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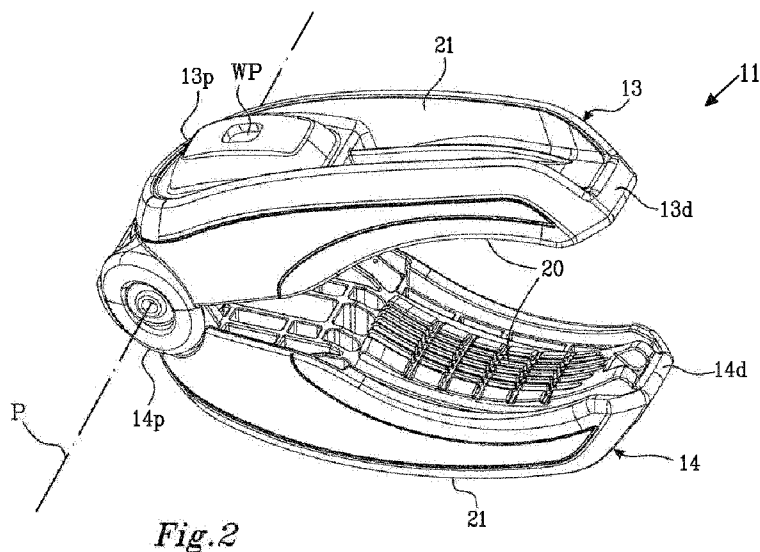
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(54) Title: CLAMPING JAW FOR A SUPPORT ASSEMBLY FOR A BICYCLE CARRIER



(57) Abstract: A jaw member (11) for a support assembly (10) for securing a bicycle (1) to a load carrier (2) for a vehicle (8). The jaw member (13, 14) comprises a frame work structure formed by at least one support element and at least one rib (31, 32, 35, 36). The frame work structure is specifically adapted to enable the jaw member to withstand a relative high amount of tensile stress while still being relatively light weight.

CLAMPING JAW FOR A SUPPORT ASSEMBLY FOR A BICYCLE CARRIER

TECHNICAL FIELD

A clamping jaw for a support assembly for a bicycle carrier for a vehicle, a knob for
5 transferring torque to the clamping jaw of the support assembly and a support assembly
comprising the clamping jaw and the knob.

BACKGROUND

Load carriers for vehicles are widely used to provide the vehicles, such as automobiles,
10 with an increased loading capacity. A load carrier is usually mounted on the vehicles tow
hook, an equivalent position at the rear of the vehicle, or on roof racks. Wherever the load
carrier is mounted, there is a need to readily secure the bicycle to the load carrier
especially before transportation of the bicycle in traffic environments. A bicycle which is
accidentally detached from the load carrier during transportation could cause severe
15 damage

Support assemblies for securing a bicycle to a load carrier for a vehicle are widely used
together with load carriers for bicycles. It is common that support assemblies use a
clamping jaw to secure the bicycle to the support assembly. One such support assembly
20 is disclosed in the International patent application no. WO 2009/065817 Thule Sweden
AB. The clamping jaw of the support assembly comprises a first and a second jaw
member which upon tightening with a tightening device, such as a rotating knob, are
pressed together about a portion of a bicycle, usually the frame of the bicycle, to secure
the bicycle to the load carrier. It is the mouth ribs, i.e. side edges, of the jaw members
25 which engage the bicycle to retain the bicycle to the load carrier.

A clamping jaw of a support assembly can be manufactured in a wide variety of different
ways. It has become more common lately to manufacture the clamping jaw from a plastic
material e.g. by form molding the two jaw members for example. To provide structural
30 integrity to a jaw member, the jaw member in the WO 2009/065817 document is formed
by a frame work structure in terms of that the jaw member comprises a plurality of ribs
which project from the outer housing and towards the interior of the jaw member and
supportive ribs extending between the side edges of the jaw member. The inside of the

"mouth" of the clamping jaw thus has a plurality of exposed ribs. A grip section can be formed at the center section of the jaw member by filling the cavities, or grooves, formed by the frame work structure with a soft thermoplastic polymer. It requires a large amount of thermoplastic polymers to fill the void formed by the frame work structure to provide a
5 reasonable grip section which further adds weight to the clamping jaw.

There is a need for the clamping jaws of the support assemblies and its individual components to withstand a high amount of crash violence. Crash violence is a term for describing the forces imparted to the components during an accident with the vehicle,
10 such as a crash or a collision scenario with another vehicle. During a crash or a collision, the vehicle, the bicycle carrier and of course the support assembly retaining the bicycle to the bicycle carrier is subjected to an extreme amount of crash violence. It has been found that clamping jaws of support assemblies can accidentally break during such high levels of stress, especially when mounted to larger bicycles. In order to overcome this problem
15 clamping jaws are made stronger by increasing the thickness of the material of the clamping jaw. This however makes the clamping jaws bigger and clumsier and more difficult to mount to bicycles as these sometimes tend to have a limited amount of space available for the clamping jaw.

20 It has been found that during a crash or a collision scenario, at least one of the jaw members of the clamping jaw of a support assembly is especially vulnerable when subjected to high tensile stress. The tensile stress is generally as highest in the mouth of the clamping jaw, i.e. on the bicycle facing side. With reference to a cross section of the jaw member at the center of the mouth, the tensile stress is gradually decreasing closer to
25 the centre of gravity of the cross section and will transcend to a compression stress towards the distal end of the structure.

It has now been found that clamping jaws of the aforementioned kind have some disadvantages. If a clamping jaw having a frame work structure needs to be very rigid
30 they tend to become very large and very heavy, and thus not very user friendly nor easy to mount to a bicycle.

The support assembly disclosed in the WO 2009/065817 document comprises a rotateable knob connected to an axle to impart the first and the second jaw members of
35 the clamping jaw with a force to press the jaws together. The axle extends to an opposing

end of the support assembly comprising an annular clamp which counteracts the rotating motion of the knob to press the first and the second jaw member together.

There is however always a risk of the user imparts the knob with a too high torque and thus accidentally damages the bicycle. Some support assemblies are thus provided with a torque limiting mechanism to limit the amount of transferrable torque to the clamping jaw via the knob. One such support assembly is disclosed in the European patent application no. EP 2,230,412 A1.

10 To prevent or significantly reduce the risk of theft of bicycles, support assemblies for load carriers can be provided with locks. The support assembly disclosed in the European patent application no. EP 2,230,412 A1 also comprises a lock mechanism which is cooperating with the torque limiting mechanism to lock or unlock the support assembly. The solution disclosed in the latter document is however associated with a number of
15 drawbacks. The lock mechanism is quite complex due to the configuration of the torque limiting mechanism.

SUMMARY

It is an object of the present disclosure to solve at least one of the aforementioned
20 drawbacks, or to provide for a useful alternative. The object is at least partly met by a jaw member for a support assembly for securing a bicycle to a load carrier for vehicles. The jaw member comprises a frame work structure formed by at least one support element and at least one rib. The support element of the jaw member comprises a bicycle facing side adapted to be positioned adjacent, or substantially adjacent, the bicycle when
25 mounted thereto, and a distal side. The rib extends from the distal side of the support element of the jaw member.

The frame work structure of the jaw member has at least one rib which extends from the distal side of the support element provides for a jaw member which is rigid, i.e. has a high
30 structural integrity and can resist relatively high load of tensile stress, while still being relatively light weighted. It provides a clamping jaw with improved resistance against tensile stress while still having a relatively low weight. In this aspect, the ribs mentioned herein are strengthening ribs. A strengthening rib can have a width/height ratio of at least 1/5, i.e. it is at least five times higher than its thickness, and preferably a length which is at

least as long as its height, preferably at least twice as long as the height, more preferably five times the height.

A clamping jaw comprising a first and a second jaw member, the first and/or the second
5 jaw member can have said frame work structure, i.e. the second jaw member can also comprise the frame work structure. The second jaw member can be pivotally attached to the first jaw member, or in the proximity thereof, at a pivot axis to form a clamping jaw.

The rib can extend from the distal side of the support element in a direction substantially
10 perpendicular to the support element. The jaw member becomes extra rigid if the rib extends substantially perpendicular, or perpendicular, out from the distal side of the support element, even if the support element itself has an arc form.

According to an aspect, the frame work structure is positioned at a centre section of the
15 jaw member. Having the frame work at the centre of the jaw member, independently if it is the first or the second, the jaw member is provided with a substantially planar bicycle facing side surface at the centre, i.e. in the mouth. This enables the bicycle facing side to be coated, or provided with a second material, different from which the jaw member or the frame work structure is manufactured from. For example, the frame work structure of the
20 jaw member can be form moulded using a first thermo plastic polymer e.g. polypropylene, and the bicycle facing side of the jaw member can be coated, or provided, with a second thermoplastic polymer such as a softer polyethylene. The support element provides fro a flat smooth surface to be coated, which requires little amount of coating material. Hence the bicycle facing side can be provided with a relative soft material, or a friction enhancing
25 material easy and at low cost. The frame work structure can comprise a friction enhancing material defining a grip section.

According to an aspect the first and/or the second jaw member can comprise a first and a second mouth rib. The frame work structure is positioned between the first and the
30 second mouth ribs. Optionally the mouth ribs are separated by a groove on either side of the frame work structure but can be formed integrally therewith. The grooves provide added strength by providing additional ribs to the jaw member.

According to an aspect, the frame work structure comprises two or more ribs, preferably
35 three or more ribs. The two or more ribs are advantageously positioned on either side of a

longitudinal centreline of the jaw member and extend along the longitudinal centreline, preferably parallel with the longitudinal centre line.

At least one additional supportive rib can be positioned between two ribs. The at least one supportive rib interconnects the two ribs, or the two or more ribs, and provide additional strength to the jaw member while adding very little weight to the jaw member. A more complex frame work structure is achieved. Instead of having longitudinal groves between the ribs, the jaw member tends to get square like grooves, or triangular formed grooves dependent of the angle between the ribs, and the supportive ribs.

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According to an aspect the at least one rib has a base having a width proximal to the support element, and a rim distal to the support element, wherein the width is gradually decreasing towards the rim. The cross section of the rib thus has a slightly tapered form. It has been found that this is important as the weight can be reduced while the structural integrity is still kept high. There are two positive effects, not only is the structural integrity of the jaw member improved but the ribs are also easier to manufactured when form moulding a jaw member using two opposing form moulding tools.

