lever linked with the wedge via cam engagement. However, in a mechanism of this type, the urging force of the spring becomes weaker as the wedge is advanced into the slot. Furthermore, when the empty weight of the clamp is considerably heavy, and the clamp is used in the attitude wherein the slot is laterally directed and the wedge is located above the slot, the wedge is readily moved back against the urging force of the spring by means of the empty weight of the clamp. Therefore it is desirable to provide a slot-width adjusting mechanism which is operable in a clamp having a considerable heavy empty weight, and which may advance the wedge with substantially a constant urging force.

Reference is made to US-A-3843186 which discloses a lifting clamp having the features in the pre-characterising clause of claim 1.

It is an object of the present invention to provide a clamp having an improved slot-width

adjustment mechanism which may avoid or minimise moving back distance of wedge.

It is another object of the present invention to provide an improved slot-width adjusting mechanism which is quickly operable for adjustment.

It is a further object of the present invention to provide an improved slot-width adjustment mechanism which may be applicable for a clamp having a considerable heavy empty weight.

Accordingly, the present invention provides a lifting clamp of the type comprising: a body member having a pair of leg portions defining therebetween a slot to receive a material to be gripped; a first jaw disposed on one of the leg portions; a shackle for attachment to a lifting cable and movable relative to the body; link means for operatively linking the shackle to the first jaw adapted to translate the lifting force applied to shackle into gripping force; a second jaw disposed on the other leg portion and movable relative to the body while keeping its flat gripping surface parallel to the median plane of the slot; guide means comprising first means fixed to the body for defining a guide plane inclined to the median plane of the slot at an acute angle convexed toward the opening of the slot and second means fixed to the second jaw for defining a guided plane adapted cooperatively to engage with the first means for guiding the second jaw along the guide plane adapted to provide with predetermined play for allowing the second means to be disengaged from the first means; detention means comprising a first series of ridges disposed fixedly to the body along a plane substantially parallel to the guide plane and a second series of ridges disposed fixedly to the second jaw along a plane substantially parallel to the guide plane and adapted selectively to mate with the first series of ridges for prohibiting relative movement of the body and the second jaw; biasing means for normally urging the second jaw along the guide plane in the direction toward the opening of the slot; locking means adapted to prohibit the relative movement of the first and second jaws at least in the situation wherein the distance between the gripping surfaces of first and second jaws is largest; and driving means for driving said second jaw to-and-fro along the guide plane; wherein each of said ridges is defined with a second surface which extends in a plane perpendicular to the median plane or inclined thereto at an acute angle toward the opening of the slot less than 90°; characterised in that: each of said ridges is defined with a first surface which extends in a plane parallel to the median plane or inclined thereto at an acute angle, convexed toward the bottom of the slot, less than 5°.

For the first means defining a guide plane and for the second means defining a guided plane, a variety kinds of known structures can be utilized. Also a variety kinds of known structures can be utilized for giving a predetermined play for allowing the second means to be disengaged from the first means.

The limitations to the angles referred in the above are not critical, but when the inclination of the first surface exceeds 5°, disengagement of the first and second series of ridges cannot be smoothly made when resilient means are not provided and the backward movement of the second jaw becomes larger. Said first series of ridges can be disposed on the body member or any member fixed thereto. Also said second series of ridges can be disposed on the surface of the second jaw or any member fixed thereto. However, the two series of ridges must be arranged to be selectively mated each other for prohibiting the relative movement of the body and the second jaw, when predetermined gripping force is applied to the gripping surface of the second jaw. More particularly, they are mated each other when the first and the second means of the guide means are disengaged so that the second jaw is prohibited to move back relative to the body, and they are not mated each other when the first and second means of the guide means are engaged so that the second jaw is allowed to move to-and-fro adjusting the slot-width. Any known structures can be utilized for enabling such operation. Each of first and second series of ridges can be a series of parallel ridges which extend in parallel to the intersecting line formed by the median plane of the slot and the guide plane. However it is found to be preferable that each of the first and second series of parallel ridges extend in the direction inclined to the intersecting line so that they can provide wider abutting surfaces to detent surely the second jaw against the body. Also it has been found more preferable that each of the first and second series of ridges is formed in a chevron pattern, since they can provide more wider abutting surfaces within the limited width of the portions of the body and the second jaw or any members fixed thereto.

In accordance with the present invention, driving means is preferably comprises a hydraulic cylinder one end of which is pivoted on a pin secured to the body member and the other end of which is pivoted on a pin secured to the second jaw, a pump for supplying pressure oil to the cylinder through piping, and an oil reservoir for receiving oil drained from the cylinder and for supplying oil to the pump through piping. The hydraulic cylinder can be a conventional type, and if necessary, can be of a specific type which has a function for locking the rod when pressure oil is not introduced in the cylinder. The pump can be operable manually or any other means. The merit of using a hydraulic cylinder is that the limitation to empty weight of the clamp and/or limitation to attitude of clamp in use referred in the above can be eliminated. Another merit is that the driving means is easily operable by one touch operation without requiring structural members such as rocking arm, extensible arm, resilient means, and stopper which are required in another embodiment of the present invention described hereinafter.

The driving means in accordance with another embodiment of the present invention may comprise at least a rocking arm having a pin secured thereon and pivotably supported on the body in cantilevered fashion, at least a stopper for limiting the pivotal movement of the rocking arm within a predetermined angle, and an extensible arm, for example, comprising a rod, a sleeve for slidably receiving one end of the rod therein and interconnecting means for defining the longest length of the extensible arm at least one end of which is pivoted on a pin secured to either of the rocking arm or the second jaw with intervention of a resilient means for biasing the second jaw toward the slot and the other end of which is pivoted on a pin secured to the other of the second jaw or the rocking arm. If desired another type of extensible arm can be utilized for the same purpose. The rocking arm is stopped by the stopper at two positions, one for keeping the second jaw at its retracted position and the other for keeping the second jaw at its advanced position. During the pivotal movement of the rocking arm, it is necessary to pass a dead point so that the rocking arm is latched at the respective positions.

In the preferred embodiment of the present invention, on one of the leg portions is provided with safety cam means which is operable, when the material gripped slips out of the clamp, in such a manner that the toothed cam surface of the safety cam may bite into the surfaces of the material for avoiding slipping out accident with sacrificing the merit of non-damaging clamp.

The invention having been generally described, certain specific embodiments will now be described in detail with reference to the accompanying drawings in which :

Fig. 1 is a front elevation of a lifting clamp in accordance with one of the embodiments of the invention ;

Fig. 2 is an enlarged fragmental view of one of the leg portions ;

Fig. 3 shows different patterns of ridges ;

Fig. 4 is a front elevation of a lifting clamp in accordance with another embodiment of the invention ;

Fig. 5 is a front elevation of a lifting clamp in accordance with a further embodiment of the invention ;

Referring now to Fig. 1, a clamp in accordance with one of the embodiments of the invention comprises body member 10, shackle 20, a first jaw 30, link means 40, and a slot width adjusting mechanism which comprises a second jaw 50, guide means 60, driving means 70, and detention means 80.

Body member 10 has a pair of leg portions 11 defining therebetween a slot S for receiving a material (not shown) to be lifted.

Shackle 20 has an eye 21 for attachment to a lifting cable (not shown).

First jaw 30 is disposed on one of the leg portions 11.

Link means 40 comprises a bell crank arm 41 and link arm 42. Bell crank arm 41 is pivoted on a

pin 41a secured to the body and is connected to the shackle with a pivot pin 22 and to one end of link arm 42 with a pin 41b secured to the bell crank arm which extends into an elongated hole 42a formed at the end of link arm 42. Link arm 42 is pivoted on a pin 42b secured on the body at its other end. On the intermediate portion between the elongated hole 42a and the pin 42b, first jaw 30 is pivoted on a pin 42c. Thus first jaw 30 is linked with shackle 20.

Second jaw 50 has a flat gripping surface 51 parallel to the median plane M of slot S and a rear surface 52 inclining to the median plane at an acute angle ϕ convexed to opening So of the slot to thereby form a wedge like profile. Second jaw 50 is movable along a guide plane G between the retracted position shown by dotted line and the advanced position (not shown).

Guiding means 60 comprises a guide plate 61 as first means having a guide surface 61a defining guide plane G inclining to the median plane M at an acute angle ϕ convexed to the opening So of the slot, and second means comprising a sliding plate 61b, a pair of guide pins which are secured on the rear surface 52 of second jaw 50 and a pair of nuts 61d for defining a guided plane. Guide plate 61 is provided with a slit (not shown) in which guide pins 61c are received. Sliding plate 61b is provided with a pair of holes for receiving the guide pins. The free ends of guide pins 61c are threaded for receiving nuts 61d thereon leaving predetermined play in the axial direction of the pins to thereby allow selective engagement of the first means and the second means. Thus the second jaw is guided along the guide plane with play.

Driving means 70 in this embodiment is shown as a hydraulic cylinder 71 one end of which is pivoted on a pin 71a secured to the body and the other end of which is pivoted on a pin 71b secured to the second jaw. A pump for supplying pressure oil to cylinder 71 and piping therefor and an oil reservoir for receiving oil drained from the cylinder and for supplying oil to the pump as well as piping therefor are not shown, but they are actually disposed on the body.

