(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 168 003 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
25.12.2019 Bulletin 2019/52

(21) Application number: **14897379.5**

(22) Date of filing: **07.07.2014**

(51) Int Cl.:
B25B 13/46 *(2006.01)* ***B25G 1/06*** *(2006.01)*
B25B 23/00 *(2006.01)*

(86) International application number:
PCT/ES2014/000114

(87) International publication number:
WO 2016/005611 (14.01.2016 Gazette 2016/02)

(54) **RATCHET WRENCH**

RATSCHENSCHLÜSSEL

CLÉ À ROCHET

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(43) Date of publication of application:
17.05.2017 Bulletin 2017/20

(73) Proprietor: **Blasco Monter, Emilio**
08860 Castelldefels (Barcelona) (ES)

(72) Inventor: **OLIVER LAGARDERA, Sergio**
08859 Begues (Barcelona) (ES)

(74) Representative: **Juncosa Miró, Jaime et al**
Torner, Juncosa i Associats, S.L.
Gran Via de les Corts
Catalanes, 669 bis, 1o, 2a
08013 Barcelona (ES)

(56) References cited:
FR-A- 637 741
US-A- 266 595
US-A- 822 962
US-A- 1 050 131
US-A- 1 381 128
US-A- 1 547 865
US-A- 1 868 892
US-A- 4 445 404
US-A1- 2013 255 060

EP 3 168 003 B1

Description

Field of the art

[0001] The present invention in general relates to a ratchet wrench and, more particularly, to a wrench that comprises a functional head and a handle connected to each other capable of relative rotation around a hinge axis, a ratchet mechanism associated with said hinge axis and a releasing mechanism operable to release the hinge from said ratchet mechanism.

Background of the invention

[0002] Document ES 0215567 A3 relates to a ratchet wrench that comprises a head provided with a pair of clamps, a handle connected to the head capable of relative rotation around a hinge axis, and a ratchet mechanism that includes a ratchet wheel section coaxial to said hinge axis, integrally formed with the head body and provided with circumferential teeth along part of a peripheral edge thereof, a ratchet pawl movably installed on the handle, and an elastic element which biases said ratchet pawl against said circumferential teeth of the ratchet wheel. The wrench additionally includes a releasing member movably installed on the handle and linked to the ratchet pawl so that when the releasing member is manually moved from a rest position to a release position, the ratchet pawl is disengaged from the ratchet wheel against the bias of said elastic working element.

[0003] A drawback of the ratchet wrench from the referenced document ES 0215567 A3 is that the releasing member is rigidly connected to the ratchet pawl, and, consequently, the movements that the ratchet pawl inevitably experiences when, during its operation, it jumps from one tooth to another of the circumferential teeth of the ratchet wheel, are transmitted to the releasing member, which can cause unnecessary noise and inconvenience to the user that is gripping the tool by the handle. Another drawback is that the ratchet pawl is provided with guided linear movements in a direction aligned with the hinge axis and has a single tooth that engages the circumferential teeth of the ratchet wheel in a radial direction, which is hardly prone to resisting the tangential stresses experienced by the ratchet mechanism when operating in the retention direction.

[0004] Document US 20060225539 A1 relates to a wrench provided with a handle attached to a head with two movable clamps through a driving mechanism that comprises a driving screw rotatably mounted on the head body and provided with two externally threaded portions with opposite threading directions respectively engaged to corresponding internally threaded holes with opposite threading directions formed on both clamp bodies, respectively. On both ends of the driving screw respective gripping elements are fixed arranged in positions accessible to be gripped and turned by a user.

[0005] A drawback of the wrench from referenced document US 20060225539 A1 is that the material of both clamp bodies surrounding by 360° the respective internally threaded holes occupies a relatively large space in the head body, and this space, in case one wishes to connect the handle with the head by means of a ratchet mechanism, it would force one to provide a ratchet wheel with a relatively small diameter or to place the hinge axis relatively far from the damps, both options being unfavourable as regards the mechanical performance of the components and the versatility of the tool. Another drawback is that it includes a retention device located in a central position that prevents the complete closure of the clamps.

[0006] Document US 822962 A discloses a ratchet wrench comprising a functional head rotatably connected to a handle about a hinge axis, a ratchet wheel coaxial with the hinge axis rigidly attached to the functional head and provided with circumferential teeth along a peripheral edge thereof, a ratchet pawl movably installed on the handle and provided with at least a restraining tooth engageable to the circumferential teeth of the ratchet wheel, an elastic working element that biases the ratchet pawl to an engaged position with the circumferential teeth of the ratchet wheel, a releasing member movably installed on the handle and manually operable to disengage the ratchet pawl against the bias of the elastic working element, and a locking element movably installed on the handle and manually operable between a rest position, in which the locking element does not interfere with the ratchet pawl, and a locking position.

[0007] Document US 1547865 A discloses a ratchet wrench having a functional head, a handle, a ratchet wheel provided with ratchet teeth, and two pawls which can be moved by a shifter bar, wherein the shifter bar in movable to such a position where an intermediate element linked to the shifter bar holds one pawl in engagement with the ratchet teeth.

Disclosure of the invention

[0008] The present invention contributes to alleviate the above and other drawbacks by providing a ratchet wrench that comprises a functional head and a handle connected to each other capable of relative rotation around a hinge axis, and a ratchet mechanism between the handle and the functional head. Said ratchet mechanism comprises a ratchet wheel coaxial with said hinge axis, rigidly attached to the functional head and provided with circumferential teeth along at least part of a peripheral edge thereof, a ratchet pawl movably installed on the handle, and an elastic working element which biases said ratchet pawl to an engaged position against said circumferential teeth of said ratchet wheel.

[0009] The ratchet wrench of the present invention additionally comprises a releasing member and a locking element. Said releasing member is movably installed on the handle and is manually operable. A return elastic element permanently biases the releasing member to a

rest position. Said locking element is also movably installed on the handle and is manually operable to move between a rest position, in which said locking element does not interfere with the ratchet pawl, and a locking position, in which the locking element contacts the ratchet pawl, holding it in said engaged position with the ratchet wheel.

[0010] According to the invention, the locking element is slidingly installed in a cavity of the handle and has a protrusion that fits in a first recess of said cavity when the locking element is in said rest position and in a second recess of said cavity when the locking element is in said locking position. The locking element has, for example, the shape of an elongated rod with a contour defining the protrusion, and the protrusion is pushed against the first and second cavity recesses as a result of some elasticity of the locking element in cooperation with the configuration of the cavity.

[0011] Optionally, said releasing member is linked to the ratchet pawl by means of a unidirectional actuation kinematic chain, which, when the releasing member is manually moved from said rest position to a release position, it positively acts to transmit the movement of the releasing member to the ratchet pawl, resulting in a movement of the ratchet pawl to a position out of engagement with the ratchet wheel against the bias of said elastic working element. Instead, when the releasing member is returned and held in the rest position by said elastic return element, said unidirectional actuation kinematic chain does not act and the interaction between the releasing member and the ratchet pawl is interrupted, which prevents that movements experienced by the ratchet pawl, when it jumps from a tooth to the next of the circumferential teeth of the ratchet wheel during its operation, be transmitted to the releasing member.

[0012] In one embodiment, the ratchet pawl is installed on the handle so that it can pivot around a pivoting axis parallel to the hinge axis and it has at least one or more restraining teeth that fit with the circumferential teeth of the ratchet wheel. Preferably, the arrangement of the ratchet pawl and of its pivoting axis relative to the ratchet wheel and the hinge axis is such that the geometric plane that contains said pivoting axis and that goes approximately through the centre of the restraining tooth or of that of the restraining teeth farthest from the pivoting axis is a substantially tangential plane to the circumferential teeth of the ratchet wheel.

[0013] Preferably, the ratchet pawl is installed on the handle between the ratchet wheel and the releasing member. However, the unidirectional actuation kinematic chain allows two alternative opposite embodiments. In the first embodiment, the unidirectional actuation kinematic chain acts on compression but not on traction; in other words, it is capable of pushing but is not capable of pulling. In a second embodiment, the unidirectional actuation kinematic chain acts on compression; in other words, it is capable of pulling but is not capable of pushing.

[0014] In the first embodiment, the releasing member is farther away from the hinge axis when it is in the rest position than when it is in the release position, so that, for it to be moved from the rest position to the release position, it must be manually displaced bringing it closer to the hinge axis against the bias of the elastic return element, thereby the unidirectional actuation kinematic chain pushing the ratchet pawl out of engagement with the ratchet wheel against the bias of the elastic working element. When the releasing member is released, the elastic return element returns it to the rest position at the same time as the elastic working element moves the ratchet pawl back into engagement with the ratchet wheel.

[0015] However, since in this first embodiment the unidirectional actuation kinematic chain is not capable of pulling, the unidirectional actuation kinematic chain does not transmit the movements experienced by the ratchet pawl to the releasing member as it jumps from one tooth to another of the circumferential teeth of the ratchet wheel during the escape operation of the ratchet mechanism.

[0016] In the second alternative embodiment, the releasing member is closer to the hinge axis when it is in the rest position than when it is in the release position, so that for it to be moved from the rest position to the release position it must be manually displaced away from the hinge axis against the bias of the elastic return element, thereby the unidirectional actuation kinematic chain pulling the ratchet pawl out of engagement with the ratchet wheel against the bias of the elastic working element. When the releasing member is released, the elastic return element returns it to the rest position at the same time as the elastic working element moves the ratchet pawl back into engagement with the ratchet wheel.

[0017] However, since in the second embodiment the unidirectional actuation kinematic chain is not capable of pushing, the unidirectional actuation kinematic chain does not transmit the movements experienced by the ratchet pawl to the releasing member as it jumps from one tooth to another of the circumferential teeth of the ratchet wheel during the escape operation of the ratchet mechanism.

[0018] The first embodiment comprises a pushing member installed on the handle so that it may pivot around a pivoting axis and a pushing rod that has an end linked to the releasing member and another end linked to said pushing member, and said unidirectional actuation kinematic chain includes a simple push contact between the pushing member and the ratchet pawl only when the pushing member is pivoted by the pushing rod as a result of the movement of the releasing member from the rest position to the release position.

[0019] In contrast, when the releasing member is returned to the rest position by the elastic return element, the ratchet pawl is returned to the working position by the elastic working element, but since the push contact between the pushing member and the ratchet pawl is

interrupted, the movements experienced by the ratchet pawl, which is normally biased into engagement with the ratchet wheel by the elastic working element, in its interaction with the ratchet wheel, are not transmitted to the releasing member.

[0020] In the second embodiment, the unidirectional actuation kinematic chain comprises a connecting rod that has an end hingedly connected to the releasing member by a pivoting juncture and another end hingedly connected to the ratchet pawl by a pivoting and sliding juncture, so that the connecting rod pulls the ratchet pawl away from the ratchet wheel only when the releasing member is manually moved from the rest position to the release position.

[0021] In contrast, when the releasing member is returned to the rest position by the elastic return element, the ratchet pawl is returned to the working position by the elastic working element, but since the pin can be freely moved relative to the ratchet pawl by virtue of said pivoting and sliding juncture, the interaction between the connecting rod and the ratchet pawl is interrupted, so that the ratchet pawl, which is normally biased into engagement with the ratchet wheel by the elastic working element, can experience the movements caused by the interaction with the toothed wheel, these movements not being transmitted to the releasing member.

[0022] The functional head can be of different types. In an embodiment, the functional head comprises a head body, two movable clamp bodies installed on said head body so that they can move along a clamp guide arranged in a direction perpendicular to the hinge axis, and a driving mechanism installed on the head body and connected to the clamp bodies so that the driving mechanism, when it is manually operated, moves said clamp bodies in opposite directions towards or away from each other, thereby adjusting the spacing between mutually opposed clamp surfaces of the clamp bodies.

[0023] In one embodiment, said driving mechanism comprises a driving screw rotatably mounted on the head body, arranged in a position parallel to said clamp guide and placed between the clamp guide and the hinge axis. This driving screw has two externally threaded portions with opposite threading directions, which are engaged to corresponding internally threaded sections with opposite threading directions formed on the clamp bodies, respectively.

[0024] Said internally threaded sections of the clamp bodies do not completely surround the driving screw, but only encompass certain angle, for example an angle equal to or less than 180°, about the driving screw. This implies a significant reduction of the space occupied by the driving mechanism compared with other prior art devices, which permits the installation of a ratchet wheel of larger diameter and/or reduce the distance between the hinge axis and the driving screw, thereby favouring the mechanical performance of the components and the versatility of the tool.

[0025] In another alternative embodiment, the driving mechanism comprises a threaded stem rigidly attached to one of the clamp bodies or integrally formed therewith, an internally threaded section rigidly attached to the other of the clamp bodies or integrally formed therewith, and a driving sleeve rotatably mounted but not axially displaceable on the head body. Said threaded stem is parallel to the clamp guide and has a first threading direction, said internally threaded section is likewise parallel to the clamp guide and has a second threading direction opposite to said first threading direction, and said driving sleeve has an internally threaded hole that has said first threading direction and an external thread that has said second threading direction. The internal thread of the driving sleeve engages the threaded stem of one of the clamp bodies and said external thread of the driving sleeve engages the internally threaded section of the other of the clamp bodies.