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According to an aspect, the support element and the at least one rib are formed in one unitary piece of material, preferably by form moulding.

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The jaw member can comprise a second frame work structure at the pivot axis, and the a first frame work structure at the mouth of the clamping jaw. The first frame work structure is as mentioned above, while the second frame work structure can have the ribs projecting from the bicycle facing side of the support element, i.e. the ribs of the support elements projects into the mouth, i.e. from the bicycle facing side of the jaw member and not from the distal side of the support element. This could be advantageous for the configuration of the tensioning device of a support assembly.

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According to an aspect, the clamping jaw comprises a first and a second opposing jaw member adapted to be clamped together about a portion of a bicycle, wherein the first jaw member comprises a frame work structure comprising a support element and at least on rib projecting from the support element. The rib of the support element projects from the support element in a direction away from the second jaw member. Optionally the second jaw member comprises a frame work structure comprising a support element and at least

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on rib projecting from the support element. The rib of the support element projects from the support element in a direction away from the first jaw member.

According to a second aspect, it is an object of the present disclosure to solve at least one
5 of the aforementioned drawbacks, or to provide for a useful alternative. The object is at least partly met by a knob for transferring a torque to an object, such as a support assembly for a bicycle carrier. The knob has a torque limiting mechanism and a lock. The lock can be operated between a locked position in which the knob is unable to transfer torque to the object, and an unlocked position in which the knob is able to transfer torque
10 to the object. The torque limiting mechanism comprises a first and a second gear member, the first gear member is biased into working cooperation with the second gear member wherein upon a torque threshold value, the first and second gear members are disengaged from the working cooperation so that a torque limiting mechanism is provided. The knob has a longitudinal centre axis about which the knob is adapted to rotate to
15 transfer the torque. The first gear member is biased towards the second gear member in a direction along the longitudinal centre axis of the knob into the working cooperation.

The knob provides for a compact knob which is tamper resistant via a lock and still has a good torque limiting mechanism using few components.

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According to an aspect, the lock engages the first and/or second gear member directly when being in the unlocked position.

According to an aspect, the lock comprises a lock cylinder; the lock cylinder engages the
25 first and/or the second gear member directly when the lock cylinder is in the unlocked position.

According to an aspect, the first gear member comprises gear teeth adapted to engage the second gear member. The second gear member can comprise corresponding gear
30 teeth. The second gear member can further as an option, comprise lock teeth to engage the lock. The lock teeth advantageously extend around the periphery of the second gear member forming a plurality of positions in which the lock, and especially the lock cylinder, can engage the second gear member directly. Instead of a lock cylinder, which generally tends to work by rotating about its own longitudinal axis, a displaceable lock pin or the like

can be used.

According to an aspect, the gear teeth of the first and/or the corresponding gear teeth of the second gear member extends in a direction along the longitudinal centre axis of the knob. As the biasing direction of the first gear member is biased along the longitudinal centre line of the knob, it is very advantageous that the respective gear teeth extend along the longitudinal centre line. They thus have their contact surfaces intersecting with the longitudinal centre line should they be extrapolated.

10 According to an aspect, the lock teeth of the second gear member extend in a radial direction with respect to the longitudinal centre axis of the knob.

According to an aspect, the present invention relates to a bicycle carrier comprising at least one support assembly comprising at least one clamping jaw and at least one knob for tightening the clamping jaw as disclosed herein.

BRIEF DESCRIPTION OF THE DRAWINGS

Non-limiting embodiments of the present invention will be described in greater detail with reference to the accompanying figures in which;

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figure 1 shows a bicycle mounted on a bicycle carrier on a vehicle and retained by a support assembly having a clamping jaw according to an embodiment of the present invention;

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figure 2 shows the clamping jaw of figure 1 with a view in perspective and in greater detail;

figure 3 shows the clamping jaw of figure 1 with a view towards the side;

figure 4 shows an exploded view of the clamping jaw of figure 1;

figure 5 shows the first jaw member of the clamping jaw of figure 1;

figure 6 shows a cross section of the first jaw member of figure 5;

30 figure 7 shows a cross section of the second jaw member of figure 1;

figure 8 shows a schematic cross section of the cross section shown in figure 6;

figure 9a-9c shows schematic cross sections of different jaw members;

figure 10 shows the knob of the support assembly of figure 1;

35 figure 11a-11b shows an exploded view of the knob of figure 10 in different perspective views and;

figure 12 shows a cross section of the knob shown in figure 10.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Figure 1 shows a bicycle 1 having a frame 3 mounted on a bicycle carrier 2 on a vehicle
5 6. A support assembly 10 retains the bicycle 1 to the bicycle carrier 2 and assists in preventing the bicycle from accidentally detach from the bicycle carrier 2. The bicycle carrier 2 can be provided with one or more support assemblies 10, preferably two or more.

- 10 The support assembly 10 comprises a clamping jaw 11 clamping about the frame 3 of the bicycle 2. A tightening device 12 in the form of a rotateable knob 50 is used to tighten or untighten the clamping jaw 11 from the frame 3 of the bicycle 2.

Figure 2 shows the clamping jaw 11 in greater detail. The clamping jaw 11 comprises a
15 first and a second jaw member 13, 14 which in the shown embodiment are pivotably arranged to each other about a pivot axis P. Each jaw member 13, 14 comprise a proximal end 13p, 14p, and a distal end 13d, 14d, with respect to the pivot axis P. The rotateable knob 50 (not shown in figure 2) has a working position WP between the pivot axis P and the distal ends of the first and the second jaw member 13, 14. When the
20 rotateable knob 50 is rotated the jaw members 13, 14 are pivotally displaced together, i.e. pressed together, or pivotally displaced from each other to release the frame 3 of the bicycle 2.

Figure 3 shows the clamping jaw 11 as seen from the side. The first and the second jaw
25 members 13, 14 comprise a support element 19 (not shown) having a bicycle facing side 20, which also can be referred to as a frame facing side, facing towards the frame 3 of the bicycle 2, and a distal side 21 facing away from the frame 3 and the bicycle 2. The frame 3 is indicated with dashed lines in figure 3. The bicycle facing sides 20 of the support elements 19 of the first and the second jaw members 13, 14 define a mouth 22 having a
30 gap 23. The gap 23 is formed by the distal ends 13d, 14d, of the first and the second jaw member 13, 14. As is noticeable, the bicycle facing sides 20 of the first and the second jaw members 13, 14 have an arc shaped form forming a mouth having a substantially oval form when seen from the side as shown in figure 3. The oval form of the mouth 22 permits the clamping jaw 11 to readily grasp around the frame 3 of the bicycle 2 and retain the
35 same after the first and the second jaw members 13, 14 are pressed together.

Figure 4 shows an exploded view of the clamping jaw 11 of figure 2. Figure 4 shows the first and the second jaw members 13, 14, a biasing member 15 in the form of a spring 16. A bolt 17 connects the first and the second jaw members 13, 14 and extends through the
5 spring 16. The spring 16 biases the first and the second jaw members 13, 14, away from each other, so that when the knob 50 is rotated to untighten the clamping jaw 11, the first and the second jaw members 13, 14 are biased away from each other.

Figure 5 shows a perspective view of the first jaw member 13 in greater detail and with a
10 view towards the upper side of the first jaw member 13, referred to as the distal side 21 of the support element 10 of the first jaw member 13. Figure 5 further shows the proximal end 13p and the distal end 13d of the jaw member 13, and the pivot axis P. An aperture 17 extends through the first jaw member 13 and permits an axle (not shown) of the tightening device 12 to extend through the first jaw member 13 as will be explained below
15 in greater detail. Such mentioned axle would be connected to the knob 50 in the present case. A longitudinal centerline CJ extends along the first jaw member 13.

A first and a second rib 31, 32 extend along the longitudinal centerline CJ. The purpose of these ribs 31, 32 will be explained with reference to figure 6.

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Figure 6 is a cross section of figure 3 along the lines I-I. Figure 6 shows a cross section of the first jaw member 13, the support element 19 having the bicycle facing side 20 and the distal side 21, the mouth 22, and the first and the second ribs 31, 32. For the purpose of orientation, the longitudinal centerline CJ and a vertical axis V divides the first jaw
25 member into a left and a right section.

The bicycle facing side 20 of the support element 19 has a planar surface and a first and a second rib 31, 32 which extends from the distal side 21 of the support element 19 of the first jaw member 13. The first jaw member 13 thus comprises a center section CS which
30 extends along the longitudinal centerline CJ and with respect to the cross section, has an extension perpendicular to the longitudinal centerline CJ. The center section CS is formed by a portion of the first jaw member 13, in this case the support element 19. The bicycle facing side 20 of the support element 19 has as mentioned above a slightly arc shaped form along the longitudinal center line, but a smooth planar surface, in contrast to the
35 distal side 21 of the support element 19 of the first jaw member 13 which has the first and

the second rib 31, 32 extending from the distal side 21. It is of course possible that the bicycle facing side can have a flat planar surface, a slightly concave or convex surface, nevertheless it has no protruding ribs from the bicycle facing side, in contrast to the distal side of the support element 19.

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This makes the bicycle facing side 20 of the support element 19 suitable for being provided with a second material, such as a friction enhancing material. With the planar surface of the support element forming the bicycle facing side, low amounts of friction enhancing material can be used.

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The cross section of the first jaw member 13 when viewed as shown in figure 6 could be described as having raised walls extending from the distal end 21 of the support element 19 extending in a direction away from the bicycle facing side 20 of the support element 19. A third and a forth rib 35, 36 form a first and a second side rib 35, 36. The ribs 31, 32, 15 35, 36 together define three grooves 45 formed between the ribs 31, 32, 35, 36. Having grooves 45 reduces the overall weight of the first jaw member 13. The first and the second side ribs 35, 36 diverges back towards the bicycle facing side 20 and defines a first and a second mouth rib 37, 38 of the mouth 22 of the first jaw member 13. A groove 39 separates the first and the second side rib 35, 36 from the first and the second mouth 20 rib 37, 38

The cross section of the first and the second ribs 31, 32 have a thicker base as compared to the thickness at the top. In figure 6, the thickness of the base is indicated as TB and the thickness at the top, just before the top transcends to a smooth apex, is indicated with TT. 25 The ribs 31, 32 are thus tapered in their cross section. At least one jaw member having at least one rib, preferably one rib arranged on either side of the centerline, having a tapering cross section, has been found to be very advantageous.