Referring to Figs. 1 and 2, detention means 80 in this embodiment comprises a first series of parallel ridges 81a extending in parallel to the intersection line formed by median plane M and guide plane G and disposed on the surface of the guide plate facing to the slot, and a second series of parallel ridges 81b extending in the same direction and disposed on rear surface 52 of the second jaw. Each of the ridges is defined with a first surface Fs which extends in a plane parallel to median plane M or inclined thereto at an acute angle convexed toward bottom Sb of the slot less than 5° and a second surface Ss which extends in a plane perpendicular to the median plane or inclined thereto at an acute angle convexed toward the opening So of the slot less than 90° . First and second series of ridges are complementary in shape and in dimensions.

In operation, a material is inserted into the slot,

and then driving means 70 is actuated to advance second jaw 50 into the slot, the second jaw is guided along guide plane G with chattering the mating ridges, since guide means is provided with play, until gripping surface 51 contacts with the material. When the second jaw is further advanced into the slot, the second jaw is laterally pushed by the material whereby first and second series of ridges 81a and 81b mate each other for prohibiting relative movement of the second jaw and the body.

In order to eliminate wearing of the mating ridges, resilient means 90 such as coil springs 91 one of which is shown in Fig. 2 can be provided between guide plate 61 and second jaw. Coil spring 91 is disposed around the pin 61c and between guide plate 61 and second jaw 50. When a load overcoming the urging force of spring 91 is applied to the gripping surface, the second jaw is laterally moved (to the right in Fig. 2) and the mating ridges are engaged each other. Alternatively when a load overcoming the urging force is not applied to the gripping surface, the mating ridges are disengaged and second jaw is slidable along the guide plane.

It will be understood that the slot-width adjustment mechanism of this embodiment can be utilized for a clamp having a heavy empty weight regardless of the attitude of the clamp, since a hydraulic cylinder is used as driving means. When a specific hydraulic cylinder which has a function for locking the rod previously referred to is utilized, slipping out accident can be avoided upon unintentional pressure drop due to failure of the hydraulic system.

In the first embodiment, first and second series of ridges are described as they are disposed on the surface, facing to the slot, of guide plate 61 and on the rear surface 52 of second jaw 50, and ridges extend in parallel to the intersection line formed by median plane M and guide plane G. However, ridges can be disposed on other surfaces, for example, each of the opposing surfaces of a pair of side plates of the body can be provided with a shoulder having a surface facing to the slot and inclined to the median plane, and the second jaw can be provided with a pair of complementary shoulders each having inclined surface on its opposite sides, the series of ridges can be disposed on the surfaces of the shoulders. It has been found that when the width of the surfaces on which ridges are to be formed are relatively narrow, it is preferable to provide series of parallel ridges extending with an inclination to the intersection line at an acute angle preferably less than 30°. More preferably, series of ridges are formed in a chevron pattern. In Fig. 3, (a) shows a rear surface of a second jaw having a series of parallel ridges extending in parallel to intersection line I, (b) shows a rear surface having a series of parallel ridges extending with an inclination to the intersection line, and (c) shows a surface having a series of chevron ridges. In the case of chevron ridges, a groove 81c can be formed on the center line as shown in Fig. 3 (c) for

the convenience of manufacturing.

In Fig. 4, a front elevation of a lifting clamp in accordance with another embodiment of the invention is shown. In this embodiment, the driving means comprises a pair of rocking arms 101, an extensible arm comprising a rod 102 and a sleeve 103, resilient means 104, a stopper 106, and a crank lever 107. More particularly, Each of rocking arms 101 has a pin 108 secured thereto which is pivotably received on one of opposing surfaces of side plate of the body. One end of rod 102 is pivoted on a pin 109 secured to the pair of rocking arms 101 between the opposing surfaces thereof. One end of sleeve 103 is pivoted on a pin 110 secured to second jaw 50. Other end of rod 102 having a head 102a is inserted into the other end of sleeve 103 having a cap for restraining the head within the sleeve to thereby define the maximum extension length of the extensible arm. Resilient means 104 which is shown as a coil spring is disposed around the extensible arm and the opposite ends of the spring are supported on escutcheons secured to the rod and sleeve thereby to tend extend constantly the extensible arm. Stopper 106 is secured to the body in the vicinity of rocking arms so as to provide two extreme positions of pivotal movement of rocking arms 101 for driving the second jaw to-and-fro along the guide plane. Suitable arrangement of relative positions of pins 108-110 and stopper 106 may provide a latching function to the driving means. Crank lever 107 is secured to the pin 108 at its end which extends to the out side of one of the side plates of the body.

In the embodiment shown in Fig. 4, there is provided a locking lever 120 for locking shackle 20 at their deepest nesting position when rocking arms 101 are stopped at its retracted position. Locking lever 120 is pivoted on a pin 101 secured to the body and has two Arms 120a and 120b. Arm 120a has a path of pivotal movement interfering with the path of pivotal movement of the shackle and/or bell crank arm 41. Arm 120b has a path of pivotal movement interfering with the path of pivotal movement of rocking arms 101. It will be apparent that suitable arrangement of the paths of pivotal movement as shown in Fig. 4 may provide the aimed locking function.

Referring now to Fig. 5, a clamp according to a further embodiment of the invention is illustrated wherein the rocking arms are somewhat modified for serving the functions of rocking arms 101 and locking arm 120 of Fig. 4. A pair of rocking arms 130 in this embodiment have a mushroom like profile defined with a circular arc 131 and a pair of recesses 132a and 132b disposed on a pair of radii. Each of the rocking arms has a pin 133 secured thereto at its centre and is pivotably supported on one of opposing surfaces of the side plates of the body. Stopper 106 is secured to the body to engage with the recesses 122a and 122b for providing two extreme positions of pivotal movement of the rocking arms. The circular arc 131 has a path of pivotal movement interfering with that of shackle 20 and/or bell

crank arm 41.

In the embodiment of Fig. 5, there is provided a safety cam means which comprises a pair of safety cams 140, an L shaped arm 141, a lever arm 142, resilient means 143 and a crank lever (not shown).

Before entering into detailed explanation of the safety cam means, additional explanation of link means 40 will be needed for better understanding of the safety cam means. A pair of link arms 42 are pivoted on a pin 42b secured to the body. First jaw is pivoted on a pin 142c secured to and between the link arms.

Now reverting to the detailed explanation of the safety cam means, a pair of safety cams 140 are pivoted on pin 42b sandwiching link arms 42 therebetween. Each of safety cams 140 has eccentric cam surface 140a having tooth on the side facing to the slot and a tail 140b on the opposite side. L shaped arm 141 is pivoted on a pin 140c secured to and between tails 140b of the safety cams. Lever arm 142 has a pin 142a secured to one end thereof and said pin is pivotably supported to the body. The other end 142b of lever arm 142 is forked into two portions between which the corner of L shaped arm 141 is received and pivoted on a pin 142c secured to end 142b. Free end of L shaped arm 141 extends toward the bottom Sb of the slot. Resilient means 143 is illustrated as a tension coil spring one end of which is secured to the pin 140c between safety cams 140 and the other end of which is secured to a pin 144 fixed to the body. The arrangement of pins 140c, 142a and 142c is such that pin 142c may move across the line passing through pins 140c and 142a as lever arm is pivoted on pin 142a. It will be understood that L shaped arm 141 located at the position illustrated with the dotted line in Fig. 5 tend to pivot lever arm 142 clockwise by means of tension spring 143, since pin 142c is located at left side of the line passing through pins 140c and 142a. However they are latched at that position, since L shaped arm is stopped by pin 144. When lever arm 142 is pivoted counterclockwise in Fig. 5, pin 142c move across the line to the right side and free end 142d of the L shaped arm is moved toward the bottom Sb of the slot until it is stopped by materials inserted in the slot or gripping surface 51 of the second jaw. When free end 142d of the L shaped arm is stopped by the material inserted in the slot, eccentric toothed surfaces 140a of the safety cams is kept out of contact with the material. When the material slips toward opening So of the slot, free end 142d is moved into the slot and toothed cam surfaces are allowed to contact with the slipping material.

From the foregoing description taken with the accompanying drawings, it will be apparent to those skilled in the art that many modifications of the slot-width adjustment mechanism can be made within the scope of the appended claims.

