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(54) ADJUSTABLE SELF-LOCKING PLIERS

(57) In principle, it is provided with a fixed handle (1), a fixed jaw (2), a movable jaw (3) and a connecting rod connected to a mechanism for adjusting the distance between the dentations of both jaws.

It is characterized in that the adjustment mechanism comprises a spindle (10) disposed along a longitudinal inner cavity of the fixed handle (1), while being axially retained in both directions.

The spindle (10) is connected to a nut carriage (9) guided in the longitudinal inner cavity without rotational motion.

The pliers are further characterized in that they comprise a release cam (8) that includes a swivel converter, which in one of its closing positions is interposed in the support of the release cam (8) onto the connecting rod (6-6').

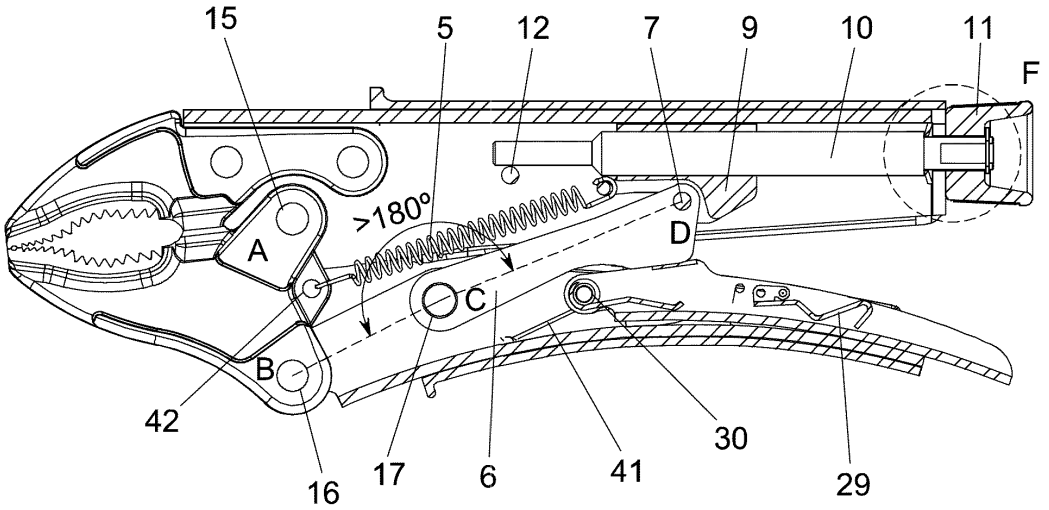

FIG. 2

A-A

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Description

OBJECT OF THE INVENTION

[0001] The present invention, as stated in the title of this specification, refers to adjustable self-locking pliers wherein the structural and ergonomic characteristics aids the user in the handling thereof and the regulation of its opening, reducing the efforts to be applied in such regulation and providing a protection of the threads of the spindle against bumps or welding projections.

[0002] It also has a cam for unlocking the tool, which has a converter device that allows using the adjustable pliers as an adjustable pliers wrench installed, providing more gripping ergonomic regardless of the thickness of the piece to be held and taking advantage of the multiplier effect of tightening efforts provided by an adjustable pliers.

BACKGROUND OF THE INVENTION

[0003] The adjustable pliers work so as to tighten different thicknesses of objects by varying the positions geometry of points A - B - C - D, hinges that make up the kinematic chain of the system.

[0004] In open position, these hinge points form a hinged quadrilateral so that the sides of said quadrilateral comprise:

- AB: A movable jaw.
- BC: A movable handle
- CD: A connecting rod.
- DA: A fixed handle plus an adjustment mechanism and a fixed jaw.

[0005] To lock the pliers about an object, in a closed position, the quadrilateral is transformed into a triangle by aligning three of its hinge points B-C-D.

[0006] The adjustment for different thicknesses of objects is obtained by varying the length of some sides of the quadrilateral, in this case by varying the side DA.

[0007] Moreover, in practice, since three aligned points are in an unstable balance, the stability of the block needs to be ensured by making the connecting rod and the release cam to support each other, so that a centred hinge point is located inside the line comprising the centred hinge point and other two end hinge points (angle formed between these three points higher than 180°). To release this lock and to obtain the open position said angle must pass to an angle lesser than 180° using the cam lever.

[0008] The most common way to control the opening of adjustable pliers is performed by turning a knob of a screw that is housed in the rear of the pliers fixed handle and which moves axially away from the fixed handle while increasing the thickness of the object to be grasped and, therefore, the necessary separation between the jaws of the pliers.

[0009] Another known form of control consists of rotating a nut located in the central area of the fixed handle, which axial movement is immobilized by the handle itself, said nut displacing a spindle which is immobilized with the connected connecting rod.

[0010] More recently, the invention patent with publication number in Spain ES2125757, employs a control system operated by a knob that moves away from the fixed handle, which spins a spindle on which a staple is moved, which is guided in a number of openings made on the fixed handle, the back of the connecting rod being hinged on said staple.

[0011] The problem of such system lies, on the one hand, in that said openings leave the grooving of the spindle unprotected against the entry of impurities, bumps, etc., which may affect the control of the pliers.

[0012] On the other hand, the fact of having the spindle embedded in the end of the fixed handle generates, at said end, bending moments and high stresses making difficult, in case of extreme openings, the adjustment of the pliers, reducing the useful life thereof.

[0013] It also has to be added that such control mechanism is not removable, thereby it is very difficult to perform maintenance therein.

[0014] Such patent protects a system for turning the adjustable pliers into a pliers wrench; said system is based on a movable slider located in the fixed handle and a pointed screw protruding from the release cam, in such a way that in the position of the slider functioning as pliers wrench the screw abuts the same avoiding the blockage.