As mentioned, the first and the second ribs 31, 32 extend substantially parallel with the 30 longitudinal centerline CJ. As is also noticeable, the distal side 21 of the support element 19 is not covered, e.g. by a lid or similar. The upper side of the first jaw member 13 thus has grooves or channels, which reduces the overall weight of the first jaw member 13 while still providing a good structural strength to the first jaw member 13.

Figure 7 shows the cross section of the second jaw member 14 along the line II-II as seen in figure 2. The frame work structure of the second jaw member 14 will be described in greater detail below. As is noticed in figure 7, the second jaw member 14 has a support element 19' having a bicycle facing side 20. The second jaw member 14 further

5 comprises a center section CS which extends along the longitudinal centerline CJ. The support element 19' has a planar surface at the center section CS, and a first and a second rib 33, 34 which extends from the distal side 21 of the support element 19'. The bicycle facing side 20 of the support element 19' has as mentioned above an arc shaped form, but a smooth planar surface, in contrast to the distal side 21 of the of the support

10 element 19' which comprises the first and the second rib 33, 34 extending from the distal side 21 and away from the bicycle facing side 20 of the support element 19'.

A third and a forth rib 35, 36 form a first and a second side rib 35, 36 extending substantially parallel with the first and the second ribs 33, 34. The first and the second

15 side ribs 35, 36 diverges back towards the bicycle facing side 20 and define a first and a second side mouth rib 37, 38 of the mouth 22 of the second jaw member 14. A groove 39 separates the first and the second side rib 35, 36 from the first and the second mouth rib 37, 38.

20 The second jaw member 14 also has support ribs 38 extending between the ribs 33, 34, 35, 36 interconnecting the ribs 33, 34, 35, 36 to further improve the structural integrity of the second jaw member 14. The support ribs 38 have the same height as the first and the second rib 33, 34. The support ribs 38 form a plurality of square like grooves 45' together with the ribs 33, 34, 35, 36. Having longitudinal grooves 45' reduces the overall weight of

25 the second jaw member 14 while still providing a relatively high structural strength to the second jaw member 14.

The first and the second jaw member 13, 14 will be described in further with reference to figure 8, which shows a schematic cross section of the second jaw member 14 shown in

30 figure 7. It should be noted however that the cross section of the second jaw member 14 is in principle the same as the cross section of the first jaw member 13, shown in figure 6.

Figure 8 shows the jaw member 14 having a support element 19' comprising a continuous planar center section CS having a bicycle facing side 20 and a distal side 21. The support

35 element 19' comprises four ribs 33, 34, 35, 36 extending from the distal side 21 of the

support element 19' and substantially perpendicular from the support element 19'. A first and a second rib 33, 34 is positioned on either side of the longitudinal centerline CJ, a first and second side rib 35, 36 is positioned on either side of the first and the second rib 33, 34 forming three grooves 45' between the ribs 33, 34, 35, 36. The first and the second side ribs 35, 36 diverges back towards the bicycle facing side 20 of the support element 19' forming the first and the second side mouth rib 37, 38.

Having a continuous planar bicycle facing side 20 on the support element 19', and especially in the center section CS, will make the second jaw member 14 more resistant against tensile stress as the second jaw member 14 will have plenty of material withstanding the tensile stress at the bicycle facing side 20. The centre of gravity of the cross section, as seen in figures 8-9c is relatively close towards the bicycle facing side 20 of the support element 19' which further indicates that the transition from tensile stress to compression stress is closer to the support element and thus the bicycle facing side 20, it would also indicate that the tensile stress is lower than the compression stress, which is very positive with respect to the structural strength of the second jaw member 14. The same reasoning applies to the first jaw member 13 of course.

As can be seen in figure 8, the bicycle facing side 20 of the support element 19', in this case on the second jaw member 14, comprises a grip section 40. The grip section is positioned on the center section CS of the second jaw member 14 and is formed by a relatively soft thermoplastic material such as polyethylene or a mixture of polyethylene and polypropylene. The purpose of the grip section 40 is to improve the grip between the clamping jaw and the frame of the bicycle.

The grip is improved by providing an improved friction between the frame of the bicycle and the clamping jaw, and by providing an increased grip area. As used herein, the term grip area is intended to mean the actual surface area which is in contact with the frame of the bicycle after the clamping jaw has been mounted to the bicycle and tightened in an appropriate manner permitting transportation of the bicycle on public roads and in a normal traffic situation.

As is also noticeable is that the first and the second side mouth ribs 37, 38 comprises grip sections 41, 42

With reference to figures 9a-9c, different schematic center sections will be briefly described. Figure 9a shows a cross section of a jaw member having a support element 19 with a bicycle facing side 20 and a distal side 21. A first and a second side rib 35, 36 extending substantially perpendicularly from the distal side 21 of the support element 19 and which diverges back towards the bicycle facing side 20 of the support element 19 forming a first and a second side mouth rib 37, 38.

The jaw member of figure 9b has only a first and a second side rib 35, 36 which extends substantially perpendicular from the distal side 21 of the support element 19 of the jaw member. The jaw member of figure 9b does not have any side mouth ribs, the form and extension of the support element 19 thus defines the sides of the mouth of the clamping jaw. The jaw member of figure 9c is similar to the jaw member of figure 9b with the difference that it comprises an additional rib 33' extending from distal side 21 of the support element 19 and which is centrally positioned between the first and the second side ribs 35, 36.

The bicycle facing side 20 is as mentioned planar. According to an aspect, the bicycle facing side 20, at least in the central section CS, has a continuous planar surface area of about at least 2 cm^2 , preferably at least 3 cm^2 , more preferably $4\text{-}20\text{ cm}^2$. A continuous planar surface area on the bicycle facing side will not only permit the formation of a grip section 40, but also improve the structural properties of the jaw member. The planar surface can be flat, concave or convex, while still being planar.

As mentioned above with reference to the first and the second jaw member 13, 14, the grooves 45 can be longitudinal channel like grooves if the ribs are not interconnected with support ribs. If support ribs are present, the grooves 45, 45' can be square like grooves or triangular formed grooves for example. Mixtures of grooves having different forms are of course possible.

The distinct configuration of the first jaw member 13, and the second jaw member 14 is configured similarly or identical, provides a clamping jaw 11 which has a low weight and a high structural integrity, i.e. strength. As mentioned, it has been found that clamping jaws of support assemblies for bicycle carriers are known to break when being exposed to too high tensile stress, i.e. due to a low tolerance against tensile stress. The clamping jaw

described herein has a low weight while still being resistant to a relatively high tensile stress subjected to the jaw member at the bicycle facing side of the support element.

The first jaw member 13 and optionally the second jaw member 14 are form moulded
5 using a two component technique and using a hard plastic material and a softer plastic material. The first and the second jaw members 13, 14 can be similarly formed and configured but it is also possible that the first jaw member is different from the second jaw member, the first jaw member could be form moulded and the second jaw member could be formed by stainless steel for example. In the shown embodiment in figure 4, both the
10 first and the second jaw members 13, 14 are manufactured using a form molding technique.

Figure 10 shows the tightening device 12 in the form of the rotateable knob 50 in greater detail. The knob 50 is used to press the first and the second jaw members together (not
15 shown in figure 10). When the knob 50 is rotated, or turned, the first and the second jaw members are either pressed together or displaced from each other upon which a clamping force will be reduced. The knob 50 is provided with a lock 51, in this case a lock cylinder 51 adapted to receive a key (not shown) for operating the lock cylinder 52. The lock 51 is configured to either prevent the knob 50 from being able to displace the first and the
20 second jaw members from each other or to permit the first and the second jaw members to be pressed against each other, in a manner which will be described in greater detail herein.

The individual components of the knob 50 will be described in greater detail with
25 reference to figures 11a-11b simultaneously. Figures 11a-11b show the knob 50 having a longitudinal center axis C in exploded view and with a perspective view. From the left, figures 11a-11b show a first and a second housing screw 53, 54, a housing 55, an axle receiving member 56, an interior housing 57, a spring 58, a first gear member 59, a second gear member 60, a lock washer 61, a lid 62 and the lock cylinder 52 having a lock
30 bolt 52a, in this case a rotateable lock bolt.

An axle, such as a screw or bolt cooperating with the opposite end of the support assembly is connected to the axle receiving member to form the tightening device 12. Such connection and function is known per se and will not be described further herein.

The knob 50 comprises a torque limiting mechanism 70, the torque limiting mechanism 70 is adapted to prevent a user from imparting too much torque to the axle receiving member 53, and thus from pressing the first and the second jaw members (not shown) together too hard.

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The torque limiting mechanism 70 is operating through the interaction between the first and the second gear members 59, 60 as will be described herein. As can be noted, the first gear member 59 comprises gear teeth 59' extending along the longitudinal center axis C and having an angled surface 59'' on each of the gear teeth 59'. The first gear member 59 is adapted to be in working cooperation with the second gear member 60. The second gear member 60 also comprises gear teeth 60' extending along the longitudinal center axis C and having an angled surface 60'' on each of the gear teeth 60'. The gear teeth 59' of the first gear member 59 are adapted to interact with the gear teeth 60' of the second gear member 60 so as to transfer torque imparted by a user there between, however, as a threshold level of torque is reached the gear teeth 59', 60' will start to slip and eventually loose grip with each other. As the grip between the first and the second gear member 59', 60' is lost the first gear member 59 will rotate with respect to the second gear member 60 and thus prevent the rotating motion imparted by the user from being transferred between the first and the second gear members 59, 60.

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A biasing member, in the form the spring 58, in this case a helical spring, biases the first and the second gear members 59, 60 together. The spring 58 is configured to bias the first gear member 59 in a direction along the longitudinal center axis C towards the second gear member in into working cooperation with the second gear member 60.

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The spring 58 and the first gear member 59 are positioned inside of the interior housing 57. The interior housing 57 comprises an aperture 57a through which the axle receiving member 56 extends. The axle receiving member 56 and the interior housing 57 are further prevented from rotation with respect to each other via a polygonal connection 56b, 57b, in this case a hexagonal connection on the axle receiving member 56 and the interior housing 57. The first gear member 59 can be displaced inside of the interior housing 57 and while being guided along tracks 57c on the interior surface of the interior housing 57. The tracks 57c of the interior housing 57 prevents the first gear member 59 from rotation with respect to the interior housing 57 while permitting the first gear member 59 to be

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displaced along the longitudinal center line C of the knob 50. Corresponding guiding tracks 59 are arranged on the first gear member 59.

