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Van de Wetering

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[54] **HOIST CLAMP**

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[51] **Int. Cl.** **B66c 1/48**
[58] **Field of Search** ..... 294/96, 101, 102 R, 103 R, 294/104, 114, 86 R, DIG. 1; 24/263 SW

[56] **References Cited**

UNITED STATES PATENTS

2,347,922	5/1944	Nelson	294/86 R
2,360,602	10/1944	Waldrup	294/104
2,559,223	7/1951	Murray	294/102 R
2,986,422	5/1961	Renfroe	294/101
3,003,806	10/1961	Shramek	294/101
3,370,881	2/1968	Renfroe	294/101

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[57] **ABSTRACT**

A hoist clamp for clampingly gripping plate-shaped pieces to be hoisted, the clamp comprising a toggle lever system operatively connected with a hoisting eye and co-operating with a wedge that is adjustable in the direction of the thickness of the plate material to be gripped, this wedge co-operating, by means of toothed faces, with a stationary block and being arranged to be urged under the influence of spring pressure in the direction of the smallest thickness of said plate material after a locking mechanism acting upon the toggle lever system has been released.

5 Claims, 5 Drawing Figures

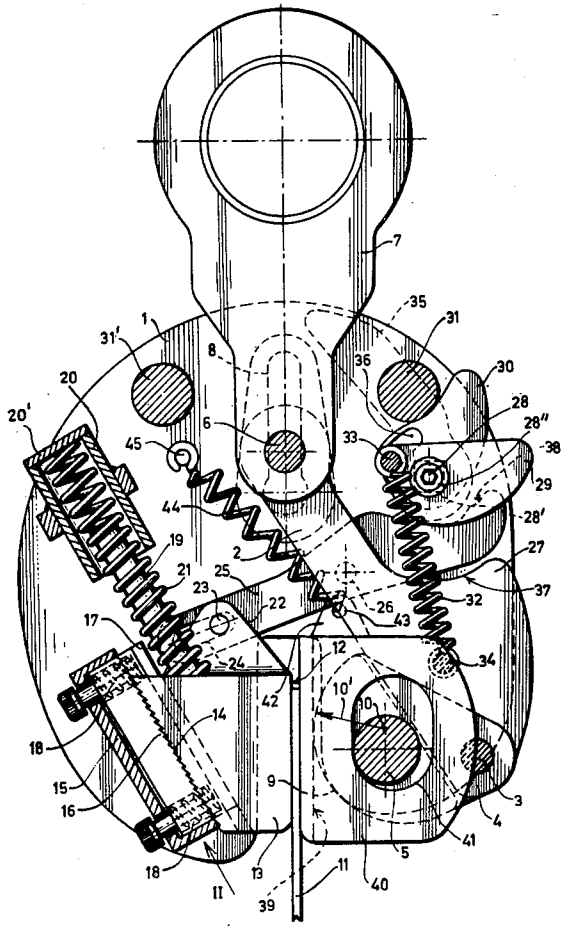
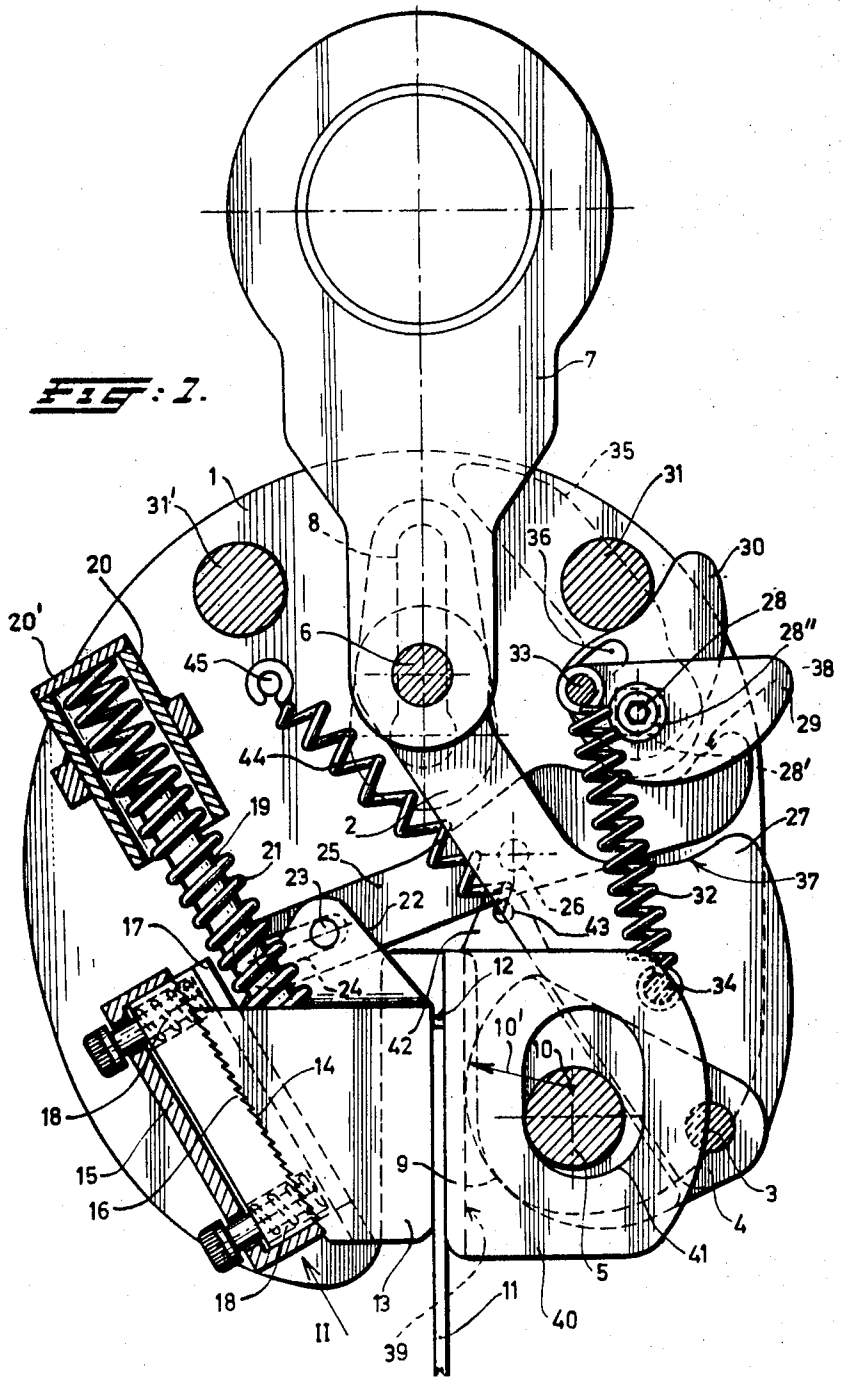