Claims

1. A lifting clamp of the type comprising: a body member (10) having a pair of leg portions (11) defining therebetween a slot (S) to receive a material to be gripped; a first jaw (30) disposed on one of the leg portions (11); a shackle (20) for attachment to a lifting cable and movable relative to the body (10); link means (40) for operatively linking the shackle (20) to the first jaw (30) adapted to translate the lifting force applied to shackle (20) into gripping force; a second jaw (50) disposed on the other leg portion (11) and movable relative to the body (10) whilst keeping its flat gripping surface (51) parallel to the median plane (M) of the slot (S); guide means (60) comprising first means fixed to the body (10) for defining a guide plane (G) inclined to the median plane (M) of the slot (S) at an acute angle convexed toward the opening (So) of slot (S) and second means (61b) fixed to the second jaw (50) for defining a guided plane adapted cooperatively to engage with the first means for guiding the second jaw along the guide plane (G) and adapted to provide with predetermined play for allowing the second means (61b) to be disengaged from the first means; detention means (80) comprising a first series of ridges (81a) disposed fixedly to the body (10) along a plane substantially parallel to the guide plane (G) and a second series of ridges (81b) disposed fixedly to the second jaw (50) along a plane substantially parallel to the guide plane (G) and adapted selectively to mate with the first series of ridges (81a) for prohibiting relative movement of the body (10) and the second jaw (50); biasing means for normally urging the second jaw (50) along the guide plane (G) in the direction toward the opening (So) of the slot (S); locking means adapted to prohibit the relative movement of the first and second jaws (30), (50) at least in the situation wherein the distance between the gripping surfaces of first and second jaws is largest; and driving means (70) for driving said second jaw to-and-fro along the guide plane; wherein each of said ridges (81a, 81b) is defined with a second surface (Ss) which extends in a plane perpendicular to the median plane (M) or inclined thereto at an acute angle toward the opening of the slot (S) less than 90°; characterised in that: each of said ridges (81a, 81b) is defined with a first surface (Fs) which extends in a plane parallel to the median plane (M) or inclined thereto at an acute angle, convexed toward the bottom of the slot (S), less than 5°.

2. A lifting clamp according to Claim 1, characterised in that said body member (10) comprises a pair of side plates between which a support plate is fixedly disposed along a plane inclining to the median plane (M) of the slot (S) at an acute angle convexed toward opening of the slot (S), and said first and second series of parallel ridges (81a, 81b) extend, on the respective surfaces, in the direction inclined to the intersection line of the guide plane (G) and the median plane (M) at an acute angle less than 30°.

3. A lifting clamp according to Claim 1, charac-

terised in that said body member (10) comprises a pair of side plates between which a support plate is fixedly disposed along a plane inclining to the median plane (M) of the slot (S) at an acute angled convexed toward the opening of the slot (S) and said detention means (80) comprises :

a) A first series of ridges (81a) each having a pattern of chevron disposed on the surface, of the support plate, facing to the second jaw (50) ; and

b) a second series of ridges (81b) each having a pattern of chevron disposed on the surface of the second jaw (50) facing to the support plate.

4. A lifting clamp according to any preceding claim, characterised in that said drive means (70) comprises :

a) a hydraulic cylinder (71) one end of which is pivoted on a pin (71a) secured to the body member (10) and the other end of which is pivoted on a pin (71b) secured to the second jaw (50) ;

b) a pump for supplying pressure oil to the cylinder (71) through piping ;

c) an oil reservoir for receiving oil drained from the cylinder (71) and for supplying oil to the pump through piping.

5. A lifting clamp according to any preceding claim, characterised in that said driving means (70) comprises :

a) at least one rocking arm (101) pivoted on a pin (108) secured to the body member (10) in cantilevered fashion ;

b) at least one stopper (106) for limited the rotational movement of the arm (101) within a predetermined angle ;

c) an extensible arm comprising : a rod (102), a cylinder (103) for slidably receiving one end of the rod (102) therein, and interconnecting means for defining the longest length of the extensible arm at least one end of which is pivoted on a pin (109 or 110) secured to either of the rocking arm (101) or the second jaw (50) with intervention of a resilient means (104) for biasing the second jaw (50) toward the slot (S) and the other end of which is pivoted on a pin (109 or 110) secured to the other of the second jaw (50) or the rocking arm (110).

6. A lifting clamp according to Claim 5, characterised in that :

a) a pair of rocking arms (130) are provided, each having a mushroom like profile defined with a circular arc (131) and a pair of recesses (132a, 132b), and each having a first pin (133) secured thereto at its center which is pivotably received on one of the side plates of the body member (10) in cantilevered fashion ;

b) one end of said extensible arm being pivoted on a second pin secured to the second jaw and the other end thereof being pivoted on a third pin secured to and between the rocking arms ;

c) at least one stopper (106) secured to the body member (10) on the path of pivotal movement of the recesses (132a, 132b) of the rocking arms (130) and adapted to engage therewith for defining the limitations of pivotal movement of

the rocking arms (130) ; and

d) said first, second and third pins as well as said recesses and stopper being so arranged that the third pin is located on one side of the line passing through the first and second pins when the rocking arms are stopped at one end of the limitations of pivotal movement of the rocking arms and the third pin is located on the other side of the line passing through the first and second pins when the rocking arms are stopped at the other of the limitations of the pivotal movement of the rocking arms.

7. A lifting clamp according to Claim 5, characterised in that :

a) a pair of rocking arms (101) being provided each having a first pin (133) secured thereto at its center which is pivotably received on one of the side plates of the body member (10) in cantilevered fashion ;

b) one end of said extensible arm being pivoted on a second pin secured to the second jaw and the other end thereon being pivoted on a third pin secured to and between the rocking arms ;

c) a stopper (106) secured to the body member (10) on the path of pivotal movement of the rocking arms (101) and adapted to engage therewith for defining the limitations of the pivotal movement of the rocking arms (101) ;

d) a bell crank lever (41) being further provided which is pivoted on a pin (22) at its intermediate portion secured to the body member (10) in the vicinity of the rocking arms (101) and shackle (20) and/or link means (40) for linking the first jaw (30) to the shackle (20), and which has a first free end having its path of movement crossing with the path of movement of the third pin and a second free end having its path of movement crossing with the path of movement of the shackle (20) and/or link means (40) ;

e) said first, second and third pins as well as said rocking arms and stopper being so arranged that the third pin is located on one side of the line passing through the first and second pins when the rocking arms are stopped at one of the limitations of pivotal movement of the rocking arms and the third pin is located on the other side of the line when the rocking arms are stopped at the other of the limitations of the pivotal movement of the rocking arms ; and

f) said first and second free ends of the bell crank lever, the third pin and the shackle and/or link means (40) being so arranged that when the rocking arms (101) are stopped at one of the limitations of their pivotal movement for positioning the second jaw (30) at its retracted position and when the shackle (20) is located at its most deepest nesting position, the first free end of the bell crank lever, and the second free end of the bell crank lever engages with the third pin for prohibiting the pivotal movement of the bell crank lever to thereby prohibit the relative movement of the shackle (20) and the body member (10), and that when the rocking arms (101) are stopped at the other of the limitations of their pivotal move-

ment for positioning the second jaw (50) at its advanced position, the third pin is moved out of the path of movement of the second free end of the bell crank lever for allowing the pivotal movement of the bell crank lever to thereby allow the shackle (20) and the link means (40) to move relative to the body member.

8. A lifting clamp according to any preceding claim, characterised in that resilient means (90) is further provided which is adapted to urge the second jaw (50) to engage the first and second means of the guide means (60) and disengage the first and second series of ridges (81a, 81b) for guiding the second jaw (50) along the guide plane (G) when a load overcoming the urging force is not applied to the gripping surface of the second jaw (50), and adapted to be yielded to disengage the first and second means of the guide means (60) and to allow the first and second series of ridges (81a, 81b) to be engaged for prohibiting the relative movement of the second jaw (50) and the body member (10).

9. A lifting clamp according to Claim 8, characterised in that:

a) said body member (10) comprises a pair of side plates between which a support plate is fixedly disposed along a plane inclining to the median plane of the slot (S) at an acute angle convexed toward the opening of the slot;

b) said support plate being provided with a slit extending in the direction of the movement of the second jaw (50);

c) said second jaw (50) is disposed in the vicinity of the support plate on the side of the slot (S);

d) said detention means (80) is disposed on a surface of the support plate facing to the slot (S) and the second jaw (50);

e) said guide means (60) comprises: at least two guide pins (61c) secured to the second jaw (50) and extending through the slit; a slide plate (61b) connected to the guide pins (61c) for sliding engagement to the other surface of the support plate opposite to the slot (S) with predetermined play for allowing selective engagement of the detention means (80);

f) said resilient means (90) comprises at least two coil springs each disposed around one of the guide pins (61c), and between the support plate and the second jaw (50).

10. A lifting clamp according to any preceding claim, characterised in that a safety cam mechanism is further provided which comprises:

a) a safety cam (140) pivoted on a fourth pin (42b) secured to the body member (10) having an eccentric toothed surface (140a) extending from the fourth pin (42b) toward the bottom of the slot (S) and a tail (140b) oppositely extending from the fourth pin (42b) adapted to bite into the surface of the article when it tends to slip off the clamp;

b) a latch lever (142) pivoted on a pin (142a) secured to the body member (10) on its one end;

c) an L-shaped arm (141) pivoted on a fifth pin (142c) secured to the free end of the latch lever (142) at its corner portion and having first

and second arms angularly extending from the corner, the end of the first arm is pivoted on a pin secured to the rail of the safety cam, and the end of the second arm is extending toward the bottom of the slot;

d) resilient means (143) urging the safety cam to be rotated in the direction for engaging the eccentric toothed surface, and urging the L-shaped arm (141) to be rotated in the direction for engaging the end of the second arm thereof to the article clamped by the clamp at the bottom area of the slot, thereby allow the L-shaped arm (141) and the safety cam (140) to be rotated when the article gripped in the slot (S) is slipped.