The second gear member 60 comprises an aperture through which the axle receiving member 56 extends. The lock washer 61 is positioned around the axle receiving member 56 at the end thereof to connect the second gear member 60 to the axle receiving member 56.

The lock cylinder 52, which is accessible from the outside of the lid 62, is configured to cooperate directly with the second gear member 60. The lock mechanism of the knob 50 is thus configured to operate directly on one of the gear members 59, 60, in this case the second gear member 60, to provide for the locking function.

As is noticeable, the second gear member 60 comprises lock teeth 60a which extends in a direction substantially perpendicular to the longitudinal center axis C and are thus adapted to operate in a radial direction thereof. The lock teeth 60a has a form which is adapted to cooperate with a lock bolt 52a of the lock cylinder 52.

The housing 55 and the lid 62 can rotate freely with respect to the axle receiving member 56, the interior housing 57, the first gear member 59 and the second gear member 60 when the lock cylinder 52 is not engaging the second gear member 60. The knob 50 is thus tamper proof and cannot be used to press first and the second jaw members together. When the lock bolt 52a is rotated into engagement with the lock teeth 60a of the second gear member 60, the lid 62 and the housing 55 are engaged with the torque limiting mechanism 70 and thus can be used to tighten or releasing the first and the second jaw members. A simple and useful theft protection function is incorporated into the knob 50 which uses relatively few components.

Figure 12 shows a cross section of the knob 50 with the longitudinal center axis C. Figure 12 shows the housing 55 connected to the lid 62 via the first and the second housing screws 53, 54 (not shown in figure 12). The axle receiving member 56, enveloped by the interior housing 57. The spring 58 is threaded onto the axle receiving member 56 and biasing the first gear member 59 into engagement with the second gear member 60. The lock cylinder 52 is directly engaging the second gear member 60 while being accessible from the outside via the lid 62.

In general terms, the clamping jaw can comprise a first and a second opposing jaw member adapted to be clamped together about a portion of a bicycle, wherein the first jaw member comprises a frame work structure comprising a support element and at least on
5 rib projecting from the support element. The rib of the support element projects from the support element in a direction away from the second jaw member. Optionally the second jaw member comprises a frame work structure comprising a support element and at least on rib projecting from the support element. The rib of the support element projects from the support element in a direction away from the first jaw member.

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The support element provides the jaw members(s) and the clamping jaw with a planar, or flat, surface towards the bicycle while the supporting ribs project away from the planar, or flat, bicycle facing surface.

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CLAIMS

1. A jaw member (11) for a support assembly (10) for securing a bicycle (1) to a load carrier (2) for a vehicle (6), said jaw member (13, 14) comprising a frame work structure formed by at least one support element (19) and at least one rib (31, 32, 35, 36),
5 **characterized in that**
said support element (19) of said jaw member (13, 14) comprises a bicycle facing side (20) adapted to be positioned adjacent, or substantially adjacent, said bicycle (1) when mounted thereto, and a distal side (21), wherein said rib (31, 32)
10 extends from said distal side (21) of said support element (19) of said jaw member (13, 14).
2. The jaw member (13, 14) according to claim 1, wherein said at least one rib (31, 32, 33, 34, 35, 36) extends from said distal side (21) of said support element (19)
15 in a direction substantially perpendicular to said support element (19).
3. The jaw member (13, 14) according to any one of the preceding claims, wherein said frame work structure is positioned at a centre section (CS) of said jaw member (13, 14).
20
4. The jaw member (13, 14) according to claim 3, wherein said jaw member (13) comprises a first and a second mouth rib (37, 38), and in that said frame work structure is positioned between said first and said second mouth rib (37, 38) and being separated by a groove (39) on either side of said frame work structure.
25
5. The jaw member (13, 14) according to claim 3 or 4, wherein said jaw member (13, 14) comprises three grip sections, wherein said frame work structure and said support element (19) forms, or supports, a center grip section between two grip sections.
30
6. The jaw member (13, 14) according to any one of the preceding claims, wherein said frame work structure comprises two or more ribs (31, 32, 33, 34, 35, 36), preferably three or more ribs.

7. The jaw member (13, 14) according to claim 6, wherein at least one additional supportive rib (45') is positioned between and interconnecting said two or more ribs (33, 34, 35, 36).
- 5 8. The jaw member (13, 14) according to any one of the preceding claims, wherein said at least one rib (31, 32, 33, 34) has a base having a thickness (TB) proximal to said support element (19), and a rim distal to said support element (19), wherein said thickness (TB) is gradually decreasing towards said rim.
- 10 9. The jaw member (13, 14) according to any one of the preceding claims, wherein said support element (19) and said at least one rib (31, 32, 33, 34, 35, 36) are formed in one unitary piece of material, preferably by form moulding.
- 15 10. The jaw member (13, 14) according to any one of the preceding claims, wherein said bicycle facing side (20) of said support element (19) comprises a friction enhancing material defining a grip section (40).
- 20 11. The jaw member (13, 14) according to any one of the preceding claims, wherein said jaw member (13, 14) comprises a lid adapted to enclose said at least one rib (31, 32, 33, 34, 35, 36) and said distal side of said support element (19).
- 25 12. The jaw member (13, 14) according to any one of the preceding claims, wherein said jaw member comprises a section having a second frame work structure formed by a support element having a bicycle facing side and a distal side, and at least one rib, wherein said at least one rib extends from said bicycle facing side.
- 30 13. The jaw member (13, 14) according to any one of the preceding claims, wherein said jaw member (13) is a first jaw member (13), and a second jaw member (14) is attached to said first jaw member (13), or in the proximity thereof so as to form a clamping jaw (11).
14. The jaw member (13, 14) according to claim 13, wherein said second jaw member (14) is a jaw member according to any one of the preceding claims.
- 35 15. The jaw member (13, 14) according to claim 13 and 14, wherein said clamping jaw (11) is arranged with a tightening device and a second attachment

arrangement, to form a support assembly (10) for securing a bicycle (1) to a load carrier (2) for a vehicle (6).

5 16. The jaw member (13, 14) according to claim 15, wherein said second attachment arrangement is a clamping jaw (11) comprising at least one jaw member (13, 14) according to any one of the preceding claims.

10 17. The jaw member (13, 14) according to any one of the claims 13-16, wherein said first jaw member comprises said second frame work structure at said pivot axis, and said first frame work structure at said mouth of said clamping jaw, said second frame work structure having a support element and ribs, wherein said ribs projects from said bicycle facing side of said jaw member.

15 18. A Knob (50) for transferring a torque to a clamping jaw (11) of a support assembly (10), said knob (50) having a having a torque limiting mechanism (70) and a lock (51), said lock (51) being operable between a locked position in which said knob (50) is unable to transfer torque to said object, and an unlocked position in which said knob (50) is able to transfer torque to said object,
20 said torque limiting mechanism (70) comprising a first and a second gear member (59, 60), said first gear member (59) is biased into working cooperation with said second gear member (60) wherein upon a torque threshold value, said first and second gear members (59, 60) are disengaged from said working cooperation so that a torque limiting function is provided,
25 said knob (50) having a longitudinal centre axis (C) about which said knob (50) is adapted to rotate to transfer said torque,
characterized in that
said first gear member (59) is biased towards said second gear member (60) in a direction along said longitudinal centre axis (C) of said knob (50) into said working cooperation.

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19. The knob according to claim 18, wherein said lock (51) engages the first and/or second gear member (59, 60) directly when being in the unlocked position.

35 20. The knob according to claim 19, wherein said lock (51) comprises a lock cylinder (52, 52a), said lock cylinder (52, 52a) engages said first or second gear member

(59, 60) directly when said lock cylinder (52, 52a) is in said unlocked position.

21. The knob according to any one of the claims 18-20, wherein said first gear member (59) comprises gear teeth (59') adapted to engage said second gear member (60), preferably said second gear member (60) further comprises lock teeth (60a) adapted to engage said lock (51).
22. The knob according to any one of the claims 18-21, wherein said gear teeth (59') of said first gear member (59) and/or corresponding gear teeth (60') of the second gear member (60) extends in a direction along said longitudinal centre axis (C) of said knob (50).
23. The knob according to any one of the claims 18-22, wherein said second gear member (60) comprises lock teeth (60a) adapted to engage said lock (52), said lock teeth (60a) of said second gear member (60) extends in a radial direction with respect to said longitudinal centre axis (C) of said knob (50).
24. A support assembly for a vehicle comprising a clamping jaw (11) comprising at least one jaw member (13, 14) according to any one of the claims 1-15 and a knob (50) for transferring torque to the clamping jaw (11) according to any of the claims 16-21.
25. Knob for transferring a torque to an object, said knob (50) having a having a torque limiting mechanism (70) and a lock (51), said lock (51) having a locked position in which said knob (50) in unable to transfer torque to said object, and an unlocked position in which said knob (50) is able to transfer torque to said object, said torque limiting mechanism (70) comprising a first and a second gear member (59, 60), said first gear member (59) is biased into working cooperation with said second gear member (60) wherein upon a torque threshold value, said first and second gear members (59, 60) are disengaged from said working cooperation so that a torque limiting mechanism is provided,
characterized in that
said lock (51) is arranged to lock said first or second gear member (59, 60) from rotation when positioned in said lock position by engaging said first and/or second gear members (59, 60) directly.