FIG. 1.


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4
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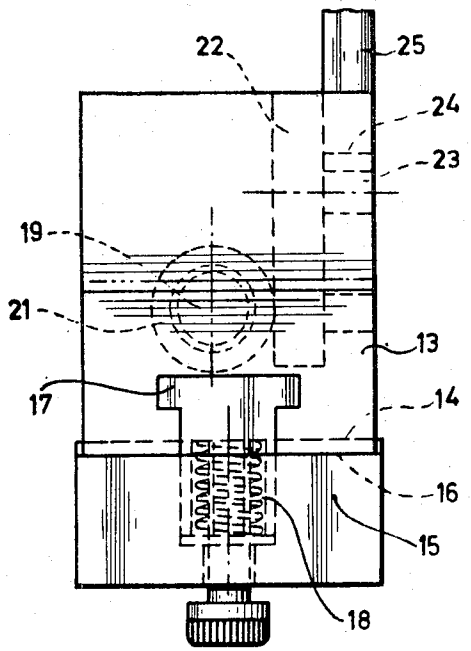


Fig. 2.

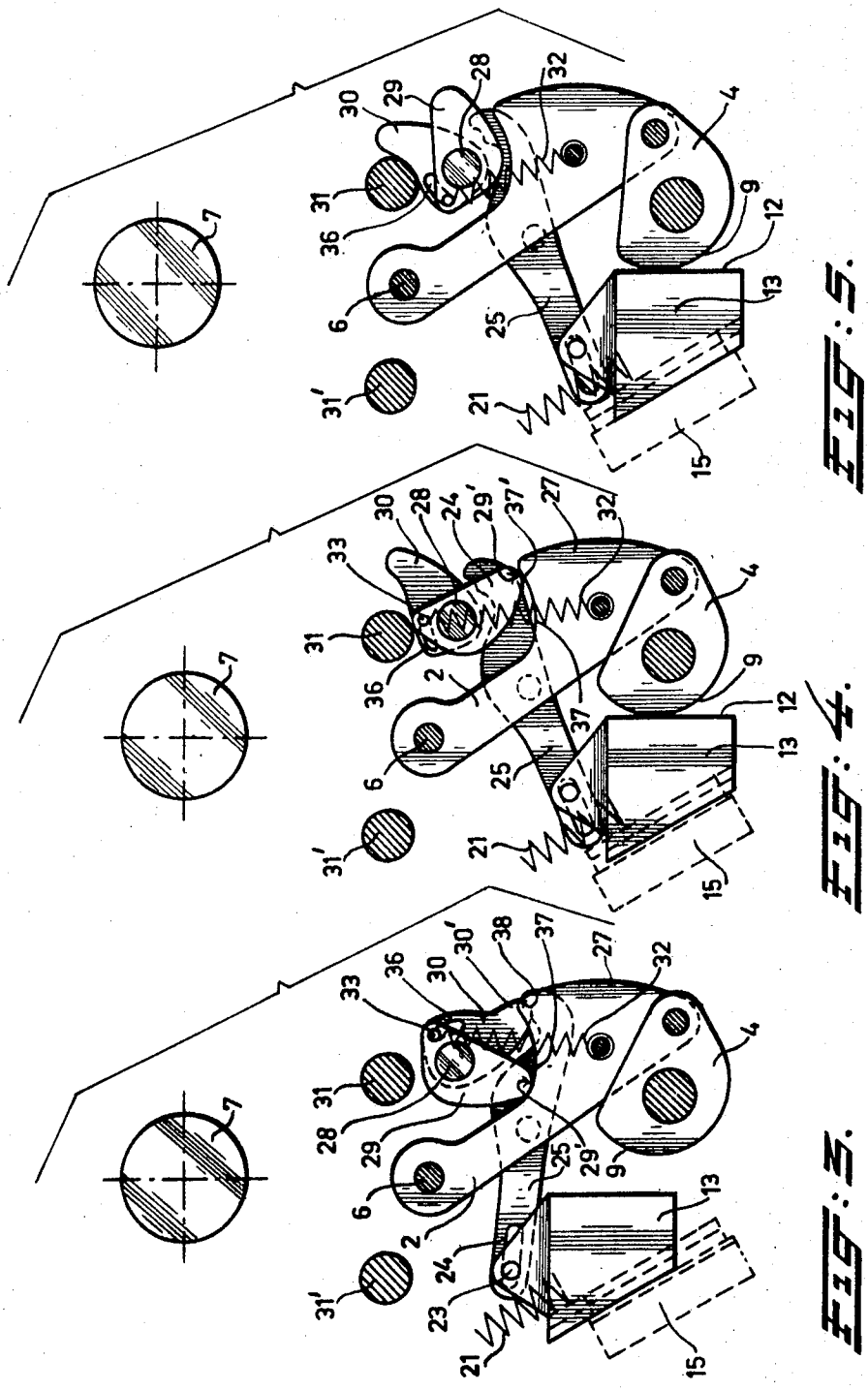


FIG. 5.

FIG. 4.

FIG. 3.

HOIST CLAMP

BACKGROUND OF THE INVENTION

My invention relates to a hoist clamp for clampingly gripping plate-shaped pieces to be hoisted.

Hoist clamps for plates are known, which comprise a toggle lever system, the eccentric clamping segment of which is provided with a set of teeth which engage the plate to be clamped. With such hoist clamps no special measures need be used to handle plates of a diverse thickness, for the toggle lever can be dimensioned in such a way that its clamping segment has a high degree of eccentricity. Owing to the presence of teeth on the clamping member, a sufficient clamping force is rapidly obtained, it be at the cost of the risk of damaged spots on the plate material.