[0026] The internally threaded section of the other of the clamp bodies only encompasses certain angle, for example an angle equal to or less than 180°, around the driving sleeve, which implies a significant reduction of the space occupied by the driving mechanism compared with other prior art devices, and allows the installation of a ratchet wheel of larger diameter and/or the reduction of the distance between the hinge axis and the driving screw, thereby favouring the mechanical performance of the components and the versatility of the tool.

[0027] In another alternative embodiment, the functional head comprises a tube wrench, and in yet another alternative embodiment the functional head comprises an adjustable nut wrench with a fixed jaw and a movable jaw.

Brief description of the drawings

[0028] The above and other features and advantages will be more apparent from the following detailed description of a number of embodiment examples with reference to the attached drawings, in which:

Fig. 1 is a front view of a ratchet wrench according to one embodiment of the present invention, including a functional head and a handle mutually related by a ratchet mechanism;

Fig. 2 is a side view of the ratchet wrench of Fig. 1;

Fig. 3 is a front view of the ratchet mechanism of Fig. 3 in a working position;

Fig. 4 is a front view of the ratchet mechanism of Fig. 3 in a release position;

Fig. 5 is a front view of a ratchet mechanism of the wrench of Figs. 1 and 2 according to a first alternative embodiment thereof in a locking position;

Fig. 6 is a partial perspective view of a handle end where the ratchet mechanism of Figs. 3, 4 and 5 is housed;

Fig. 7 is a cross-sectional view taken along a plane VII-VII in Fig. 6 including, in addition, a grooved ratchet shaft;

Fig. 8 is a perspective view of the grooved ratchet shaft;
Fig. 9 is a front view of a ratchet mechanism according to a second alternative embodiment thereof in a working position;
Fig. 10 is a front view of the ratchet mechanism of Fig. 9 in a release position;
Fig. 11 is a perspective view of the functional head of the wrench of Figs. 1 and 2;
Fig. 12 is a cross-sectional view taken along the plane XII-XII in Fig. 11;
Fig. 13 is a perspective view of two clamp bodies of the head of Figs. 11 and 12;
Fig. 14 is a perspective view of a driving screw in cooperation with both clamp bodies of Fig. 13 in a completely closed position;
Fig. 15 is a perspective view of the driving screw in cooperation with both clamp bodies of Fig. 13 in a completely open position;
Fig. 16 is a perspective view of a functional head according to another alternative embodiment thereof;
Fig. 17 is a cross-sectional view of a head body of the functional head of Fig. 15 taken along the plane XVII-XVII in Fig. 16;
Fig. 18 is a perspective view of two clamp bodies and a driving sleeve of the functional head of Fig. 16;
Fig. 19 is a perspective view of a functional head according to yet another alternative embodiment thereof;
Fig. 20 is a cross-sectional view of a head body of the functional head of Fig. 19 taken along the plane XX-XX in Fig. 19;
Fig. 21 is a perspective view of two clamp bodies and a driving sleeve of the functional head of Fig. 19;
Fig. 22 is a front view of a ratchet wrench according to another alternative embodiment of the present invention, which includes a functional head that comprises a tube wrench; and
Fig. 23 is a front view of a ratchet wrench according to yet another alternative embodiment of the present invention, which includes a functional head that comprises an adjustable nut wrench with a fixed jaw and a movable jaw.

Detailed description of exemplary embodiments

[0029] With reference first to Figs. 1 and 2, a ratchet wrench according to one embodiment of the present invention is shown therein, which comprises a functional head 1 and a handle 2 connected to each other capable of relative rotation around a hinge axis 3 in cooperation with a ratchet mechanism that will be described in detail hereinbelow.

[0030] Handle 2 comprises a handle body 29 that has a flattened region on an end with one or more housings in which several elements of the ratchet mechanism are housed, and a lid 30 fixed to said handle body 29 closing said housings. On another opposite end of the handle 2 there is a handgrip 66 ergonomically configured to be gripped by hand. In the handle 2 there are also movably installed releasing buttons 73 accessible from both sides of the flattened region and a locking button 72 accessible from a side edge of the flattened region. Any of said releasing buttons 73 is manually operable to release the ratchet mechanism and said locking button 72 is manually operable to lock the ratchet mechanism, as will be described hereinbelow. Alternatively, handle 2 can include two or more lids 30 fixed to the handle body 29 to close the housings depending on the shape and arrangement of the housings.

[0031] The functional head 1 comprises a head body 17 that has two mutually opposed lugs 27, 28 between which said flattened region of the handle end 2 is housed. In the embodiment shown in Figs. 1 and 2, the functional head 1 comprises two movable clamp bodies 18, 19 installed on the head body 17, and said clamp bodies 18, 19 have mutually opposed clamp surfaces 35, 36. This and other embodiments of the functional head will be described in detail hereinbelow.

[0032] Figs. 3 to 8 show a ratchet mechanism according to a first embodiment that comprises a ratchet wheel 4 coaxial with said hinge axis 3 housed in a housing of the handle body 29 in the flattened region of the handle end 2 covered by the lid 30. The ratchet wheel 4 has circumferential teeth 4a formed along a peripheral edge thereof.

[0033] As is shown in Figs. 6 and 7, from the sides of the ratchet wheel 4 cylindrical hub portions 31 protrude that are inserted and rotatably guided in respective guide holes 32, 33 formed on said handle body 29 and on the lid 30, respectively. However, the ratchet wheel 4 is rigidly attached to the functional head 1 by means of a grooved ratchet shaft 52 (Fig. 8) inserted through grooved holes 50, 51 formed on the lugs 27, 28 of the head body 17 and through a grooved axial hole 34 formed on the ratchet wheel 4, which prevents the relative rotation between the ratchet wheel 4 and the head body 17.

[0034] The handle body 29 has other housings covered by the lid 30 in which a ratchet pawl 5 and a releasing member 7 are housed. Said releasing member 7 is connected to the releasing buttons 73 through openings formed on the handle body 29 and on the lid 30. In the embodiment shown in Fig. 7, said releasing member 7 and one of the releasing buttons 73 are formed by a first piece and the other releasing button 73 is formed by a second piece fixed to the first by means of a screw.

[0035] Said ratchet pawl 5 has several restraining teeth 5a meshed with the circumferential teeth 4a of the ratchet wheel 4, and is installed on the handle 2 between the ratchet wheel 4 and the releasing member 7 so that it can pivot around a pivoting axis 9 parallel to the hinge axis 3 between a working position (Fig. 3), in which the restraining teeth 5a of the ratchet pawl 5 are engaged with the circumferential teeth 4a of the ratchet wheel 4, and a release position (Fig. 4), in which the restraining

teeth 5a of the ratchet pawl 5 are disengaged from the circumferential teeth 4a of the ratchet wheel 4. An elastic working element 6, such as a helical spring arranged on compression between the handle body 29 and the ratchet pawl, permanently biases the ratchet pawl 5 towards the working position (Fig. 3) against the ratchet wheel 4.

[0036] In the example illustrated in Figs. 3 to 5, the pivoting axis 9 of the ratchet pawl 5 is determined by a partially cylindrical end of the ratchet pawl 5 rotatably received in a combined partially cylindrical recess formed in the housing of the handle body 29.

[0037] The arrangement of the ratchet pawl 5 relative to the ratchet wheel 4 is such that a geometrical plane P (Fig. 3) that contains said pivoting axis 9 and that goes through said restraining teeth 5a, or more specifically through the restraining tooth 5a farthest from the hinge axis 3, is a plane substantially tangential to the circle of the circumferential teeth 4a of the ratchet wheel 4. Consequently, when in is intended that the functional head 1 rotate along with the ratchet wheel 4 in a first direction D1 (Fig. 3) relative to the handle 2, the restraining teeth 5a of the ratchet pawl 5 are restrained in the circumferential teeth 4a of the ratchet wheel 4, preventing the relative rotation. In contrast, if the functional head 1 is made to rotate along with the ratchet wheel 4 in a second direction D2 (Fig. 3) relative to the handle 2, the restraining teeth 5a of the ratchet pawl 5 jump from one tooth to another of the circumferential teeth 4a of the ratchet wheel 4 allowing the relative rotation.

[0038] The releasing member 7 is linked to the ratchet pawl 5 by a unidirectional actuation kinematic chain that includes a pushing member 11 and a pushing rod 10 arranged in other housings of the handle body 29 covered by the lid 30. Said pushing member 11 is installed in a position adjacent to the ratchet pawl 5 so that it can pivot around a pivoting axis 12, while the releasing member 7 is installed on the handle 2 in a relatively distant position of the ratchet pawl 5 and is guided so that it can slide in a direction substantially aligned with a geometric plane that contains the hinge axis 3.

[0039] In this example, the pivoting axis 12 of the pushing member 11 is determined by trunnions 11a (Fig. 7) protruding from opposite sides of the pushing member 11 inserted in corresponding holes of the handle body 29 and the lid 30.

[0040] The releasing member 7 may be moved in its housing between a rest position (Fig. 3) and a release position (Fig. 4). The releasing member 7 is farther from the hinge axis 3 in the rest position than in the release position. An elastic return element 8, such as a helical spring, permanently biases the releasing member 7 against the rest position.

[0041] The pushing rod 10 has an end slidingly and loosely inserted in a gap 67 formed on the releasing member 7 and another opposite end that is slidingly and loosely inserted in a gap 68 formed on the pushing member 11. Said elastic return element 8 is arranged on compression between a surface of the handle body 29 and the releasing member 7 and is wound around the pushing rod 10.

[0042] Thus, when the releasing member 7 is manually moved from the rest position (Fig. 3) to the release position (Fig. 4) against the bias of the elastic return element 8, the releasing member 7 pushes the pushing rod 10 and this, in turn, pushes the pushing member 11, making it pivot around the pivoting axis 12, whereby the pushing member 11 establishes a push contact against the ratchet pawl 5 and it makes the ratchet pawl 5 pivot around the pivoting axis 9 towards the release position against the bias of the elastic working element 6. While the releasing member 7 is manually held in the release position, the ratchet pawl 5 is also held in its release position and the functional head 1 can freely rotate relative to the handle 2.

[0043] When the releasing member 7 is released, the elastic working element 6 moves the ratchet pawl 5 back to its working position and the elastic return element 8 moves the releasing member 7 back to its rest position. However, by virtue of the simple push contact in the unidirectional actuation kinematic chain that links the releasing member 7 and the ratchet pawl 5, movements experienced by the ratchet pawl 5 when the restraining teeth 5a of the ratchet pawl 5 jump from one tooth to another of the circumferential teeth 4a of the ratchet wheel 4 as the functional head 1 rotates in the second direction D2 relative to the handle 2, are not transmitted to the releasing member 7, which is held static in its rest position by the elastic return element 8.

[0044] The handle body 29 has an elongated cavity formed, between the housing of the releasing member 7 and a side edge of the handle body 29, that in its end closest to the hinge axis 3 communicates with the housing of the ratchet pawl 5 and in its end farthest from the hinge axis 3 communicates with the exterior through an opening formed on said side edge of the handle body 29. Said cavity 71 is also covered by the lid 30. In the cavity 71 a locking element 69 of elongated configuration is slidingly installed, which has a contacting end 69a adjacent to the housing of the releasing member 7 and an actuation end 69b connected to the previously mentioned locking button 72 through said opening on the side edge of the handle body 29.

[0045] Said locking element 69 is manually operable by means of the locking button 72 between a rest position (Figs. 3 and 4), in which the locking element 69 does not interfere with the ratchet pawl 5, and a locking position (Fig. 5), in which said contacting end 69a of the locking element 69 contacts the ratchet pawl 5 holding it in said engaged position with the ratchet wheel 4.

[0046] The locking element 69 has a protrusion 70, and the cavity 71 has a first recess 71a and a second recess 71b. Said protrusion 70 of the locking element 69 fits in said first recess 71a of the cavity 71 when the locking element 69 is in said rest position (Figs. 3 and 4) and the protrusion 70 of the locking element 69 fits in said second recess 71b of the cavity 71 when the locking element 69

is in said locking position (Fig. 4). In the illustrated example, the locking element 69 is formed from a metal rod which has an end that defines a contacting end 69a, a contour that defines the protrusion 70 and a bend that defines the actuation end 69b, and the protrusion 70 is pushed against the first and second recesses 71a, 71b of the cavity 71 as a result of some elasticity of said metal rod in cooperation with an adequate configuration of the cavity 71.

[0047] When the locking element 69 is held in the locking position by the engagement of the protrusion 70 in the second recess 71b of the cavity 71, the action of the ratchet mechanism is cancelled and the functional head 1 is secured with the handle 2. This option is useful, for instance, in those jobs in which repeated engaging and disengaging operations of the wrench relative to a nut are required, for example, applying moderate force.

[0048] Figs. 9 and 10 show a second embodiment of the ratchet mechanism, wherein the ratchet wheel 4, the ratchet pawl 5 and the elastic working element 6 are configured and arranged in a way similar to the first embodiment described above in connection with Figs. 3, 4 and 5. The releasing member 7 is also slidingly installed on the handle 2, although, in contrast with the first embodiment, in this second embodiment the releasing member 7 is closer to the hinge axis 3 in the rest position than in the release position, and the elastic return element 8 is arranged in an opposite position so as to bias the releasing member 7 to the rest position.