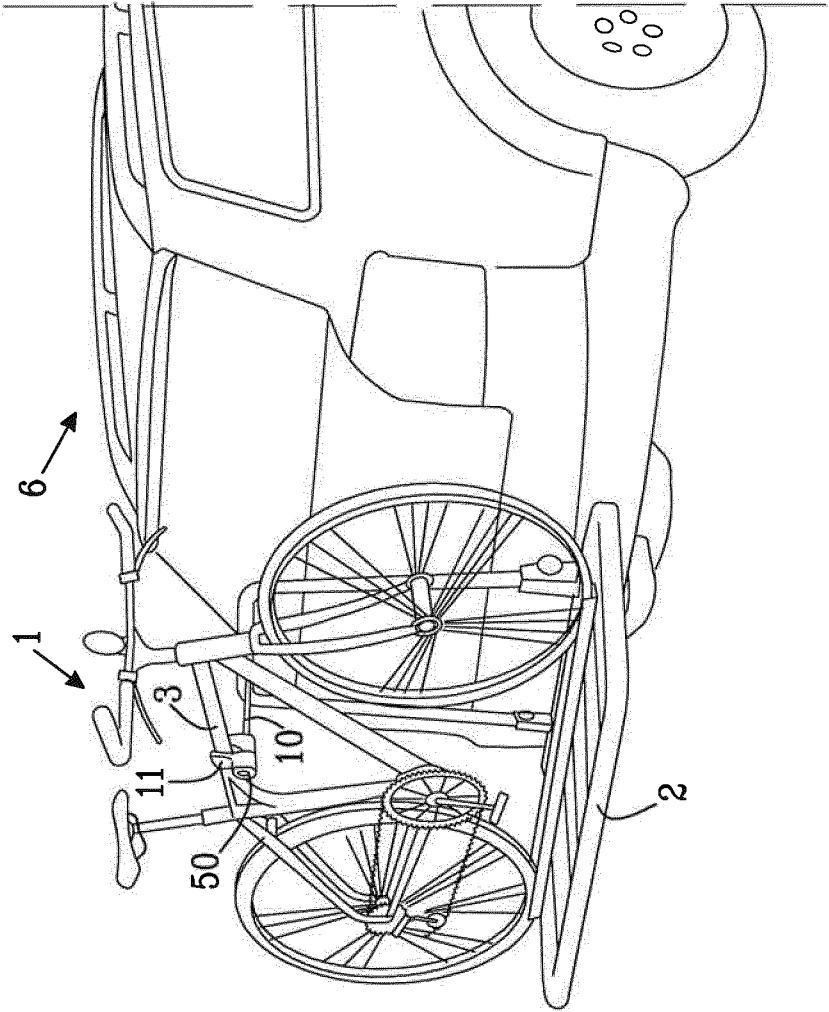


Fig.1

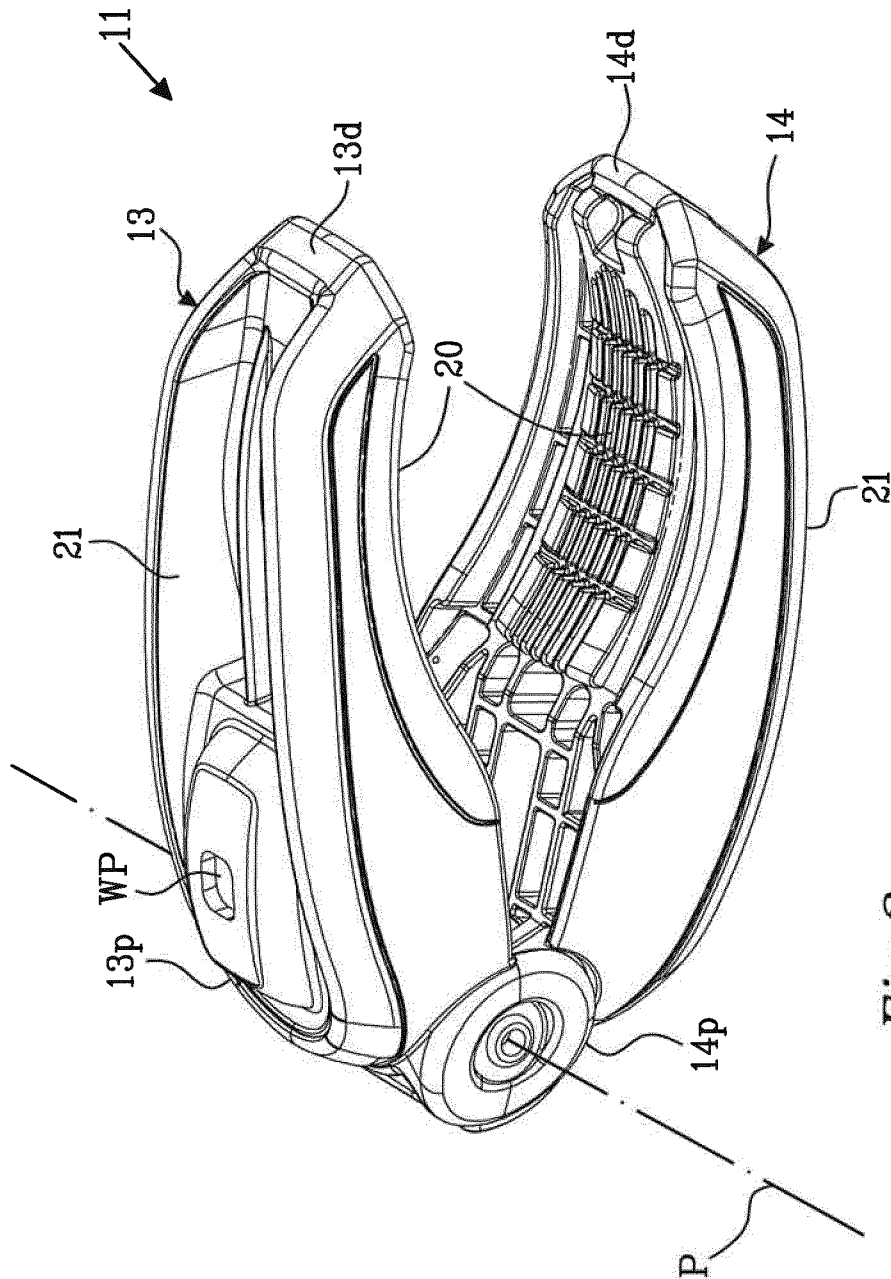


Fig. 2

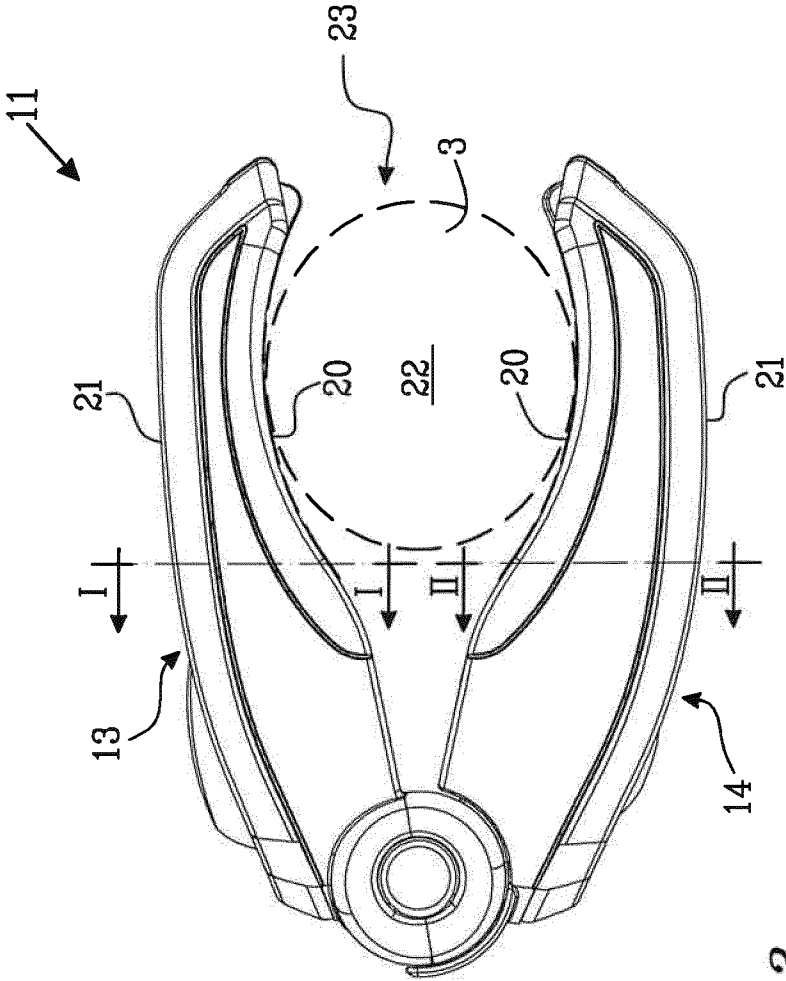
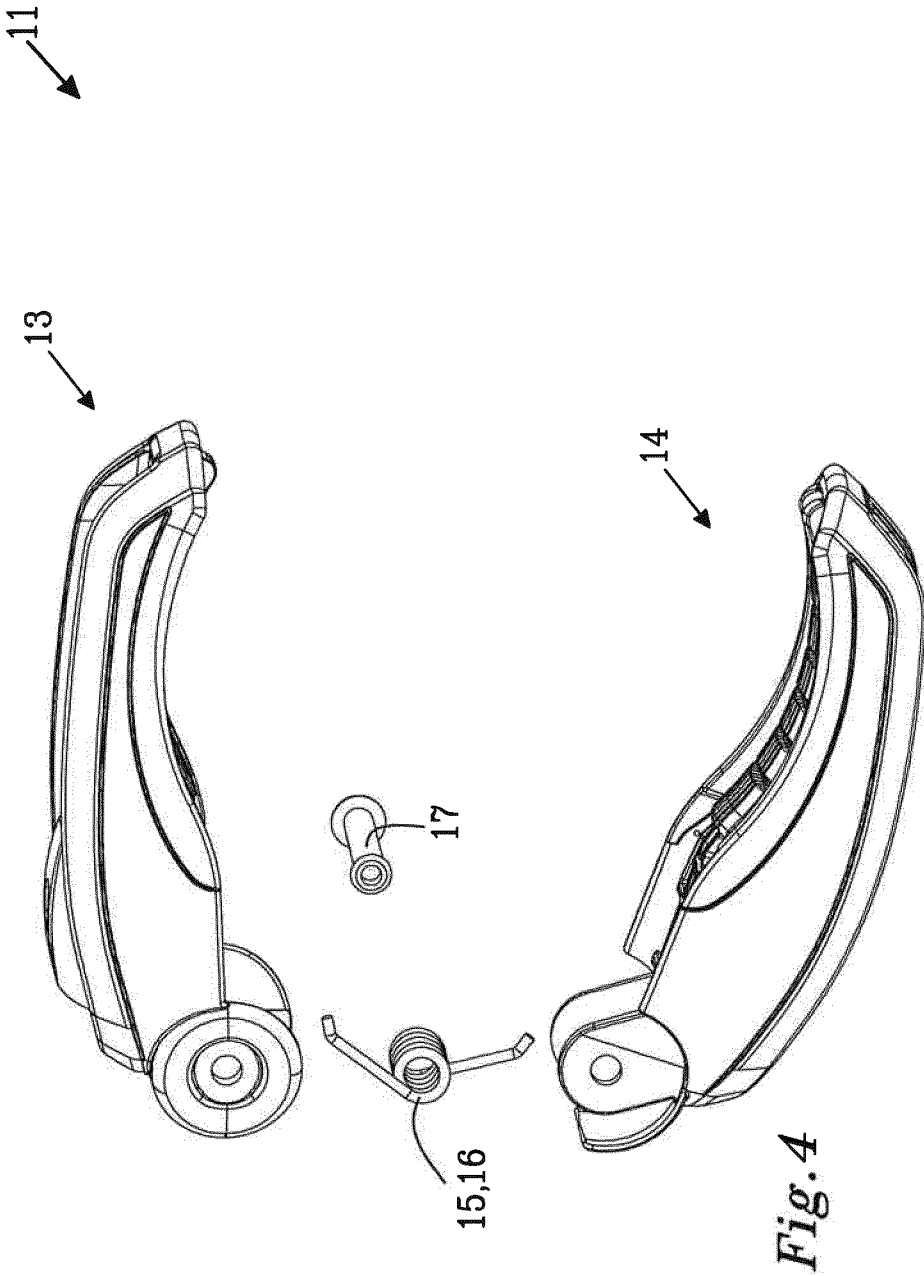


