A CLAMPING AND HOLDING DEVICE AND A METHOD FOR ADJUSTABLY CLAMPING AND HOLDING AN OBJECT

Fig. 3

Abstract: This invention relates to a method and a clamping and holding device, such as for a vise, a clamp or the like, said device (1, 2) comprising two holding and clamping members (1, 2) having holding faces (23) and fitting parts (200), said fitting parts (200) being arranged to fit said holding and clamping members (1, 2) with their holding faces (23) in opposite relation, characterized in that at least one of said holding and clamping members (1, 2) include a support member (20) and an arrangement to the support member (20) a movable and rotationally adjustable clamping member (21) means of a coupling arrangement (22, 25) arranged them between and in said coupling arrangement (22), on one side includes that the support member (20) has a first coupling interface (220, 251) and that the clamping member (21) has a second coupling interface (221, 252).
A CLAMPING AND HOLDING DEVICE AND A METHOD FOR ADJUSTABLY CLAMPING AND HOLDING AN OBJECT

This invention relates to a method for clamping and holding an object and a clamping and holding device, such as for a vise, a clamp or the like, said device comprising two holding and clamping members having holding faces and fitting parts, said fitting parts being arranged to fit said holding and clamping members with their holding faces in opposite relation, on a vise, a clamp or the like.

BACKGROUND OF THE INVENTION
In many instances, such as for example during different kinds of hand crafting and/or machine working, there exists a need to manually hold/clamp one or more objects in a safe and reliable manner. The use of vises, clamps or the like is a typical way of fastening/clamping objects, and also hold-down tools (hold-down clamps) are well known such devices. However, known such holding and clamping arrangements may be rather complicated to use in situations where there is a need of being rather precise when attaching an object therein, or attaching two objects (or two sub-parts of the same object) in a specific position in order to work on one object relatively to the other object. This problem may exist in relation to object of any form, e.g. flat, but is especially apparent when objects of non-rectangular form, e.g. triangular-, pentagonal- or other polygonal-shaped objects, in a reliable and simple manner are to be fixated.

A further problem with existing designs for a clamping and holding arrangement such as a clamp or vise is that it can be difficult to handle an object with one hand to be held/clamped in a desired position, which is needed due to the fact that mostly one hand is needed for tightening of the clamping and holding arrangement. Furthermore, yet another problem is that many holding and clamping arrangements need numerous adapters to be adapted for use in connection with different objects.

In order to simplify the fastening of objects, many different types of designs have been suggested. One example of this kind of clamping device is described in US 4134578, wherein the clamping device is comprised of two spring-loaded jaws with contact surfaces which are designed to be turnable toward and away from one another. The design allows only for limited adjustability in regards to the form of the piece to be worked. The design is comprised of many parts making it expensive to manufacture and its moving parts are susceptible to dust, shavings and other particles that are produced during working.
Furthermore, from US 2399714 a kind of clamp is known which is intended for facilitating the clamping of two objects with one another. The design consists of a clamp equipped with contact surfaces of a specific form. The design is intended for example to be used for holding round objects.

WO2006075983 describes a device and method of clamping bicycles in a mouth having a moveable jaw and a stationary jaw to which a high load potential may be utilized within a toggle joint and ratchet mechanism and a release may be triggered to open a mouth in a quick movement. Certain embodiments also contain a multi-sized object secured grip which may be located on a contact surface of a moveable jaw and a stationary jaw to allow for universal gripping of various sized objects.

With regards to the description of the technical problems and the known art, there exists a need of improvement to facilitate adjustable clamping and holding of an object.

BRIEF DESCRIPTION OF THE INVENTION
It is an object of the present invention to provide a device and method that may significantly upon situations as described above, which achieved by means of a holding and clamping device in accordance with claim 1.

Thanks to the invention it is significantly easier to manually hold and clamp a huge variety of different sized objects of greatly varied geometrical shapes in desired position.

Further, thanks to the invention it may be easy to adjust an object's 3D position before "holding" starts (prior to the applying of the final high clamping force that secure the object relatively to the jaws), as well as adjusting it during the work on. With the invention this may be achieved without losing the position of the object relatively to the jaws. For example, to change an object's position for the purpose of a quick or a cyclic inspection from different direction and/or to identify in advance desired physical changes or distortions or failures of the object.

Furthermore, many times during a combined hold of two parts of the same object or two objects attached to each other there may be a need to re-adjust them relatively to each other, either to correct (e.g. all kinds of welding) or to execute a new step of their process (e.g. high accuracy simultaneously drilling). Even if a minor decrease of the clamping force has to be made in order to allow such re-positioning of sub-parts or
objects relatively to each other (i.e., in some embodiments of the invention to allow the RUH mode), yet the main 3D position of the total object under hold may be desired to remain relatively the jaws. This need to rotate one or both of the jaws in a fast-safe-accurate operation and by that to change the interface between sub-parts of the total object but without changing the interface between the object and the jaws, is a further advantage that may be achieved by this invention, since there must not be a loss of the main grip during work-on while the total object could spin around the clamping axis for inspection or any other reason, i.e. there is no need for the user to find again and again the objects' correct position relatively to the jaws.

Moreover, it may provide the possibility to adjust object's 3D position before "holding" starts as well as adjusting it during the work on, but with the ability not to lose or change the main vector of holding, i.e. to maintain the original level of holding force pre-defined for a specific work until the work is done, while rotating the object to new position/s.