[0049] In the second embodiment, the unidirectional actuation kinematic chain that links the releasing member 7 with the ratchet pawl 5 comprises a connecting rod 13 that has a first end linked to the releasing member 7 by a pivoting juncture that comprises, for example, a first pin 65 attached to the connecting rod 13 and inserted in a cylindrical hole of the releasing member 7, and a second end linked to the ratchet pawl 5 by a pivoting and sliding juncture that comprises, for example, a second pin 14 attached to the connecting rod 13 and inserted in an elongated hole 15 formed in an appendage 16 of the ratchet pawl 5. It will be understood that a reverse construction, that is, with said first pin 65 attached to the releasing member 7 and inserted in a cylindrical hole of the connecting rod 13 and/or with said second pin 14 attached to the appendage 16 of the ratchet pawl 5 and inserted in an elongated hole formed on the connecting rod 13, would provide an equivalent result and would be within the scope of the present invention.

[0050] Thus, when the releasing member 7 of the second embodiment is manually moved from the rest position (Fig. 9) to the release position (Fig. 10) against the bias of the elastic return element 8, the releasing member 7 pulls the connecting rod 13 and this, in turn, pulls the appendage 16 of the ratchet pawl 5 and makes it pivot around the pivoting axis 9 towards the release position against the bias of the elastic working element 6, which permits the free rotation of the functional head 1 relative to the handle 2 while the releasing member 7 is manually held in the release position.

[0051] When the releasing member 7 is released, the elastic working element 6 moves the ratchet pawl 5 back to its working position and the elastic return element 8 moves the releasing member 7 back to its rest position. However, by virtue of the elongated hole 15 in the unidirectional actuation kinematic chain that links the releasing member 7 and the ratchet pawl 5, movements experienced by the ratchet pawl 5 when the restraining teeth 5a of the ratchet pawl 5 jump from one tooth to another of the circumferential teeth 4a of the ratchet wheel 4 as the functional head 1 rotates in the second direction D2 relative to the handle 2, are not transmitted to the releasing member 7, which is held static in its rest position by the elastic return element 8.

[0052] Figs. 11 to 15 show a functional head 1 according to an embodiment thereof corresponding to the one shown in Figs. 1 and 2, which comprises two movable clamp bodies 18, 19 installed on said head body 17 so that they can move along a clamp guide 21, 22 (Fig. 12) arranged in a direction perpendicular to the hinge axis 3. The functional head 1 includes a driving mechanism installed on the head body 17 and manually operable to move said clamp bodies 18, 19, which allows adjusting the spacing between mutually opposed clamp surfaces 35, 36 of the clamp bodies 18, 19.

[0053] The driving mechanism comprises a driving screw 20 parallel to said clamp guide 21, 22 rotatably mounted on the head body 17 and located between the clamp guide 21, 22 and the hinge axis 3. This driving screw 20 has two externally threaded portions 23, 24 with opposite threading directions and the clamp bodies 18, 19 have corresponding internally threaded sections 25, 26 formed with opposite threading directions respectively coupled to said two externally threaded portions 23, 24 of the driving screw 20.

[0054] As is best shown in Fig. 12, the head body 17 comprises two side walls 38, 39 that have mutually opposed surfaces that cooperatively define with another part of the head body 17 a screw housing 37 sized to house and rotatably guide the driving screw 20. In said mutually opposed surfaces of the side walls 38, 39 respective channels are formed that jointly define the clamp guide 21, 22.

[0055] Each of the clamp bodies 18, 19 (Fig. 13) has a respective main guide follower portion 40, 41 that engages one of said channels that jointly define the clamp guide 21, 22 of the head body 17. Furthermore, each of the clamp bodies 18, 19 has a respective auxiliary guide follower portion 42, 43 that slidingly engages a corresponding slot of the auxiliary guide 44, 45 formed on the other of the clamp bodies 18, 19.

[0056] The auxiliary guide follower portions 42, 43 of the clamp bodies 18, 19 have respective mutually sliding surfaces located in a central plane perpendicular to the hinge axis 3, which slide in contact with each other when both clamp bodies 18, 19 are moved to adjust the spacing between the clamp surfaces 35, 36. One of the clamp

bodies 19 has a rib 74 that protrudes from its corresponding sliding surface. This rib 74 is slidingly inserted in a slot 75 formed on the sliding surface of the other clamp body 18.

[0057] In the clamp bodies 18, 19 guide protrusions 48, 49 are also formed that slidingly engage corresponding longitudinal recesses 46, 47 (Fig. 12) formed on respective distal edges parallel to the clamp guide 21, 22 of the side walls 38, 39 of the head body 17. On each of ends of the driving screw 20 a gripping element 53 is fixed in a position accessible to be gripped and turned, and these gripping elements 53 act to axially retain the driving screw 20 in said screw housing 37.

[0058] Preferably, both clamp bodies 18, 19 are identical to each other, except for the existence of said rib 74 and slot 75 and for the fact that the respective internally threaded sections 25, 26 have opposite threading directions.

[0059] Thanks to the attachment and guidance of the clamp bodies 18, 19 in the head body 17 provided by the configuration of the clamp guide 21, 22 and of the main guide follower portions 40, 41 engaged therewith, it is not necessary for the internally threaded sections 25, 26 of the clamp bodies 18, 19 to completely surround the driving screw 20, but the latter only encompass an angle equal to or less than 180° about the driving screw 20. In the illustrated embodiment, the internally threaded sections 25, 26 encompass a 120° angle about the driving screw 20, which is enough to ensure the trailing of the clamp bodies 18, 19 and also allows for an extraordinarily compact design of the functional head 1.

[0060] The guide protrusions 48, 49 of the clamp bodies 18, 19 slidingly engaged in the longitudinal recesses 46, 47 of the head body 17 prevent the side walls 38, 39 of the head body 17 from being deformed and open outwardly due to the stresses to which they are exposed during the use of the ratchet wrench. The rib 74 and the slot 75 of the clamp bodies 18, 19, slidingly engaged to each other, contribute to minimize the bending tendency experienced by the auxiliary guide follower portions 42, 43 of the clamp bodies 18, 19 due to the stresses experienced during the use of the ratchet wrench.

[0061] Figs. 16 to 18 show another alternative embodiment of the functional head 1, which comprises a head body 17 wherein first and second clamp bodies 18, 19 are installed that can be moved in a direction perpendicular to the hinge axis 3 along the clamp guide 21, 22 (Fig. 17) formed on the head body 17 by a driving mechanism.

[0062] The driving mechanism comprises a threaded stem 54 rigidly attached to said first clamp body 18. This threaded stem 54 is parallel to a clamp guide 21, 22 and has a first threading direction. The second clamp body 19 has a rigidly attached internally threaded section 55 parallel to the clamp guide 21, 22 and which has a second threading direction opposite to said first threading direction. In the head body 17, a driving sleeve 56 (best shown in Fig. 18) is rotatably but not axially displaceably mounted that has a hole with an internal thread 57 with said first threading direction engaged to said threaded stem 54 of the first clamp body 18, and an external thread 58 with said second threading direction engaged to said internally threaded section 55 of the second clamp body 19.

[0063] Said internally threaded section 55 of the second clamp body 19 only encompasses an angle equal to or less than 180°, for example 120°, around the driving sleeve 56, allowing for a compact design of the functional head 1.

[0064] As is best shown in Fig. 17, the head body 17 comprises two side walls 38, 39 with mutually opposed surfaces that, along with another part of the head body 17, define a stem housing 59 sized to house and axially guide the threaded stem 54. These mutually opposed surfaces of the side walls 38, 39 respectively include a flat face and a channel that jointly define the clamp guide 21, 22. The head body 17 also comprises a sleeve housing 60 in the shape of a through-passage in a direction perpendicular to the clamp guide 21, 22 and which intersects both the stem housing 59 and the clamp guide 21, 22.

[0065] The clamp bodies 18, 19 (best shown in Fig. 18) have respective main guide follower portions 61, 62 that engage said flat face and said channel, respectively, that jointly define the clamp guide 21, 22 of the head body 17 and respective flat auxiliary guide portions 63, 64 that slidingly engage each other.

[0066] Figs. 19 to 21 show yet another alternative embodiment of the functional head 1, which is entirely analogous to the one described above in connection with Figs. 16 to 18, except that, here, the mutually opposed surfaces of the side walls 38, 39 of the head body 17 (Fig. 20) comprise respective channels of different sizes, which jointly define the clamp guide 21, 22, and in which the first and second clamp bodies 18, 19 (best shown in Fig. 21) have respective convex main guide follower portions 61, 62 of different sizes that respectively engage said differently sized channels that jointly define the clamp guide 21, 22 of the head body 17.

[0067] Another different feature of the embodiment shown in Figs. 19 to 21 is that the first clamp body 18 has a first concave auxiliary guide portion 63 while the second clamp body 19 has a second convex auxiliary guide portion 64 that slidingly engages said first auxiliary guide portion 63 of the first clamp body 18, thus contributing to better resist stresses in radial directions relative to the axis of the threaded stem 54.

[0068] Figs. 22 and 23 show ratchet wrenches according to two further alternative embodiments of the present invention, which include a functional head 1 and a handle 2 connected to each other capable of relative rotation around a hinge axis 3 in cooperation with a similar ratchet mechanism to the one described above in connection with Figs. 1 to 10. However, in the ratchet wrench of Fig. 22 the functional head 1 comprises a tube wrench and in the ratchet wrench of Fig. 23 the functional head 1 comprises an adjustable nut wrench.

[0069] The tube wrench included in the functional head

1 of the ratchet wrench of Fig. 22 comprises a fixed jaw 76 integral with the head body 17 and a movable jaw 77 connected to the head body 17 so that it can freely pivot around a pivoting axis 78 parallel to the hinge axis 3 so that it can come closer to or away from the fixed jaw 76. The fixed and movable jaws 76, 77 have respective mutually opposed toothed surfaces. The toothed surface of the fixed jaw 76 is inscribed in a convex curved surface, while the toothed surface of the movable jaw 77 includes two inscribed sections in two planes that form an obtuse angle to each other.

[0070] The adjustable nut wrench included in the functional head 1 of the ratchet wrench of Fig. 23 comprises a fixed jaw 79 integral with the head body 17 and a movable jaw 80 connected to the head body 17 by means of linear guides. The fixed and movable jaws 79, 80 have respective mutually parallel and opposed smooth surfaces. In the head body 17, an endless toothed wheel 81 is rotatably installed that meshes with corresponding teeth 82 formed on the movable jaw 80. The endless toothed wheel 81 can be manually driven to bring the movable jaw 80 closer to or away from the fixed jaw 79.

[0071] In both alternative embodiments of Figs. 22 and 23, the head body 17 has two mutually opposed lugs 27, 28 between which the flattened region of the handle end 2 is housed that supports the hinge axis 3, and where the ratchet mechanism is arranged according to what has been described above in connection with Figs. 1 to 10. The handle 2 comprises a handle body 29 that has one or more housings in which there are housed several elements of the ratchet mechanism, a lid 30 that closes said housings, a locking button 72, a releasing button 73 and a handgrip 66. The handle 2 of the ratchet wrench of Fig. 22 has two lids 30a, 30b instead of one single lid.

Claims

1. A ratchet wrench that comprises:

a functional head (1) and a handle (2) connected to each other capable of relative rotation around a hinge axis (3);
a ratchet wheel (4) coaxial with said hinge axis (3), rigidly attached to the functional head (1) and provided with circumferential teeth (4a) along at least part of a peripheral edge thereof;
a ratchet pawl (5) movably installed on the handle (2) and provided with at least a restraining tooth (5a) engageable to said circumferential teeth (4a) of the ratchet wheel (4);
an elastic working element (6) that biases said ratchet pawl (5) to an engaged position with said circumferential teeth (4a) of said ratchet wheel (4);
a releasing member (7) movably installed on the handle (2) and manually operable between a rest position and a release position;
a kinematic chain arranged between said releasing member (7) and said ratchet pawl (5), wherein said kinematic chain transforms a movement of the releasing member (7) from said rest position to said release position into a movement of the ratchet pawl (5) to a position out of engagement with the ratchet wheel (4) against the bias of said elastic working element (6),; and
a locking element (69) movably installed on the handle (2), said locking element (69) being manually operable between a rest position, in which the locking element (69) does not interfere with the ratchet pawl (5), and a locking position,

characterized in that:

the locking element (69) in said locked position contacts the ratchet pawl (5) and holds the ratchet pawl (5) in said engaged position with the ratchet wheel (4);
the locking element (69) is slidingly installed in a cavity (71) of the handle (2) and has a protrusion (70); and
said cavity (71) has a first recess (71a) in which said protrusion (70) fits when the locking element (69) is in said rest position, and a second recess (71b) in which the protrusion (70) fits when the locking element (69) is in said locking position.

2. A ratchet wrench according to claim 1, wherein the locking element (69) is formed from a metal rod that has a contacting end (69a) to contact the ratchet pawl (5), a contour that defines the protrusion (70) and a bend that defines an actuation end (69b) connected to a locking button (72) through an opening in the handle (2), and wherein the handle (2) comprises a handle body (29) that has a flattened region in which said cavity (71) is formed in which the locking element (69) is housed, and the handle (2) has one or more housings in which the ratchet wheel (4), the ratchet pawl (5), the releasing member (7), and other associated elements thereto are housed, and at least one lid (30) fixed to said handle body (29) closing said cavity (72) and said housings.