Fig. 3



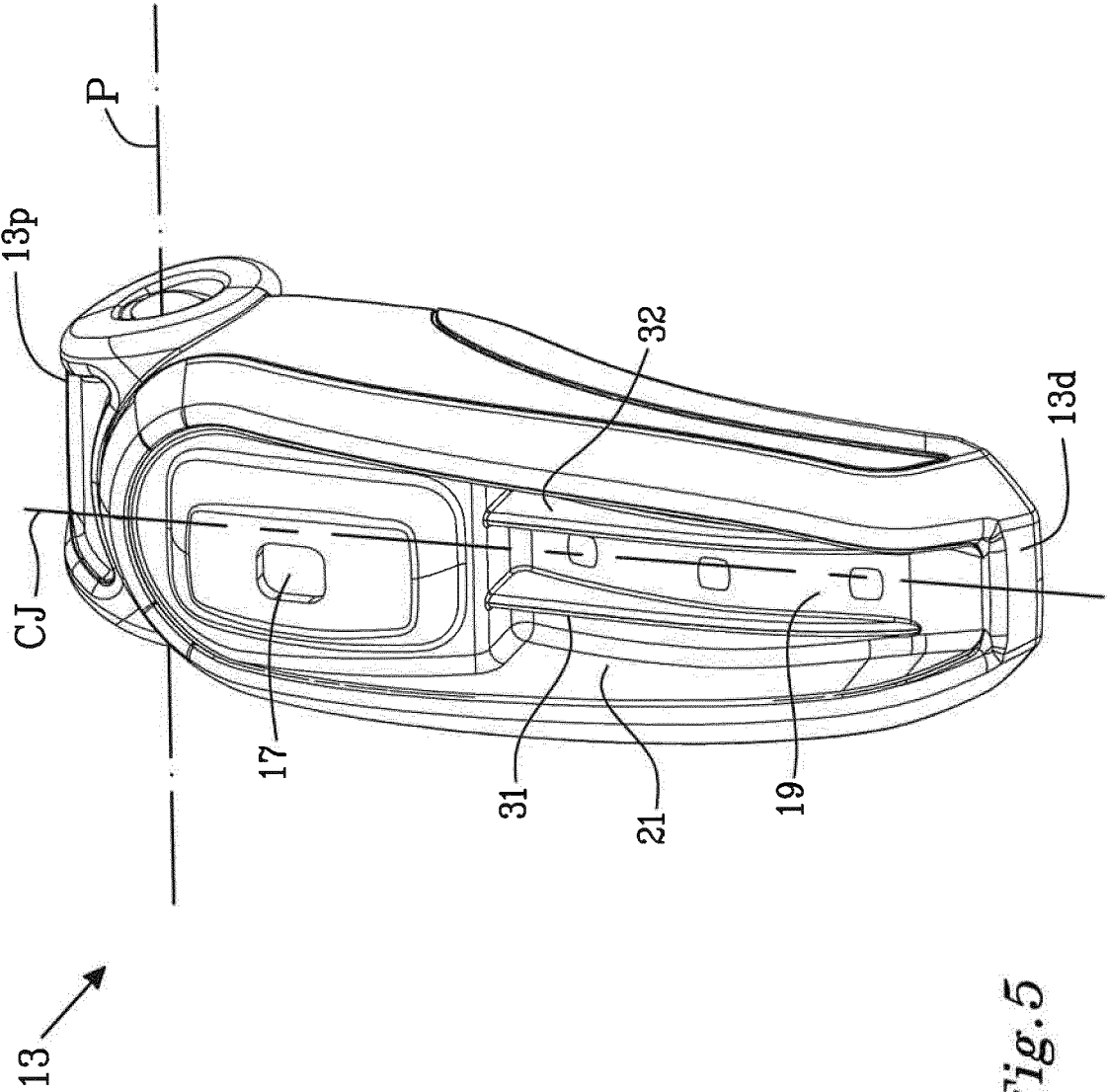
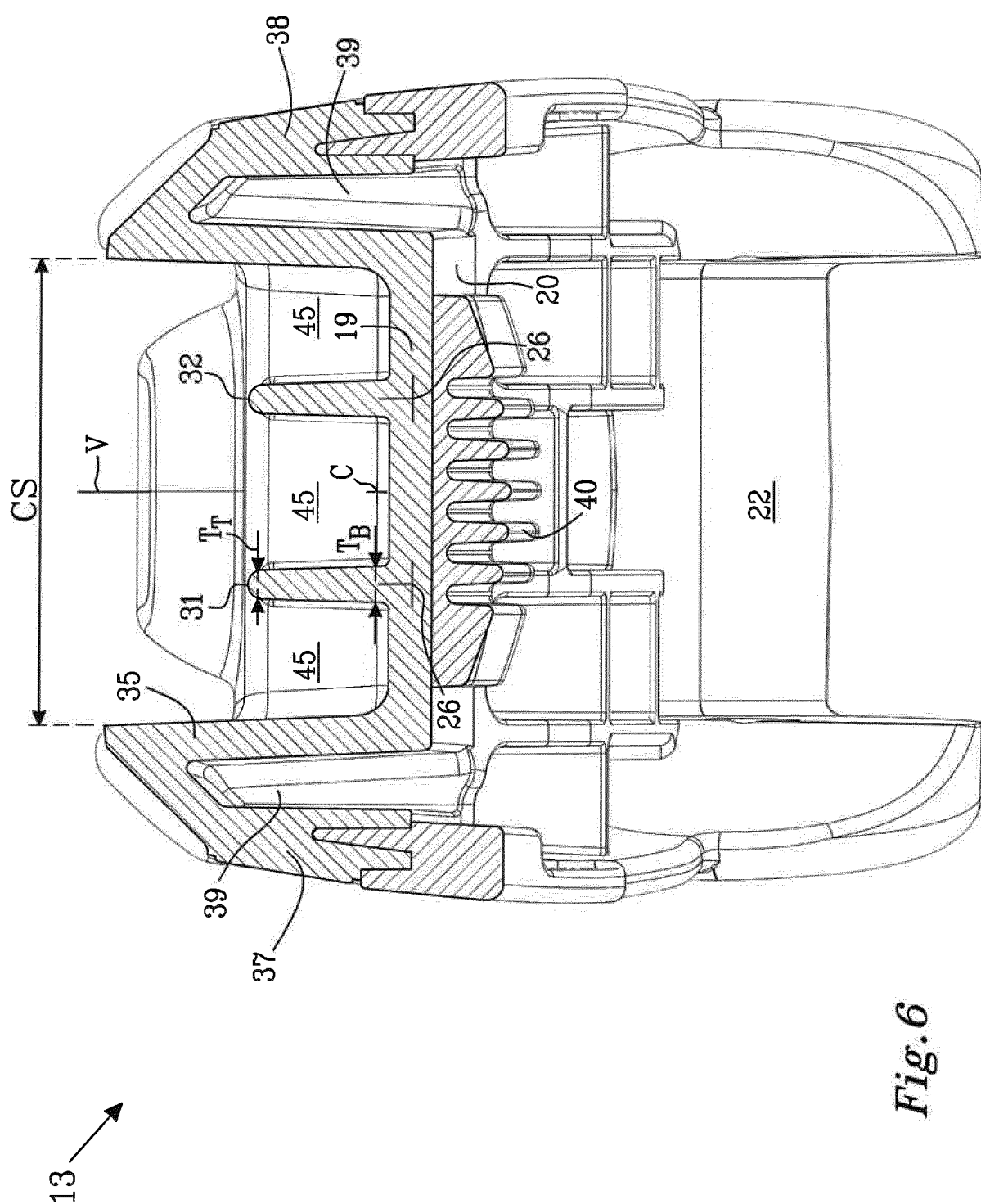