The invention may also provide the advantage to enable safe and reliable holding and working with objects of different weight or with objects that are subject to different external torques along the main clamping axis, e.g., if the object's center of mass is out of the main clamping axis.

The invention may further improve the ergonomics and/or safety of the user while working, e.g. if using dangerous power-tools, the user may easily change the position of the object.

Moreover, the invention may drastically save time and labor while dealing with difficult clamping situations.

BRIEF DESCRIPTION OF THE FIGURES

In the following, the invention will be described in more detail with reference to the enclosed figures, wherein:

Fig. 1 shows a perspective view of an exemplary device according to the invention, wherein a vice is arranged with a holding arrangement according to the invention,

Fig. 2 is a side view of the embodiment shown in Fig. 1 and also incorporating an object to behold,
Fig. 3  shows an exploded perspective view of the embodiment shown in Figs. 1 and 2.

Fig. 4  shows an off-centered cross-sectional view of a detail of the holding arrangement according to the invention, in a first position,

Fig. 5  shows a similar view as in Fig. 4 in a second position,

Fig. 6  shows a similar view as in Figs. 4 and 5 in a third position,

Fig. 7  shows schematically, basic functions in accordance with the invention including optional functions that may be applied in some embodiments,

Fig. 8  shows schematically different principle modes in accordance with the invention,

Fig. 9  shows a second embodiment in accordance with the invention in a perspective view,

Fig. 10  shows a cross-sectional centered view of a holding arrangement in accordance with a second embodiment as presented in Fig. 9,

Fig. 11  shows a further cross-sectional view along the lines shown in Fig. 10,

Fig. 11A shows a modified embodiment of the arrangement in Figs. 10 and 11,

Fig. 12  shows an exploded view of a further alternate embodiment in accordance with the invention,

Fig. 13  shows a perspective view of a handhold clamping device equipped with clamping and holding device in accordance with the invention,

Fig. 14  shows an exploded view of a clamping a holding device in accordance with the preferred embodiment, in Fig 13,

Fig. 15  shows a cross section vertical view, through one of the clamping a holding device in figure 13,

Fig. 16  shows an exploded view of clamping member, in a prospective view, as used in the embodiment of figures 13 -15,

Fig. 17  shows a perspective view of another well-known clamping and holding arrangement equipped with clamping and holding devices in accordance with the invention,

Fig. 18  shows a perspective view in exploded form, of a support member used in accordance with the embodiment shown figure 17,

Fig. 19 shows alternate embodiment in accordance with the invention, where the coupling arrangement is arranged substantially radially,

Fig. 20 is a schematic view of a further embodiment in accordance with the invention where there is used specifically designed interface surfaces for a radial coupling arrangement,
Fig 1 shows still further embodiment in accordance with the invention wherein a friction coupling arrangement is used, in connection with pivotally arranged portions of a clamping member, and,

Fig 22 shows a holding and clamping device according to a modified form that may be used in connection with the invention, in a perspective and exploded view, and,

Fig. 23 A-D show a further embodiment according to the invention.

DETAILED DESCRIPTION

In Fig. 1 there is shown a vice having a fixed part 4 and a movable part 3, as is well known in the art. At the clamping ends 30, 40 of the vice 3, 4 there are generally oppositely arranged holding and coupling members 1, 2 in accordance with the invention. Each holding and coupling member 1, 2 includes a support member 20, an adjustable clamping member 21 and a coupling arrangement 22 arranged there between. Each clamping member 21 is arranged with a holding face 23 generally oppositely arranged, to facilitate fixation of an object 5 there between, for working of said object 5. Preferably a kind of recess 230, e.g. in the form of a V-groove, is arranged in at least one holding face 13, 23.

The coupling arrangements 22 have the purpose to facilitate adjustment of the position of the work object 5, as will be described more in detail below. As is evident from the figures, the invention is exemplified in connection with a vice that normally has a base member 41 for fixation of the vice to a horizontal, stable surface. However, as is evident for the skilled person the basic principles of the invention may be used in many different applications, e.g. handheld holding devices without any fixation of any part to a fixed surface, etc.

In Fig. 3 there is shown an exploded view of a vice 3, 4 arranged with holding and coupling members 1, 2 in accordance with the invention. In the following merely one of the coupling arrangements 22, will be explained more in detail, because their design preferably, as in this embodiment, is the same on both sides.

It can be seen that the coupling arrangement 22, on one side, includes that the support members 20 has a first coupling interface 220 and that clamping member 21 is arranged with a corresponding second coupling interface 221. Further there is a spring 223 arranged within annular grooves 224, 222 arranged within the opposing surfaces of the
support member 20 and the clamping member 21. In the center there is arranged a hole 201, within the support member 20, adapted for interaction with a stub shaft 211. The stub shaft 211 has a radially protruding blocking member 214 at the end thereof. The blocking member 214 is somewhat resilient and snuggly fits into the hole 201 to enable snap in into the inside of collar 201A (see fig. 15) provided by a larger diameter at the inner part of hole 201, thereby providing free sliding of the blocking member 214 inside the collar and the main part of the stub shaft 211 within the hole 201. Hence, the collar 201A provides a sufficient counterforce to hold the clamping member 21 in a joint arrangement with the support member 20 against the force of the spring 223.