3. A ratchet wrench according to claim 1 or 2, wherein it further comprises an elastic return element (8) that biases said releasing member (7) to said rest position, and in that said kinematic chain is a unidirectional actuation kinematic chain that transmits the movement of the releasing member (7) when it is moved from the rest position to the release position to the ratchet pawl (5) and it does not transmit movements experienced by the ratchet pawl (5) as it jumps from one tooth to another of the circumferential teeth (4a) of the ratchet wheel (4) to the releasing member (7) when the releasing member (7) is held in the rest

position by said elastic return element (8).

4. A ratchet wrench according to any one of the preceding claims, wherein the ratchet pawl (5) is installed on the handle (2) so that it can pivot around a pivoting axis (9) parallel to said hinge axis (3) and wherein the ratchet pawl (5) is installed between the ratchet wheel (4) and the releasing member (7).

5. A ratchet wrench according to claim 4, wherein the releasing member (7) is farther away from the hinge axis (3) in the rest position than in the release position, and said unidirectional actuation kinematic chain comprises a pushing rod (10) linked to the releasing member (7) and a pushing member (11) installed on the handle (2) so that said pushing member (11) can pivot around a pivoting axis (12), wherein a pushing contact exists between said pushing member (11) and the ratchet pawl (5) only when the pushing member (11) is pivoted by said pushing rod (10) as a result of the movement of the releasing member (7) from the rest position to the release position.

6. A ratchet wrench according to claim 4, wherein the releasing member (7) is closer to the hinge axis (3) in the rest position than in the release position, and said unidirectional actuation kinematic chain comprises a connecting rod (13) that has an end linked to the releasing member (7) by a pivoting juncture and another end linked to ratchet pawl (5) by a pivoting and sliding juncture.

7. A ratchet wrench according to claim 2, wherein the ratchet wheel (4) has cylindrical hub portions (31) that protrude from both its sides and that are inserted and rotatably guided in respective guide holes (32, 33) formed on said handle body (29) and on said lid (30), respectively.

8. A ratchet wrench according to claim 7, wherein said functional head (1) further comprises a head body (17) that has two opposed lugs (27, 28) between which an end of said flattened region of the handle (2) is housed where the ratchet wheel (4) is installed, and wherein the ratchet wheel (4) has a grooved axial hole (34), and said lugs (27, 28) of said head body (17) have respective grooved holes (50, 51) aligned with said grooved axial hole (34) of the ratchet wheel (4), and a grooved ratchet shaft (52) coaxial with the hinge axis (3) is inserted through said grooved holes (50, 51) of the lugs (27, 28) and through the grooved axial hole (34) of the ratchet wheel (4) preventing the relative rotation between the ratchet wheel (4) and the head body (17).

9. A ratchet wrench according to claim 8, wherein said functional head (1) further comprises two movable clamp bodies (18, 19) installed on said head body (17) so that they can move along a clamp guide (21, 22) arranged in a direction perpendicular to the hinge axis (3), and a driving mechanism installed on the head body and manually operable to move said clamp bodies (18, 19), thereby adjusting the spacing between mutually opposed clamp surfaces (35, 36) of the clamp bodies (18, 19), and wherein said driving mechanism comprises a driving screw (20) parallel to said clamp guide (21, 22) rotatably mounted on the head body (17) and located between the clamp guide (21, 22) and the hinge axis (3), said driving screw (20) having two externally threaded portions (23, 24) with opposite threading directions respectively engaged to corresponding internally threaded sections (25, 26) with opposite threading directions formed on the clamp bodies (18, 19), respectively, and wherein at least on an end of said driving screw (20) a gripping element (53) is fixed in a position accessible to be gripped and turned

10. A ratchet wrench according to claim 9, wherein said internally threaded sections (25, 26) of the clamp bodies (18, 19) encompass an angle equal to or less than 180° around the driving screw (20).

11. A ratchet wrench according to claim 9 or 10, wherein the head body (17) comprises two side walls (38, 39) with mutually opposed surfaces that define at least part of a screw housing (37) sized to house and rotatably guide the driving screw (20), and said mutually opposed surfaces of said side walls (38, 39) include respective channels that jointly define the clamp guide (21, 22) and wherein each of the clamp bodies (18, 19) has a respective main guide follower portion (40, 41) that engages one of said channels that jointly define the clamp guide (21, 22) of the head body (17) and a respective auxiliary guide follower portion (42, 43) that slidingly engages a corresponding auxiliary guide slot (44, 45) formed on the other of the clamp bodies (18, 19), and wherein the side walls (38, 39) of the head body (17) comprise respective distal edges parallel to the clamp guide (21, 22) in which longitudinal recesses (46, 47) are formed that slidingly engage guide protrusions (48, 49) formed on the clamp bodies (18, 19).

12. A ratchet wrench according to claim 11, wherein the clamp bodies (18, 19) have respective mutually sliding surfaces perpendicular to the hinge axis (3) and one of the clamp bodies (18, 19) has a rib (74) that protrudes from its corresponding sliding surface and that is slidingly inserted in a slot (75) formed on the sliding surface of the other clamp body (18, 19).

13. A ratchet wrench according to claim 9, wherein said driving mechanism comprises a threaded stem (54) rigidly attached to one of the clamp bodies (18, 19),

parallel to said clamp guide (21, 22) and with a first threading direction, an internally threaded section (55) rigidly attached to the other of the clamp bodies (18, 19), parallel to the clamp guide (21, 22) and with a second threading direction opposite to said first threading direction, and a driving sleeve (56) rotatably mounted but not axially displaceable on the head body (17), said driving sleeve (56) having a hole with an internal thread (57) with said first threading direction engaged to said threaded stem (54) and an external thread (58) with said second threading direction engaged to said internally threaded section (55), and wherein said internally threaded section (55) of the other clamp bodies (18, 19) encompasses an angle equal to or less than 180° around the driving sleeve (56).

14. A ratchet wrench according to claim 13, wherein the head body (17) comprises two side walls (38, 39) with mutually opposing surfaces that, along with the head body (17), define a stem housing (59) sized to house and axially guide the threaded stem (54), said mutually opposing surfaces of said side walls (38, 39) including respective longitudinal guide elements that jointly define the clamp guide (21, 22), and the head body (17) further comprises a sleeve housing (60) in the shape of a through-passage in a direction perpendicular to the clamp guide (21, 22) and that intersects said stem housing (59) and the clamp guide (21, 22).

15. A ratchet wrench according to claim 14, wherein the clamp bodies (18, 19) have respective main guide follower portions (61, 62) that engage said longitudinal guide elements that jointly define the clamp guide (21, 22) of the head body (17) and respective auxiliary guide portions (63, 64) that slidingly engage each other.

Patentansprüche

1. Ratschenschlüssel, umfassend:

einen Funktionskopf (1) und einen Griff (2), die miteinander verbunden und relativ um eine Gelenkachse (3) drehbar sind;
ein zu der genannten Gelenkachse (3) koaxiales Ratschenrad (4), das starr am Funktionskopf (1) befestigt ist und zumindest entlang eines Teils seiner Umfangslinie mit umlaufend angeordneten Zähnen (4a) versehen ist;
eine Sperrklinke (5), die beweglich am Griff (2) angebracht und mit mindestens einem Haltezahn (5a) versehen ist, der mit den genannten umlaufend angeordneten Zähnen (4a) des Ratschenrads (4) in Eingriff gebracht werden kann;
ein elastisches Arbeitselement (6), das die genannte Sperrklinke (5) in eine Eingriffsposition mit den genannten umlaufend angeordneten Zähnen (4a) des genannten Ratschenrads (4) vorspannt;
ein am Griff (2) beweglich angebrachtes Entriegelungselement (7), das zwischen einer Ruheposition und einer Entriegelungsposition manuell betätigbar ist;
eine zwischen dem genannten Entriegelungselement (7) und der genannten Sperrklinke (5) angeordnete kinematische Kette, wobei die genannte kinematische Kette eine Bewegung des Entriegelungselements (7) aus der genannten Ruheposition in die genannte Entriegelungsposition in eine Bewegung der Sperrklinke (5) in eine Nichteingriffsposition mit dem Ratschenrad (4) gegen die Vorspannung des genannten elastischen Arbeitselements (6) umwandelt; und
ein am Griff (2) beweglich angebrachtes Verriegelungselement (69), wobei das genannte Verriegelungselement (69) zwischen einer Ruheposition, in der das Verriegelungselement (69) nicht mit der Sperrklinke (5) in Wechselwirkung ist, und einer Verriegelungsposition manuell betätigbar ist,
dadurch gekennzeichnet, dass:

das Verriegelungselement (69) in der genannten verriegelten Position mit der Sperrklinke (5) in Berührung ist und die Sperrklinke (5) in der genannten Eingriffsstellung mit dem Ratschenrad (4) hält;
das Verriegelungselement (69) verschiebbar in einem Hohlraum (71) des Griffs (2) installiert ist und einen Vorsprung (70) aufweist; und
der genannte Hohlraum (71) eine erste Aussparung (71a) aufweist, in die der genannte Vorsprung (70) passt, wenn sich das Verriegelungselement (69) in der genannten Ruheposition befindet, sowie eine zweite Aussparung (71b), in die der Vorsprung (70) passt, wenn sich das Verriegelungselement (69) in der genannten Verriegelungsposition befindet.

2. Ratschenschlüssel nach Anspruch 1, wobei das Verriegelungselement (69) aus einer Metallstange mit einem Berührungsende (69a), um die Sperrklinke (5) anzuschlagen, einer den Vorsprung (70) definierenden Kontur und einer Krümmung besteht, die ein durch eine Öffnung im Griff (2) mit einem Verriegelungstaster (72) verbundenes Betätigungsende (69b) definiert, und wobei der Griff (2) einen Griffkörper (29) mit einem abgeflachten Bereich umfasst, in dem der genannte Hohlraum (71), in dem das Verriegelungselement (69) untergebracht ist, ausgebildet ist, und wobei der Griff (2) ein oder mehrere Ge-

häuse, in denen das Ratschenrad (4), die Sperrklinke (5), das Entriegelungselement (7) und andere zugeordnete Elemente untergebracht sind, aufweist, sowie mindestens einen an dem genannten Griffkörper (29) befestigten Deckel (30), der den genannten Hohlraum (72) und die genannten Gehäuse schließt.

3. Ratschenschlüssel nach Anspruch 1 oder 2, wobei er ferner ein elastisches Rückstellglied (8) umfasst, das das genannte Entriegelungselement (7) in die genannte Ruheposition vorspannt und wobei die genannte kinematische Kette eine unidirektional wirkende kinematische Antriebskette ist, die die Bewegung des Entriegelungselements (7) bei dessen Bewegung aus der Ruheposition in die Entriegelungsposition auf die Sperrklinke (5) überträgt, und die Bewegungen der Sperrklinke (5) bei ihrem Springen von Zahn zu Zahn der umlaufend angeordneten Zähne (4a) des Ratschenrads (4) nicht auf das Entriegelungselement (7) überträgt, wenn das Entriegelungselement (7) von dem genannten elastischen Rückstellglied (8) in der Ruheposition gehalten wird.

4. Ratschenschlüssel nach einem der vorstehenden Ansprüche, wobei die Sperrklinke (5) so am Griff (2) angebracht ist, dass sie um eine Schwenkachse (9) parallel zur genannten Gelenkachse (3) schwenkbar ist, und wobei die Sperrklinke (5) zwischen dem Ratschenrad (4) und dem Entriegelungselement (7) angeordnet ist.

5. Ratschenschlüssel nach Anspruch 4, wobei das Entriegelungselement (7) in der Ruheposition weiter von der Gelenkachse (3) entfernt ist als in der Entriegelungsposition, und die genannte unidirektional wirkende kinematische Antriebskette eine mit dem Entriegelungselement (7) verbundene Schubstange (10) und ein am Griff (2) angebrachtes Schubelement (11) umfasst, sodass das genannte Schubelement (11) um eine Schwenkachse (12) schwenkbar ist, wobei zwischen dem genannten Schubelement (11) und der Sperrklinke (5) nur dann ein Schubkontakt besteht, wenn infolge der Bewegung des Entriegelungselements (7) aus der Ruheposition in die Entriegelungsposition das Schubelement (11) von der genannten Schubstange (10) geschwenkt wird.

6. Ratschenschlüssel nach Anspruch 4, wobei das Entriegelungselement (7) in der Ruheposition näher an der Gelenkachse (3) liegt als in der Entriegelungsposition, und die genannte unidirektional wirkende kinematische Antriebskette eine Verbindungsstange (13) umfasst, die ein Ende, das über eine Schwenkverbindung mit dem Entriegelungselement (7) verbunden ist, und ein weiteres Ende, das über eine Schwenk- und Schiebeverbindung mit der Sperrklinke (5) verbunden ist, aufweist.

7. Ratschenschlüssel nach Anspruch 2, wobei das Ratschenrad (4) zylindrische Nabenabschnitte (31) aufweist, die beidseitig aus ihm heraustreten und in entsprechende, jeweils an dem genannten Griffkörper (29) und dem genannten Deckel (30) ausgebildete Führungslöcher (32, 33) eingebracht und drehbar geführt sind.