[0015] The problem of such system is that the clamping force must be controlled with the screw, thus manually, making difficult and uncomfortable the use of the pliers.

[0016] Similarly, the adjustable pliers have a spring between the fixed jaw or the fixed handle and the movable jaw, which helps to open such pliers when unlocked, exerting its maximum pulling when the pliers are adjusted for a minimum thickness with the disadvantage that the spring force is reduced when the thickness of the work piece to be held increases, resulting when the thickness is maximum in a lack of force.

[0017] The same applies to patent WO 9937445, which incorporates a screw having an integral knob, a spring anchored to a fixed point, a carriage encapsulated into the fixed handle by flanges bent at the extremities of the wings of said handle and with a non-detachable hinge from the connecting rod in position coaxial with the spindle.

DESCRIPTION OF THE INVENTION

[0018] In order to achieve the aims and avoid the drawbacks mentioned in the preceding paragraphs, the invention provides adjustable self-locking pliers provided with a fixed handle, to which a fixed jaw in turn complemented with a movable jaw is jointly connected. This movable jaw is hinged to the fixed handle and, through its other end to a movable handle, with the movable handle being

connected to the front end of a connecting rod that, at its rear end and through a cross pin, is connected to and supported on a mechanism for adjusting the distance between the opposed dentations of both jaws.

[0019] The invention is characterized in that the adjustment mechanism comprises a spindle disposed along a longitudinal inner cavity of the fixed handle, while it is axially retained in both directions, said spindle being connected to a nut carriage guided along said longitudinal inner cavity without rotational movement, said nut carriage being connected to the connecting rod at its rear end by a rear hinge pin.

[0020] Another feature of the invention is that the longitudinal inner cavity of the fixed handle includes a dome-shaped arched bottom on which the upper curve-convex part of the nut carriage is complementarily supported.

[0021] The spindle is supported, by a forward portion thereof, on the upper pin attached to the fixed handle, such forward portion being determined by a diametric narrowing.

[0022] Another feature of the invention is that the hinge between the connecting rod and the nut is interchangeably produced in a male-female or a female-male configuration, on a transverse axis offset with respect to the longitudinal axis of the spindle discharging and spreading without any problem all eccentric loads on the spindle itself and over a large area at the bottom of the fixed handle.

[0023] Another feature of the invention is that the nut carriage includes an open housing with a lower support having a single or double seat, in the bottom of which the rear pin of the connecting rod is coupled being removable in the hinge.

[0024] Another feature of the invention is that the spindle receives the longitudinal load through the nut, transmitting it to the fixed handle through a large diameter section in an area of maximum strength of its rear wall, thus improving the load distribution, since in most existing models the load is only received by the tip of the narrow section of the spindle.

[0025] Another feature of the invention is that the pliers comprise a spring connected to two movable elements, the movable jaw and the nut carriage, which move in the same direction, thus eliminating the problem of reducing the force for opening the jaws.

[0026] Another feature of the invention is that the spindle is axially retained in an outward direction in a rear wall of the fixed handle, said rear wall being provided with a through hole, through which a terminal section of such spindle protrudes outwardly, said spindle having an annular shoulder abutting against the inner face of the mentioned rear wall of said fixed handle acting as an axial retention means in the outward direction of said spindle, as mentioned above, and as a strength support for unloading efforts. Said annular shoulder can be replaced by a flat or elastic washer that collects the spindle trust and supplies it into the wall of the fixed handle, which may simultaneously serve in its case, as an elastic spring for releasing the stiffness in the lock.

[0027] The pliers are also characterized in that they comprise a knob coupled to the end portion of the spindle, the knob having an axial hole into which the said end portion of the spindle is embedded.

[0028] Another feature of the invention is that the coupling, between the end portion of the spindle and the axial hole of the knob, comprises relative anti-rotation means between both elements determined by flat areas complemented to each other.

[0029] Another feature of the invention is that by decoupling said knob the whole adjusting mechanism can be removed.

[0030] On the other hand, the invention incorporates a converter hinged to the release cam with a transverse pin that remains locked in two positions. On the one hand, in a retracted position in the recess of the cam and, on the other hand, oscillating by a simple twist with a finger until it rests on the area of the cam making contact with the connecting rod and interposed between the support of both, thereby preventing the locking in all adjustment positions, allowing the operation of the tool as a pliers wrench whilst remaining ergonomic for grasping work pieces of large thickness, which is impossible with a universal pliers wrench.

[0031] Another feature of the invention is that the release cam, always made of metal in this type of pliers, attached into the movable handle therein by the pressure of a spring, is made of a resistant plastic material and carries a small tempered steel plate inserted in the area making contact with the connecting rod for higher specific resistance to compression and friction.

[0032] Finally, it should be noted that another feature of the invention is that there are arranged two separate plastic linings covering the two handles so as to provide a better contact with increased comfort and in such a way that given the dielectric characteristics of the linings, the knob and the release cam can they insulate the hand from a household voltage.

[0033] Next, in order to provide a better understanding of this specification and being an integral part thereof, some figures wherein the object of the invention has been represented, in an illustrative and not limitative manner, are attached.

BRIEF DESCRIPTION OF THE DRAWINGS

[0034]

Figure 1. - Shows a side view of the adjustable self-locking pliers object of the invention. The pliers are in a closed position with adjustment to zero thickness.

Figure 2. - Shows a view of the profile section of the adjustable self-locking pliers of the invention.

Figure 3. - Shows a view similar to the previous one, wherein the pliers are in open position and wherein the handles are shown.

Figure 4. - Shows a sectional view corresponding to the cut G-G of Figure 1.

Figures 5 to 15. - Show different perspective views of some features and pieces which include the pliers of the invention.