When, however, plate material is concerned the surfaces of which should not at all be damaged, like e.g. in case of plates from stainless steel, the clamping segment is not allowed to be toothed. In that case exclusively a smooth surface of the operative part of the eccentric end face of the lever is permissible. This results in that, at the same clamping force of the clamping segment with respect to the counter clamping segment, a considerably reduced clamping effect is obtained. This may be compensated by a greater clamping force which may be obtained by a modified dimensioning of the toggle lever system, but this implies that the maximum range of the change of the effective radius of the eccentric clamping element is reduced to a fraction, so that it is not possible anymore to handle any aribitrary thickness of plate.

As a solution for this problem it has already been suggested to make the counter clamping segment in form of a wedge adjustable by hand, by means of a threaded rod. In itself this construction is satisfactory but it has a considerable drawback in that for each thickness of plate to be handled the counter clamping segment should be adjusted by hand with an accuracy of about 2 mm. When this is forgotten the consequences are not too serious when, after having handled a thin plate an adjustment for thicker plates should be effected, because this thicker plate simply cannot enter the clamp. In the converse case it may, however, occur that the plate is not sufficiently confined between the clamping segment and the counter clamping segment, so that the plate falls from the clamp.

SUMMARY OF THE INVENTION

The principal object of my present invention is therefore to provide a hoist clamp for plates the surface of which is not allowed to be damaged.

A further object of my invention is to provide a hoist clamp, the clamping cheek of which will automatically adapt itself to the thickness of each plate to be clamped.

Another object of my invention is to provide a hoist clamp having a locking mechanism providing maximum width of the clamping check in the locked condition, and, after having been released, taking care of automatically confining any plate introduced into the check.

A still futher object of my invention is to provide such locking mechanism which can be easily operated by hand.

A still further object of my invention is to provide such hoist clamp having further means acting to distribute the clamping force over a greater area of the plate to be gripped.

The hoist clamp according to my invention comprises a toggle lever system operatively connected with a hoisting eye and cooperating with a wedge that is adjustable in the direction of the thickness of the plate material to be gripped, this wedge co-operating by means of toothed faces, with a stationary block and being arranged to be urged under the influence of spring pressure in the direction of the smallest thickness of said plate material after a locking mechanism acting upon the toggle lever system has been released.

With a hoist clamp constructed in this way it is achieved that the opening of the clamp has initially the maximum value, so that the clamp can be applied to plate material of any arbitrary thickness, but that the clamping effect can be exclusively produced after the lock has been released, while due to releasing the lock the plate available at that moment is completely confined by the wedge. Because in this construction the lock must be released before hoisting can take place, it cannot possibly occur that an initially hoisted plate appears after a short time to be not sufficiently fixed and falls from the clamp.

DESCRIPTION OF THE DRAWINGS

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:

FIG. **1** is a sectional view of a hoist clamp,

FIG. **2** is a detail view taken on the arrow II in FIG. **1**, and

FIGS. **3, 4** and **5** illustrate diagrammatically the operation of a slightly modified form of hoist clamp.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIG. **1** the rear (as viewed) of the two symmetrical side plates between which, in conventional manner, the remaining parts of the hoist clamp are confined, is denoted by **1**, the other side plate being omitted in order to show various levers. A clamping mechanism includes first and second levers **2** and **4** pivotally connected together by a pin **3**. The second lever **4** is mounted for rotation about the axis of a shaft **5** mounted in the side plates. The upper (in FIG. **1**) end of the lever **2** is pivotably connected by a pin **6** to the lower (in the Figure) end of a lifting or hoisting eye **7**. The lifting eye **7** is vertically (in the Figure) movable since the pin **6** runs in guide paths **8** on the inner sides of the two side plates. The effective surface **9** of the second lever **4** has a radius of curvature **10'** the centre **10** of which is eccentric with respect to the axis of the shaft **5**. The lever **2** at the end in the proximity of the pin **3** is provided with a wing **27** which is co-planar with the remainder of the lever **2**.