Accordingly, the spring 223 will urge the two members 20, 21 apart. The members 20, 21 may be made in plastic, which is in many cases is preferred. The snap-in and withhold-function of the clamping member 20 within the holding member 21 may then be achieved by arranging the dimensions sufficiently snuggly to allow the elasticity of the plastic to provide the desired withholding force against the spring 223, but enable detachment when a larger pulling force is applied, without causing damage to any part. If made in metal it is for example possible to use a spring activated ball to achieve the snapping function, as is well known in the art. Thanks to this arrangement, the interface 220 in the clamping member 21 in its inactivated state maybe positioned out of contact, or with limited contact, in relation to the interface 221 in the support member 20, and the clamping member 21 may be moved into contact with the support member 20 by means of pushing it against the spring force of the spring 223.

In Figs. 4, 5 and 6 the basic principle of the holding and clamping devices 1,2 in accordance with the invention will be described more in detail, but in relation to an embodiment without presenting any solid guiding devices, e.g. hole 201 and stub shaft 211 (as described above), for keeping the two members coaxial. Indeed, in some embodiments it may be sufficient to merely use the spring 223 itself to provide the functions of positioning, withholding and centering the two members 20, 21 in relation to each other.

In Figs. 4, 5 and 6 the different operational modes of a coupling and holding arrangement according to the invention are shown, wherein before Fig. 4 there is a totally released position (FFP, Friction-Free Positioning, not shown) wherein the object may be freely rotated in relation to the clamping members 21. When using arch shaped jaw faces 23, as shown in fig. 13 this may be performed without risk of dropping the object 5, i.e. being positioned in a limited space thanks to the arch shaped jaw faces 23.
Thereafter, when the clamping members 21 are moved against each other there will be occur a frictional force between the object 5 and the clamping members 21 due to the counter force of the spring 223. In this mode the two members 20, 21 may be freely rotated in relation to each other but with some hold of the object 5. Fig. 5 shows modes ABL. Adjustment before Lock and/or RUH, Rotation Under Hold, where the clamping members 21 have been moved even further against each other, wherein each clamping members 21 may be rotated in relation to the support member 20, but stepwise in interaction with the dented coupling interfaces 220, 221 of the shown embodiment. Fig. 6 shows a locked position (LP), wherein the clamping members 21 have been moved still further against each other, such that no rotation may be exert between the two members 20, 21.

The gap X in the released position between the opposing parts of the interfaces should preferably be substantially smaller than the distance Y of maximum possible movement in interlocked position between the coupling interfaces, i.e. the distance Y between a position where the interface 220, 221 start to interact (enables contact between them) and the most locked position where the interfaces 220, 221 cannot be moved further towards each other.

In Fig. 7 there is shown a schematic view of functional blocks in accordance with an exemplary presentation of the invention. In the middle of the figure there is shown an object 5 (or objects) being hold by means of the device, e.g. a vice 3, 4. In-between the parts of the holding device 3, 4 there are arranged the different functional attributes in accordance with the invention. In contact with the object 5 there are two opposing clamping members 21. Both of these clamping members 21 may be rotated in a mode where the object 5 is being loosely gripped, by means of having the coupling arrangements 22 (so called ABL) rotatable, in relation to their support members 20. As presented in connection with the figures described above, an axially acting coupling 22 may be adjusted into different modes, one mode where the object is freely rotatable, also in relation to the clamping members 21, (so called FFP, see Fig 8), a second mode where the object is rotatable, but with some fixation in relation to the clamping members 21, (so called ABL, see Fig 8), a third mode where the object is rotatable but with a fixation force that may provide some counter acting rotational torque when the object is rotated (so called RUH, see Fig 8) and a further mode where the coupling is totally locked (so called LP see Fig 8) and no rotation of the object 5 is possible.

Furthermore, this figure shows that according to a further embodiment according to the invention (see Figs. 9-11) it is feasible to add one or more further coupling member/s 25
that act radially, whereby one or both of the clamping members 21 may be locked, irrespective of the other coupling arrangements 22. This further coupling member 25 is arranged with a release function for their different modes of either locking or totally released. In a further embodiment (see Fig. 11A) a radially acting coupling arrangement 25 may be used alone to achieve the desired functionality. Further in still another embodiment (see Figs. 23A-D) there is used an axially acting coupling 22, but also an indirect second further coupling member 25, that in a supplementary manner may provide easy and quick change between locked position (LP) and any of the different modes (FFP, ABL or RUH) of the primary coupling arrangement 22.

In Fig. 8 there is shown a principle view of the different steps when using holding and coupling arrangement in accordance with one embodiment according to the invention. In a first step A, the object 5 is merely positioned between the clamping members and in this mode the object 5 is free to be moved, rotated also in relation to the clamping members 21. In the next step, step B, the distance between the clamping ends 30, 40 of the vice 3, 4 is diminished wherein gripping, frictional force is obtained between the object 5 and the interfaces 23 of the clamping members. Now in this mode, the object 5 may still be freely rotated by means of having the clamping members 21 freely rotatable in relation to the support members 20. When further diminishing of the distance between the clamping ends 30, 40 is performed the coupling interfaces will enter into engagement whereby step C is achieved. In this mode the object 5 may be rotated but in interaction with the surfaces of the couplings 22, implying that if dented surfaces are used there will be a kind of ratchet function, i.e. stepwise distinct repositioning when the object 5 is being rotated. When the distance is diminished further, i.e. larger forces applied, the coupling members 22 will move into the locked mode as shown in step D. In this mode the object may not be moved in relation to the clamping ends 30, 40 of the vice 3, 4, i.e. a mode where work may be performed which needs fixed position of the object 5. Thereafter a slight increase of the distance, step E will again reposition the arrangement in the same kind of mode as in step C, i.e. allowing the object 5 to be repositioned in connection with interaction with the coupling interfaces.