Figure 16. - Comparison between the gripping of a pliers wrench and the pliers with work pieces of different thicknesses.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0035] Considering the numbering adopted in the figures, the adjustable self-locking pliers comprise a fixed handle 1, the inner space of which serves as a guiding system for a nut carriage 9, said guidance system being correspondent with the arc-shaped nut 9 in its upper arched surface with the dome-shaped bottom having the fixed handle therein.

[0036] The nut carriage 9 is axially moved on a spindle 10 thanks to the guidance system, which prevents rotating the nut carriage 9 on the spindle 10, when the same is rotated through a knob 11.

[0037] This knob 11 is kept in an unchanged position with respect to the fixed handle 1 and, it is attached to spindle 10, either by threading or by a retention washer 18.

[0038] In order to prevent the rotation of the knob 11 on the spindle 10 and so the two of them rotate jointly, both the spindle 10 at its end part and the knob 11 have a male-female coupling with two or more flat faces 13-14 in parallel or opposed to each other.

[0039] The spindle 10 is embedded in the end where the knob 11 is located and at the opposite end it is supported on an upper pin 12, so that this support, on the one hand provides a reduction of the momentum and efforts in the embedding, thus prolonging the life of the tool and facilitating the opening thereof for large thicknesses and, on the other hand, avoids the bending of the opposite end of the spindle 10 when the nut carriage 9 gets close to that position.

[0040] The forward portion of the pin 10 resting on the upper spindle 12 comprises a diametric narrowing 23.

[0041] Furthermore, these pliers have a spring 5 anchored to the movable jaw 3 and to the nut carriage 9, instead of between the movable and fixed jaws or between the moveable jaw and the fixed handle as in traditional pliers, so that this arrangement of the spring 5 increases its tensile strength as the adjustment of the thickness of the object to be held with the pliers is increased, resulting in an appropriate and sufficient grasp in all the adjustment positions. The movable jaw 3 is supplemented with a fixed jaw 2 attached to the fixed handle 1 through pins 20 and 21.

[0042] Finally, the nut carriage 9 is associated to one end of a connecting rod 6-6' by a rear hinge pin 7, which hinges the connecting rod 6-6' and the nut carriage 9 thanks to the shape of said nut carriage 9 on its underside. In turn, the connecting rod 6-6' is connected at its opposite end to the movable handle 4 through a front hinge pin 17.

[0043] The rear hinge pin 7 of the nut carriage 9 is a cylindrical support of such rear pin 7 on the mentioned cradle, which enhances the discharge of forces and thus allows and makes the assembly and disassembling, cleaning and maintaining thereof easier, as well as also making the replacement of the spring 5 easier.

[0044] The fixed handle 1 is complemented by the movable handle 4 to which a release cam 8 is connected, while said movable handle 4 is connected to the movable jaw 3 through a lower hinge pin 16, with the movable jaw 3 being coupled to the fixed handle 1 through a centre hinge pin 15.

[0045] On the other hand, it should be noted that the nut carriage 9 has an open lower bearing housing 19, at the bottom of which the rear hinge pin 7 connecting the 6-6' to the mentioned nut carriage 9 is hinged.

[0046] In a first embodiment, the open lower support housing 19 comprises a structure by way of male element that is located between a pair of wings 44 forming part of the connecting rod 6'.

[0047] In a second embodiment, the open lower support housing 19 comprises a structure by way of female element receiving an end portion of the connecting rod (6).

[0048] Furthermore, it should be noted that the spring 5 is connected through a front end thereof into a hole 42 of the movable jaw 3, while the rear end of such spring 5 is connected to a bore 22 provided in a area ahead of the nut carriage 9. Such hole 42 is located between the hinge of the centre hinge pin 15 and the lower hinge pin 16.

[0049] The spindle 10 is outwardly retained in an axial direction in a rear wall 24 of the fixed handle 1, said rear wall 24 is provided with a through hole 25 through which an terminal section 26 of such spindle 10 outwardly protrudes, such spindle 10 having an annular shoulder 27 abutting against the inner face of the rear wall 24 of the fixed handle 1 as an axial retention means in the outward direction of the mentioned spindle. Said annular shoulder 27 can be replaced by an elastic flat washer 43.

[0050] The knob 11 is coupled to the terminal section 26 of the spindle 10, while said knob has an axial hole 28 into which said terminal section 26 of the spindle 10 is embedded, the axial retention being performed in the inward direction of the mentioned spindle.

[0051] The coupling between the terminal section 26 of the spindle 10 and the axial hole 28 of the knob 11 comprises anti-rotation means determined by the male-female coupling corresponding with the flat faces 13-14 mentioned above.

[0052] The release cam 8 is attached under pressure to the movable handle 4 in its interior by means of a spring 41 arranged in correspondence with opposed hinge holes 30 of the release cam 8 connected to the movable handle 4.

[0053] Said release cam has a body 39, preferably

made of resistant plastic material that can be made of other materials, said body 39 including a small tempered steel sheet 40 in the area making contact with the connecting rod 6-6' for further specific resistance to compression and friction.

[0054] The body 39 has also a hinge hole 31 and locking holes 33 and 34 arranged on both sides of said hinge hole 31.

[0055] The release cam 8 has a swivel converter 29 hinged into the hinge hole 31, which in one position leaves some appendages 32 embedded into the locking holes 33 of the cam 8, thus the converter 29 remaining retracted into the recess thereof. Such appendages 32 are symmetric and convex.

[0056] In the other position, the appendages 32 are left embedded in the locking holes 34 of the cam 8, thereby the converter 29, due to a wedge 35 that it has at its end, is inserted between the support of the cam 8 with the connecting rod 6-6' preventing the locking in any adjustment position, which enables the operation of the adjustable pliers as a pliers wrench whilst remaining ergonomic for grasping work pieces of large thicknesses and which may act with multiplied tightening power, facts which are impossible with ordinary or universal pliers wrenches.