Patentansprüche

1. Hebeklemme des Typs mit: einem Körperelement (10), das zwei Schenkelabschnitte (11) aufweist, die zwischen sich einen Schlitz (S) zum Aufnehmen eines zu erfassenden oder zu ergreifenden Materialstücks festlegen, mit einer an einem der Schenkelabschnitte (11) angeordneten ersten Backe (30), mit einem relativ zum Körper (10) bewegbaren Schäkel (20) für den Anschluß eines Hebe- oder Heißseils, mit einer Lenkereinheit (40) zum wirkungsmäßigen Anlenken des Schäkels (20) an der ersten Backe (30) zwecks Umsetzung der auf den Schäkel (20) ausgeübten Heißkraft in eine Greifkraft, mit einer zweiten, am anderen Schenkelabschnitt (11) angeordneten und relativ zum Körper (10) bewegbaren, dabei aber ihre flache Greiffläche (51) parallel zur Mittelebene (Halbierenden) (M) des Schlitzes (S) haltenden Backe (50), mit einer Leit- oder Führungseinheit (60) mit am Körper (10) befestigten ersten Mitteln zur Festlegung einer zur Mittelebene (M) des Schlitzes (S) unter einem spitzen Winkel, konvex zur Öffnung (So) des Schlitzes (S) verlaufend, geneigten Führungsebene (G) sowie an der zweiten Backe (50) befestigten zweiten Mitteln (61b) zur Festlegung einer geführten Ebene, die zusammenwirkend an den ersten Mitteln anzugreifen vermögen, um die zweite Backe längs der Führungsebene (G) zu führen, und die ein vorbestimmtes Spiel zu liefern vermögen, um die zweiten Mittel (61b) von den ersten Mitteln trennen zu können, mit einer Rasteinheit (80), die eine erste Reihe von fest am Körper (10) längs einer praktisch parallel zur Führungsebene (G) verlaufenden Stegen oder Leisten (81a) und eine zweite Reihe von fest an der zweiten Backe (50) längs einer Ebene praktisch parallel zur Führungsebene (G) angeordneten Leisten (81b) aufweist, welche selektiv in Paßeingriff mit der ersten Reihe von Leisten (81a) bringbar sind, um eine Relativbewegung von Körper (10) und zweiter Backe (50) zu verhindern, mit Vorbelastungsmitteln, um die zweite Backe (50) normalerweise längs der Führungsebene (G) in der Richtung zur Öffnung (So) des Schlitzes (S) zu drängen bzw. vorzubelasten, mit einer Sperreinheit zum Verhindern der Relativbewegung von erster und zweiter Backe (30; 50) zumindest in dem Fall, in welchem der Abstand

zwischen den Greifflächen von erster und zweiter Backe am größten ist, und mit einer Antriebseinheit (70) zum hin- und hergehenden Antreiben der zweiten Backe längs der Führungsfläche, wobei jede der Leisten (81a, 81b) mit einer (durch eine) zweite(n) Fläche (Ss) definiert ist, die in einer Ebene verläuft, welche senkrecht zur Mittelebene (M) liegt oder zu dieser unter einem spitzen Winkel von weniger als 90° zur Öffnung des Schlitzes (S) hin geneigt ist, dadurch gekennzeichnet, daß jede der Leisten (81a, 81b) mit (durch) eine(r) erste(n) Fläche (Fs) definiert ist, die in einer Ebene verläuft, welche parallel zur Mittelebene (M) liegt oder zu dieser unter einem spitzen Winkel, konvex zur Unterseite des Schlitzes (S) verlaufend, von weniger als 5° geneigt ist.

2. Hebeklemme nach Anspruch 1, dadurch gekennzeichnet, daß das Körperelement (10) zwei Seitenplatten aufweist, zwischen denen eine Tragplatte fest längs einer Ebene angeordnet ist, die unter einem spitzen Winkel zur Mittelebene (M) des Schlitzes (S), konvex zur Öffnung des Schlitzes (S) verlaufend, geneigt ist, und die ersten und zweiten Reihen von parallelen Leisten (81a, 81b) auf den jeweiligen Flächen in der Richtung verlaufen, die zur Schnittlinie der Führungsebene (G) und der Mittelebene (M) unter einem spitzen Winkel von weniger als 30° geneigt ist.

3. Hebeklemme nach Anspruch 1, dadurch gekennzeichnet, daß das Körperelement (10) zwei Seitenplatten aufweist, zwischen denen eine Tragplatte fest längs einer Ebene angeordnet ist, die zur Mittelebene (M) des Schlitzes (S) unter einem spitzen Winkel, konvex zur Öffnung des Schlitzes (S) verlaufend, geneigt ist, und die Rasteinheit (80) umfaßt:

a) eine erste Reihe von Leisten (81a) mit jeweils einem Muster von Winkeln auf der Oberfläche der Tragplatte, der zweiten Backe (50) zugewandt, und

b) eine zweite Reihe von Leisten (81b) mit jeweils einem Muster von Winkeln an der Oberfläche der zweiten Backe (50), der Tragplatte zugewandt.

4. Hebeklemme nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß die Antriebseinheit (70) umfaßt:

a) einen Hydraulikzylinder (71), dessen eines Ende auf einem am Körperelement (10) befestigten Bolzen (71a) schwenkbar gelagert ist, und dessen anderes Ende auf einem an der zweiten Backe (50) befestigten Bolzen (71b) schwenkbar gelagert ist,

b) eine Pumpe zur Lieferung von Drucköl zum Zylinder (71) über eine Rohrleitung, (und)

c) einen Ölbehälter zum Aufnehmen des vom Zylinder (71) abgelassenen Öls und zur Zuspiesung von Öl zur Pumpe über die Rohrleitung.

5. Hebeklemme nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß die Antriebseinheit (70) umfaßt:

a) mindestens einen Schwingarm (101), der auf einem am Körperelement (10) befestigten Bolzen (108) auskragend schwenkbar gelagert ist,

b) mindestens einen Anschlag (106) zur Begrenzung der Drehbewegung des Arms (101) innerhalb eines vorbestimmten Winkels, (und)

5 c) einen ausziehbaren Arm, bestehend aus einer Stange (102), einem Zylinder (103) zur verschieblichen Aufnahme bzw. Führung des einen Endes der Stange (102) in ihm und einer Verbindungseinrichtung zur Festlegung der größten Länge des ausziehbaren Arms, dessen (deren) 10 mindestens eines Ende auf einem Bolzen (109 oder 110) gelagert ist, welcher entweder am Schwingarm (101) oder an der zweiten Backe (50) befestigt ist unter Zwischenfügung eines elastischen Mittels (104) zum Vorbelasten der zweiten 15 Backe (50) zum Schlitz (S) hin, und dessen (deren) anderes Ende auf einem am jeweils anderen Element aus zweiter Backe (50) oder Schwingarm (110) befestigten Bolzen (109 oder 110) schwenkbar gelagert ist.

20 6. Hebeklemme nach Anspruch 5, dadurch gekennzeichnet, daß

a) zwei Schwingarme (130) vorgesehen sind, von denen jeder ein pilzartiges Profil in Form eines Kreisbogens (131) und zweier Ausnehmungen (132a, 132b) besitzt und jeder einen in seinem 25 Zentrum befestigten ersten Bolzen (133) aufweist, der auskragend schwenkbar in eine der Seitenplatten des Körperelements (10) eingesetzt ist,

b) das eine Ende des ausziehbaren Arms auf einem zweiten, an der zweiten Backe befestigten Bolzen schwenkbar gelagert ist und sein anderes Ende an einem dritten Bolzen, der an den Schwingarmen und zwischen diesen befestigt ist, 30 schwenkbar gelagert ist,

35 c) mindestens ein Anschlag (106) am Körperelement (10) auf der Bahn der Schwenkbewegung der Ausnehmungen (132a, 132b) der Schwingarme (130) befestigt ist und damit zusammenzugreifen vermag, um die Begrenzungen der Schwenkbewegung der Schwingarme (130) fest- 40 zulegen, und

d) die ersten, zweiten und dritten Bolzen sowie die Ausnehmungen und der Anschlag so angeordnet sind, daß der dritte Bolzen auf der 45 einen Seite der durch ersten und zweiten Bolzen verlaufenden Linie liegt, wenn die Schwingarme am einen Ende der Begrenzungen der Schwenkbewegung der Schwingarme angehalten sind, und der dritte Bolzen auf der anderen Seite der durch ersten und zweiten Bolzen verlaufenden 50 Linie liegt, wenn die Schwingarme an der anderen der Begrenzungen der Schwenkbewegung der Schwingarme angehalten sind.