In Fig. 9 there is shown a second embodiment according to the invention where the basic principles as described above are basically the same but wherein a further coupling member 25 is added to the concept. In Figs 10 and 11 there are shown cross-sectional views of a device according to Fig. 9. It is shown that the support member 20 is arranged with a radially extending passage 253 for inter fit with a locking and release
member 250. This locking and release member 250 is radially moveable within the
passage 253.

Further, the support member 20 has a central through-hole 201 where the passage opens.
The clamping member 21 is arranged with a corresponding stub shaft 211 fitting into
the hole 201 of the support member. At the periphery of the stub shaft 211 there are
radial dents 252 fitting to corresponding dents 251 at the inner end of the locking and
release member 250.

Accordingly, when the locking and release member 250 is positioned radially, inwardly
it may lock the support member 20 to the clamping member 21, and when it is moved
radially, outwardly it will release the clamping member 21 from the support member 20,
whereby the clamping member 21 may be rotated if the first coupling 22 is in its non-
locked position. Accordingly, in this second embodiment the object 5 may not be
rotated even if the first couplings 22 are in a released state. Thanks to this arrangement
there is achieved a further control function, i.e. that the further coupling member 25
may provide easy and quick change between locked position (LP) and any of the
different modes (FFP, ABL or RUH) of the primary coupling arrangement 22.

This control function may assist in making an easy adjustment of the position of the
object, since in the preferred form as shown in Fig 10, this is combined with a control
stop arrangement 208/218 to control that the coupling interfaces 220, 221 of the first
coupling arrangement 22 may not be moved into a locking position (LP) but merely to a
non-destructive interacting position (RUH). In the shown embodiment this feature is
achieved by having a protruding stop member 218 on the clamping member 21, that
interacts with a recess 208 in the support member 20, wherein the recess 208 is wider
than the stop member 218 to provide a desired play of movement of the clamping
member 21 in relation to the support member 20. Hence, it this embodiment the further
coupling arrangement 25 need to be activated to achieve a locked mode, (LP). It is to be
noted that the stop member 218 must not be integrated with the clamping member 21,
but may be a separate part, e.g. an axial bearing that would also beneficially eliminate
any undesired friction between the jaw 21 and the support member, during relative
rotation them between.

In fig 11A there is shown a modified embodiment using a radial coupling arrangement
25 to achieve the desired functionality. Here, the locking and release member 250 is
constructed by the use of a plurality of interactive parts, in order to achieve further
functionality compared to what is described regarding the further coupling arrangement 25 above. The interacting teeth 251 are applied on a first inner part 250A. This first inner part 250A is arranged with the lower portion 250A1 that has a larger diameter (or rectangular) cross-section than an upper portion thereof. The upper portion 250A2 fits into a central passage in an intermediate part 250B, which has a cylindrical configuration. Accordingly, the upper portion 250A2 may move within the through passage 250B1 in the intermediate part 250B. A washer 250C is arranged between the inner end of the intermediate part 250B and the transition area between the upper portion 250A2 and the lower portion 250A1, where a shoulder 250A3 provides a first limit stop for the washer 250C and the inner end of the intermediate part 250B presents the other stop limit for the washer 250C. A spring member 250C1 urges the washer 250C in a direction against the intermediate part 250B. Accordingly the lower end of the intermediate part 250C and its position thereof, will decide how much the spring 250C1 will urge the inner member 250A against the interface 252. Further the intermediate part 250B is arranged with outer threads 250B2 adapted to enable positioning of the intermediate part 250B at different radial positions within the radial passage 253 (merely indicated in Fig. 11A) within the support member 20.

Moreover, the intermediate part 250B is also arranged with threads 250B3 at the upper portion thereof within the inner passage. In these threads there are arranged two opposing grooves 250D4, which grooves extend in the radial direction C. An outer member 250D is arranged within the intermediate part 250B by means of a shaft portion 250D1 that protrudes into the passage 250B1 of the intermediate part 250B. Lugs 250D2 are arranged at opposite positions on the protruding portion 250D1 of the outer member 250D which lugs are arranged with threads corresponding to the threads 250B3 within the intermediate part. The lugs have a width that is slightly smaller than the radial grooves 250D4, implying that the outer member 250D may be freely moved radially when the lugs 250D2 are within the grooves 250D4.