[0057] Such wedge 35 is configured by a metal plate having one or more folds, also performing in addition to its function of preventing the blockage, a spring-effect function facilitating the opening between the handles.

[0058] Finally it should be noted that the adjustable pliers can have some plastic material linings 36 and 37, covering the metal surface of the fixed 1 and movable 4 handles, the inner forms of which adjust to the outer forms of their respective handles.

[0059] Such linings also have an extension of its wings in the form of flanges 38 that peripherally surround the edges of said handles and fix said linings to said edges.

[0060] By means of these linings made of dielectric material, the handles are insulated, while obtaining a better grasping ergonomics.

Claims

1. Adjustable self-locking pliers, provided with a fixed handle, to which a fixed jaw complemented with a mobile jaw hinged to the fixed handle is connected, while such movable jaw is hingely connected to a movable handle connected thereto with a front end of a connecting rod, which is hingely connected through a rear end to a mechanism for adjusting the distance between the opposed dentations of both jaws; **characterized in that** the adjustment mechanism comprises a spindle (10) disposed along a longitudinal inner cavity of the fixed handle (1) while being axially retained in both directions by a rear wall (24) of the fixed handle (1) and by a knob (11), such spindle (10) being connected to a nut carriage (9) guided along said longitudinal inner cavity without any rotational movement, said nut carriage (9) being connected to the connecting rod (6-6') through its rear end by a rear hinge pin (7); likewise the adjustable pliers comprise a release cam (8) that incorporates a swivel converter (29) that in one of its closing positions is interposed in the support of the release cam (8) onto the connecting rod (6-6').

2. Adjustable self-locking pliers according to claim 1, **characterized in that** the longitudinal inner cavity of the fixed handle (1) comprises a dome-shaped arched bottom on which the upper curve-convex part of the nut carriage nut (9) is complementarily supported.

3. Adjustable self-locking pliers, according to any one of the preceding claims, **characterized in that** the spindle (10) is supported by a forward portion thereof on an upper pin 12 embedded in the fixed handle (1).

4. Adjustable self-locking pliers according to claim 3, **characterized in that** the forward portion of the pin (10) resting on the upper pin (12) comprises a diametrical narrowing (23).

5. Adjustable self-locking pliers, according to any one of the preceding claims, **characterized in that** the nut carriage (9) incorporates an open lower support housing (19), at the bottom of which the rear hinge pin (7) is coupled.

6. Adjustable self-locking pliers according to any one of the preceding claims, **characterized in that** they comprise a spring (5) connected at its front end into a hole (42) of the movable jaw (3), while the rear end of such spring (5) is connected into a bore (22) established in an area ahead of the nut carriage (9).

7. Adjustable self-locking pliers according to any one of the preceding claims, **characterized in that** the spindle (10) is axially retained in an outward direction in the rear wall (24) of the fixed handle (1), being said rear wall provided with a through hole (25) through which a terminal section (26) of such spindle (10) outwardly protrudes, the spindle (10) having in turn axial retaining means extending outwardly from said spindle (10).

8. Adjustable self-locking pliers according to claim 7, **characterized in that** the axial retaining means extending outwardly from the spindle (10) comprise an annular shoulder (27) abutting against the inner face of the rear wall (24) of the fixed handle (1).

9. Adjustable self-locking pliers according to claim 7, **characterized in that** the axial retaining means extending outwardly from the spindle (10) comprise an elastic flat washer (43).

10. Adjustable self-locking pliers according to claim 7, **characterized in that** the knob (11), coupled to the terminal section (26) of the spindle (10), has an axial hole (28) wherein the aforementioned terminal section (26) of the spindle (10) is embedded.

11. Adjustable self-locking pliers according to claim 10, **characterized in that** the coupling between the terminal section (26) of the spindle (10) and the axial hole (28) of the knob (11) comprise anti-rotation means defined by flat faces (13-14) complemented with each other and arranged in such terminal section (26) and axial hole (28).

12. Adjustable self-locking pliers according to claim 6, **characterized in that** the hole (42) of the movable jaw (3) where the front end of the spring (5) is connected, is located between a central hinge pin (15) that associates the movable jaw (3) to the fixed handle (1) and a lower hinge pin (16) that connects the movable handle (4) with the movable jaw (3).

13. Adjustable self-locking pliers, according to any one of the preceding claims, **characterized in that** the knob (11) is made of a dielectric material

14. Adjustable self-locking pliers, according to any one of the preceding claims, **characterized in that** the knob (11) is removable and can remove the whole adjustment mechanism.

15. Adjustable self-locking pliers according to any one of the preceding claims, **characterized in that** the hinging of the connecting rod (6-6') with the nut carriage (9) corresponding to the rear hinge pin (7) is performed with eccentricity with respect to the axis of the spindle (10).

16. Adjustable self-locking pliers according to claim 1, **characterized in that** the release cam (8) is made of resistant plastic material.

17. Adjustable self-locking pliers according to claim 16, **characterized in that** the release cam (8) has a small tempered steel plate (40) inserted in the area making contact with the connecting rod (6-6').

18. Adjustable self-locking pliers according to claim 1, **characterized in that** the swivel converter (29) has, on at least one of its sides, symmetrical and convex appendages (32) housed in the locking holes (33) and (34) of the release cam (8).

19. Adjustable self-locking pliers according to claims 15 to 17, **characterized in that** the swivel converter (29) has a wedge (35) at its end.

20. Adjustable self-locking pliers according to claim 18, **characterized in that** the wedge (35) is constituted by a metal foil with at least one fold.

21. Adjustable self-locking pliers, according to the preceding claims, **characterized in that** the fixed handle (1) and the movable handle (4) have linings (36, 37) inserted thereto.

22. Adjustable self-locking pliers according to claim 21, **characterized in that** the linings (36, 37) are made of dielectric material.