In use, initially the pin **6** is at the lower (in the Figure) part of the guide paths **8**. After unlocking a locking mechanism to be described hereinafter, when a hoisting force is produced the pin **6** moves upwards in the guide paths so that the toggle lever system **2/4** is slightly extended and a greater radius of the effective surface **9** with respect to the axis of the shaft **5** becomes

effective at the location of a plate **11** to be clamped. The effective face **9** acts, via a plate formed by the web **39** of a channel member **40,** on the plate **11** which is pressed against a back pressure surface **12** which is smooth as is the surface **9** and as are the surfaces of the web **39.** However, if desired, the surface **9** and/or the surface of the web **39** which it engages may be coarse so as to ensure an effective grip between these two surfaces.

The back pressure surface **12** is formed on a wedge **13** which has toothing on its inclined face **14** remote from the surface **12.** This toothing engages toothing of a face **16** of a block **15** which is directed towards the face **14** of the wedge, this block being stationary with respect to the side plates.

As appears from FIG. **2** the block **15** carries a T-profile slide **17** engaged in a correspondingly sectioned slot in the wedge **13** which is thus movable in a direction parallel to the toothed faces **14, 16.** In the absence of a compressive force on the wedge **13,** i.e. when no plate is clamped, the toothed faces **14, 16** of the wedge **13** and the block **15** respectively are pressed away from each other over a short distance by a pair of compression springs **18** provided within the block **15,** so that the T-profile slide **17** is freed for movement in a direction which is at right angles to the toothed face **16.** In this way in the absence of clamping force the wedge **13** is capable of moving, with the toothed faces **14, 16** unhampering such movement, parallel to the block **15** in the direction making an acute angle with the main surface of the plate **11** to be clamped.

Extending from the wedge **13** there is a pin **19** which enters, with some clearance so as to be movable therein, a fixed sleeve **20.** A compression spring **21** around the pin **19** bears against the closing end wall **20'** of the sleeve **20** and presses the wedge **13** downwards (in the Figure) as far as this is not prevented by a locking mechanism to be described hereinafter. The wedge **13** is further provided with a lug carrying a pin **23** which is engaged in a slot **24** in a lever **25.** This lever **25** can pivot about a stationary shaft **26** situated approximately centrally of the clamp.

A shaft **28** mounted in the side plates and protruding through the resr (in the Figure) side plate **1** carries, on its protruding portion, a handle **35** so that a swinging motion can be imparted thereto. The shaft **28** has a double lock mechanism consisting of a first lock member **29** and a second lock member **30** the effect of which will be described hereinafter. In FIG. **1** a lock-released condition is illustrated in which the toggle lever system **2/4** clamps the plate **11.** In this condition the lock member **30** contacts one of two distance pins **31, 31'** whereby the side plates are held together in a known way.

In FIG. **1** is also shown a tension spring **32** which extends between a pin **33,** carried by the lock member **29,** and the pin **34** carried by the wing **27** of the lever **2.** In the lock-released condition as depicted in FIG. **1,** this spring **32** acts to straighten the toggle lever system **2/4** as far as possible, whereby consequently the pin **6** assumes the highest (in the Figure) position allowed by the thickness of the plate **11.** This position is taken already without the lifting eye **7** being urged upwards (in the Figure).

The pair of lock members **29, 30** serve to unlock, upon operation of the handle **35** on the shaft **28,** at first only the lever **25** of the wedge **13,** so that the wedge **13** has the effect that the plate **11** is confined with minor force irrespective of the thickness thereof. Upon further turning of the handle **35** the toggle lever system **2/4** is straightened, so that at first the plate **11** is confined with greater force, while simultaneously the toothed faces **14, 16** engage each other, and from that moment on it is possible to commence hoisting so that further straightening of the toggle lever system **2/4** is effected, and a greater clamping force on the plate **11** is built up under the influence of the weight being hoisted.

The two lock members **29, 30** are movable through an angle with respect to each other. The shaft **28** by which the lock members **29, 30** are externally operated is provided with a square part **28'** on which a corresponding hole in the lock member **30** is secured. This lock member **30** follows therefore automatically any movement of the handle **35** of the shaft **28.** The lock member **29,** on the contrary, is provided with a circular hole on a circular part **28''** of the shaft **28** and is freely rotatable with respect to the shaft **28.** The lock member **29** follows the movement of the lock member **30.** There is a curved slot **36** in which the pin **33** carried by the lock member **29** is engaged.