Accordingly, the outer member 250D may easily be positioned at any level within the intermediate upper part of 250B by quickly first moving it to a desired level with the lugs 250D2 in the grooves 250D4 and thereafter rotate the outer member 250D to thereby engage the lugs with threads and lock the outer member 250D in that desired position. To make the outer member 250D more easily maneuverable it has a larger maneuver part 250D3 at its outwardly protruding portion. Further it is understood that the inner surface 250D5 of the outer member 250D will provide a definite radial stop limit for the inner member 250A. Accordingly, if it is desired to move the coupling 25
into a lock mode (LP) the outer member 250D is pushed down with the lugs in the
grooves until contact is achieved with the upper surface 250A6 of the inner part 250A
and thereafter rotating to lock the inner part 250A in a position where it is pressed with
its interface members 251 into secure contact with the interface members 252 of the jaw
21. By unscrewing and lifting the outer member 250D up along the groove this locking
mode is released.

Further, the intermediate member 250B may be used to apply an adjustable pressure
onto the inner member 250A via the spring 250C1, by means of using the threads to
position the intermediate body 250B at a desired level, whereby a ratcheting providing
an adjustable torque may be achieved (RUH). And if the intermediate member 250B is
positioned even higher up there will be achieved an ABL mode.

It is evident from the above that the invention may be applied by the use of various
kinds of coupling arrangements, and that it may be applied by the use of two coupling
arrangements 22, 25 in combination that provides the desired functionality, or merely
one coupling arrangement e.g. 25, that provides the desired functionality. For instance,
as is evident for the skilled person, the modified arrangement as described in Fig 11A
may be used as the single coupling embodiment.

In Fig. 12 there is shown a further embodiment in accordance with the invention
wherein the release and lock function of the further coupling member 25 is achieved by
means of using a member with a threaded part 254 having an end 251 that in contact
with the outer surface 252 of the stub end 211 may lock the coupling in fixed positions.
Accordingly, the passage through the support member 20 in this embodiment is
arranged with threads corresponding to the threaded portion 254 of the locking and
release member 250 and preferably the locking and release member 250 is arranged
with a lever for easy activation and deactivation of the locking and release member 250.

In figure 13 there is shown a perspective view of a well-known handhold clamping
device that has been equipped with clamping and holding devices 1, 2 according to the
invention. It is shown a preferred combined embodiment of the present invention,
wherein said holding faces 23 comprise a plurality of arch-shaped contact surfaces 230
that converge at a joint point 231, arranged to enable a holding without clamping range
(FFP) of an object 5 between said holding faces 13, 23 without any clamping force,
such that free rotation of the object in relation to said holding faces 23 is easily
facilitated.
In Fig. 14 there is shown an exploded perspective view of the embodiment shown in Fig. 13. The members are preferably made by form molding, by the use of an appropriate polymer composition, wherein the support member 20 is made in one piece and having threaded nuts 202 in side walls for attachment of screws 203 to securely attach the devices 1, 2 to the clamping members 3, 4.

In Fig. 15 there is shown a cross sectional view of one of the devices in assembled form wherein it is shown that in a preferred combination according to the invention the dented interface surfaces 220, 221 have a depth Y that is relatively small in relation to the thickness T of the clamping members 11, 21, i.e. in a range of 2 < T/Y < 100, more preferred 5 < T/Y < 70, and most preferred 10 < T/Y < 50.

Further it is shown that the interface 220 on one of the members, here the clamping member 21, may be arranged merely in some segments, which may suffice for an interaction with the other interface 221 that preferably is arranged over the whole range of 360° around the axis of rotation C for the clamping member.

Moreover, as is shown in Fig. 16 the clamping member 21 may preferably be made from a plurality of pieces, i.e. a front part 21A and a wall part 21B, that are attached by means of screws 214. In the space formed between them there is positioned a resilient member 223. The resilient member 223 may be in the form of basic resilient body 223A that cooperates with a plurality of protruding elements 223B, positioned inside of the wall part 21B that is releasable attached to the front part 21A of the clamping member 21. The wall member 21B includes a plurality of holes 215 adapted for the resilient protruding members 223B.

In Fig. 17 and 18 there is shown a further embodiment in accordance with the invention. Here the device according to the invention is arranged on to a clamp of a more traditional kind having a moveable part 3 including a threaded rod 35. At the fixed end 4 the same kind of support and clamping members 20, 21 may be used as described above. At the other end there is a need to adapt the support member 20 for appropriate interaction with the end of the threaded rod 35. The support member 20, as is shown in Fig. 18 therefor may include an adaptive member 217 with an interfit part 217A.

In Fig. 19 there is shown an alternative embodiment according to the invention wherein merely differing details will be focused on. As is evident from the figure the coupling arrangement 22 is designed in a different manner compared to what is shown above.
Instead of using plane opposing interfaces 220, 221 for the coupling arrangement 22 there are arranged partly radially arranged interfaces. The basic principle is the same as described above, but as evident for the skilled person the counter acting forces will have different vectors compared to the embodiments described above, which in some applications may be an advantage.