Fig. 5



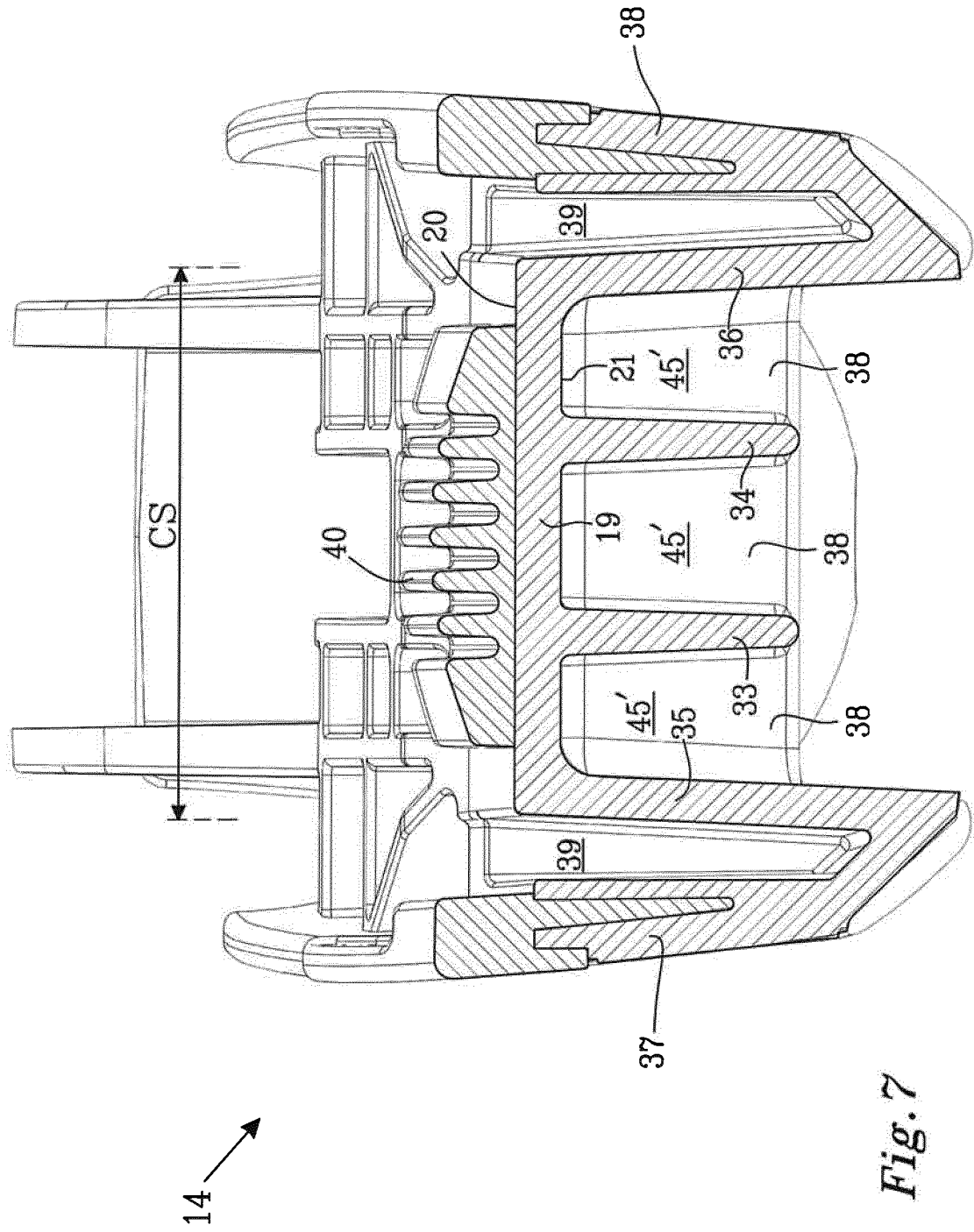


Fig. 7

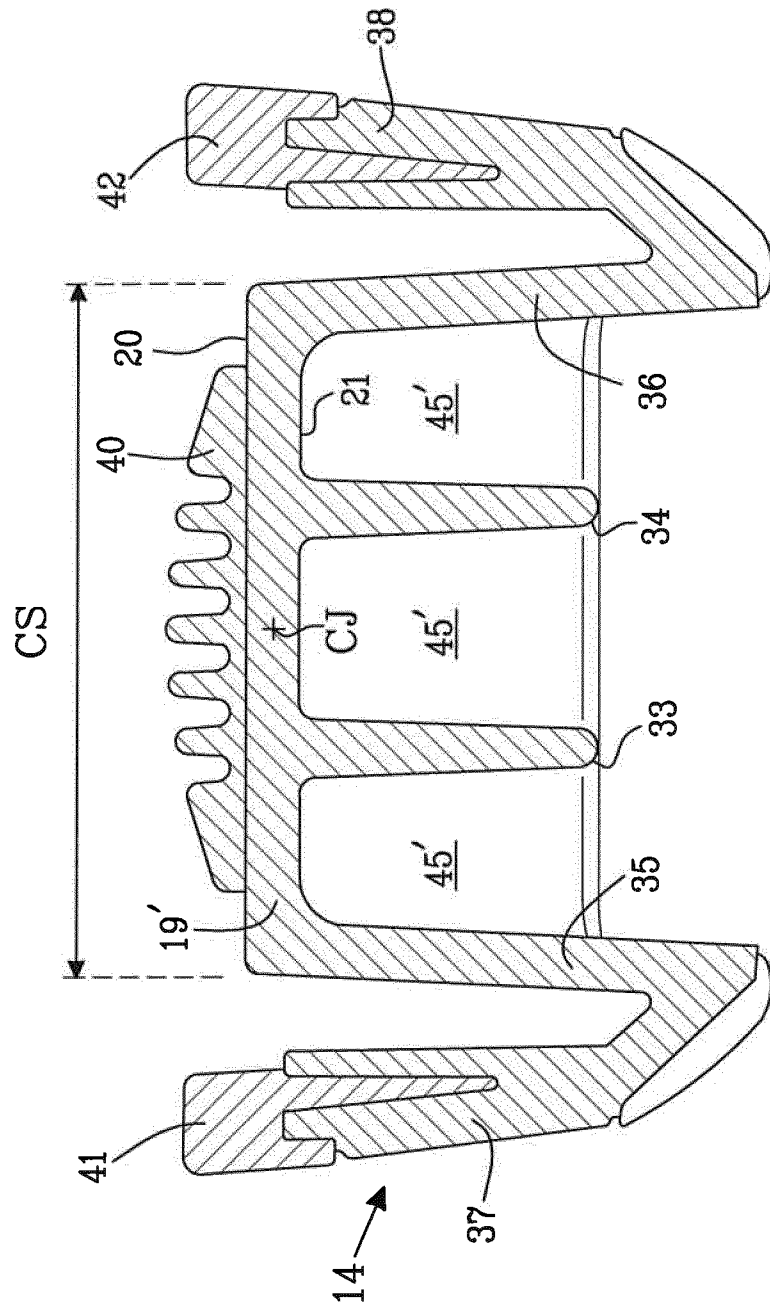


Fig. 8

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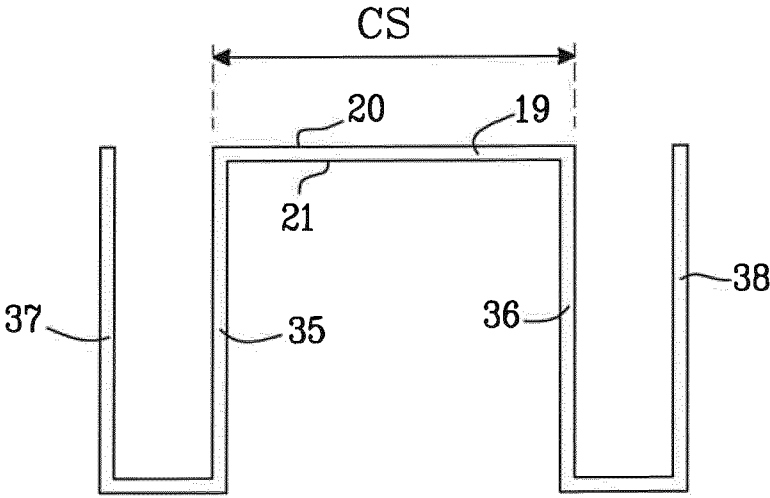