Further particulars of the construction will be described with reference to FIGS. **3** to **5,** whereby simultaneoulsy the effect of the clamp will become clar. For the sake of clarity an embodiment is represented in FIGS. **3** to **5** which differs from that according to FIG. **1** in that the channel member **40** is omitted and, in view of this, the horizontal (in the Figures) dimension of the wedge **13** is slightly greater than that of the wedge of FIG. **1,** and the effective surface **9** of the second lever **4,** as well as the back pressure surface **12** of the wedge **13,** is formed as a high quality smooth face. For the rest the two embodiments are identical.

The point of application of the spring **32** on the lock members **29** and **30,** i.e. at the pin **33,** is of great importance for the proper effect of the clamp. FIG. **3** shows the completely locked position of the hoist clamp, that is to say the position in which the wedge **13** is held in its highest (in the Figure) position and in which the toggle lever system **2/4** is in its most-folded, locked condition, so that between the clamping surfaces **9** and **12** no plates can be clamped. In this locked position the line of action of the tension spring **32** extends to the right of the shaft **28** as viewed in FIG. **3,** the spring being operative in such a way that the locked position is maintained, the two lock members **29, 30** being urged clockwise. In this position the end surface **29'** of the lock member **29** is situated against a curved surface **37** by which a straight part of the lever **2** merges into the wing **27.** This curved surface **37** has a radius equal to the distance of the end **29'** of the lock member **29** with respect to the axis of the shaft. The right-hand (in FIG. **3**) end of the lever **25** is provided with a valley shaped surface part **38** in which, in the locked position of FIG. **3,** comes to lie an end surface **30'** of the lock member **30.** It is to be noted that in reaching the locked position of FIG. **3** the lever **25** has turned clockwise under the influence of the lock member **30,** lifting the wedge **13,** and the pin **23** has moved in the slot **24** in the lever **25.**

When the locking operation is carried out in the above-mentioned way the lock member **30** is positively driven by clockwise (as viewed in FIG. **3**) rotation of the operation handle **35** on the shaft **28.** With this

movement the upper (in the Figure) end of the slot **36** carries along the pin **33**, so that the lock member **29** leads with respect to the lock member **30**. In this embodiment the angle between the lines connecting the extreme ends **29'**, **30'** of the two lock members **29, 30** with the axis of the shaft **28**, is about 55°. As a consequence when the locking operation is carried out the lock member **29** at first contacts the curved surface **37** of the lever **2**, so that the toggle lever system **2/4** is fixed in position. The lock member **29** then moves through the angle of about 55° just mentioned along the surface **37** to the position shown in FIG. **3** without affecting the position of the toggle lever system **2/4**. Towards the end of this movement the lever **25** is swung by the lock member **30** so that the wedge **13** is lifted.

In hoisting, a plate such as **11** is disposed in the opened hoist clamp between the effective surfaces **9** and **12**. Then the locking mechanism is turned by rotating the operating handle **35** anti-clockwise as viewed in the Figures. Due to the construction described initially only the lock member **30** acting on the wedge **13** is turned anti-clockwise so that the wedge **13** is released and moves downwards (in the Figures) in order to confine the plate **11**. This movement of the wedge continues until the plate **11** is just confined between the surfaces **9** and **12** with a minor force determined by the action of the compression spring **21**. The toothed faces **14, 16** are then not yet engaged with one another.