8. Ratschenschlüssel nach Anspruch 7, wobei der genannte Funktionskopf (1) ferner einen Kopfkörper (17) mit zwei gegenüberliegenden Vorsprüngen (27, 28) umfasst, zwischen denen ein Ende des genannten abgeflachten Bereichs des Griffs (2) untergebracht ist, wo das Ratschenrad (4) angebracht ist, und wobei das Ratschenrad (4) eine gerillte axiale Bohrung (34) aufweist und die genannten Vorsprünge (27, 28) des genannten Kopfkörpers (17) entsprechende, mit der genannten gerillten axialen Bohrung (34) des Ratschenrads (4) fluchtete gerillte Bohrungen (50, 51) aufweisen, und eine zur Gelenkachse (3) koaxiale gerillte Ratschenwelle (52) durch die genannten gerillten Bohrungen (50, 51) der Vorsprünge (27, 28) und durch die gerillte axiale Bohrung (34) des Ratschenrads (4) eingebracht ist und dadurch die gegenseitige Verdrehung zwischen dem Ratschenrad (4) und dem Kopfkörper (17) verhindert wird.

9. Ratschenschlüssel nach Anspruch 8, wobei der genannte Funktionskopf (1) ferner umfasst: zwei bewegliche Spannkörper (18, 19), die so auf dem genannten Kopfkörper (17) angebracht sind, dass sie sich entlang einer senkrecht zur Gelenkachse (3) angeordneten Spannführung (21, 22) bewegen können, und einen auf dem Kopfkörper angebrachten, manuell zu betätigenden Antriebsmechanismus zur Bewegung der genannten Spannkörper (18, 19) unter Verstellen des Abstands zwischen einander gegenüberliegenden Spannflächen (35, 36) der Spannkörper (18, 19), und wobei der genannte Antriebsmechanismus eine zur genannten Spannführung (21, 22) parallele Antriebsschraube (20) umfasst, die drehbar auf dem Kopfkörper (17) gelagert und zwischen der Spannführung (21, 22) und der Gelenkachse (3) angeordnet ist, wobei die genannte Antriebsschraube (20) zwei Außengewindeabschnitte (23, 24) mit entgegengesetzten Gewinderichtungen aufweist, die jeweils in entsprechende, jeweils an den Spannkörpern (18, 19) ausgebildete Innengewindeabschnitte (25, 26) mit entgegengesetzten Gewinderichtungen eingreifen, und wobei zumindest an einem Ende der genannten Antriebsschraube (20) ein Griffelement (53) in einer zugänglichen Position, die dessen Greifen und Drehen ermöglicht, befestigt ist.

10. Ratschenschlüssel nach Anspruch 9, wobei die genannten Innengewindeabschnitte (25, 26) der

Spannkörper (18, 19) einen Winkel gleich oder kleiner als 180° um die Antriebsschraube (20) umschließen.

11. Ratschenschlüssel nach Anspruch 9 oder 10, wobei der Kopfkörper (17) zwei Seitenwände (38, 39) mit einander gegenüberliegenden Flächen umfasst, die mindestens einen Teil eines Schraubengehäuses (37) begrenzen, das zur Aufnahme und Drehführung der Antriebsschraube (20) bemessen ist, und wobei die genannten, einander gegenüberliegenden Flächen der genannten Seitenwände (38, 39) jeweils Kanäle umfassen, die zusammen die Spannführung (21, 22) definieren, und wobei jeder der Spannkörper (18, 19) ein jeweiliges Hauptführungsfolgesegment (40, 41) aufweist, das mit einem der genannten Kanäle, die zusammen die Spannführung (21, 22) des Kopfkörpers (17) definieren, in Eingriff steht, sowie ein jeweiliges Hilfsführungsfolgesegment (42, 43), das gleitend mit einer auf dem anderen der Spannkörper (18, 19) ausgebildeten zugehörigen Hilfsführungsnut (44, 45) in Eingriff steht, und wobei die Seitenwände (38, 39) des Kopfkörpers (17) jeweils distale Kanten parallel zu der Spannführung (21, 22) aufweisen, in denen Längsaussparungen (46, 47) ausgebildet sind, die gleitend mit auf den Spannkörpern (18, 19) ausgebildeten Führungsvorsprüngen (48, 49) in Eingriff stehen.

12. Ratschenschlüssel nach Anspruch 11, wobei die Spannkörper (18, 19) jeweils beidseitig Gleitflächen senkrecht zur Gelenkachse (3) aufweisen und einer der Spannkörper (18, 19) eine aus seiner entsprechenden Gleitfläche ragende Rippe (74) aufweist, die gleitend in eine auf der Gleitfläche des anderen Spannkörpers (18, 19) ausgebildete Nut (75) eingebracht ist.

13. Ratschenschlüssel nach Anspruch 9, wobei der genannte Antriebsmechanismus umfasst: einen Gewindestift (54), der parallel zu der genannten Spannführung (21, 22) starr an einem der Spannkörper (18, 19) befestigt ist und eine erste Gewinderichtung aufweist, einen Innengewindeabschnitt (55), der parallel zu der Spannführung (21, 22) starr an dem anderen der Spannkörper (18, 19) befestigt ist und eine der genannten ersten Gewinderichtung entgegengesetzte zweite Gewinderichtung aufweist, und eine drehbar gelagerte, aber nicht axial verschiebbare Mitnehmerhülse (56) auf dem Kopfkörper (17), wobei die genannte Mitnehmerhülse (56) eine Bohrung mit einem Innengewinde (57) aufweist, wobei die genannte erste Gewinderichtung mit dem genannten Gewindestift (54) in Eingriff steht, und ein Außengewinde (58), wobei die genannte zweite Gewinderichtung mit dem genannten Innengewindeabschnitt (55) in Eingriff steht, und wobei der genannte Innengewindeabschnitt (55) der anderen Spannkörper (18, 19) einen Winkel gleich oder kleiner 180° um die Mitnehmerhülse (56) umschließt.

14. Ratschenschlüssel nach Anspruch 13, wobei der Kopfkörper (17) zwei Seitenwände (38, 39) mit einander gegenüberliegenden Flächen umfasst, die zusammen mit dem Kopfkörper (17) ein Stiftgehäuse (59) begrenzen, das zur Aufnahme und axialen Führung des Gewindestifts (54) bemessen ist, wobei die genannten einander gegenüberliegenden Flächen der genannten Seitenwände (38, 39) jeweils Längsführungselemente einschließen, die zusammen die Spannführung (21, 22) definieren, und der Kopfkörper (17) ferner ein Hülsengehäuse (60) in Form eines Durchgangs senkrecht zur Spannführung (21, 22) umfasst, das das genannte Gewindegehäuse (59) und die Spannführung (21, 22) schneidet.

15. Ratschenschlüssel nach Anspruch 14, wobei die Spannkörper (18, 19) jeweils Hauptführungsfolgesegmente (61, 62) aufweisen, die mit den genannten Längsführungselementen, die zusammen die Spannführung (21, 22) des Kopfkörpers (17) definieren, in Eingriff stehen, sowie jeweils Hilfsführungssegmente (63, 64), die gleitend miteinander in Eingriff stehen.

Revendications

1. Une clé à cliquet comportant :

une tête fonctionnelle (1) et un manche (2) reliés entre eux, capables d'une rotation relative autour d'un axe de pivotement (3) ;
une roue à rochet (4) coaxiale à cet axe de pivotement (3), rigidement attachée à la tête fonctionnelle (1) et pourvue de dents circonférentielles (4a) le long d'au moins une partie d'un de ses bords périphériques ;
un doigt d'encliquetage (5) mobile installé sur le manche (2) et pourvu d'au moins une dent d'arrêt (5a) pouvant être engagée à ces dents circonférentielles (4a) de la roue à rochet (4) ;
un élément de travail élastique (6) qui fait orienter ce doigt d'encliquetage (5) à une position engagée à ces dents circonférentielles (4a) de cette roue à rochet (4);
un élément de déclenchement (7) installé mobile sur le manche (2) et pouvant être actionné à la main entre une position de repos et une position de déclenchement.
une chaîne cinématique agencée entre cet élément de déclenchement (7) et ce doigt d'encliquetage (5), où cette chaîne cinématique transforme un mouvement de l'élément de déclenchement (7) de cette position de repos à cette position de détente en un mouvement du doigt

d'encliquetage (5) à une position dégagée de la roue à rochet (4) contrecarrant l'orientation de cet élément de travail élastique (6) ; et
un élément de verrouillage (69) installé mobile sur le manche (2), cet élément de verrouillage (69) pouvant être actionné à la main entre une position de repos, dans laquelle l'élément de verrouillage (69) n'interfère pas avec le doigt d'encliquetage (5), et une position de verrouillage,

caractérisée en ce que :

l'élément de verrouillage (69) dans cette position verrouillée contacte le doigt d'encliquetage (5) et retient le doigt d'encliquetage (5) dans cette position engagée à la roue à rochet (4) ;
l'élément de verrouillage (69) est installé coulissant dans une cavité (71) du manche (2) et possède une protubérance (70) ; et
cette cavité (71) possède un premier renfoncement (71a) dans lequel cette protubérance (70) s'adapte lorsque l'élément de verrouillage (69) est dans cette position de repos et un deuxième renfoncement (71b) dans lequel la protubérance (70) s'adapte lorsque l'élément de verrouillage (69) est dans cette position de verrouillage.

2. Une clé à cliquet conformément à la revendication 1, dans laquelle l'élément de verrouillage (69) est formé par une tige métallique possédant une extrémité de contact (69a) pour contacter le doigt d'encliquetage (5), un contour qui définit la protubérance (70) et une courbure qui définit une extrémité d'actionnement (69b) reliée à un bouton de verrouillage (72) à travers une ouverture dans le manche (2), et où le manche (2) comporte un corps de manche (29) possédant une région aplatie dans laquelle cette cavité (71) est formée dans laquelle l'élément de verrouillage (69) est logé, et le manche (2) possède un ou plusieurs boîtiers dans lesquels la roue à rochet (4), le doigt d'encliquetage (5), l'élément de déclenchement (7) et d'autres éléments qui lui sont associés sont logés et au moins un couvercle (30) fixé à ce corps de manche (29) fermant cette cavité (72) et ces boîtiers.

3. Une clé à cliquet conformément à la revendication 1 ou 2, laquelle comporte en plus un élément de rappel élastique (8) qui oriente cet élément de déclenchement (7) à cette position de repos et en ce que cette chaîne cinématique est une chaîne d'actionnement unidirectionnel qui transmet le mouvement de l'élément de déclenchement (7), lorsqu'il est déplacé de la position de repos à la position de déclenchement, au doigt d'encliquetage (5) et il ne transmet pas de mouvements que connait le doigt d'encliquetage (5) lorsqu'il saute d'une dent à l'autre, des dents circonférentielles (4a) de la roue à rochet (4) à l'élément de déclenchement (7), lorsque l'élément de déclenchement (7) est retenu dans la position de repos par cet élément de rappel élastique (8).

4. Une clé à cliquet conformément à une quelconque des revendications précédentes, dans laquelle le doigt d'encliquetage (5) est installé sur le manche (2) de sorte qu'il puisse pivoter autour d'un axe pivotant (9) parallèle à cet axe de pivotement (3) et dans laquelle le doigt d'encliquetage (5) est installé entre la roue à rochet (4) et l'élément de déclenchement (7).

5. Une clé à cliquet conformément à la revendication 4, dans laquelle l'élément de déclenchement (7) est plus éloigné de l'axe de pivotement (3) dans la position de repos que dans la position de déclenchement, et cette chaîne cinématique d'actionnement unidirectionnel comporte une tige-poussoir (10) reliée à l'élément de déclenchement (7) et un élément poussoir (11) installé sur le manche (2) de sorte que cet élément poussoir (11) puisse pivoter autour d'un axe pivotant (12), où un contact de poussée n'existe, entre cet élément poussoir (11) et le doigt d'encliquetage (5), que lorsque l'élément poussoir (11) est pivoté par cette tige-poussoir (10) suite au mouvement de l'élément de déclenchement (7) de la position de repos à la position de déclenchement.

6. Une clé à cliquet conformément à la revendication 4, dans laquelle l'élément de déclenchement (7) est plus proche de l'axe de pivotement (3) dans la position de repos que dans la position de déclenchement, et cette chaîne cinématique d'actionnement unidirectionnel comporte une bielle (13) qui possède une extrémité reliée à l'élément de déclenchement (7) par un joint pivotant et une autre extrémité reliée au doigt d'encliquetage (5) par un joint pivotant et coulissant.

7. Une clé à cliquet conformément à la revendication 2, dans laquelle la roue à rochet (4) possède des parties de moyeu cylindriques (31) qui dépassent de chacun de ses côtés et qui sont insérées et guidées en rotation dans des trous de guidage respectifs (32, 33) formés sur ce corps de manche (29) et sur ce couvercle (30) respectivement.