23. Adjustable self-locking pliers according to claim 5, **characterized in that** the open lower support housing (19) comprises a structure as a male element located between a pair of wings (44) forming part of the connecting rod (6').

24. Adjustable self-locking pliers according to claim 5, **characterized in that** the open lower support housing (19) comprises a structure as a female element that receives an end portion of the connecting rod (6).

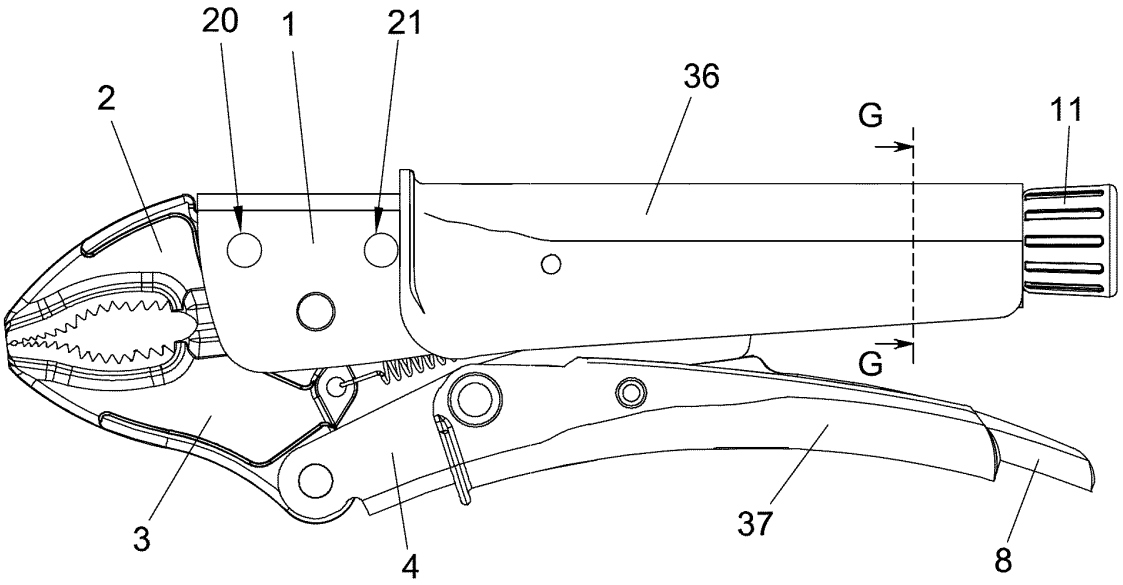

FIG. 1

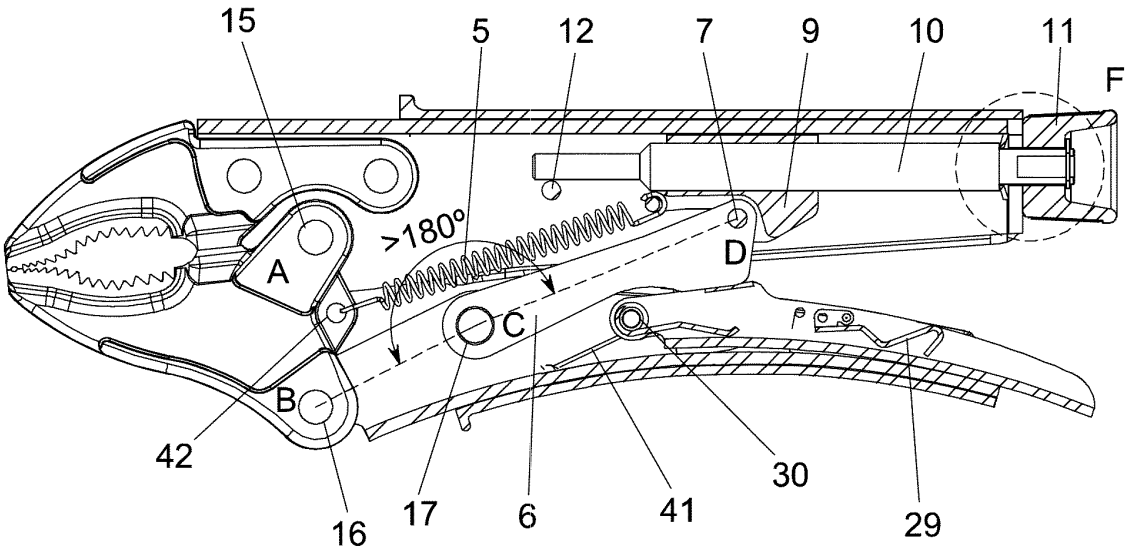

FIG. 2

A-A

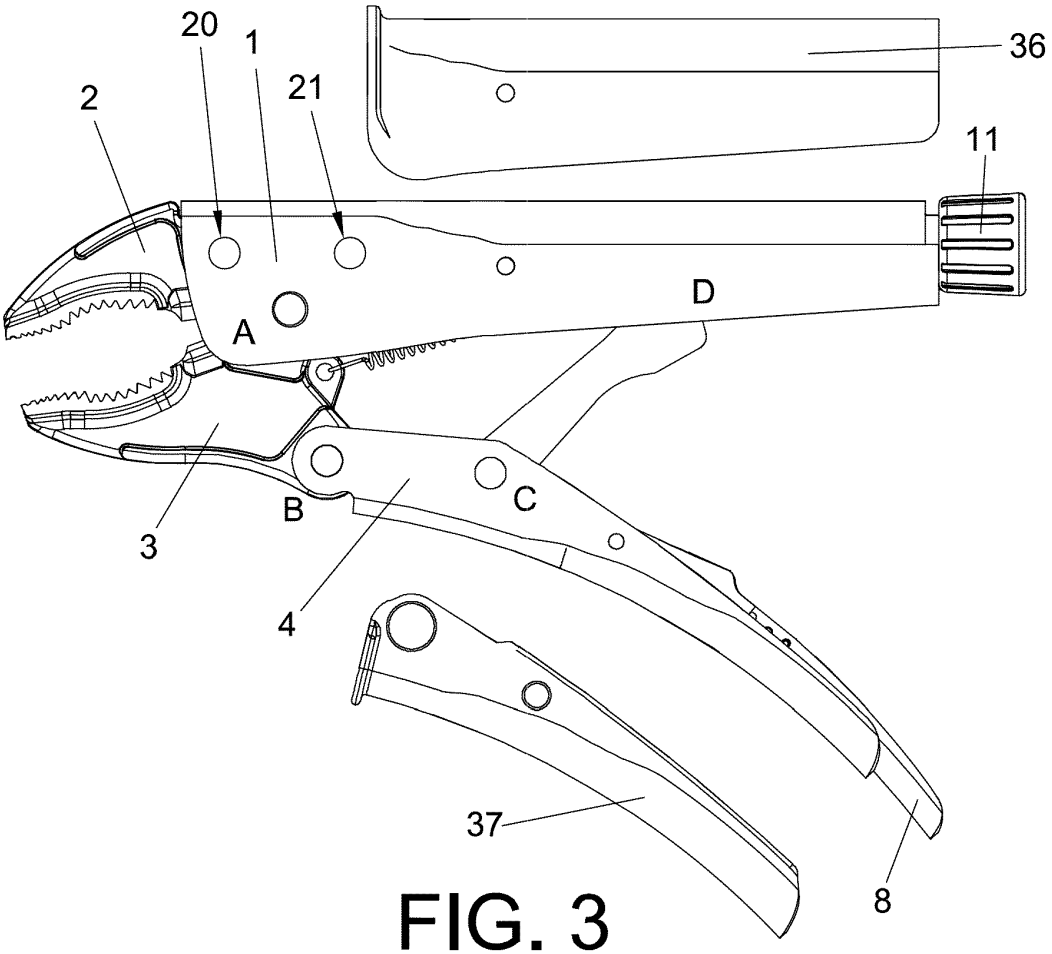

FIG. 3

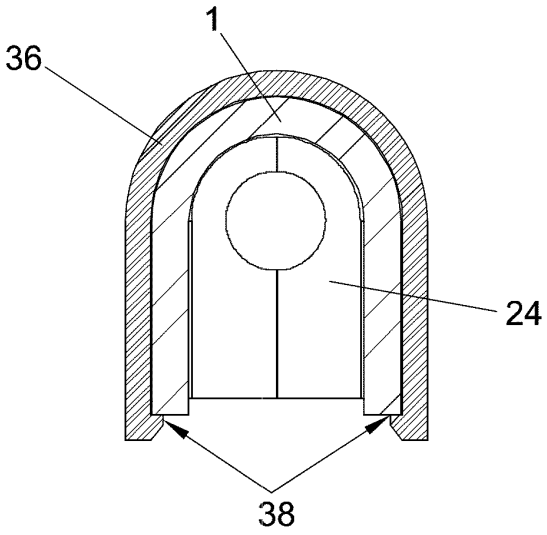

FIG. 4

G-G

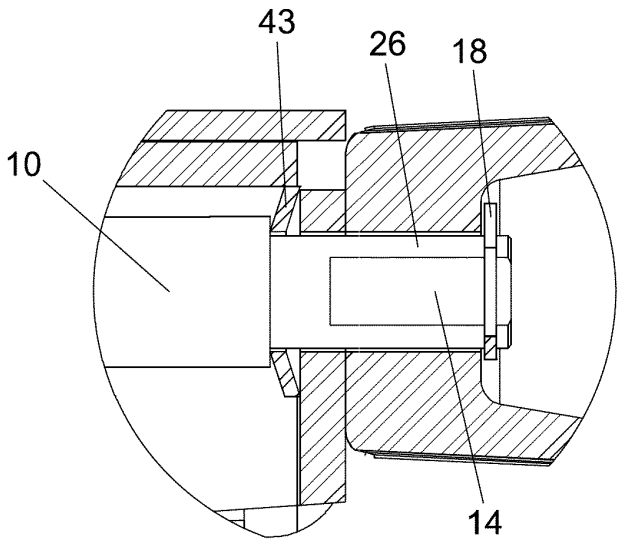

FIG. 5

F

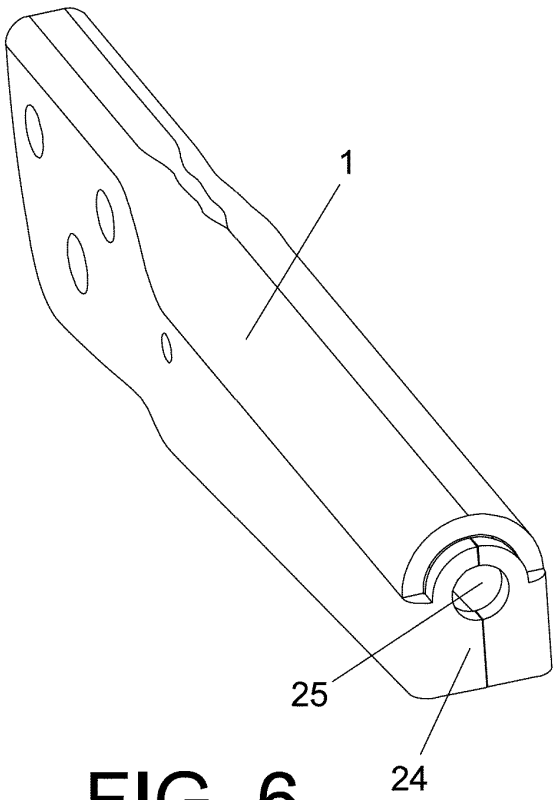

FIG. 6

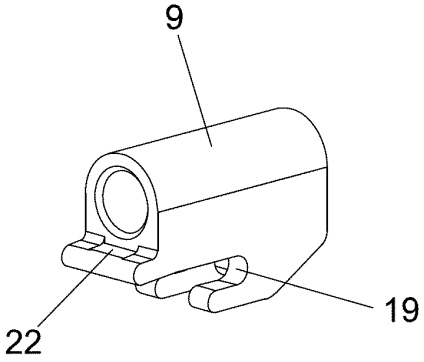