7. Hebeklemme nach Anspruch 5, dadurch gekennzeichnet, daß

a) zwei Schwingarme (101) vorgesehen sind, die jeweils einen ersten, an ihrem (jeweiligen) Zentrum befestigten Bolzen (133) aufweisen, welcher schwenkbar und auskragend von einer der 60 Seitenplatten des Körperelements (10) aufgenommen ist,

b) das eine Ende des ausziehbaren Arms auf einem an der zweiten Backe befestigten zweiten Bolzen schwenkbar gelagert ist, während sein 65 anderes Ende auf einem dritten Bolzen schwenk-

bar gelagert ist, welcher an den und zwischen den Schwingarmen befestigt ist,

c) ein Anschlag (106) am Körperelement (10) auf der Bahn der Schwenkbewegung der Schwingarme (101) befestigt ist und damit in Eingriff zu gelangen vermag, um die Begrenzungen der Schwenkbewegung der Schwingarme (101) festzulegen,

d) weiterhin ein Kniehebel (41) vorgesehen ist, der auf einem Bolzen (22), an seinem Mittelabschnitt am Körperelement (10) befestigt, in der Nähe der Schwingarme (101) und des Schäkels (20) und/oder der Lenkereinheit (40) drehbar gelagert ist und der ein erstes freies Ende, dessen Bewegungsbahn die Bewegungsbahn des dritten Bolzens kreuzt bzw. schneidet, und ein zweites freies Ende aufweist, dessen Bewegungsbahn die Bewegungsbahn des Schwäkels (20) und/oder der Lenkereinheit (40) kreuzt bzw. schneidet,

e) die ersten, zweiten und dritten Bolzen sowie die Schwingarme und der Anschlag so angeordnet sind, daß der dritte Bolzen auf einer Seite der durch ersten und zweiten Bolzen verlaufenden Linie liegt, wenn die Schwingarme an einer der Begrenzungen der Schwenkbewegung der Schwingarme angehalten sind, und der dritte Bolzen auf der anderen Seite der Linie liegt, wenn die Schwingarme an der anderen der Begrenzungen der Schwingbewegung der Schwingarme angehalten sind, und

f) die ersten und zweiten freien Enden des Kniehebels, der dritte Bolzen und der Schäkel und/oder die Lenkereinheit (40) so angeordnet sind, daß dann, wenn die Schwingarme (101) an einer der Begrenzungen ihrer Schwingbewegung angehalten sind zwecks Positionierung der zweiten Backe (30) in ihrer zurückgezogenen Stellung, und wenn sich der Schäkel (20) in seiner tiefsten Einziehstellung befindet, das erste freie Ende des Kniehebels und das zweite freie Ende des Kniehebels am dritten Bolzen angreift zwecks Verhinderung der Schwenkbewegung des Kniehebels, um damit die Relativbewegung des Schäkels (20) und des Körperelements (10) zu verhindern bzw. zu sperren, und daß dann, wenn die Schwingarme (101) an der anderen der Begrenzungen ihrer Schwenkbewegung angehalten sind zwecks Positionierung der zweiten Backe (50) in ihrer vorgeschobenen Stellung, der dritte Bolzen aus der Bewegungsbahn des zweiten freien Endes des Kniehebels herausbewegt ist, um die Schwenkbewegung des Kniehebels zuzulassen und damit den Schäkel (20) und die Lenkereinheit (40) sich relativ zum Körperelement bewegen zu lassen.

8. Hebeklemme nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß weiterhin ein elastisches Mittel (90) vorgesehen ist, welches die zweite Backe (50) zum Angreifen an erstem und zweitem Mittel der Führungseinheit (60) und zum Trennen der ersten und zweiten Reihen von Leisten (81a, 81b) zu beaufschlagen vermag zwecks Führung der zweiten Backe (50) längs der Führungsebene (G), wenn eine die Vorbelastungsoder Beaufschlagungskraft überwindende Last nicht auf die Greiffläche der zwei-

ten Backe (50) einwirkt, und welches nachzugeben vermag, um die ersten und zweiten Mittel der Führungseinheit (60) außer Eingriff zu bringen und die ersten und zweiten Reihen von Leisten (81a, 81b) in Eingriff kommen zu lassen zwecks Verhinderung der Relativbewegung von zweiter Backe (50) und Körperelement (10).

9. Hebeklemme nach Anspruch 8, dadurch gekennzeichnet, daß

a) das Körperelement (10) zwei Seitenplatten aufweist, zwischen denen eine Tragplatte fest längs einer Ebene angeordnet ist, die zur Mittelebene des Schlitzes (S) unter einem spitzen Winkel, konvex zur Öffnung des Schlitzes verlaufend, geneigt ist,

b) die Tragplatte mit einem in der Richtung der Bewegung der zweiten Backe (50) verlaufenden Langloch versehen ist,

c) die zweite Backe (50) in der Nähe der Tragplatte an der Seite des Schlitzes (S) angeordnet ist,

d) die Rasteinheit an einer Oberfläche der Tragplatte, dem Schlitz (S) und der zweiten Backe (50) zugewandt, angeordnet ist,

e) die Führungseinheit (60) umfaßt: mindestens zwei an der zweiten Backe (50) befestigte und sich durch das Langloch erstreckende Leitbolzen (61c), eine für Gleitbewegung mit den Leitbolzen (61c) verbundene Gleitplatte (61b) an der anderen, dem Schlitz (S) gegenüberliegenden Fläche der Tragplatte, und zwar mit einem vorbestimmten Spiel zur Ermöglichung eines selektiven An- oder Eingreifens der Rasteinheit (80), (und)

f) das elastische Mittel (90) mindestens zwei Schraubenfedern umfaßt, die jeweils um einen der Leitbolzen (61c) herum und zwischen Tragplatte und zweiter Backe (50) angeordnet sind.

10. Hebeklemme nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß weiterhin ein Sicherheitskurvenmechanismus vorgesehen ist, der umfaßt:

a) eine auf einem vierten, am Körperelement (10) befestigten Bolzen (42b) schwenkbar gelagerte Sicherheitskurve (140) mit einer exzentrisch gezahnten Fläche (140a), die vom vierten Bolzen (42b) in Richtung auf die Unterseite des Schlitzes (S) verläuft, und einer in entgegengesetzter Richtung vom vierten Bereich (42b) abgehenden Nase (140b), die sich in die Oberfläche des Gegenstands einzugraben vermag, wenn dieser von der Hebeklemme abzurutschen bestrebt ist,

b) einen Klinken- oder Sperrhebel (142), der an seinem einen Ende auf einem am Körperelement (10) befestigten Bolzen (142a) schwenkbar gelagert ist,

c) einen L-förmigen Arm (141), der an seinem Eckabschnitt auf einem fünften, am freien Ende des Klinken- oder Sperrhebels (142) befestigten Bolzen (142c) schwenkbar gelagert ist und erste und zweite, unter einem Winkel vom Eckabschnitt abgehende Arme aufweist, wobei das Ende des ersten Arms auf einem an der Schiene der Sicherheitskurve befestigten Bolzen schwenkbar gelagert ist und das Ende des zweiten Arms sich zur Unterseite des Schlitzes hin erstreckt, (und)

d) ein elastisches Mittel (143), welches die Sicherheitskurve für eine Drehung im Sinne eines Eingreifenlassens der exzentrischen gezahnten Fläche vorbelastet oder beaufschlagt und den L-förmigen Arm (151) für eine Drehung in der Richtung zum Angreifenlassen des Endes seines zweiten Arms an dem durch die Hebeklemme verspannten Gegenstand am unteren Endbereich des Schlitzes vorbelastet oder beaufschlagt, um damit den L-förmigen Arm (141) und die Sicherheitskurve (140) sich verdrehen zu lassen, wenn der im Schlitz (S) erfaßte Gegenstand (im Schlitz) rutscht.

Revendications

1. Une pince de levage du type comprenant : un élément (10) de corps possédant une paire de parties (11) de patte définissant entre elles une fente (S) pour recevoir un matériel à saisir ; une première mâchoire (30) disposée sur l'une des parties (11) de patte ; un œil porte-charge (20) destiné à être attaché à un câble de levage et mobile par rapport au corps (10) ; des moyens (40) de liaison pour relier en fonctionnement l'œil porte-charge (20) à la première mâchoire (30) aptes à transformer la force de levage appliquée à l'œil porte-charge (20) en une force de saisie ; une deuxième mâchoire (50) disposée sur l'autre partie (11) de patte et mobile par rapport au corps (10) tout en gardant sa surface plate (51) de saisie parallèle au plan médian (M) de la fente (S) ; des moyens (60) de guidage comprenant des premiers moyens fixés au corps (10) pour définir un plan de guidage (G) incliné par rapport au plan médian (M) de la fente (S) selon un angle aigu en saillie vers l'ouverture (So) de la fente (S) et des deuxièmes moyens (61b) fixés à la deuxième mâchoire (50) pour définir un plan guidé apte à s'engager de façon coopérative avec les premiers moyens pour guider la deuxième mâchoire le long du plan de guidage (G) et apte à réaliser un jeu déterminé au préalable pour permettre aux deuxièmes moyens (61b) d'être dégagés des premiers moyens ; des moyens (80) de retenue comprenant une première série de nervures (81a) disposées de façon fixe par rapport au corps (10) le long d'un plan sensiblement parallèle au plan de guidage (G) et une deuxième série de nervures (81b) disposées de façon fixe par rapport à la deuxième mâchoire (50) le long d'un plan sensiblement parallèle au plan de guidage (G) et aptes à correspondre de façon sélective à la première série de nervures (81a) pour interdire un déplacement relatif entre le corps (10) et la deuxième mâchoire (50) ; des moyens de sollicitation pour solliciter normalement la deuxième mâchoire (50) le long du plan de guidage (G) vers l'ouverture (So) de la fente (S) ; des moyens de verrouillage aptes à interdire le déplacement relatif des première et deuxième mâchoires (30), (50) au moins dans la situation dans laquelle la distance entre les surfaces de saisie des première et deuxième mâchoires est la plus grande ; et des moyens (70)

d'entraînement pour entraîner ladite deuxième mâchoire en va-et-vient le long du plan de guidage ; dans laquelle chacune desdites nervures (81a, 81b) est définie avec une deuxième surface (Ss) qui s'étend dans un plan perpendiculaire au plan médian (M) ou qui est inclinée par rapport à celui-ci selon un angle aigu inférieur à 90° vers l'ouverture de la fente (S) ; caractérisée en ce que :

5 chacune desdites nervures (81a, 81b) est définie avec une première surface (Fs) qui s'étend dans un plan parallèle au plan médian (M) ou qui est inclinée par rapport à celui-ci selon un angle aigu, en saillie vers le fond de la fente (S), de moins de 5°.