Fig. 9a

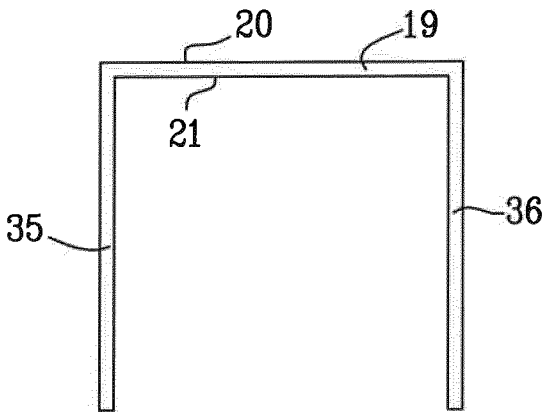


Fig. 9b

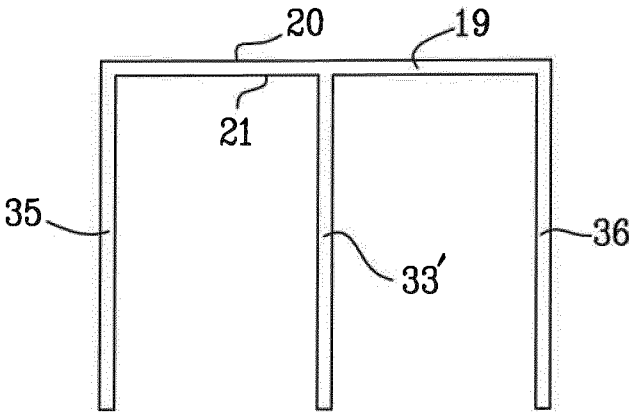


Fig. 9c

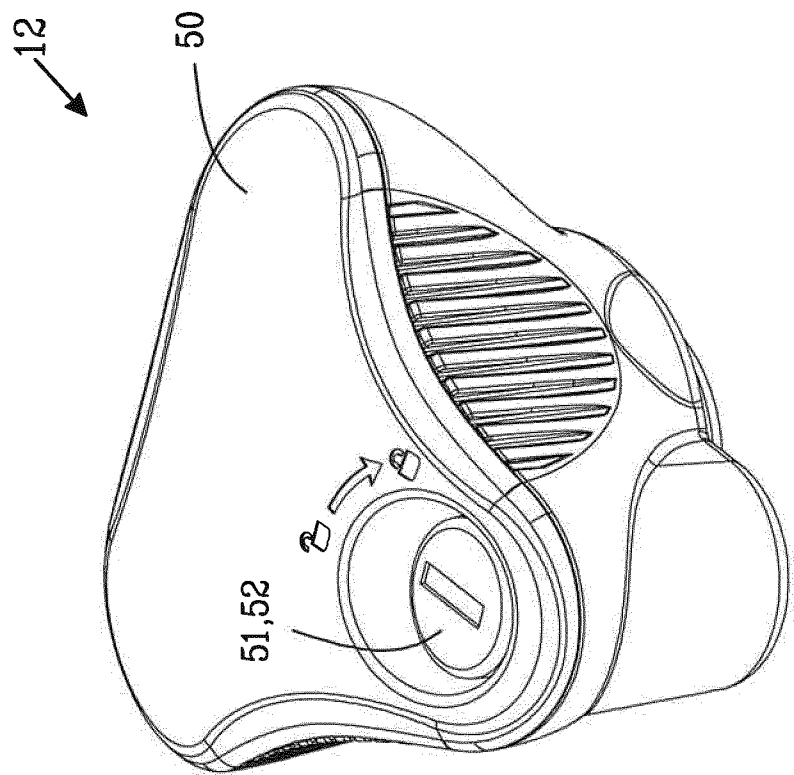


Fig. 10

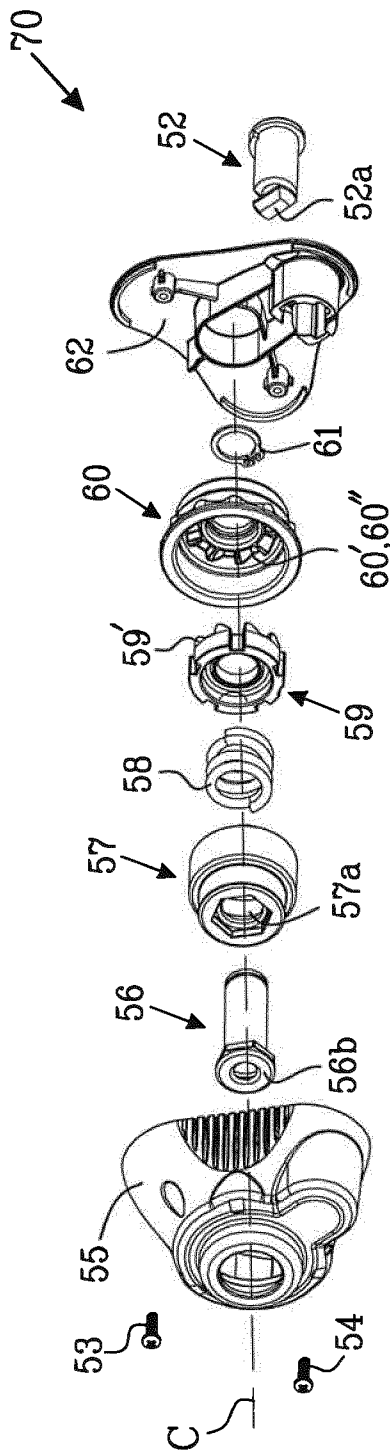


Fig. 11a

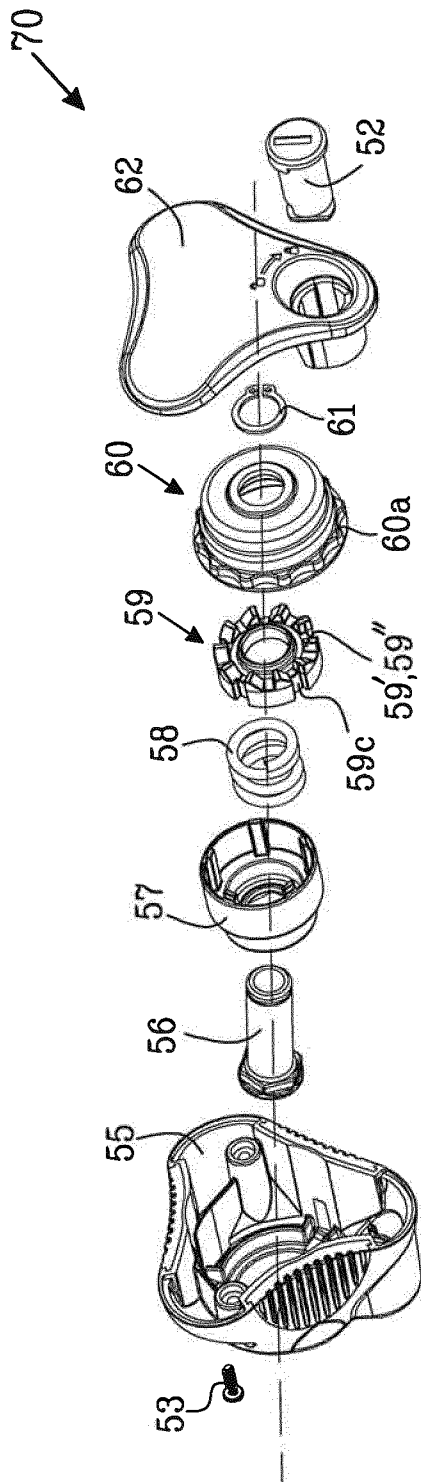


Fig. 11b

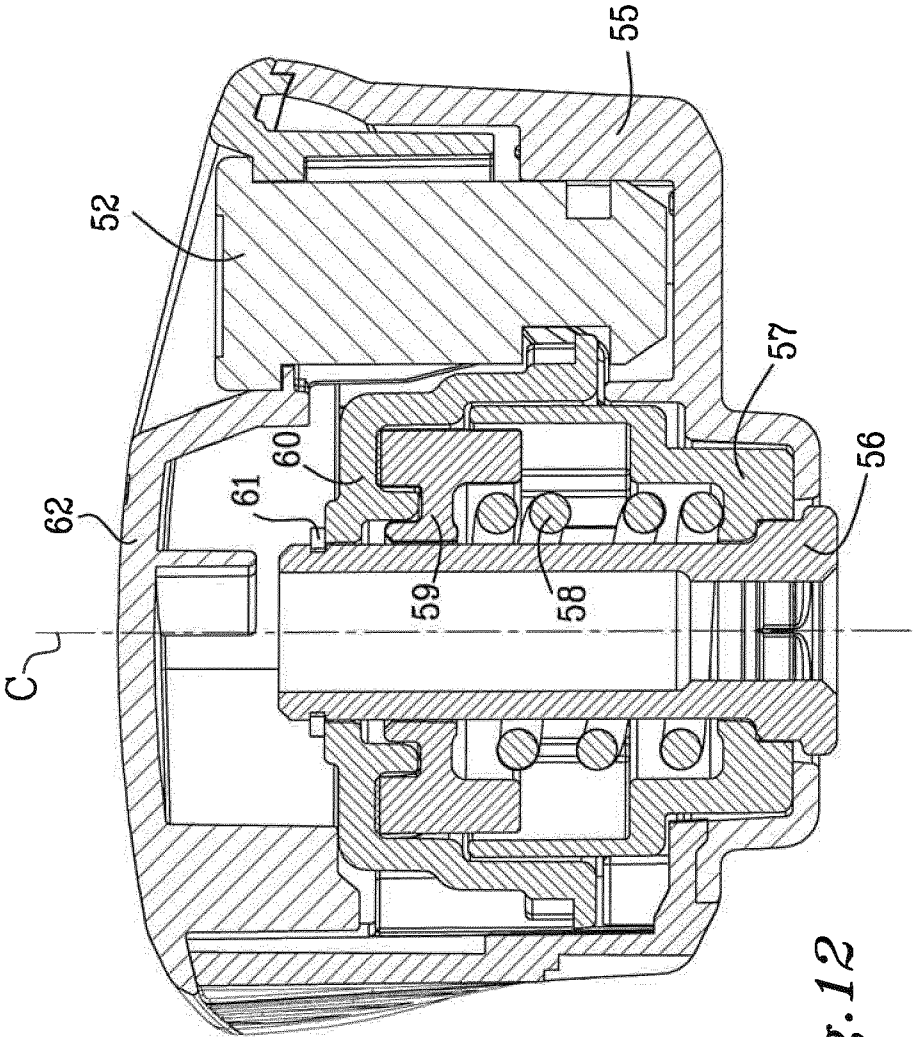


Fig.12

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2014/061487

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☒ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/061487

A. CLASSIFICATION OF SUBJECT MATTER

INV. B60R9/048 B60R9/10 F16B2/10 F16B37/08 F16B31/02
G05G1/08

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)

B60R F16B G05G G01G

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 598 959 A (LORENSEN ROBBIN R [US] ET AL) 4 February 1997 (1997-02-04)	1-9, 11-17
Y	column 4, line 66 - column 5, line 17; figures 2,2A,2B,5,8	10
Y	DE 20 2006 017802 U1 (MFT TRANSP SYSTEME GMBH [DE]) 18 January 2007 (2007-01-18) paragraph [0050]; figure 1	10
A	WO 2009/065817 A1 (THULE SWEDEN AB [SE]; MALM TORBJOERN [SE]) 28 May 2009 (2009-05-28) cited in the application the whole document	1-17
X	EP 2 230 412 A1 (EURO LOCKS SA [BE]) 22 September 2010 (2010-09-22)	25
Y	claims 1-3,8; figures 1-25	18-24
	-/-	

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

19 September 2014

Date of mailing of the international search report

26/09/2014

Name and mailing address of the ISA/

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Authorized officer

Matos Gonçalves, M

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2014/061487

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 1 142 760 A1 (SCAMBIA IND DEV AG [LI]) 10 October 2001 (2001-10-10) paragraphs [0016], [0017], [0034]; figures 2,3,7,9,11,13,15-17 -----	18-24
Y	WO 2013/004789 A1 (LABOMATIC INSTR AG [CH]; MARCHAND CLAUDE LOUIS [CH]; FEHR CHRISTIAN [C] 10 January 2013 (2013-01-10) page 19, line 13 - page 20, line 17; claims 1-4; figures 8a,8b -----	18-24

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2014/061487

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5598959	A	04-02-1997	NONE
DE 202006017802	U1	18-01-2007	NONE
WO 2009065817	A1	28-05-2009	CN 101855107 A 06-10-2010 EP 2212156 A1 04-08-2010 US 2010288810 A1 18-11-2010 WO 2009065817 A1 28-05-2009
EP 2230412	A1	22-09-2010	NONE
EP 1142760	A1	10-10-2001	AT 257099 T 15-01-2004 DE 60007507 D1 05-02-2004 DE 60007507 T2 09-09-2004 EP 1142760 A1 10-10-2001
WO 2013004789	A1	10-01-2013	DE 102011106696 A1 10-01-2013 EP 2715201 A1 09-04-2014 WO 2013004789 A1 10-01-2013

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-17

Jaw member for a support assembly

2. claims: 18-25

A knob for transferring torque to a clamping jaw