FIG. 7

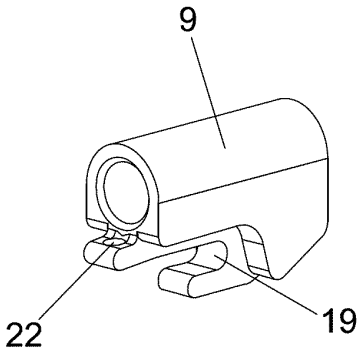

FIG. 8

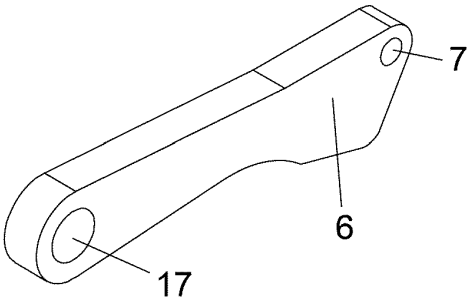

FIG. 9

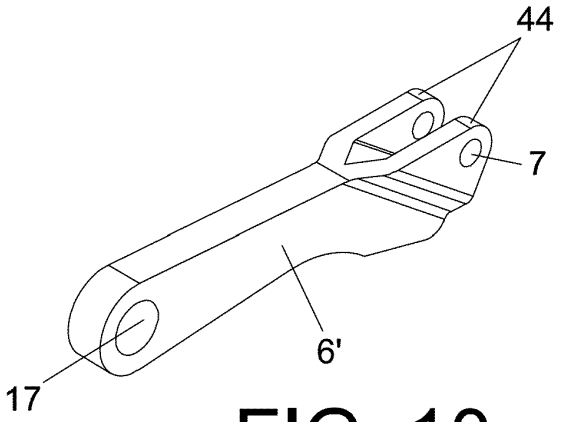

FIG. 10

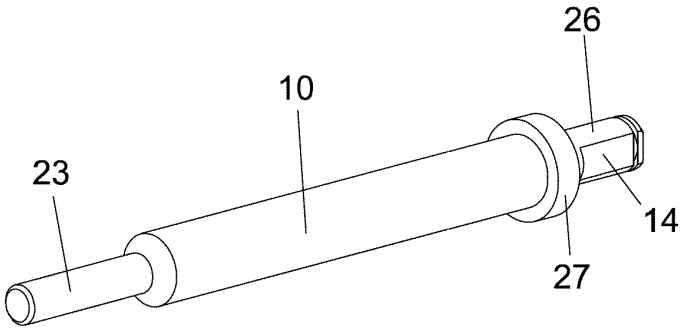

FIG.11

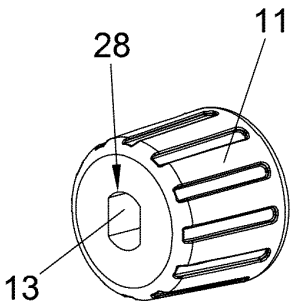

FIG. 12

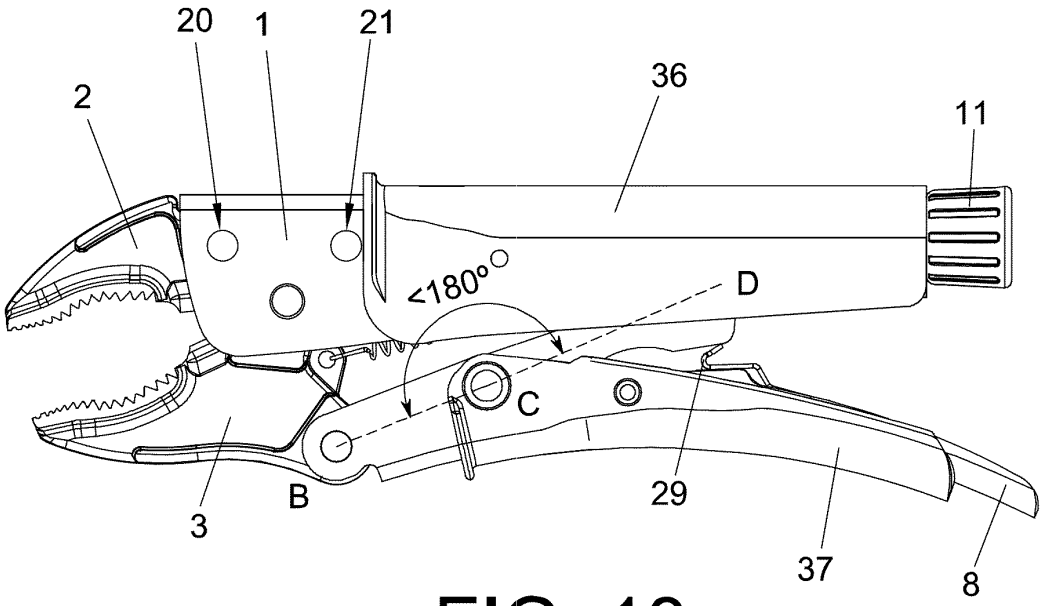

FIG. 13

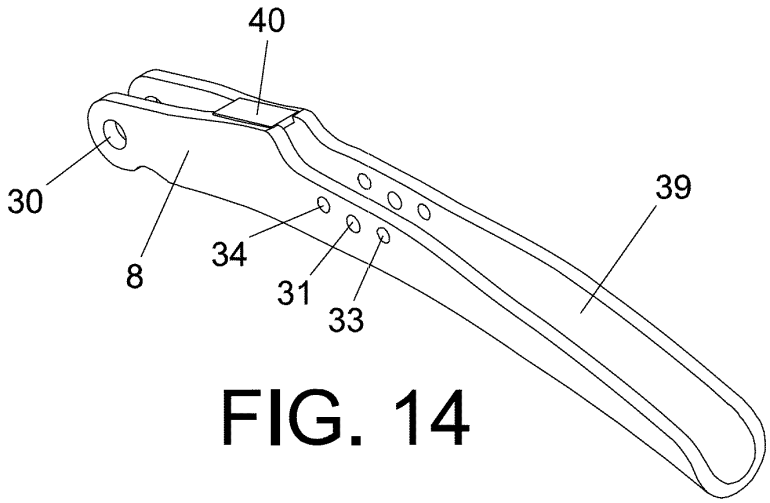

FIG. 14

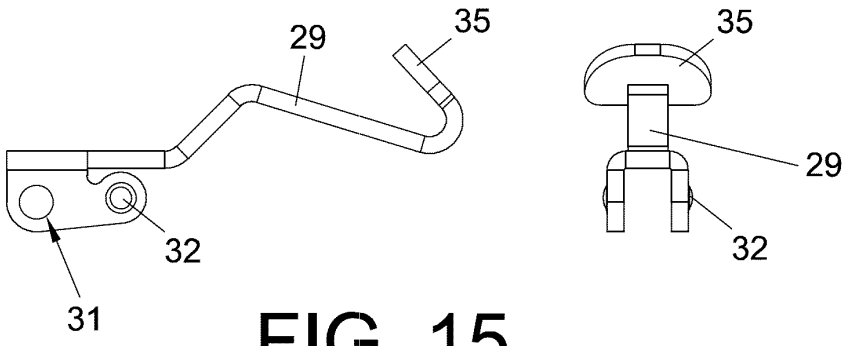

FIG. 15

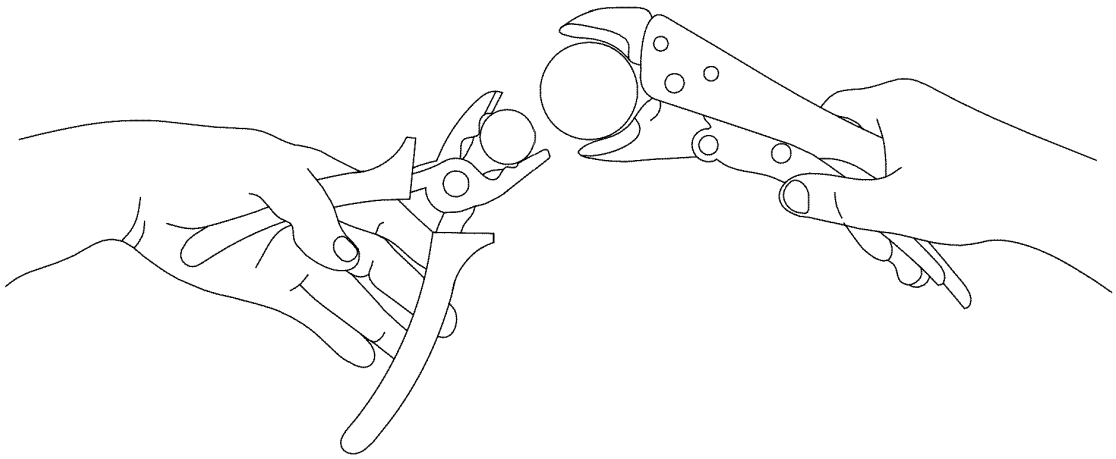

FIG. 16

INTERNATIONAL SEARCH REPORT

International application No.
PCT/ES2011/070612

A. CLASSIFICATION OF SUBJECT MATTER

B25B7/12 (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B25B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, INVENES

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 6450070 B1 (WINKLER JOHN ANDREW ET AL.) 17/09/2002, column 2, line 45 - column 4, line 64; figures 1 - 7.	1-24