10 2. Une pince de levage selon la revendication 1, caractérisée en ce que ledit élément de corps (10) comprend une paire de plaques latérales entre lesquelles est disposée de façon fixe une plaque de support le long d'un plan qui s'incline par rapport au plan médian (M) de la fente (S) selon un angle aigu en saillie vers l'ouverture de la fente (S), et en ce que lesdites première et deuxième séries de nervures parallèles (81a, 81b) s'étendent, sur les surfaces respectives, dans la direction inclinée par rapport à la ligne d'intersection du plan de guidage (G) et du plan médian (M) selon un angle aigu inférieur à 30°.

3. Une pince de levage selon la revendication 1, caractérisée en ce que ledit élément de corps (10) comprend une paire de plaques latérales entre lesquelles est disposée de façon fixe une plaque de support le long d'un plan qui s'incline vers le plan médian (M) de la fente (S) selon un angle aigu en saillie vers l'ouverture de la fente (S) et en ce que lesdits moyens (80) de retenue comprennent :

a) une première série de nervures (81a) dont chacune possède une configuration de chevron disposées sur la surface de la plaque de support, tournées vers la deuxième mâchoire (50) ; et

b) une deuxième série de nervures (81b) possédant chacune une configuration de chevron disposées sur la surface de la deuxième mâchoire (50) tournées vers la plaque de support.

4. Une pince de levage selon l'une quelconque des précédentes revendications, caractérisée en ce que lesdits moyens (70) d'entraînement comprennent :

a) un vérin hydraulique (71) dont une extrémité est montée en pivotement sur une broche (71a) fixée sur l'élément de corps (10) et dont l'autre extrémité est montée en pivotement sur une broche (71b) fixée sur la deuxième mâchoire (50) ;

b) une pompe destinée à fournir une pression d'huile au vérin (71) à travers une tubulure ;

c) un réservoir d'huile pour recevoir l'huile drainée depuis le vérin (71) et pour fournir de l'huile à la pompe à travers la tubulure.

5. Une pince de levage selon l'une quelconque des précédentes revendications, caractérisée en ce que lesdits moyens (70) d'entraînement comprennent :

a) au moins un bras basculant (101) monté

en pivotement sur une broche (108) fixée sur l'élément de corps (10) en porte-à-faux ;

b) au moins un arrêt (106) en vue de limiter le mouvement de rotation du bras (101) à l'intérieur d'un angle déterminé au préalable ;

c) un bras extensible comprenant : une tige (102), un vérin (103) destiné à recevoir en coulissement une extrémité de la tige (102), et des moyens de liaison pour définir la plus grande longueur du bras extensible dont au moins une extrémité est montée en pivotement sur une broche (109 ou 110) fixée soit sur le bras basculant (101) soit sur la deuxième mâchoire (50) avec une intervention d'un moyen élastique (104) pour solliciter la deuxième mâchoire (50) vers la fente (S) et dont l'autre extrémité est montée en pivotement sur une broche (109 ou 110) fixée à l'autre des éléments : deuxième mâchoire (50) ou bras basculant (110).

6. Une pince de levage selon la revendication 5, caractérisée en ce que :

a) il existe une paire de bras basculants (130), présentant chacun un profil en forme de champignon défini par un arc circulaire (131) et une paire d'évidements (132a, 132b), chacun présentant une première broche (133) qui lui est fixée en son centre et qui est reçue en pivotement sur l'une des plaques latérales de l'élément de corps (10) en porte-à-faux ;

b) une extrémité dudit bras extensible pivote sur une deuxième broche fixée sur la deuxième mâchoire et son autre extrémité pivote sur une troisième broche fixée aux bras basculants et entre eux ;

c) au moins un arrêt (106) est fixé sur l'élément de corps (10) sur le trajet du déplacement en pivotement des évidements (132a, 132b) des bras basculants (130) et il est apte à s'engager avec eux pour définir les limites d'un déplacement en pivotement des bras basculants (130) ; et

d) lesdites première, deuxième et troisième broches ainsi que lesdits évidements et ledit arrêt sont disposés de telle façon que la troisième broche est située sur un côté de la ligne passant par la première et la deuxième broches lorsque les bras basculants sont arrêtés à une extrémité des limites de déplacement de pivotement des bras basculants et que la troisième broche est située sur l'autre côté de la ligne passant par les première et deuxième broches lorsque les bras basculants sont arrêtés à l'autre limite du déplacement en pivotement des bras basculants.

7. Une pince de levage selon la revendication 5, caractérisée en ce que :

a) une paire de bras basculants (101) comportent chacun une première broche (133) qui leur est fixée en leur centre et qui est reçue en pivotement sur l'une des plaques latérales de l'élément de corps (10) en porte-à-faux ;

b) une extrémité dudit bras extensible pivote sur une deuxième broche fixée à la deuxième mâchoire et l'autre extrémité de celui-ci pivote sur une troisième broche fixée sur les bras basculants et entre eux ;

c) un arrêt (106) fixé sur l'élément de corps

(10) sur le trajet du déplacement en pivotement des bras basculants (101) est apte à s'engager avec ceux-ci pour définir les limites du déplacement en pivotement des bras basculants (101) ;

d) il existe en outre un levier à genouillère (41) qui pivote sur une broche (22) à sa partie intermédiaire fixée sur l'élément de corps (10) au voisinage des bras basculants (101) et de l'œil porte-charge (20) et/ou des moyens de liaison (40) pour relier la première mâchoire (30) à l'œil porte-charge (20), et qui comporte une première extrémité libre dont le trajet de déplacement croise le trajet de déplacement de la troisième broche et une deuxième extrémité libre dont le trajet de déplacement croise le trajet de déplacement de l'œil porte-charge (20) et/ou des moyens de liaison (40) ;

e) lesdites première, deuxième et troisième broches ainsi que lesdits bras basculants et ledit arrêt sont disposés de telle façon que la troisième broche est située sur un côté de la ligne passant par la première et la deuxième broches lorsque les bras basculants sont arrêtés à une extrémité des limites de déplacement en pivotement des bras basculants et la troisième broche est située sur l'autre côté de la ligne lorsque les bras basculants sont arrêtés sur l'autre limite de déplacement en pivotement des bras basculants ; et

f) lesdites première et deuxième extrémités libres du levier à genouillère, la troisième broche et l'œil porte-charge et/ou les moyens de liaison (40) sont disposés de telle façon que, lorsque les bras basculants (101) sont arrêtés à l'une des limites de leur déplacement en pivotement pour positionner la deuxième mâchoire (30) dans sa position rétractée et quand l'œil porte-charge (20) est situé à sa position emboîtée la plus profonde, la première extrémité libre du levier à genouillère, et la deuxième extrémité libre du levier à genouillère s'engagent avec la troisième broche pour interdire le déplacement en pivotement du levier à genouillère pour interdire ainsi le déplacement relatif entre l'œil porte-charge (20) et l'élément de corps (10), et en ce que, lorsque les bras basculants (101) sont arrêtés à l'autre limite de leur déplacement en pivotement pour positionner la deuxième mâchoire (50) à sa position avancée, la troisième broche est déplacée en dehors du trajet de déplacement de la deuxième extrémité libre du levier à genouillère pour permettre le déplacement en pivotement du levier à genouillère pour permettre ainsi à l'œil porte-charge (20) et aux moyens de liaison (40) de se déplacer par rapport à l'élément de corps.

8. Une pince de levage selon l'une quelconque des précédentes revendications, caractérisée en ce qu'il existe en outre des moyens élastiques (90) qui sont aptes à solliciter la deuxième mâchoire (50) pour engager les premiers et les deuxièmes moyens parmi les moyens de guidage (60) et dégager la première et la deuxième séries de nervures (81a, 81b) pour guider la deuxième mâchoire (50) le long du plan de guidage (G) lorsqu'une charge dépassant la force de sollicitation n'est pas appliquée à la surface de saisie de

la deuxième mâchoire (50), et aptes à céder pour dégager les premier et deuxième moyens parmi les moyens de guidage (60) et permettre à la première et à la deuxième séries de nervures (81a, 81b) d'être engagées pour interdire le déplacement relatif entre la deuxième mâchoire (50) et l'élément de corps (10).