8. Une clé à cliquet conformément à la revendication 7, dans laquelle cette tête fonctionnelle (1) comporte en plus un corps de tête (17) qui possède deux pattes opposées (27, 28) entre lesquelles une extrémité de cette région aplatie du manche (2) est logée où la roue à rochet (4) est installée et où la roue à rochet (4) possède un trou rainuré axial (34), et ces pattes (27, 28) de ce corps de tête (17) possèdent des trous rainurés respectifs (50, 51) alignés avec ce trou rai-

nuré axial (34) de la roue à rochet (4) et un arbre à cliquet rainuré (52) coaxial à l'axe de pivotement (3) est inséré à travers ces trous rainurés (50, 51) des pattes (27, 28) et à travers le trou axial rainuré (34) de la roue à rochet (4) en évitant la rotation relative entre la roue à rochet (4) et le corps de tête (17).

9. Une clé à cliquet conformément à la revendication 8, dans laquelle cette tête fonctionnelle (1) comporte en plus deux corps de serrage mobiles (18, 19) installés sur ce corps de tête (17) de sorte qu'ils puissent se déplacer le long d'un guidage de serrage (21, 22) agencé dans un sens perpendiculaire à l'axe de pivotement (3), et un mécanisme d'entraînement installé sur le corps de tête et pouvant être actionné à la main pour déplacer ces corps de serrage (18, 19), en ajustant ainsi l'espace entre des surfaces de serrage mutuellement opposées (35,36) des corps de serrage (18, 19) et où ce mécanisme d'entraînement comporte une vis d'entraînement (20) parallèle à ce guidage de serrage (21, 22) monté rotatoire sur le corps de tête (17) et situé entre le guidage de serrage (21, 22) et l'axe de pivotement (3), cette vis d'entraînement (20) ayant deux parties extérieurement filetées (23, 24) ayant des sens de filetage opposés, respectivement engagées à des sections intérieurement filetées (25,26) ayant des sens de filetage opposés formés sur les corps de serrage (18, 19), respectivement et où au moins sur une extrémité de cette vis d'entraînement (20) un élément de préhension (53) est fixé dans une position accessible pour être saisi et tourné.

10. Une clé à cliquet conformément à la revendication 9, dans laquelle ces sections intérieurement filetées (25, 26) des corps de serrage (18, 19) enferment un angle égal ou inférieur à 180º autour de la vis d'entraînement (20).

11. Une clé à cliquet conformément à la revendication 9 ou 10, dans laquelle le corps de tête (17) comporte deux parois latérales (38, 39) ayant des surfaces mutuellement opposées définissant au moins une partie d'un boitier de vis (37) ayant la dimension pour loger et guider en rotation la vis de guidage (20) et ces surfaces mutuellement opposées de ces parois latérales (38, 39) comprennent des encoches respectives qui conjointement définissent le guidage de serrage (21, 22) et où chacun des corps de serrage (18, 19) possède une partie de suiveur de guidage principal respectif (40, 41) qui s'engage dans un de ces sillons qui définit conjointement le guidage de serrage (21, 22) du corps de tête (17) et une partie de suiveur de guidage auxiliaire (42, 43) qui engage en coulissant une encoche de guidage auxiliaire correspondante (44, 45) formée sur l'autre des corps de serrage (18, 19) et où les parois latérales (38, 39) du corps de tête (17) comportent des bords distaux respectifs parallèles au guidage de serrage (21, 22) dans lesquels des renfoncements longitudinaux (46, 47) sont formés qui engagent en coulissant des protubérances de guidage (48, 49) formées sur les corps de serrage (18, 19).

12. Une clé à cliquet conformément à la revendication 11, dans laquelle les corps de serrage (18, 19) possèdent des surfaces mutuellement coulissantes respectives perpendiculaires à l'axe de pivotement (3) et un des corps de serrage (18,19) possède une nervure (74) qui dépasse sa surface coulissante correspondante et qui est insérée en coulissant dans une encoche (75) formée sur la surface coulissante de l'autre corps de serrage (18,19).

13. Une clé à cliquet conformément à la revendication 9, dans laquelle ce mécanisme d'entraînement comporte une broche filetée (54) rigidement attachée à un des corps de serrage (18, 19), parallèle à ce guidage de serrage (21, 22) et ayant un premier sens de filetage , une première section intérieurement filetée (55) rigidement attachée à l'autre des corps de serrage (18, 19), parallèle au guidage de serrage (21, 22) et ayant un deuxième sens de filetage opposé à ce premier sens de filetage et un manchon d'entraînement (56) monté rotatif mais non axialement déplaçable sur le corps de tête (17), ce manchon d'entraînement (56) ayant un trou ayant un filetage intérieur (57) ayant ce premier sens de filetage engagé dans cette broche filetée (54) et un filetage externe (58) ayant ce deuxième sens engagé dans cette section intérieurement filetée (55) et où cette section intérieurement filetée (55) des autres corps de serrage (18, 19) enferment un angle égal ou inférieur à 180º autour du manchon d'entraînement (56).

14. Une clé à cliquet conformément à la revendication 13, dans laquelle le corps de tête (17) comporte deux parois latérales (38, 39) ayant des surfaces mutuellement opposées qui, ensemble avec le corps de tête (17), définissent un boîtier de broche (59) ayant la dimension pour loger et guider axialement la broche filetée (54), ces surfaces mutuellement opposées de ces parois latérales (38, 39) comprenant des éléments de guidage longitudinaux qui définissent conjointement la guidage de serrage (21, 22) et le corps de tête (17) comprennent en plus un boîtier de manchon (60) ayant la forme d'un passage traversant dans le sens perpendiculaire au guidage de serrage (21, 22) et qui intersecte ce boîtier de broche (59) et le guidage de serrage (21,22).

15. Une clé à cliquet conformément à la revendication 14, dans laquelle les corps de serrage (18, 19) possèdent des parties de suiveur de guidage principal (61, 62) respectives qui engagent ces éléments de

guidage longitudinaux qui conjointement définissent le guidage de serrage (21, 22) du corps de tête (17) et les parties de guidage auxiliaires respectives (63, 64) qui s'engagent entre elles en coulissant.