In Fig. 20 there is schematically shown a further embodiment of the alternative embodiment of Fig. 19 wherein there is also made use of partly radially extending interfaces 220, 221. On the right hand side there is shown a support member 20 with dashed lines indicating the dents of the interface 220. On the left hand side there is shown a schematic front view of a clamping member 21 and in the middle a cross-section along X-X. The interface 221 of the clamping member 21 is arranged with two types of dents a, b, and wherein the dented portions of the interfaces within different segments are arranged with different extensions, i.e. radial dents a, b that extend with different angles a for a, β for b in relation to the axis of rotation C while the dents resolutions are A for type 'a' and B for type 'b'. Thanks to this arrangement dents 'a' are applying the ABL and RUH modes while dents 'b' are applying the LP mode, i.e., in the first phase of positioning object 5 dents 'a' alone are in contact with 220 but when increasing the clamping force it results in that also dents 'b' will start engaging with 220. As shown in Fig. 20, resolution A of dents 'a' are k times (i.e., k=2,3,4...) the resolution B, in order to allow by this arrangement to transform accurately and with no mechanical difficulties between ABL/RUH and LP modes. Further, thanks to this arrangement less precision is needed in production of the interfaces 220, 221, since the sections will be able to interact in different positions and thereby allow larger play compared to interfaces of the more traditional kind.

In Fig. 21 there is shown further embodiment in accordance with the invention where the clamping member 21 is divided into two or more pivotal parts and the activation of the coupling 22 is obtained by dividing the clamping member 21 in to two, or more, pivoting parts 21', 21"(?), held together by means of a spring 223, each one provided with a part of the interface 221 that may interact with the interface 220 of the support member 20, depending on the pivotal position that the object 5 has forced the pivoting parts 21', 21" to take. Here a friction coupling arrangement is another option to use instead of the above presented arrangement of coupling 22 using dents interfaces, i.e. friction grip between the interfaces 220, 221 is used to apply the "ABL", "RUH" and "LP" modes by the same arrangement. The pivoting parts 21', 21" are pivotally arranged, by means of having rearward extending attachment portions 21’A, 21’A
including convex spherical surfaces 213 that interact with concave spherical surfaces 208 in the support member 20 in order to allow a combined 3D operation of the pivoting parts 21', 21" and by that to maintain object 5 in its desired centered positioning. Accordingly, when the object 5 presses against a recessed portion (e.g. V-groove) at the face 230, it will force the pivoting parts 21', 21" to pivot outwardly, against the resilient force of the spring 223, and interact with support member in dependence of how large force that is applied via the object, in principle in the same manner as described above and by that to transform between the "ABL", "RUH" and "LP" modes. A few options are possible to apply the spring force of member 223 by positioning spring 223 between parts 20, 21 in different directions relatively to the main clamping axis, e.g., the spring force could be applied in parallel or vertical or some angle in between parallel to vertical angles relatively to the main clamping axis, or e.g. as a separate inner member of member 20 that is opposing the outwardly movement of member 21, or any combination of the described options to apply spring force of 223. Accordingly, an alternate solution the spherical surfaces 208, 213 are arranged with dents, or other gripping things, that may enable the "ABL-mode" and "RUH-mode" in a step prior to pressing the interfaces 220, 221 into contact, i.e. prior to "LP-mode".

In a similar manner as described in Figs. 4, 5 and 6, the gap X and the distance Y of maximum possible movement in interlocked position between the coupling interfaces 220, 221 define the different modes FFP, ABL, RUH and LP, however it is mainly the outward movement of members 21', 21" that defines the gap X and the distance Y. The desired ranges for X and Y designs, i.e., according to various considerations of the coupling 22 torque-resistance and its correlation to the main clamping vector, could be achieved in various ways, e.g. by changes made into the attachment portions 21'A, 21"A by reducing or increasing their length or their convex spherical surfaces 213, or by changing the common angle of interface 220, 221 in its LP mode relatively to the main clamping axis, or by changing the surface shape of member 21 that interface with object 5, or simply by changing the dents' dimensions of the coupling arrangement. This embodiment of Fig. 21 may allow for transforming between LP-mode and RUH-mode or vice versa, faster and more accurately in a manner that is influenced directly by the 3D shape of object 5 while requiring less clamping force and by spreading its clamping pressure in a more balanced operation.

In Fig. 22 there is shown an exploded view of a fixed holding device intended to facilitate interaction with one of the holding or clamping member in accordance with the invention, wherein one side is in the form of a fixed holding and clamping device.
In Figs. 23A-D there is shown a further embodiment according to the invention, wherein fig 23A shows an exploded cross-sectional side view, fig 23B shows a front view of a support member 20, fig 23C shows a cross-sectional side view in non locked mode (ABL or RUH) and fig 23D shows a cross-sectional side view in locked mode (LP).

The basic principles are substantially the same as has been described above. In the following there will be a focus on differing features. The same reference numbers are used as above for corresponding features, as already described. A first different feature is that the further separate coupling arrangement 25 is integrated in a different manner. Here it comprises a maneuverable coaxial body 256, 257, having a grip able rear portion 256 and a hollow cylindrical front portion 257. Further, the maneuverable part 25 includes auxiliary interlock members 258A arranged to interact with corresponding auxiliary matching members 258B in the support member 20 (it should be noted that here the interlock member 258A on the maneuverable part is a male device and the matching members 258B in the support member is a female member, but that of course this could also be made vice versa). To enable the interlocking members 258A to lock against axial displacement within the support member 20 the coaxial body 256, 257, with its interlocking members 258A, is pushed through the grooves 258B and rotated to act against an inner wall 261 in the support member 201. Thereby the end face 257A of the coaxial body 256, 257 will be positioned in an inner most position. A resilient member 259 (e.g. spiral spring) is positioned between the front wall 256A of the rear portion 256 and a back wall 260 of the support member 20. Thanks to the resilient member 259 the maneuverable part 25 will always be retained in an inactive position (see fig. 23C) if not acted upon to compress the spring 259 in order to move the first auxiliary interlocking members 258A into a locking position (see Fig. 23D) and thereafter rotated to lock against the inner wall 261 of the support member 20. Further the resilient member 259 also provides a secure locking, by means of friction, when the coaxial body 256, 257 is positioned in an inner most position. Once in a locked position there will be a fixed interlock between the support member 20 and the jaw 21, due to the end face 257A of the coaxial body 256, 257 compressing the spring 223 and urging the interlocking interfaces 220, 221 into a locked mode.