9. Une pince de levage selon la revendication 8, caractérisée en ce que :

a) ledit élément de corps (10) comprend une paire de plaques latérales entre lesquelles est disposée de façon fixe une plaque de support le long d'un plan s'inclinant vers le plan médian de la fente (S) selon un angle aigu en saillie vers l'ouverture de la fente ;

b) ladite plaque de support comporte une rainure s'étendant dans la direction de déplacement de la deuxième mâchoire (50) ;

c) ladite deuxième mâchoire (50) est disposée au voisinage de la plaque de support sur le côté de la fente (S) ;

d) ledit moyen de retenue (80) est disposé sur une surface de la plaque de support tournée vers la fente (S) et la deuxième mâchoire (50) ;

e) lesdits moyens de guidage (60) comprennent : au moins deux broches de guidage (61c) fixées sur la deuxième mâchoire (50) traversant la rainure ; une plaque coulissante (61b) reliée aux broches de guidage (61c) en vue d'un engagement coulissant avec l'autre surface de la plaque de support opposée à la fente (S) avec un jeu déterminé au préalable pour permettre un engagement sélectif du moyen de retenue (80) ;

f) lesdits moyens élastiques (90) comprennent au moins deux ressorts à boudin disposés chacun autour de l'une des broches de guidage (61c), et entre la plaque de support et la deuxième

mâchoire (50).

10. Une pince de levage selon l'une quelconque des précédentes revendications, caractérisée en ce qu'il existe en outre un mécanisme de sécurité à came qui comprend :

a) une came de sécurité (140) pivotant sur une quatrième broche (42b) fixée sur l'élément de corps (10) possédant une surface excentrique dentée (140a) s'étendant depuis la quatrième broche (42b) vers le fond de la fente (S) et une queue (140b) s'étendant à l'opposé depuis la quatrième broche (42b) apte à mordre dans la surface de l'article lorsqu'il tend à glisser hors de la pince ;

b) un levier de verrouillage (142) pivotant sur une broche (142a) fixée sur l'élément de corps (10) à l'une de ses extrémités ;

c) un bras en forme de L (141) pivotant sur une cinquième broche (142c) fixée sur l'extrémité libre du levier de verrouillage (142) à sa position de coin et possédant une premier et un deuxième bras s'étendant angulairement depuis le coin, l'extrémité du premier bras pivotant sur une broche fixée sur le rail de la came de sécurité, et l'extrémité du deuxième bras s'étendant vers le fond de la fente ;

d) des moyens élastiques (143) sollicitant la came de sécurité pour qu'elle tourne dans le sens d'un engagement avec la surface excentrique dentée, et sollicitant le bras en forme de L (141) de façon à ce qu'il tourne dans le sens d'un engagement avec l'extrémité de son deuxième bras avec l'article serré par la pince dans la zone de fond de la fente, ce qui permet au bras en forme de L (141) et à la came de sécurité (140) de tourner lorsque glisse l'article saisi dans la fente (S).