During the first phase of the unlocking operation the lock member **29** remains in the position as represented in FIG. **3** until the lock member **30** has turned anticlockwise through the angular distance permitted by the length of the slot **36**, which in this embodiment is about 48°. It should be noted that during this phase the spring **32** is not further tensioned. Upon further anticlockwise rotation of the lock member **30** with the lower (in FIG. **3**) end of the curved slot **36** in contact with the pin **33**, the lock member **29** commences to turn anti-clockwise, whereby simultaneously the spring **32** is further tensioned. FIG. **4** shows the condition at which in this way the lock member **29** has reached the end of the surface **37**. It is visible in this Figure that the lock member **30** is then only at a short distance from the pin **31** which determines the end of its movement. It is also visible in this Figure that at this stage the line of action of the spring **32** has passed, at its upper (in the Figure) end, the axis of the shaft **28** and hence the spring **32** is now in position to turn the lock member **29** further anti-clockwise, completely to release the toggle lever system **2/4** as well as to straighten this system in the intended way in order to build up the clamping force. This effect is obtained when from the position shown in FIG. **4** the locking mechanism is given a final push to the left until the lock member **30** contacts the pin **31**. The surface **29'** of the other lock member **29** is then entirely clear of the surface **37**, so that this lock member **29** can swing anti-clockwise, the pin **33** moving again in the slot **36**. Due to the abrupt swing of the spring **32** from the position according to FIG. **4** in which the spring on account of the effect of the locking mechanism, is additionally tensioned, the toggle lever system **2/4** is suddenly straightened. A compressive force is then built up by the eccentric mechanism **4/9**, whereby the wedge **13** by its toothed face **14** engages the stationary toothed face **16**. The value of the pressure on the plate **11** in the clamp is determined by the spring characteristics of the spring **32**. This situation is represented in FIG. **5**, which also shows that the pin **6** with the lifting eye **7** has moved upwards in the Figure. From this moment the lifting eye **7** can be pulled and the pull exerted will be transmitted by the toggle lever system **2/4** as a clamping force between the effective surfaces **9, 12**.

It will be apparent that due to the suitable placement of the upper point of application of the spring **32** the effect can be obtained that at the critical moment a sudden tensioning force is exerted on the toggle lever system **2/4**. As a result it is achieved that the wedge teeth immediately engage in the position which has been found when a plate with a particular thickness is being confined. It is therefore impossible that owing to a slow down in the action during the straightening of the toggle lever system **2/4** a component of motion is imparted to the wedge **13** in its normal direction of movement parallel to the toothed faces **14, 16**, whereby the toothed faces **14, 16** could engage each other in a wrong position which would result in the distance between the eccentric effective surface **9** and the surface **12** of the wedge being too great for the particular plate, so that the built-up clamping force is insufficient and the plate falls from the clamp. Due to the possibility of relative movement occurring between the two lock members **29, 30** permitted by the curved slot **36**, it is also achieved that the first phase of the unlocking operation, that is to say merely releasing the wedge **13** so that it may find its correct position for the particulr thickness of plate to be hoisted, may be carried out without it being necessary to tension the spring **32** further by the same movement. This spring **32** is then only further tensioned in the second phase that is to say after the wedge **13** has already found its correct position at the particular thickness of plate. It should be further noted that the spring **32** may be very strong without this causing difficulties in unlocking for the ratio of the moment arms at the location of the handle **35** and at the location of the upper point of application of the spring **32** with respect to the shaft **28** is very great.

It will further be clear that, when the clamp is to be taken off again from a hoisted plate, the locking mechanism will be operated in the way described above. In the first phase of the locking operation the toggle lever system **2/4** will be blocked, so that the pressure on plate **11** will be ended and the toothed faces **14, 16** will be disengaged. In the second phase the lever **25** will be blocked, the wedge **13** thereby returning to its highest position.

In the embodiment according to FIGS. **3** to **5** the lever **4** presses by its effective face **9** directly against the plate **11** and thus a line-shaped impression may be made on the plate **11** owing to the considerable specific pressure exerted by the surface **9**. To avoid this drawback, in the embodiment of FIG. **1**, the lever **4** is provided with the channel section member **40** wich is made of high-grade steel, the web **39** of this member **40** being substantially parallel to the back pressure surface **12**, and the side flanges being disposed on either side of the lever **4**. The channel section member **40** is secured by means of a pair of slots **41** to the shaft **5** so as to be free to swing since the slots **41** are breadthwise and lengthwise of larger dimension than the shaft **5**.

At its upper (in the Figure) end the channel section member **40** is provided with a lug **42** to which, by

means of a pin **43**, is secured a tension spring **44** the other end of which is hooked on a pin **45** provided between the side plates of the hoist clamp, the pin **45** being offset from the member **40** as viewed in FIG. **1**.

When there is no plate in the jaw of the clamp, the member **40** tilts slightly anti-clockwise (FIG. **1**) owing to the action of the spring **44**, so that the web **39** at its lower (in the FIG. **1**) end is at the greatest distance from the surface **12**. The shaft **5** is then at the lower (in the Figure) ends of the slots **41**.