Y	US 2711663 A (WILLIAM PETERSEN) 28/06/1955, column 2, line 3 - column 3, line 58; figures 1 - 4.	1-24
A	US 2800823 A (HEINRICH TUGEND) 30/07/1957, column 2, line 10 - column 4, line 6; figures 1 - 3.	1-15
A	US 3340754 A (BURCHETT CLARENCE G) 12/09/1967, column 2, line 32 - column 4, line 19; figures 1 - 4.	1-15

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
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"O" document referring to an oral disclosure use, exhibition, or other means.
"P" document published prior to the international filing date but later than the priority date claimed
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
27/01/2012	**(31/01/2012)**
Name and mailing address of the ISA/ OFICINA ESPAÑOLA DE PATENTES Y MARCAS Paseo de la Castellana, 75 - 28071 Madrid (España) Facsimile No.: 91 349 53 04	Authorized officer A. Andreu Cordero Telephone No. 91 3493055

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/ES2011/070612

C (continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of documents, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	US 2521276 A (LAMPE FRIEDRICH W) 05/09/1950, the whole document.	1,18-20
A	US 2201918 A (WILLIAM PETERSEN) 21/05/1940, the whole document.	1,18-20
A	US 2853910 A (WILLIAM PETERSEN) 30/09/1958, the whole document.	1,18-20

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/ES2011/070612

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REFERENCES CITED IN THE DESCRIPTION

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- WO 9937445 A **[0017]**