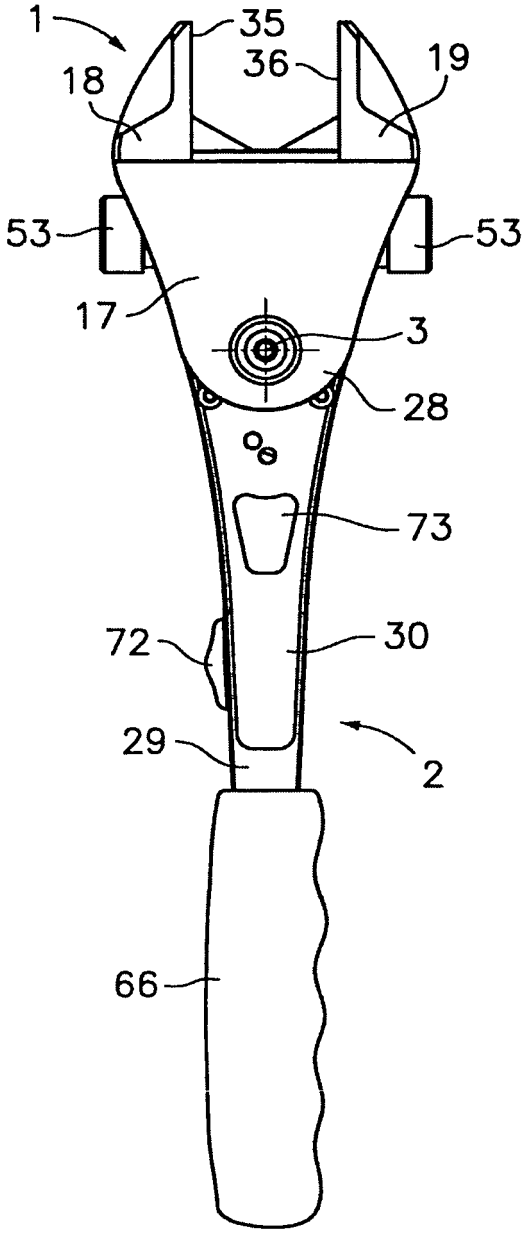

1
35
36
19
18
53
53
17
3
28
73
72
30
29
2
66

Fig. 1

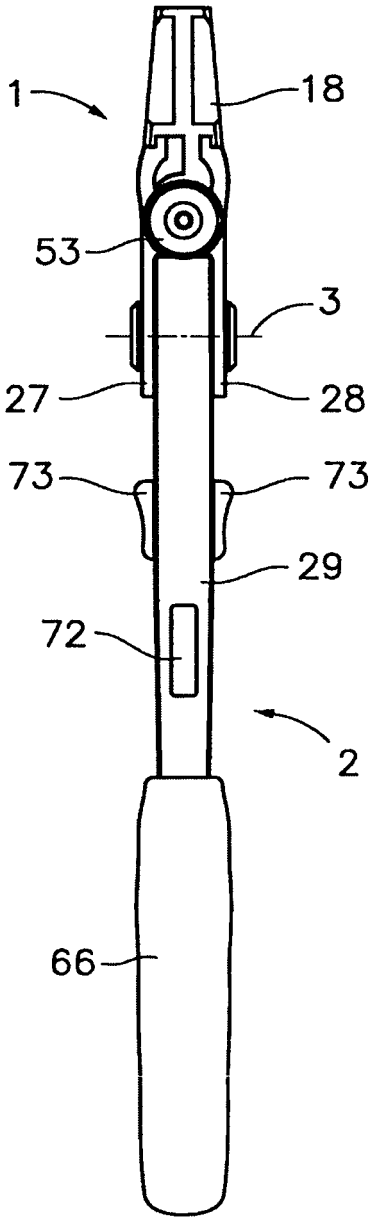

1
18
53
3
27
28
73
73
29
72
2
66

Fig. 2

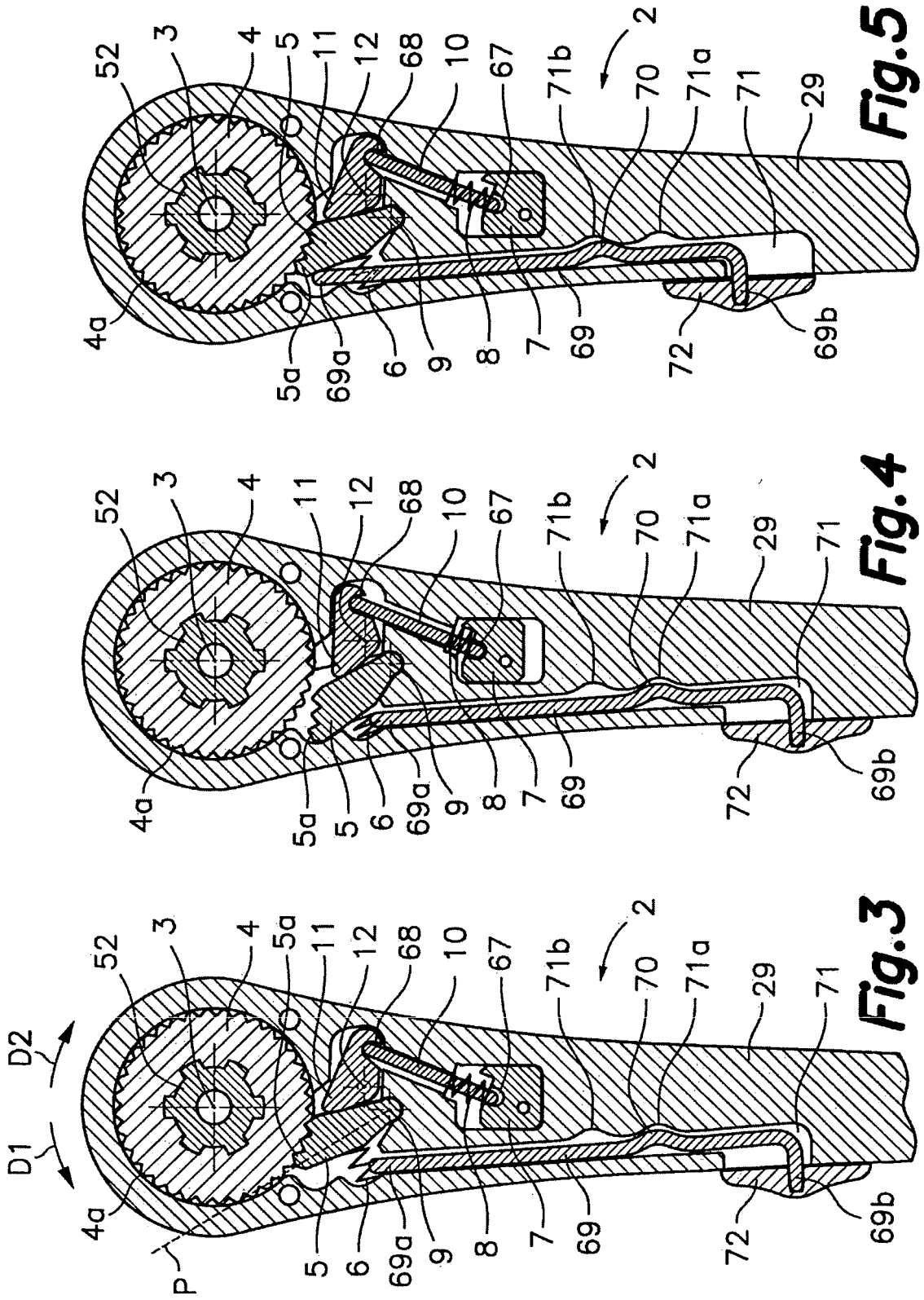


Fig.5

Fig.4

Fig.3

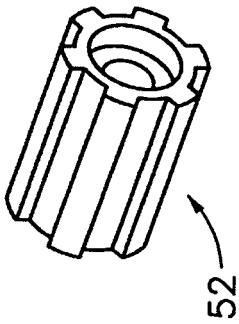


Fig.8

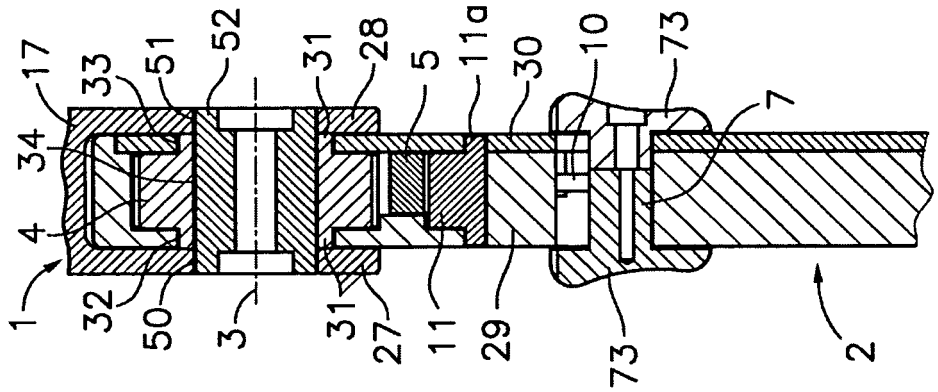


Fig.7

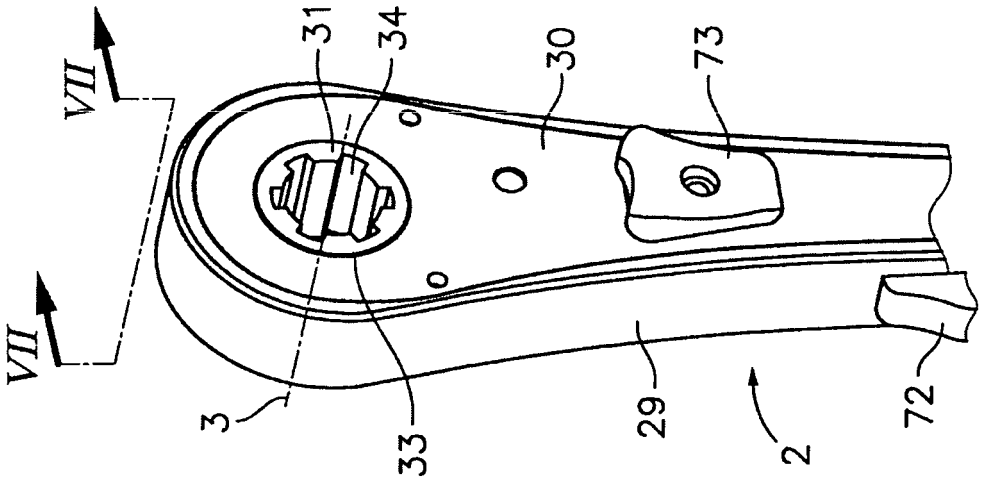


Fig.6

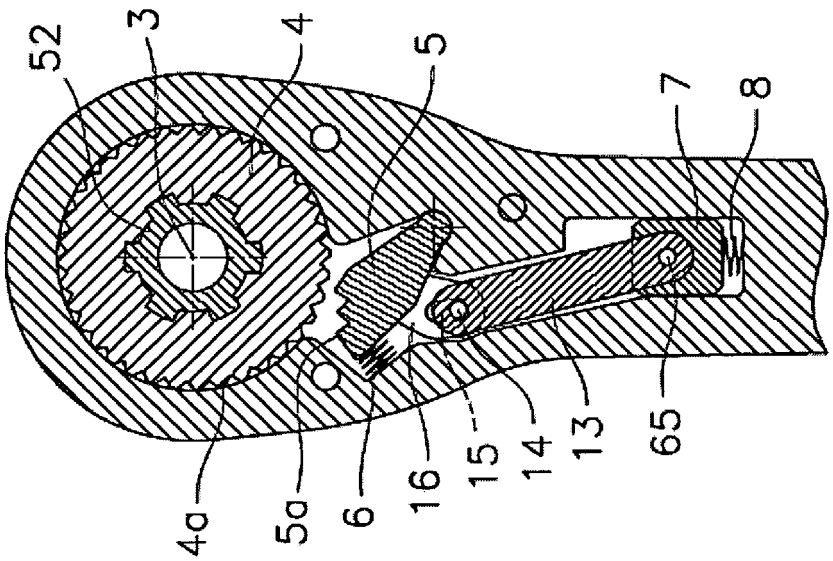


Fig.10

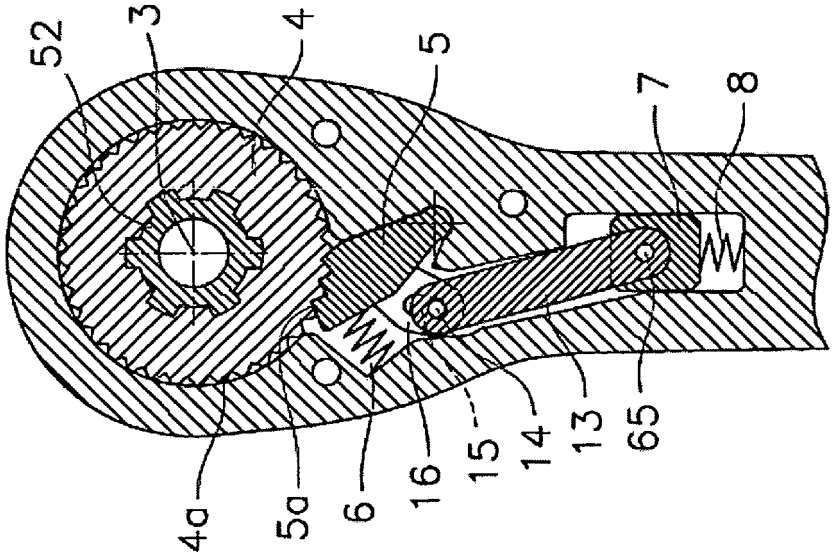


Fig.9

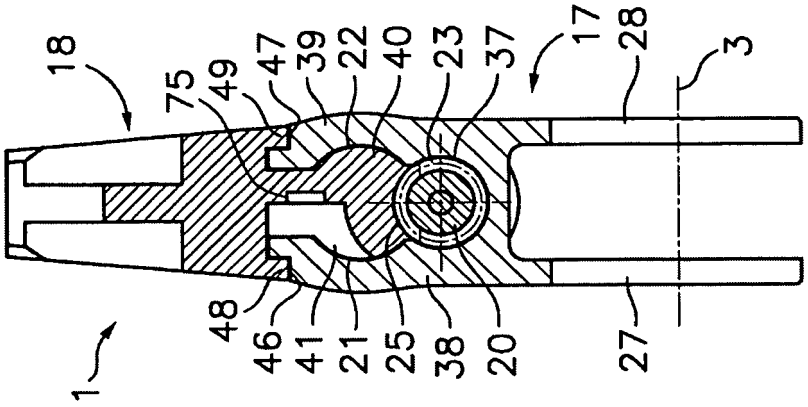

18
75
49
47
39
22
40
23
37
17
28
3
48
46
41
21
25
38
20
27
1

Fig.12

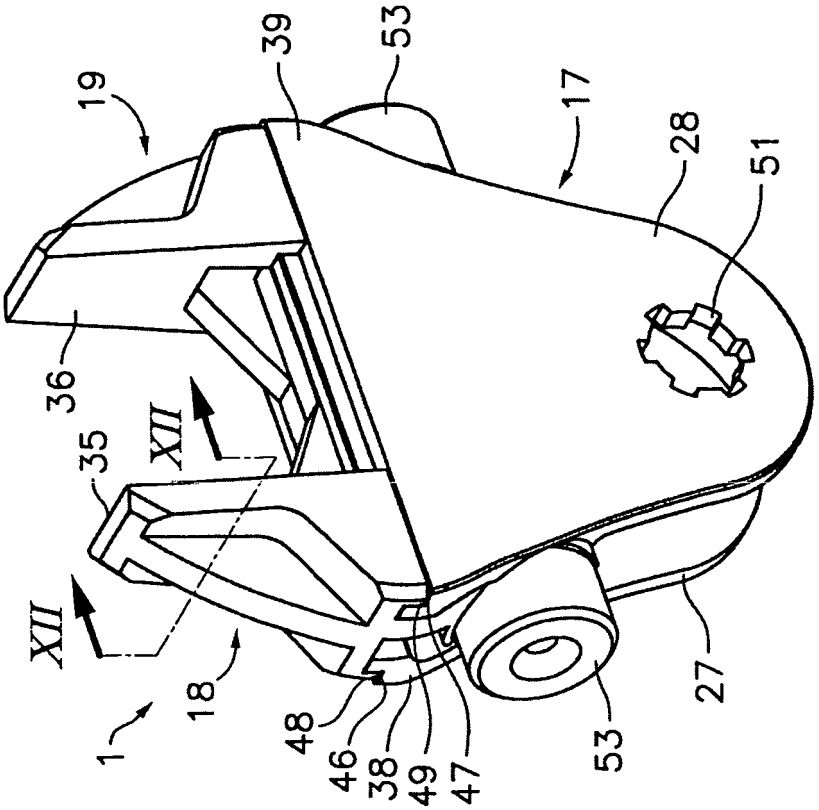

19
39
53
17
28
51
36
35
XII
XII
18
1
48
46
38
49
47
53
27

Fig.11

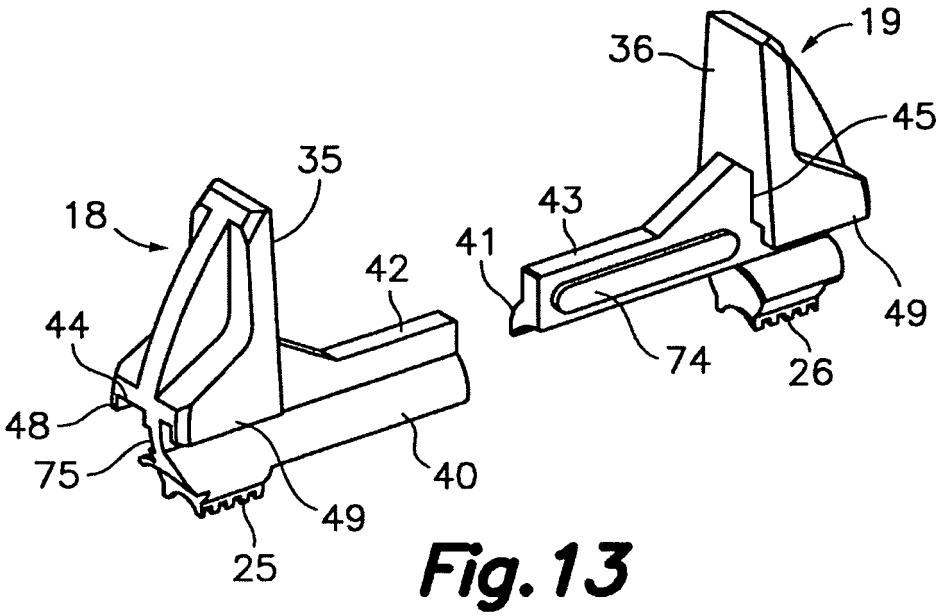


Fig. 13