After a plate **11** to be hoisted is introduced inbetween the web **39** of the member **40** and the surface **12** this plate **11** can be confined in the way described, the web **39** of the member **40** adjusting itself automatically and the surface **9** of the lever **4** coming to press against the web **39**.

The further operation is as described, the width of the slots **41** allowing an increasing radius of the lever **4** to become active, while the length of the slots **41** allows that on building up the pressure the surface **9** evolves. Analogous to what happens with the hoist clamp without the channel section member **40**, the plate **11** slides slightly downwards (in the Figure) with respect to the surface **12**. The member **40** follows this movement. As a result the clamping force of the surface **9** is, due to the intervention of the web **39**, distributed over a much larger surface so that a line-shaped impression in the plate **11** is no longer made and the plate as a consequence can be handled without damage.

In either of the embodiments described the hoist clamp may be manufactured in steel, but for certain fields of use the whole construction may be made in plastics material, e.g. such as having a good resistance against chemical influences.

It will be appreciated that the hoist clamps described, having smooth surfaces on the effective faces which contact the plate to be hoisted, are particularly suitable for hoisting plates whose surfaces should be undamaged as far as possible, for example stainless steel plates or aluminum plates.

Although the preferred embodiments of the invention have been described in detail, it should be understood that the present disclosure has been provided by way of example only. Many modifications and variations of the invention are possible in the light of the above teachings. It is, therefore, to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically disclosed.

What I claim is:

1. A hoist clamp for clampingly gripping plate-shaped pieces to be hoisted, the clamp comprising a toggle lever system operatively connected with a hoisting eye and co-operating with a wedge that is adjustable in the direction of the thickness of the plate material to be gripped, said wedge co-operating by means of toothed faces, with a stationary block and being arranged to be urged under the influence of spring pressure in the direction of the smallest thickness of said plate material after a locking mechanism acting upon the toggle lever system has been released; said locking mechanism comprising: a first pivotable lock member active for locking the wedge in its non-clamping condition, and a second pivotable lock member arranged to pivot in dependence upon pivoting movement of the first lock member, said first lock member and said second lock member having a common pivot axis, said second lock member in its locking position acting upon the toggle lever system to lock this system in its most-folded condition in which the clamp is in its non-clamping condition, and a spring of the toggle lever system arranged to be active in the sense of straightening the toggle lever system and applying clamping force to the second lock member at such a point that the line of action of this spring in said most-folded condition is disposed on one side of said common pivot axis and such that upon pivoting of the lock members to unfold the toggle lever system the spring is further tensioned and said line of action passes to the other side of said common pivot axis.

2. The hoist clamp of claim **1**, wherein said first and second lock members are interconnected for moving together by a pin carried by by the second lock member which is engaged in a curved slot in the first lock member.

3. The hoist clamp of claim **1**, wherein said first and second lock members are interconnected for moving together by a pin carried by the second lock member which is engaged in a curved slot in the first lock member, the point of application of said spring with respect to the second lock member constitutes said pin.

4. The hoist clamp of claim **1**, wherein a surface on which the first lock member is effective and the operative face of the toggle lever system on which the second lock member is effective, and also the mutual position of the two lock members and an amount of relative angular movement permitted to the two lock members are arranged and dimensioned in such a way that the wedge can be entirely unlocked without changing the condition of the toggle lever system, the second lock member and the spring of the toggle lever system.

5. A hoist clamp for clampingly gripping plate-shaped pieces to be hoisted, the clamp comprising a toggle lever system operatively connected with a hoisting eye and co-operating with a wedge that is adjustable in the direction of the thickness of the plate material to be gripped, said wedge co-operating by means of toothed faces, with a stationary block and being arranged to be urged under the influence of spring pressure in the direction of the smallest thickness of said plate material after a locking mechanism acting upon the toggle lever system has been released; a tilting channel section member which is movable in two dimensions with respect to the toggle lever system, and has a pressure distributing plate for distributing the applied pressure to the plate-shaped pieces to be hoisted, said toggle lever system acting on said wedge through said pressure distributing plate, said channel section member having a tension spring which in the open position of the clamp causes the member to tilt in the sense to open the clamp mouth.

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