Another difference is that there is arranged an adjustability for the position and/or pushing force of the second interface 221. This is achieved by a maneuverable sleeve 280 that is arranged with threads (or other "camming" members) and corresponding interacting members 281 in the support member 20. Accordingly, the maneuverable
sleeve 280 may be positioned at different axial positions along the holding device. Thereby its abutting surface 283 may be positioned at different axial positions, which in turn acts upon a distance member 284 having a front surface 286 acting upon a resilient member 223 that urges the second interface device 221. The distance member 284 is arranged with a plurality of legs 284A that extend through holes 284B in the support member 20. The second interface 221 is in the form of a separate part 221A in relation to the support member 20, arranged with protruding lugs 221A that interlock radially within corresponding grooves 221B in the support member. Accordingly, the force that the interface 221 is pushing onto the first interface 220 may be varied by means of adjusting the maneuverable sleeve 280.

Furthermore, it is shown that a bearing 290, e.g. a traditional axial roller bearing, is used to eliminate friction between the jaw 21 and the support member 20, i.e. a bearing 290 that has an inner diameter that fits onto a shoulder 291 on the jaw and faces that axially supports between the support member 20 and the jaw 21.

Thanks to the embodiment shown and described above some further advantages are gained. A first advantage is the ability to adjust the position of the object 5, in 3D, by few rotary modes, with the ability not to lose the main vector of holding, without having to release/act upon the moveable part 3 of the clamping and holding device. Hence, the original level of holding force pre-defined for a specific work may be maintained while rotating the object 5 to its new position, by needing merely once to adjust the maneuverable sleeve 280, and/or the moveable part 3 of the clamping and holding device to obtain a desired holding force. Once this single adjustment has been made, the invention allows for easy change between adjustment mode (RUH or ABL) and fixed working mode (LP) merely by an easy operation of the further separate coupling arrangement, 25, by moving it between active and inactive state, i.e. having the object 5 in a locked state (LP), and an adjustable inactive state (e.g. RUH), respectively, wherein the object 5 may be rotated by means of movement between the first coupling interfaces 220, 221 at a predetermined/pre-adjusted torque resistance in the adjustable state.

In addition, the object 5 can include several, not integrated sub-parts, with different frictions’ surfaces between them. Thanks to the double lock option of the invention, it allows to deal with different situations where different object's positioning is required. Moreover, it allows for adjusting different level of counter force for rotating via the first coupling interfaces 220, 221, e.g. which may be required if a non-symmetric object 5 is rotated to a new position where gravity exerts a larger torque. Accordingly, the
invention may save time and labor thanks to providing the user the ability to change the object's position with minimum effort.

The invention is not limited by the embodiments presented above, but may be varied within a plurality of aspects without departing from the basic principles of the invention. For instance, it is evident that the resilient force urged by the spring 223 may be achieved in various ways, e.g. by the use of a plurality of circumferentially distributed helical springs of small diameter, or integrated plastic spring portions, or magnetic repelling parts, etc. Moreover, it is evident that the basic principle of the invention may also be fulfilled without any resiliently urging force, but merely by the use of some friction resistance that counter acts at least some reaction force of an object to be held/clamped. Further it should be understood that the basic principles of the invention may also be achieved without having said coupling arrangement 22 positioned within a first subrange (ABL) of said limited range (X+Y), i.e. any gap X between said coupling interfaces 220, 221, but merely by having it providing the "second subrange (RUH)”, i.e. merely enabling a first mode where rotation by means of non-destructive relative movement between said coupling interfaces 220, 221 occur and a second mode (LP) where the coupling interfaces 220, 221 are locked, wherein the latter may either be achieved by means of the same coupling arrangement 22 or by a separate coupling arrangement 25. It is foreseen that these embodiments may be the subject for their own protection by one or more divisional applications, as may also be the case regarding other aspect/details described above and/or identified as dependent claims in the set of claims. Moreover, it evident for the skilled person that a large variety of interacting grips may be used, in a flexible manner, in accordance with the invention, to adjust/adapt to achieve a desired grip, e.g. friction grip and/or dents, and/or other gripping things.
CLAIMS

1. A clamping and holding device, such as for a vise, a clamp or the like, said device (1,2) comprising two holding and clamping members (1, 2) having holding faces (23) and fitting parts (200), said fitting parts (200) being arranged to fit said holding and clamping members (1, 2) with their holding faces (23) in opposite relation, characterized in that at least one of said holding and clamping members (1, 2) include a support member (20) and an in relation to the support member (20) a movable and rotationally adjustable clamping member (21) by means of a coupling arrangement (22, 25) arranged them between and in that said coupling arrangement (22, 25), on one side includes that the support member (20) has a first coupling interface (220, 251) and that the clamping member (21) has a second coupling interface (221, 252).