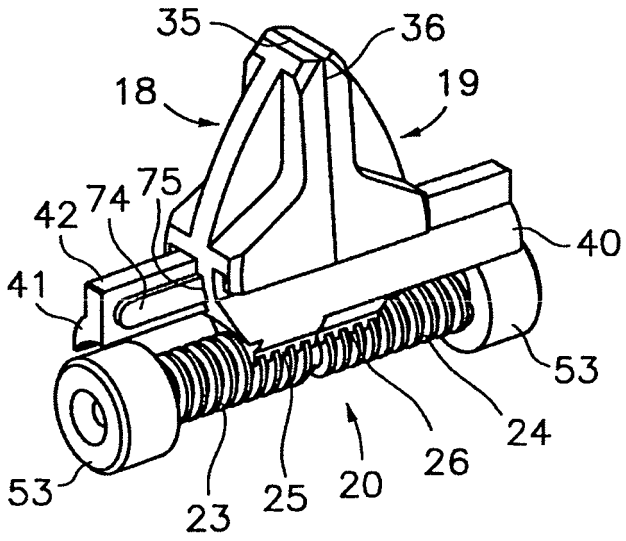


Fig. 14

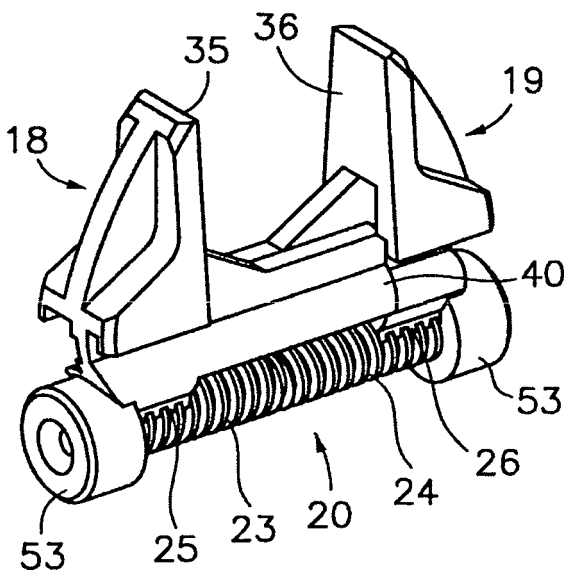


Fig. 15

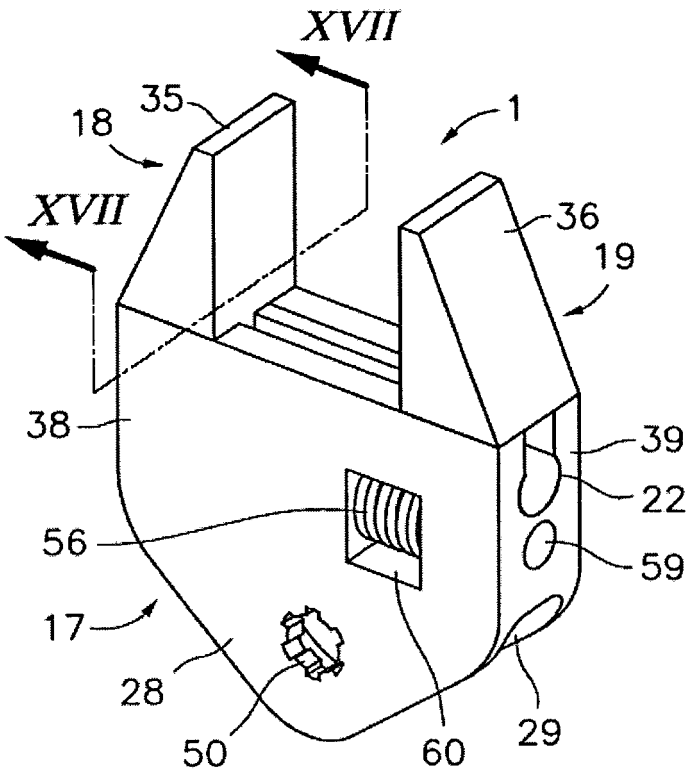


Fig. 16

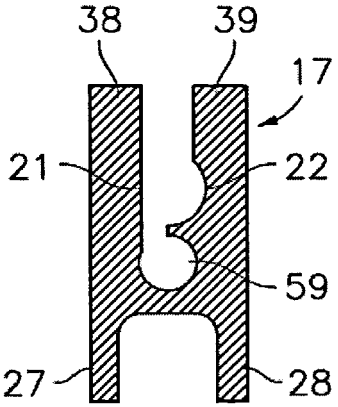


Fig. 17

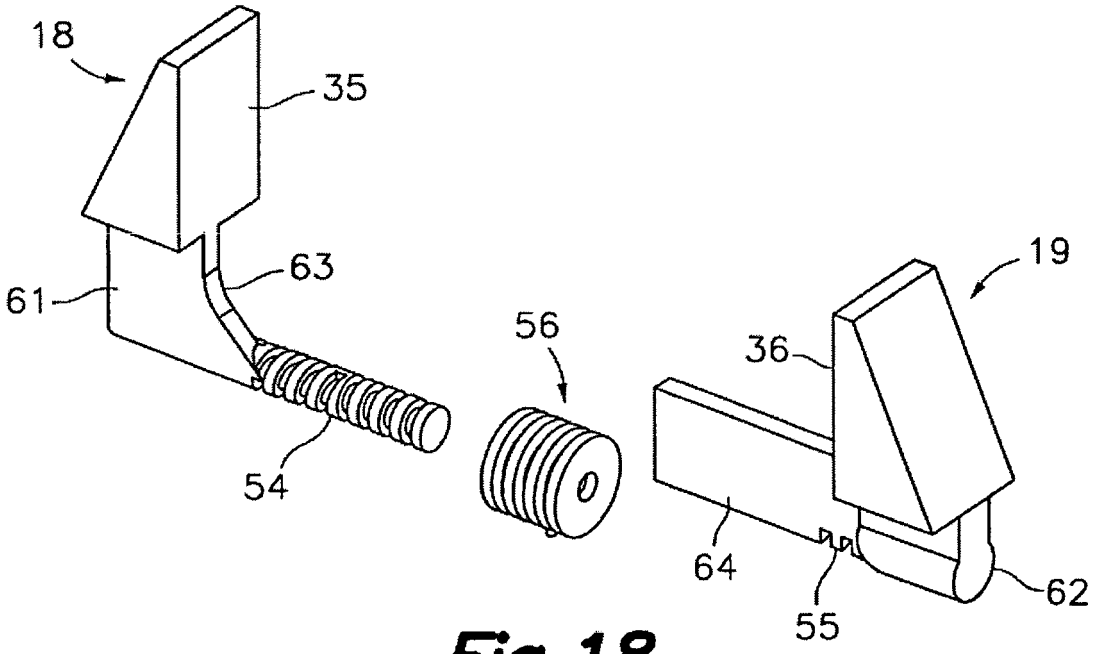


Fig. 18

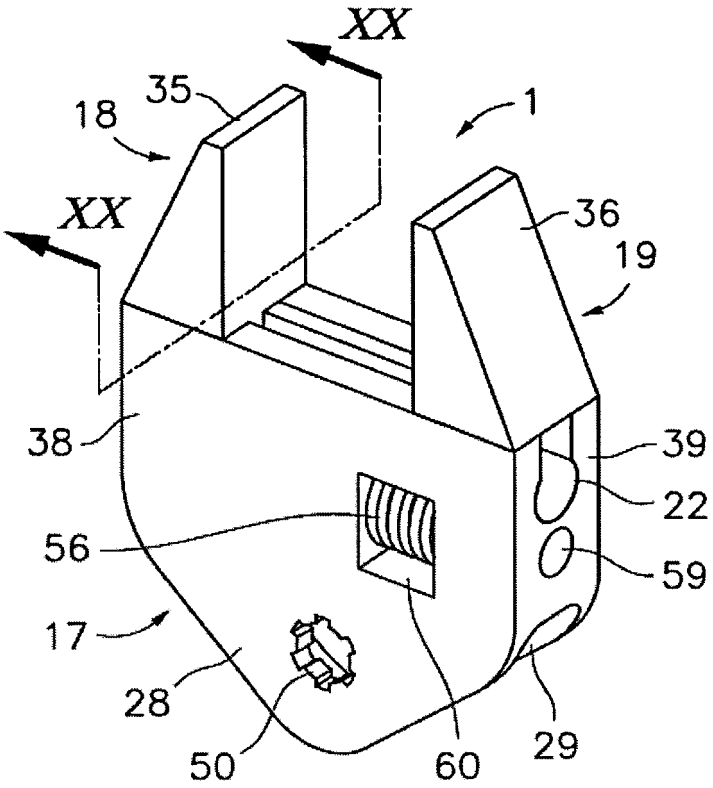


Fig.19

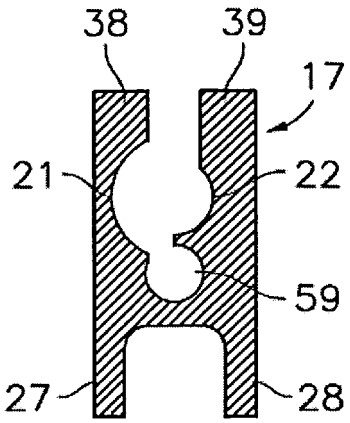
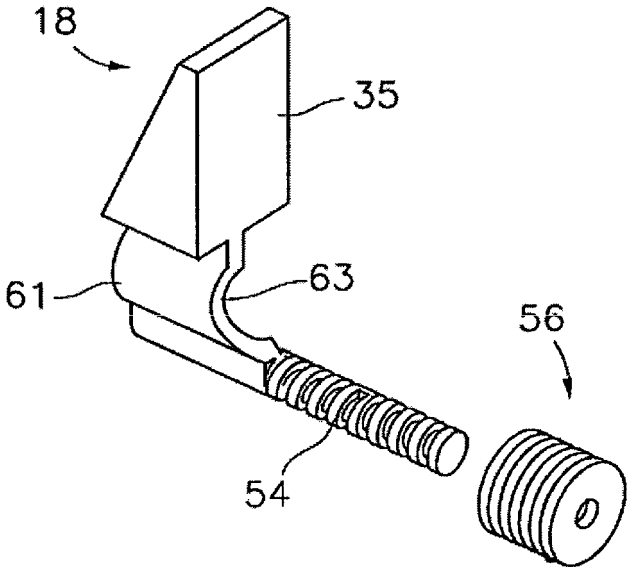


Fig.20



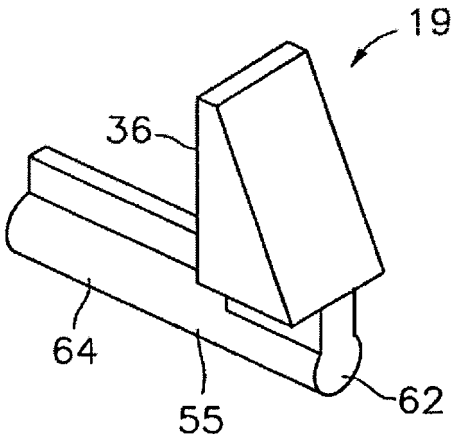


Fig.21

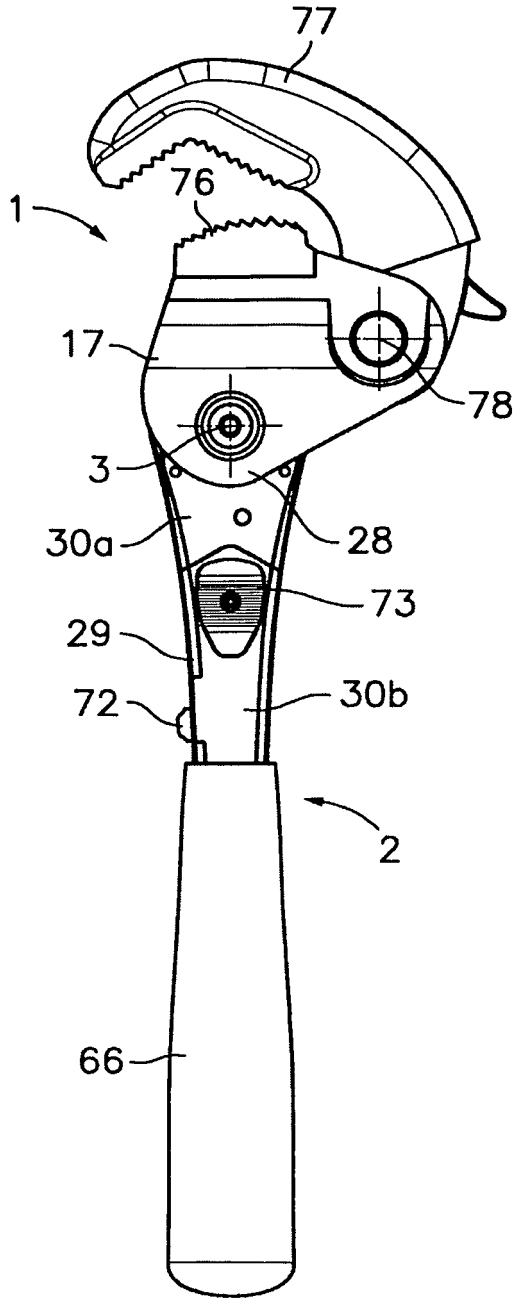

77
76
1
17
78
3
30a
28
73
29
72
30b
2
66

Fig.22

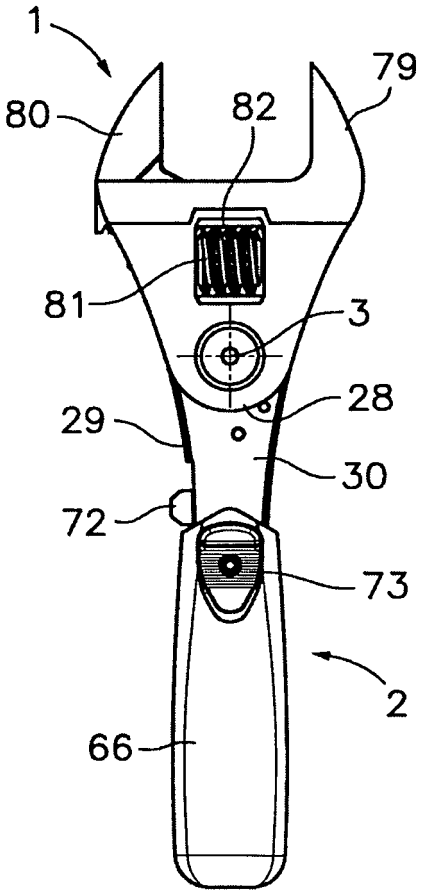

1
79
80
82
81
3
28
29
30
72
73
2
66

Fig.23

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- ES 0215567 A3 **[0002] [0003]**
- US 20060225539 A1 **[0004] [0005]**
- US 822962 A **[0006]**
- US 1547865 A **[0007]**