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Fig.2

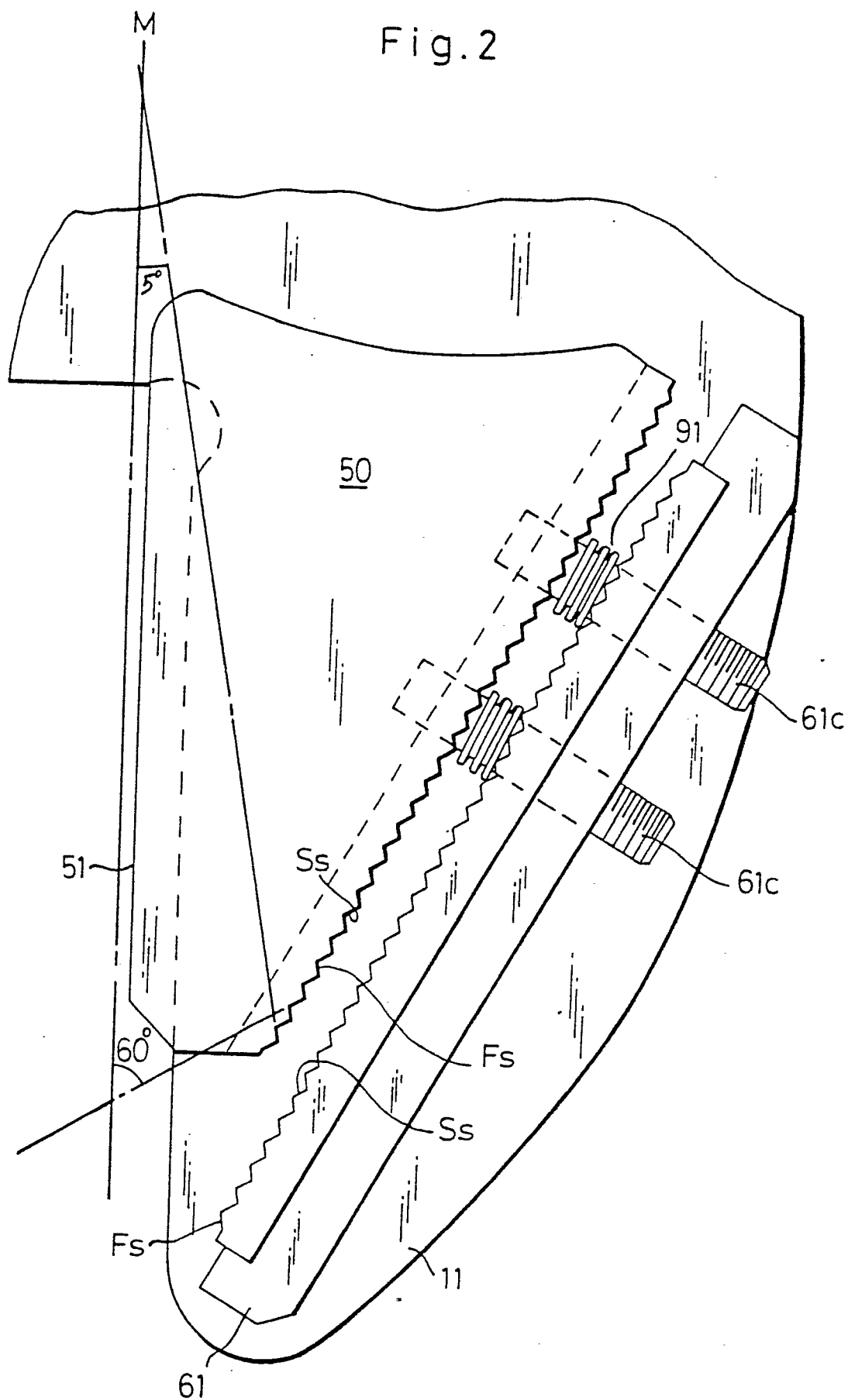


Fig.3

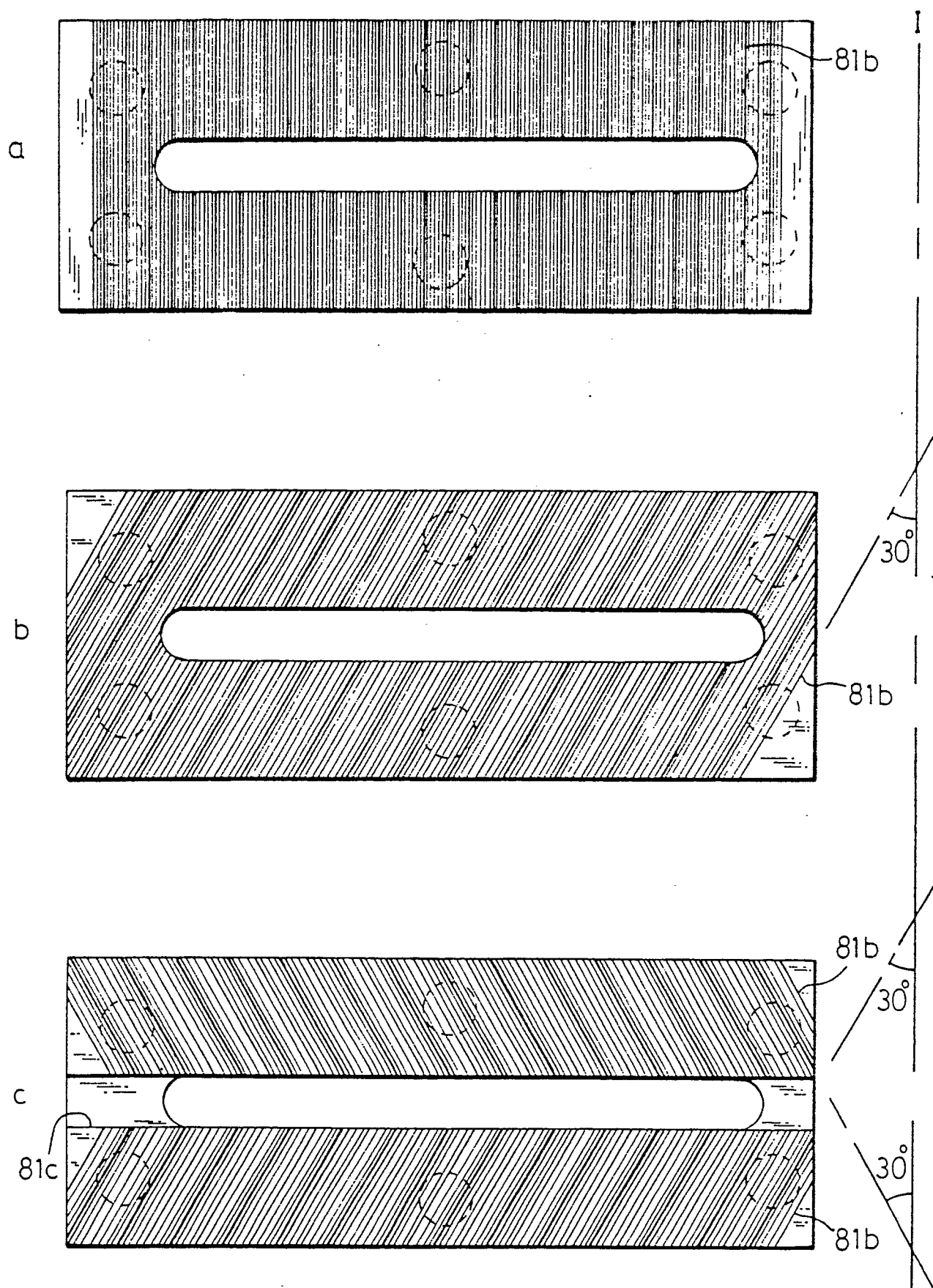


Fig.4

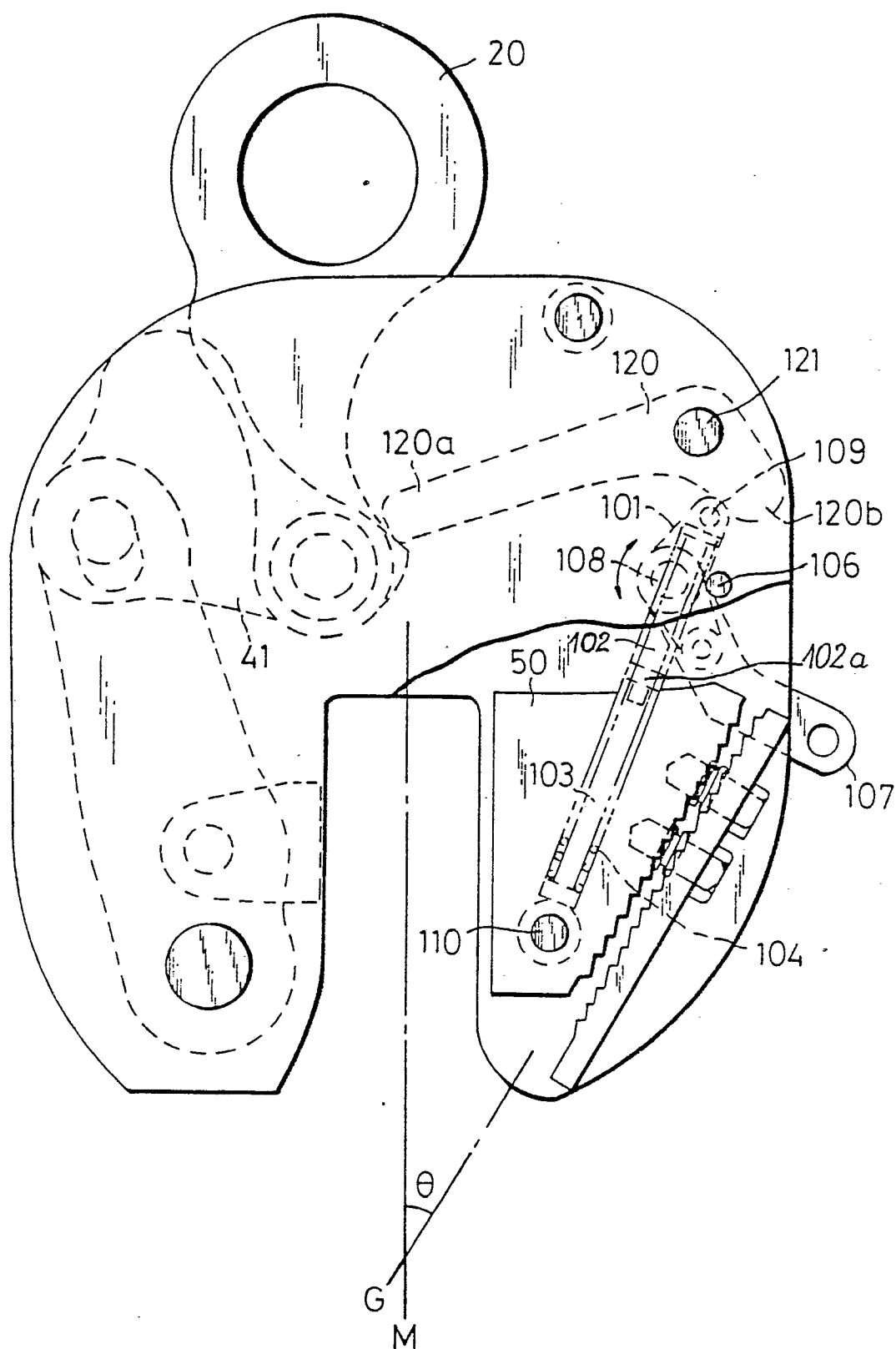
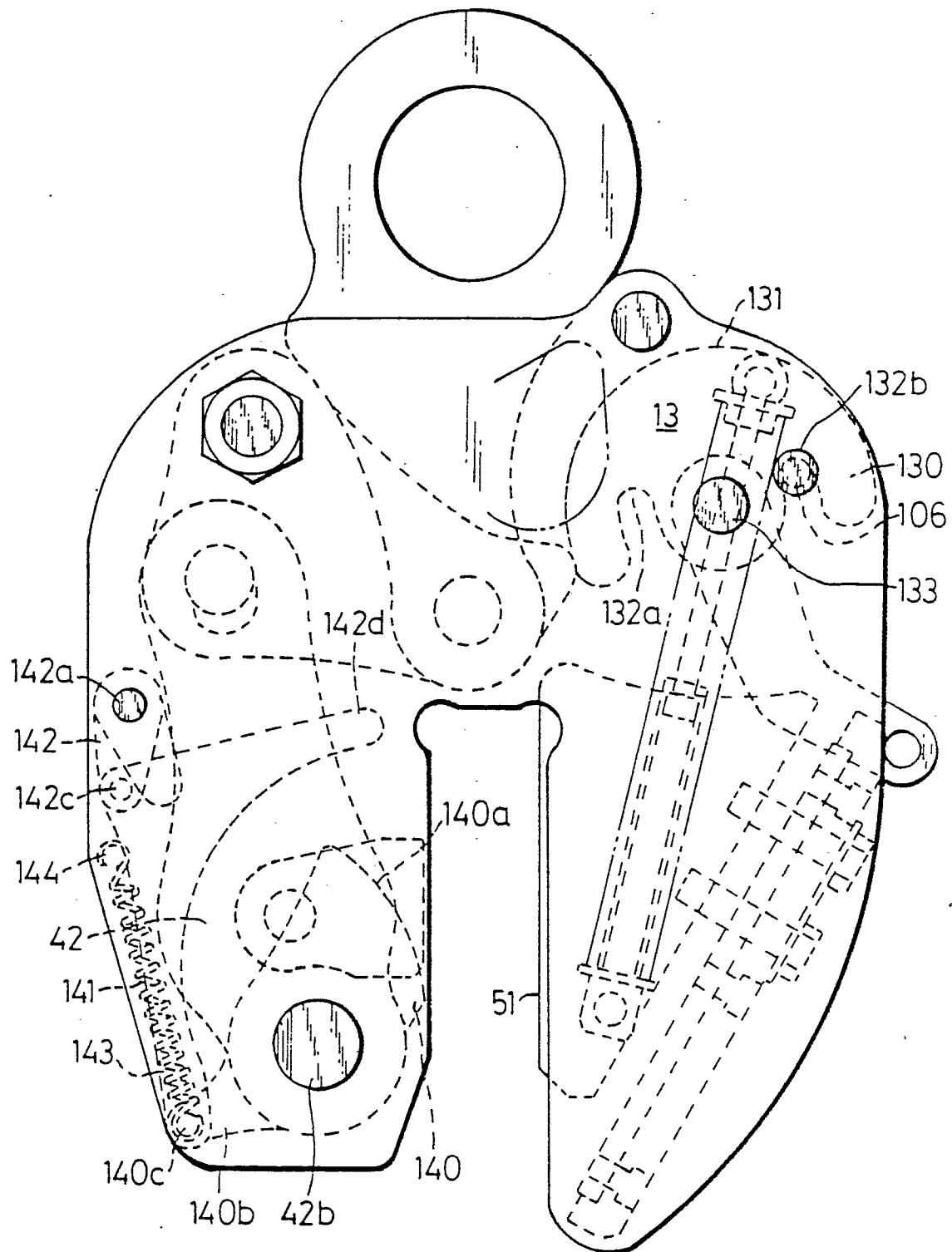


Fig.5



REFERENCE DRAWING
(PRIOR ART)