2. A clamping and holding device in accordance with claim 1, characterized in that said clamping member (21) is movable within a limited range (X+Y) in relation to said support member (20) or vice versa and that said coupling arrangement (22, 25) within a first subrange (ABL) of said limited range (X+Y) is arranged to enable rotation by means of a gap (X) between said coupling interfaces (220, 221, 251, 252) and further within a second subrange (RUH) of said limited range (X+Y) is arranged to enable rotation by means of non-destructive relative movement between said coupling interfaces (220, 221, 251, 252).

3. A clamping and holding device in accordance with claim 2, characterized in that said non-destructive relative movement between said coupling interfaces (220, 221) includes a snapping function, preferably arranged to enable equidistant stepwise adjustment in both clockwise and counter-clockwise directions.

4. A clamping and holding device in accordance with claim 2 or 3, characterized in that said coupling arrangement (22, 25) within a third subrange (LP) of said limited range (X+Y) is arranged to lock said support (20) and clamping members (21) by means of interlock between said first and second further coupling interfaces (220, 221, 251, 252).
5. A clamping and holding device in accordance with claim 2 or 3, characterized by a further, separate coupling arrangement (25) arranged with further first and second coupling interfaces (251, 252) arranged to lock said support (20) and clamping members (21) by means of interlock between said first further and second further coupling interfaces (251, 252) or interlock between said first and second coupling interfaces (220, 221).

6. A clamping and holding device in accordance with any of claims 1-5, characterized in that said holding faces (23) comprise at least one recess, preferably by means of a plurality of arch-shaped contact surfaces (230) that converge at a joint point (231), arranged to enable a holding without clamping range (FFP) of an object (5) between said holding faces (23) without any clamping force, such that free rotation of the object in relation to said holding faces (23) is facilitated, wherein preferably the geometry is such that 2<T/Y<100, wherein T is the thickness of the clamping member (11, 21) and Y is the depth of the teeth (220, 221; 251, 252).

7. A clamping and holding device in accordance with any of claims 1-6, characterized in that a resiliency member (223) is arranged to provide a resilient force urging to keep the first and second coupling interfaces (220, 221) apart from each other.

8. A clamping and holding device in accordance with claim 7, characterized by having said resiliency member (223) in the form of at least one spring.

9. A method for manually, adjustably clamping and holding an object by means of a clamping and holding arrangement in the form of a vise, a clamp or the like, said clamping and holding arrangement (3, 4) including a clamping and holding device (1,2) according to any of claims 1-7, having the fitting parts (200) fitted to the clamping and holding arrangement (3, 4) with their holding faces (23) in opposite relation comprising the steps of:

   a) using the clamping and holding arrangement (3, 4) to decrease the distance between the holding faces (23) to clamp the object (5) between the holding faces (23) in a first mode (FFP), enabling adjusting the position of the object (5),

   b) using the clamping and holding arrangement (3, 4) to further decrease the distance between the holding faces (23) to clamp
the object (5) between the holding faces (23) in a second mode (ABL), enabling adjusting the position of the object (5) by means of rotation,
c) using the clamping and holding arrangement (3, 4) to further decrease the distance between the holding faces (23) and clamp the object (5) in a third mode (RUH), including interaction with the interfaces (221, 220, 251, 252) of at least one coupling (22, 25) between the holding faces (23), enabling adjusting the position of the object (5) by means of rotation when applying higher force of torque than needed in step b),
d) fixing the position of the object (5) in a locked desired position (LP).

10. A method according to claim 9, including a further step before step a):
   - mounting and holding an object (5) in a pre-mode (FFP) between the holding faces (23), preferably by means of using at least one holding face (23) comprising a plurality of arch-shaped contact surface (230) that converge at a joint point (231), wherein preferably the geometry is such that $2 < \frac{T}{Y} < 100$, wherein $T$ is the thickness of the clamping member (11, 21) and $Y$ is the depth of the teeth (220, 221; 251, 252).

11. A method in accordance with claim 9 or 10, characterized by said third mode (RUH) is arranged to enable rotation by means of non-destructive relative movement between said coupling interfaces (220, 221, 251, 252).

12. A method in accordance with claim 11, characterized by said third mode (RUH) includes a snapping function, preferably arranged to enable stepwise adjustment.

13. A method in accordance with any of claims 9-12, characterized by said locked position (LP) is achieved by using first and second further coupling interfaces (251, 252) arranged to lock said support (20) and clamping members (21).

14. A method in accordance with any of claims 9-13, characterized by providing a resilient force urging to keep the first and second coupling interfaces (220, 221) apart from each other.
### A. CLASSIFICATION OF SUBJECT MATTER

INV. B25B1/24 B25B5/16

ADD.

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:

- EPO-Internal, WPI Data

### C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<th>Relevant to claim No.</th>
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<td>X</td>
<td>US 4 960 269 A (FONG BRIGHT K C [US]) 2 October 1990 (1990-10-02)</td>
<td>1, 2, 7, 9, 11, 14</td>
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### Date of the actual completion of the international search

31 July 2017

### Date of mailing of the international search report

10/08/2017

**Authorized officer**

Bonni n, Davi d
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